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Friday, March 15, 2019

Ms. Melanie Humphrey
Michigan Department of Environmental Quality
1504 W. Washington St.
Marquette, MI 49855

Subject: Annual Mining and Reclamation Report, Eagle Mine, LLC
Nonferrous Metallic Mineral Mining Permit (MP 01 2010), Humboldt Mill

Dear Ms. Humphrey:

Eagle Mine, LLC has an approved Mining Permit (MP 01 2010) dated February 9, 2010. General Permit Condition F-2 states, "The permittee shall file with the MMU supervisor a Mining and Reclamation Report on or before March 15 of each year, both during milling operations and post closure monitoring as required by Section 324.63213 and R 425.501. The report shall include a description of the status of mining and reclamation operations, an update of the contingency plan, monitoring results from the preceding calendar year, tonnage totals of material mined, and amount of metallic product by weight."

Please find enclosed, the 2018 Annual Mining and Reclamation Report for the Humboldt Mill.

Should you have any questions about this report, please do not hesitate to contact me at 906-339-7022.

Sincerely,

David Tornberg
Environmental Advisor

Cc: Humboldt Township

enclosure

2018 Annual Mining and Reclamation Report
Humboldt Mill
Mine Permit MP 01 2010

March 15, 2019

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Acronyms and Abbreviations

AEM	Advanced Ecological Management
BMPs	best management practices
CLO	Concentrate Load-Out Facility
CN	Canadian National
DO	dissolved oxygen
Eagle	Eagle Mine LLC.
EMT	Emergency Medical Technician
gpm	gallons per minute
HDPE	high-density polyethylene
HTDF	Humboldt Tailings Disposal Facility
KME	King and MacGregor Environmental
MER	Middle Branch Escanaba River
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MG	million gallons
MRR	Mining and Reclamation Report
µg/L	micrograms per liter
mg/L	milligrams per liter
MNFI	Michigan Natural Features Inventory
MSL	mean sea level
NPDES	National Pollution Discharge Elimination System
NREPA	Natural Resources & Environmental Protection Act
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
PEC	Probable Effects Concentration
Q1	Quarter 1
QAL	quaternary unconsolidated formation
SESC	Soil Erosion and Sedimentation Control
SU	standard units
SWPPP	Storm water Pollution Prevention Plan
t	metric ton (tonne)
TDS	total dissolved solids
TEC	Threshold Effects Concentration
UFB	upper fractured bedrock
WBR	Black River
WTP	Water Treatment Plant

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		
Eagle Mine LLC	David Tornberg	Environmental Advisor
Eagle Mine LLC	Amanda Zeidler	HSE & Permitting Manager
Eagle Mine LLC	Corey Brochu	HSE Compliance Supervisor
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Eagle Mine LLC	Jennifer Nutini	Senior Environmental Engineer
Eagle Mine LLC	Brooke Routhier	Water Systems Superintendent
Eagle Mine LLC	Todd Macco	Water Treatment Plant Supervisor
Eagle Mine LLC	Linda Carello	Transportation Coordinator
Eagle Mine LLC	Alexxa Young	HSE Data Analyst
Eagle Mine LLC	David Bertucci	Environmental Analyst
Eagle Mine LLC	Hugo Stanton	Processing Superintendent
TriMedia Environmental & Engineering	Ryan Whaley	Senior Scientist
King & MacGregor Environmental, Inc.	Matt MacGregor	Wetland Scientist/Biologist

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 (MMR) 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 memorialize the decisions and/or modifications that have been approved throughout the process.

3. Site Modifications and Amendments

In August 2017, a request for amendment to Condition F4 of MP 01 2010 was submitted to the Department for review. The Department requested additional information in February 2018 which was provided by Eagle for Departmental review in March 2018. On October 16, 2018, Eagle received notification from the Department that the amendment request was approved. Table 3. below summarizes the submittals that were provided to the Department in 2018 as required under the Part 632 Mining Permit. A copy of the current site map is provided in Appendix A.

Table 3. Submittals and Approvals Required Under Part 632

Date	Description	Approval
3/12/18	Submitted requested information for permit amendment review	N/A
3/15/18	2017 Annual Mining and Reclamation Report	N/A
5/21/18	Q1 groundwater and surface water monitoring data	N/A
7/3/18	Notification of WTP Building Expansion Project	N/A
8/3/19	Notification of CLO Building Expansion Project	N/A
8/9/18	Q2 groundwater and surface water monitoring data	N/A
	Permit amendment request (Condition F4) approved by Department	8/16/18
11/9/18	Q3 groundwater and surface water monitoring data	N/A
1/29/19	Q4 groundwater and surface water monitoring data	N/A

4. Processing Activities and Data Report

As of 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 2018 monitoring activities can be found in Section 7 of this report.

4.1. Processing Report

In 2018, 768,461 dry metric tonnes (t) of ore was transported from the Eagle Mine to the Humboldt Mill by over the road haul trucks. Table 4.1 below summarizes the dry tonnes of ore crushed and milled and the total volume of nickel and copper concentrate produced in 2018.

Table 4.1 Volume of Ore Crushed, Milled, and Concentrate Produced in 2018

Month	Ore Crushed (dry tonnes)	Ore Milled (dry tonnes)	Copper Concentrate Produced (dry tonnes)	Nickel Concentrate Produced (dry tonnes)
January	62,640	62,940	3,751	14,258
February	60,529	60,234	5,374	14,511
March	58,967	59,217	3,551	7,910
April	58,454	58,421	2,278	6,737
May	58,245	58,596	3,713	9,244
June	67,543	67,652	4,965	14,358
July	64,285	64,437	4,706	9,816
August	65,363	65,324	4,543	10,762
September	62,412	62,267	5,332	15,765
October	63,444	63,596	3,491	8,593
November	63,454	63,991	4,123	7,660
December	67,919	67,076	3,536	9,165
2018 Annual Total	753,254	753,751	49,364	128,780

Source: Mill Operations Year End Reconciled

In 2018, approximately 49,328 dry tonnes of copper and 128,868 dry tonnes of nickel were shipped offsite via rail. Mineral Range manages rail shipments from the Humboldt Mill to the Ishpeming Rail Yard. From that point Canadian National (CN), and to a lesser extent, Quebec Gatineau Railway transports the material to its final destination.

4.1.1. Tailings

Tailings are the waste material that is generated when processing ore. At the Humboldt Mill, tailings are sub-aqueously disposed in the Humboldt Tailings Disposal Facility (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 the subaqueous outfalls located within the HTDF. In 2018, the tailings line "spigot system," which was installed in 2016, was utilized for the sub-aqueous disposal of approximately 265,400,000 gallons of tailings slurry at an average rate of 504 gallons per minute. The use of multiple outfalls allows for better control of the depth of tailings in an area and optimizes the storage volume that is available.

During the winter months, tailings were deposited at the bottom, near the center of the HTDF, and from midway along the eastern wall using the spigot system during the summer and fall months. Following approval of the permit amendment request in October 2018, the maximum permitted elevation for tailings storage was increased from an elevation 1420 MSL to 1515 MSL. The maximum tailings peak measured in November 2018 was 1425 MSL with the majority of the tailings stored below elevation 1400 MSL. Due to the settling characteristics of the tailings, the spigot system was installed in order to better utilize the full capacity of the HTDF and currently discharges tailings approximately 100' below the water surface near the eastern wall of the HTDF. A new deposition plan was developed in 2018, based on the use of the spigot system to distribute tailings more efficiently throughout the basin.

Aerial view of tailings lines and shore vault at HTDF, October 2018

In accordance with permit condition, F-7, an annual bathymetry survey is required to be conducted in order to accurately monitor tailings placement and calculate changes in HTDF water storage. However, in order to better understand the settling characteristics of the tailings, two surveys were completed in 2018. The surveys were conducted in June and November and focused on the entire HTDF as tailings were dispersed to multiple areas in 2018. Copies of the bathymetry surveys are available in Appendix B.

The Metallic Minerals Lease (No. M-00602) requires the lessee to furnish a mill waste reject report on an annual basis. In 2018, 3,017 dry metric tonnes of nickel and 532 dry metric tonnes of copper were deposited in the HTDF as tailings.

5. Site Water Usage, Treatment and Discharge

Three separate sources supply water to the mill site to support various operational activities and the site water balance is comprised of well water, process water, precipitation, groundwater infiltration, and storm water runoff. All of these water sources are captured in the HTDF and is treated by the water treatment plant (WTP) before being discharged.

5.1. 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 mainly used to supply potable water to the facility, but may also be utilized to replenish the fire water tank and supplement process water requirements if necessary. In 2018, approximately 1.1 million gallons (MG) of water was drawn from the potable water well which is an increase from 2017 when 0.75 MG of water was withdrawn.

In the first half of 2018 the seal water pumps were disconnected from the fire water tank and connected directly to the reclaim water line. As a result of this change, the industrial well is no longer used to supplement seal water and is only used to keep the fire water tank full, resulting in a large drop in consumption. In 2018, approximately 0.35 MG of water was utilized from the industrial well. This is a significant improvement in terms of water usage because it was a decrease from the 1.8 MG that was withdrawn in 2017.

The third source of water at the mill site is the reclaim water which is pumped from the HTDF. This water is used throughout the process with the volume that is not consumed being recycled back to the HTDF via tailings. Where possible, reclaim water usage in the mill has been replaced with internally recycled process water and the volume of water sent to the HTDF has been reduced to match the reduction in reclaim water brought into the mill. In 2018, approximately 201 MG of reclaim water was pumped from the HTDF for use in processing ore. With the exception of approximately 4.2 MG 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.

5.2. Storm Water Control

A site grading plan was developed with the purpose of keeping all storm water onsite and directing run-off to one of two locations; the HTDF or storm water retention basin. The majority of site grading, paving, and curbing was previously completed to direct water to the series of catch basins that were installed along the length of the main facility from the rail spur to the security building. These catch basins direct storm water from the main mill facility to the HTDF. Water which falls south of the main site access road, is directed to the storm water retention basin 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 C.

Storm water control at the Humboldt Mill is managed under a National Pollutant Discharge Elimination System (NPDES) permit (MI00058649) and in accordance with Part I.B of the permit a storm water pollution prevention plan (SWPPP) has been developed. The SWPPP describes the Humboldt Mill site 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. The plan must be reviewed, and updated if necessary, on an annual basis and a written report of the review must be maintained and submitted to the Michigan Department of Environmental Quality (MDEQ) on or before January 10th of each year. The 2018 SWPPP annual review was completed and submitted to the Department on January 9th, 2019. A copy of the plan is available upon request.

5.3. Water Treatment Plant Operations and Discharge

Effluent discharges are regulated under the NPDES permit MI0058649 with analytical results and discharge volume reported to the MDEQ monthly through the MiWaters electronic reporting system. In November 2018, Eagle received approval of a modification of the NPDES permit which allowed for discharge to a newly established Outfall 004. Outfall 004 allows for direct discharge of treated effluent water to the Escanaba River and provides for more operational flexibility while still maintaining environmental protection.

One change made in 2018, as a result of the NPDES modification approval was the addition of the Escanaba River intake system. Because all treated effluent discharge is now directed to the Escanaba River via Outfall 004, the water bypasses the wetland area near the WTP (which previously received the water via Outfall 003) and gets discharged directly to the Escanaba River. The intake system, which pulls water from a location upstream of Outfall 004, pumps water from the river and discharges it to Outfall 003, essentially recirculating the water through the wetland and ultimately back to the Escanaba River. The main purpose of the Escanaba River intake system is to ensure the hydrology of the wetland is maintained during Eagle operations.

In 2018, approximately 215 MG of water was treated and discharged from the water treatment plant.

Table 5.3 below summarizes the monthly flow rate from each WTP outfall in 2018.

Table 5.3 Volume of Water Discharged in 2018

Month	Outfall 001 Volume of WTP Effluent Water Discharged (MG)	Outfall 002 Volume of WTP Effluent Water Discharged (MG)	Outfall 003 Volume of WTP Effluent Water Discharged (MG)	Volume of Escanaba River Water Recirculated through Outfall 003 (MG)	Outfall 004 Volume of WTP Effluent Water Discharged (MG)
January	0	6.2	11.1	0	0
February	0	6.2	13.2	0	0
March	0	5.0	9.6	0	0
April	0	4.7	13.6	0	0
May	0	0.48	16.1	0	0
June	0	0.009	8.5	7.5*	0
July	0	18.9	0	17.9	0
August	0	20.3	0	16.2	0
September	0	18.5	0	15.4	0
October	0	2.3	17.2	1.0	0.002
November	2.4**	0	0	0.14	18.2
December	1.8**	0	0	16.5	22.6
Total	**3.2****	**84.9**	**89.3**	**74.6**	**40.8**

Source = WTP Operators log

* Escanaba River water discharge to Outfall 003 began on 6/18/18

** Escanaba River water used to flush line

Operational modifications were made in late 2017 and early 2018, which allowed for the utilization of the HTDF deep-water layer as both the mill process water supply and WTP influent. Due to the water chemistry within the deep-water layer, an oxidation reactor (i.e. Fenton's Reaction) was added as the initial step of the WTP process. The purpose of the oxidation reactor is for pretreatment of the water prior to membrane treatment. This is accomplished by oxidizing trace levels of hydrogen sulfide and elevated levels of thiosulfate. Construction of the oxidation reactor began in Q4 2017 and commissioning commenced in April of 2018. In July of 2018, additional reverse osmosis (RO) units were added to the plant to improve efficiency of the treatment process. This allowed for extra permeate production which is then blended with the ultrafiltration product water (filtrate) to make the final effluent water. Also, in July of 2018, Eagle Mine began construction of a building expansion project which will consist of additional water clarification and filtration components, and additional storage for process chemicals. The WTP expansion project is scheduled to be completed during the fall of 2019.


Water Treatment Plant, Reverse Osmosis Unit

The water treatment process generates one waste stream which derives from the filter press. The filter press waste stream is dewatered solids from the clarifier and is primarily comprised of aluminum, 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 collected in March and May 2018 and sent to ALS Laboratory for analysis. These results as well as results collected in January 2019confirmed that this waste stream is non-hazardous. In 2018, approximately 50 tonnes of filter press waste was disposed at the Marquette County Landfill.

5.4. Water Balance

The main components of the water balance are process water, well 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. The target operating water elevation of the HTDF is between 1529.5 and 1530.5 MSL which is significantly lower than originally planned during the permitting process. The lower operating level mitigates risks associated with overflow situations and provides excess capacity to manage various operational situations.

Since late 2017 through 2018, the HTDF water level has risen due to above average rainfall occurring in June-October 2018 and operational changes in the WTP which resulted in a reduced treatment capacity. In March 2018, upon commissioning of the Fenton's Reactor to oxidize thiosalts, and subsequent commissioning of a permanent reverse osmosis system to remove TDS from treated effluent, the treatment system capacity had a net treatment reduction from approximately 900 GPM to between 400 and 550 GPM, causing water levels to rise. An annual average treatment rate of 600

GPM is needed to manage the water balance. Furthermore, biofilm formation, discussed further in Section 7.6.4, reduced treatment capacity and fouled membranes at rates faster than replacement membranes were available. As of late 2018, water levels reached approximately 1534.8 MSL. Due to the elevated water level, Eagle considered several short-term contingency methods to manage the water balance and after consultation with third parties, which included modeling and data analysis, the decision was made to temporarily add an additional reverse osmosis unit to treat surface water in addition to continuing treatment of deep water as the plant is designed to do. Furthermore, to mitigate this water level change and improve the overall capacity of the WTP, a number of water treatment plant debottlenecking projects commenced including the planned installation of an additional ultrafiltration unit, another reverse osmosis unit, and an additional clarifier. By the close of 2019, these additions are expected to bring the water level back within target operating levels.

In late 2018, Barr Engineering produced a GoldSim model prediction of the water levels which may result from expected operating conditions combined with seasonal average and above average snowpack, snowmelt, and precipitation events. Water levels were expected to be managed within the freeboard of the facility. This model was updated in March 2019 based on current snowpack and resulted in similar predictions.

As stated in a previous section, water lines from the industrial well were reconfigured and are no longer used as the primary water source for seal water which is needed in the mill processing facility. Water from this source is only used to refill the fire water storage tank as necessary. This resulted in a large decrease in groundwater consumption from this well.

Eagle utilizes an integrated groundwater, surface water, and water balance model to estimate the water balance based on several years of operational data. The model strives to estimate the water balance for the HTDF and surrounding watershed for both current watershed conditions and those consistent with pre-existing conditions prior to redevelopment of the Humboldt Mill. One of the outcomes of the effort was the development of a water discharge tool in the modeling program, GoldSim. The GoldSim tool, created in 2017, simulates the natural hydrologic cycle that occurred prior to Humboldt Mill operations and installation of the cut-off wall. The tool considers mill processes, current discharge from the WTP, precipitation, snowfall, and other weather factors such as evapotranspiration, temperature, and wind. When updated with current operational and weather information, the model provides a flow rate that Eagle should be discharging to the adjacent wetland system in order to maintain the natural (pre-existing) hydrologic balance as closely as possible. The response of the wetland will be continuously monitored over time to determine if the discharge quantities are appropriate to use as a basis of design for a passively controlled closure discharge structure.

Eagle Mine began utilizing the GoldSim discharge tool in 2017, and the model and tool will be continually refined as more data and wetland response observations become available. Copies of the 2018 quarterly water balance diagrams and HTDF water elevation data are included in Appendix D.

Aerial view of WTP and HTDF, October 2018

6. Materials Handling

6.1. Fuel Handling

The mobile diesel fuel truck, which is no longer in use at the Humboldt Mill, was the only bulk fuel storage source onsite in 2018. As of February 2019, a stationary bulk diesel tank, with a capacity of 3,000 gallons, is being utilized for fueling mobile equipment onsite. The bulk tank is refueled as necessary by an offsite fuel provider.

6.2. Bulk Chemical Handling and Storage

It is the goal of Eagle Mine to create a culture of environmental awareness throughout the workforce. Therefore, all employees and subcontractors are trained to immediately respond and report any spills that occur. In 2018, 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).

The Michigan SARA Title III Program requires reporting of onsite chemicals being stored above certain threshold quantities. Due to the volume of chemicals stored/used at the site for processing and water treatment, a Tier II Report was submitted in February 2018 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.

7. Monitoring Activities

7.1. Water Quality Monitoring

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

7.1.1. Quarterly Groundwater Quality Monitoring

Groundwater quality is monitored through a network of monitoring wells located inside the perimeter fence line of the mill site. The monitoring wells are classified as either compliance, leachate, facility or monitoring. Compliance wells are located on the north-side of the cut-off wall, outside of the influence of the HTDF; leachate wells are located on south-side of the cut-off wall and generally represent HTDF water quality; facility monitoring wells are located downgradient of each operating facility; the remaining monitoring wells are located north of the cut-off wall, but are not used to confirm effectiveness of the cut-off wall as the compliance and leachate wells are. A map of the well locations can be found in Appendix E. Four rounds of quarterly sampling were completed in March, May, August, and November 2018. The Eagle Mine Permit prescribes both a long parameter list for annual monitoring events (conducted in Q3 2018) and a short list to be used quarterly (Q1, Q2, Q4 2018). 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.

In April 2018, the calculated benchmark values were updated to incorporate all previously collected data for both groundwater and surface water to date and will be used in future benchmark analysis. These values were updated based on the methodology used in the Eagle Mine "Development of Site-Specific Benchmarks for Mine Permit Water Quality Monitoring, Version 3, March 2014" document prepared by North Jackson Company. The benchmark evaluation data tables used to perform this update are available upon request.

Monitoring Locations MW-702 QAL & UFB, Sept 2018

Monitoring Results

Twenty-four monitoring well samples were collected by TriMedia Environmental & Engineering (TriMedia) during each of the four quarterly sampling events. Samples were collected using low-flow sampling techniques, and field parameters (dissolved oxygen (DO), oxidation-reduction potential

(ORP), pH, specific conductivity, temperature, turbidity) are collected and analyzed using a flow-through cell and YSI probe. All samples are shipped overnight to Pace Analytical Services in Grand Rapids, Michigan, for analysis.

In accordance with Part 632, R426.406 (6) when a result is greater than a benchmark for two consecutive sampling events, at a compliance monitoring location, the permittee is required to notify the MDEQ and determine the potential source or cause resulting in the deviation from the benchmark. The following is a summary of the events that occurred in 2018:

- Due to turbidity levels that exceeded 3 NTU, eighteen of the twenty-four monitoring locations required field filtering for at least one quarter in 2018 and therefore the values are reported as dissolved concentrations. The remaining locations/quarters 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 fully recover due to the tight formation in which it is located. The presence of bentonite has also been observed in proximity to the screened interval of the monitoring well and may also contribute to the slow recharge rate at HW-1U. Samples from these locations are taken immediately and do not follow low-flow sampling procedures due to the limited volume of water available and slow re-charge rates.
- The majority of the metals and anion parameters analyzed reported values below the analytical reporting limit and are listed as non-detect. The cation parameters analyzed were detected at all locations with the majority of the detections below the calculated benchmarks. A summary of wells that have had one or more parameters exceed a benchmark value can be found in Appendix F.
- pH, chloride, nitrogen ammonia, and sodium were all detected above benchmark values in Q4 2017 and Q1 2018 at monitoring location HW-1U LLA. The results for these parameters all returned to baseline levels for the remainder of the year. As previously stated, HW-1U takes approximately four months to fully recover due to the tight formation in which it is located therefore low-flow sampling techniques cannot be used and results may not accurately characterize the true water quality of the location.
- Monitoring location HW-2 had results for sodium and HW-8 had results for sodium, chloride, and sulfate that were slightly above the established benchmarks for at least three of the four sampling quarters in 2018 and trended up in Q3-Q4. These locations are close to the access road to the WTP and Fenton Reactor area. A sand/salt mixture was added to the roadway starting in the winter of 2018 to ensure safe access to these locations and may be contributing to these results.
- KMW-5R is located near the COSA and reported values in Q1-Q2 2018 that were above established benchmarks for sodium, chloride, iron, mercury, and zinc. The parameters returned to baseline levels in Q3-Q4 2018. KMW-5R is a low capacity well that is pumped down a day in advance of sampling to help ensure the sample is accurately representing the

water quality of the location. Prior to Q3 2018, the location was sampled using a bailer which resulted in high turbidity and the introduction of sediment into the sample. The sediment was likely the source of many of the elevated results. In Q3-Q4 2018, a bladder pump was used for sampling which allows for low-flow monitoring techniques to be employed. This resulted in a significant reduction in turbidity and a more accurate assessment of water quality at this location.

- HYG-1 reported manganese results in 2018 that ranged from 587-671 ug/L versus a benchmark of 627 ug/L. Results trended down back towards baseline values from Q1 to Q4 2018.
- MW-703 DBA reported pH results in Q2-Q4 2018 that were below the established baseline range for this parameter. Results ranged from 8.38 SU to 8.81 SU compared to the lower benchmark range of 8.89 SU. Although slightly below the benchmark, the results continue to indicate a water quality that is basic in nature.
- Monitoring location MW-703 QAL is a compliance monitoring well located outside of the cut-off wall and therefore outside of the influence of the HTDF. With the exception of nitrogen, nitrate and pH all other results were found to be within the established benchmarks for the location. The results from MW-703 QAL were compared to leachate monitoring location MW-702 QAL to determine if there were any correlations. The review found that the pH at leachate location MW-702 QAL tends to be more basic and the major anion and cation results were consistently higher than those reported at MW-703 QAL. The water chemistry between the locations does not indicate that the water quality at MW-703 QAL is being influenced by the HTDF. Analytical results from this location are consistent with the results from 2017.
- Sulfate results at MW-704 QAL were greater than benchmarks in Q1-Q3 2018 and returned to baseline levels in Q4. Similar to 2017, results for sulfate tended to fluctuate above and below the established benchmarks which may be due to seasonal variation.
- The results for chloride and magnesium were above benchmark values at location MW-704 UFB in Q3-Q4 2018 and sulfate in Q2-Q4. Chloride and magnesium results were just above benchmarks and remained consistent in Q3-Q4. Sulfate results did trend up from Q1-Q4 2018. No additional parameters were found to be in excess of established benchmarks and no new activities were occurring in the area. The location will continue to be closely monitored to see if this trend continues.
- MW-704 LLA and MW-704 DBA reported results for hardness and alkalinity bicarbonate that were greater than benchmarks levels in three of four 2018 sampling quarters. Results fluctuated but remained only slightly above benchmark levels indicating the deviations may be related to seasonal variations.
- Sodium and chloride were above established benchmarks in Q3-Q4 2018 and results were found to trending up from baseline values at location MW-705 QAL. This location is also located near the access road to the WTP and Fenton Reactor and elevated results are likely due to the application of sand/salt on the roadway. The application of the de-icer started in this area in the winter of 2018 and therefore the timing of the elevated results correlates. Spring melt and excessive rainfall in 2018 likely caused sodium and chloride to be observed in the water more quickly than would be expected during a dry period.

- MW-705 UFB reported results for calcium and magnesium that were greater than benchmarks for this location in Q1, Q3, and Q4. The highest result was observed in Q1 and trended back to baseline values by Q4. The highest result for calcium, 29 mg/L was reported in Q1 compared to a benchmark of 26 mg/L.
- HW-8U and MW-701 QAL are similar in that sodium and chloride results have risen over the past year. Both locations are close to the access road to the WTP and Fenton Reactor area. A sand/salt mixture is used on the road to ensure safe access to these locations and may be contributing to these results.

A Mann-Kendall trend analysis was conducted for all groundwater locations. A parameter was considered to be trending if analysis determined a minimum confidence of 95%. Possible trends, either positive or negative, were identified for one or more parameters at ten compliance locations, four leachate monitoring wells, and ten monitoring locations (includes facility monitoring locations), using data collected from baseline sampling events (i.e. 2014) through December 2018. Alkalinity bicarbonate, pH, potassium, sodium and sulfate were the most frequently noted as possibly trending. Many of the results reported as potentially trending were summarized above.

A trend analysis will continue to be conducted after each quarterly monitoring event in 2019 and results reviewed to determine if the trends are attributable to milling operations. A table summarizing the potential groundwater trends can be found in Appendix G. For compliance and monitoring locations in which results were outside of established benchmarks for at least two consecutive quarters and a potential trend was identified, the trend charts are also provided in Appendix G.

7.1.2. Quarterly Surface Water Quality Monitoring

Surface water sampling was conducted on a quarterly basis in 2018 at eight surface water locations by TriMedia. 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 samples collected represent winter base flow, spring snowmelt/runoff, summer base flow, and the fall rain season. Samples were collected in March (Q1), May (Q2), September (Q3), and November (Q4) in 2018. A map of the surface water sampling locations is found in Appendix H. Samples are 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 (i.e. upper prediction limit) and are located in the tables found in Appendix I.

As stated in the groundwater quality monitoring section above (7.1.1), the surface water benchmark values were also recalculated in 2018 using results that were not determined to be trending based on statistical analysis. A sufficient data set was also available which allowed the establishment of benchmarks for each season which will help to account for seasonal variability. Benchmarks were not updated at locations HMP-009 and HMWQ-004 as they did not have enough data points to revise the benchmarks at this time. Results for these locations will continue to be compared to the initial benchmark values established in 2014. For the remaining locations, results will now be compared based on season variation (i.e. Q1 2017 compared to Q1 2018) per Special Permit Condition L2 of the Humboldt Mill Part 632 Mining Permit (MP 01 2010).


Escanaba River Monitoring Location MER-001, Sept 2018

Monitoring Results

The Humboldt Mill Surface Water and Sediment Monitoring Plan prescribes a long parameter list surface water samples that are collected annually (Q3 2018) and a shorter list to be used during the remaining quarterly monitoring events (Q1, Q2, Q4 2018). In addition to grab samples, field measurements (DO, pH, specific conductivity, temperature, and turbidity) were collected and determined through the use of an YSI multiparameter water quality monitoring platform. Flow measurements were obtained, where conditions allowed, using a wading rod and current meter. Flow rates for location MER-002 were recorded from the USGS website for the station located adjacent to the monitoring location (i.e. 04057800 Middle Branch Escanaba River Humboldt Mill location). Water quality samples were shipped overnight to Pace Analytical Services in Grand Rapids, Michigan, for analysis. Parameters requiring low-level analysis were sent to Eurofins Frontier Global Sciences in Bothell by subcontract of White Water Associates Laboratory in Amasa, MI.

The following is a summary of field observations that occurred at compliance monitoring locations in 2018:

- Water samples were unable to be collected in Q1 and Q4 at location HMP-009 due to frozen conditions within the wetland.
- Mercury and sodium were detected above benchmark levels for two consecutive Q3 sampling events at location HMP-009. It is expected that the elevated levels were likely related to the WTP effluent discharge as it strongly influenced this monitoring location prior to November 2018. In November, the discharge shifted to Outfall 004, which directly discharges to the Escanaba River.
- HMWQ-004 is located in an area in which the only contributions are related to precipitation and storm water run-off from the adjacent roadway, therefore sampling from this location is

dependent upon precipitation. Similar to previous years, there was insufficient water to collect samples from this location in 2018.

- MER-003 reported pH values that were greater than the established benchmark range for two consecutive Q2 and Q3 sampling events. Although the sample results were slightly above the benchmark ranges, the pH values observed at the two other Escanaba River locations MER-001 and MER-002 were also within the neutral pH range observed at MER-003.
- Results for boron and copper were above benchmarks for two consecutive Q3 sampling events at monitoring location WBR-003. The results were only slightly over the established benchmarks and returned to baseline levels in Q4 2018.

A Mann-Kendall trend analysis was also conducted for the surface water monitoring locations in 2018. Now that additional data has been collected, there is sufficient data to account for seasonal variation in the trend analysis. Possible trends, positive or negative, were identified for one or more parameters at four compliance and two reference monitoring locations using data collected from baseline sampling events (May 2014) through December 2018. These trends are summarized in Appendix J. A parameter was considered to be trending if analysis determined a minimum confidence of 95%. Based on this premise, over half of the parameters which were considered trending were observed during the Q2 sampling events. The Q2 event captures spring snowmelt where runoff from surrounding areas have historically resulted in temporary deviations from baseline. It should be noted that the elevated results and associated trends return to baseline levels in subsequent quarters showing that the results are likely due to seasonal variation.

A trend analysis will continue to be conducted after each quarterly monitoring event in 2019 and results reviewed to determine if the trends are attributable to milling operations. For compliance monitoring locations in which results were outside of established benchmarks for at least two consecutive quarters and a potential trend was identified, the 2018 trend charts are also provided in Appendix J.

7.2. Sediment Sampling

Sediment sampling is required on a biennial basis and was conducted on September 4, 2018 during the Q3 surface water sampling event. Sediment monitoring stations are co-located with surface water monitoring stations and consist of 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, WBR-002, and WBR-003. As required by the Part 632 Mining Permit, the sediment sample results were compared to the Consensus-Based Probable Effect Concentrations found in MacDonald et al., 2000. This included comparison to the threshold effects concentration (TEC) and probable effects concentration (PEC). A result below the TEC indicates that it is unlikely that harmful effects would be observed in sediment-dwelling organisms. In contrast, a result above the PEC indicates that harmful effects would likely be observed in sediment-dwelling organisms. To remove some of the uncertainty in effects, the Wisconsin DNR recommends calculating a Midpoint Effect Concentration (MEC) which is the calculated average between the TEC and PEC (i.e. TEC+PEC/2). Using the TEC, MEC, and PEC values, the WI DNR also established a rating system to better understand the level of concern the concentrations merit. The ranking is from one to four, with Level 1 being least concerning and Level 4, most concerning. This ranking system was used to help interpret the findings of the 2018 sediment sampling event which are summarized below.

- Six parameters at four different sampling locations had results that fell between the TEC and PEC. There were no instances where results were above PEC values.
- The arsenic result at location WBR-003 was found to be between the TEC and PEC. Review of results from the baseline sampling event conducted in May 2014, prior to the start of operations, found that the arsenic concentration at WBR-003 also fell within the TEC and PEC. The ranking for this location is a Level 2 in which there is low level of concern that harmful effects would be observed in sediment-dwelling organisms.
- Copper and nickel results at HMP-009 showed a slight increase compared to the 2016 results and fell between the TEC and PEC. This location is located near WTP Outfall 003 that was utilized for the majority of the 2018 and is strongly influenced by effluent water quality. As of November 2018, this outfall is no longer being used to discharge effluent to the wetland. The ranking for copper is a Level 2 and nickel is Level 3, in both cases, the results were below the PEC and are no harmful effects are expected to occur to sediment-dwelling organisms.
- Arsenic and copper at MER-002 were found just slightly over their respective TEC's. Arsenic levels have decreased from values observed during baseline monitoring in 2014. The copper concentrations increased in relation to previous results and reported just over the TEC in 2018. Both copper and arsenic results were rated as Level 2 indicating there is little concern that any ill effects would be observed.
- MER-003 sample results showed elevated levels of copper compared to the 2016 sample results. While the result is higher than those previously reported it remains below the PEC value for copper. The value for copper was rated as Level 3.

A summary of the sediment results is provided in Appendix K**.**

7.3. Regional Hydrologic Monitoring

7.3.1. Continuous Groundwater Elevations

Monitoring wells MW-701, MW-702, MW-703, MW-704, MW-705, HYG-1, HW-2, HW-1U, HW-1L, HW-8U are instrumented with continuous water level meters and downloaded quarterly by TriMedia field technicians. Permit condition F-9 requires that water levels are continuously monitored in Wetland EE and the HTDF. HTDF water level readings were recorded using a stilling well containing a pressure transducer which was installed in the HTDF to collect continuous water level measurements. To ensure accurate readings in the winter, an "ice eater" was installed to prevent the water surrounding the stilling well from freezing. A map of monitoring locations can be found in Appendix G.

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. As previously reported, the operating level of the HTDF was lowered from what was originally planned resulting in the HTDF water elevation being lower than the wetland elevation located outside of the cut-off wall. As of the time of this writing, there is a near neutral gradient between the wetland and the HTDF, therefore, the gradients cannot be measured in either direction. 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.

Continuous groundwater elevation results are reported by water year (October 1 – September 30). Water year is the preferred approach for reporting water levels, because the hydrographs demonstrate the effect of late fall and winter precipitation, which melts and drains in spring, in one 12-month hydrologic cycle. Copies of groundwater hydrographs are located in Appendix L. 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.
- Equipment malfunctions which resulted in data gaps of continuous water level data occurred at four locations over the course of the year. All water level meters were replaced as soon as possible after discovery of the malfunction. Table 7.3.1 summarizes the locations, duration, and potential cause of equipment malfunctions:

Table 7.3.1 Summary of Continuous Monitoring Equipment Malfunctions

Location(s)	Date Equipment Malfunction Occurred	Reason for Malfunction
HW-1U	7/25/18 – 9/13/18	Battery Failure
HW-8U	8/16/18 – 12/18/18	Battery Failure
MW-703 LLA	3/22/18-5/22/18	Battery Failure
MW-704 DBA	9/16/17 – 3/15/18	Battery Failure

- HW-1L, HW-1U LLA, MW-702 UFB, and MW-703 UFB are located in a tight formation and are very slow to recharge. MW-702 UFB, and MW-703 UFB takes approximately one month to recharge and HW-1L and HW-1U LLA takes almost four months to fully recharge. The slow recharge rates are an indication that the integrity of the cut-off wall is intact.
- Due to the rising HTDF water level, as expected, the variances between the HTDF water level and monitoring well elevations observed earlier in the year, diminished as the year progressed. At locations, MW-703 DBA, MW-704 DBA, MW-704 LLA, and MW-703 QAL, the HTDF water elevation and water levels observed in the monitoring wells were similar indicating a neutral gradient between the wetland and HTDF may have been present.
- Similar to previous years, most of the shallower, quaternary aquifer wells displayed signs of seasonal influence as groundwater elevations decreased during the winter months and increased again in during the onset of spring melt.

7.3.2. 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) and the recirculation of Escanaba River water as managed by Eagle Mine. The purpose of the continuous water level measurements is to monitor the effectiveness of the cut-off wall and record seasonal variations. However, in accordance with NPDES permit MI0058649, Eagle is required to maintain the hydrology of the wetland and deliver water flows that represent post-closure flows. This is currently accomplished through the use of a river water intake/recirculation system and due to this requirement the monitoring objective can no longer be met and therefore continuous readings are not being collected. However, surface water grab samples and field parameters will be collected quarterly when possible although results will be strongly influenced by Escanaba River water quality.

7.4. 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 (HTDF side) 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. Results from leachate monitoring location MW-701 are compared to compliance location MW-704 and results from leachate monitoring location MW-702 are compared to compliance location MW-703.

<u>Chemical Signature Review</u>

- The majority of the metals and anion parameters were consistently non-detect at both the compliance and leachate monitoring locations, therefore, chemical signature comparisons were focused on iron, manganese, mercury, chloride, sulfate, and cation parameters as these were the most frequently detected.
- In the quaternary unconsolidated formation, the iron, manganese, and mercury results were all significantly higher at compliance location MW-704 than were reported at leachate well MW-701 while chloride and all of the major cations where higher at MW-701. Iron was also higher in MW-704 in the upper fracture bedrock zone, while manganese was more than two times greater in MW-701 than MW-704. Sulfate, chloride and most cations were also found to be higher in MW-704 than leachate well MW-701. These results indicate there is a distinct difference between the leachate and compliance locations. If the containment wall was compromised, the results at the MW-701 and MW-704 would be similar.
- At leachate location MW-702 QAL pH, mercury, alkalinity bicarbonate, nitrate, calcium, sodium, sulfate, potassium and hardness were greater than results reported at compliance location MW-703 QAL. The distinct difference between the results indicate that the containment wall is functioning as expected as the results would otherwise be closer in comparison.
- Similar to previous years, iron, manganese, and sulfate were greater at compliance location MW-703 UFB than compared to leachate monitoring location MW-702 UFB. The pH results during the final two quarters of the year were also distinctly different between the two locations. Again, the differences between the leachate and compliance wells show that the containment wall has not been compromised as results would be similar if it was not functioning properly.

Water Level Review

- As previously stated in Section 5.4 of this report, the HTDF water elevation and groundwater elevations on the opposite side of the cutoff wall are currently at similar elevations. The rise in HTDF elevation is due to operational changes at the water treatment plant coupled with above average precipitation in the fall of 2018. The same is true of the elevations found in the MW-702 and 703 QAL wells.
- 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 continue to trend closely with HTDF water levels.
- Compliance monitoring location MW-703 QAL and leachate location MW-702 QAL have similar water level readings which is expected due to the current elevation of the HTDF.
- The groundwater elevations at compliance monitoring locations MW-704 QAL and UFB are approximately three feet higher than those reported at leachate monitoring locations MW-701 QAL and UFB. As expected, the water elevations recorded at MW-701 are closer to elevations reported in the HTDF. The distinct separation between the leachate and compliance monitoring wells show that the containment wall is functioning as designed.

Based on the review of the chemical signature and groundwater elevations of the leachate and compliance monitoring wells there is sufficient evidence to show 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.

7.5. Biological Monitoring

Biological monitoring events conducted in 2018 included surveys of birds, large and small mammals, frogs, toads, fish and macro invertebrates. Results from each survey have been compiled into annual reports which are available upon request. A brief summary of each survey is provided below.

7.5.1. Flora and Fauna Report

The 2018 flora, fauna, and wetland vegetation surveys were conducted by King & MacGregor Environmental, Inc. (KME). Table 7.5.1 below outlines the type and duration of the surveys that were conducted in 2018. A map of the survey locations can be found in Appendix M.

Table 7.5.1 Type and Duration of 2018 Ecological Investigation

Survey Type	Survey Date
Birds	June 11-12; September 17, 20
Small Mammals	September 18-20
Large Mammals	May - September
Toads/Frogs	May 1-2, 31; July 2
Threatened and Endangered Species	May - September

The wildlife and plant species identified during the 2018 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 428 birds representing 57 species were observed during the 2018 (June and September) surveys. In June, the Canada Goose and the white-throated sparrow were the most abundant birds observed, while the white-throated sparrow and Black-capped Chickadee were the most abundant species observed during the September 2018 survey. There was roughly the same number of Canada Geese observed in 2018 compared to 2017 (80 vs. 86 individuals) and similar to previous years it had the highest relative abundance out of all species (13.3%). There was an overall decrease in count by 86 individuals from the 2017 survey to 2018. The difference in the number of birds observed from year to year can be influenced by weather conditions including temperature, wind speed, etc., and therefore variations are expected to occur between survey events. The bird species identified in 2018 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.
- Thirty-five small mammals representing nine species were collected during the September survey period. The total number of individuals captured in 2018 increased by 3 compared to 2017 but the species richness remained the same. The most common small mammal identified during the survey being the white-footed mouse followed by 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 Areas during the 2018 surveys are typical of those expected in the habitats present and are consistent with previous survey results.
- A bobcat and a black bear with cubs were observed within the Study Area during the 2018 surveys, while tracks and scat of Whitetail deer and moose and scat of coyote were also observed. Previously observed or other regionally common species possibly present within the Study Area, but not observed during the 2018 surveys include the federally endangered gray wolf (Canis lupus), and red fox (Vulpes vulpes). The large mammal species detected during the 2018 surveys are regionally common large mammal species and are expected to utilize the habitats present.
- Four frog species were heard during the 2018 survey; none of which are threatened or endangered. Breeding frog calls were heard at all five sampling points. Similar to 2017, the most frequently heard species during the surveys in 2018 was the northern spring peeper. As stated in previous studies, elevated noise levels related to operations were noted at survey points 2 and 3, potentially diminishing the observer’s ability to hear and distinguish calls. All of the frog species identified are typical of those expected in the habitats present in the Study Area.

7.5.2. 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. Table 7.5.2 lists the species identified during the MNFI review process.

Table 7.5.2 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 threatened and endangered species survey:

- Canada grass was not observed in 2018 and is not expected to occur in the study area due to the lack of suitable habitat.
- American bittern was observed near Survey Point 5 in June, 2018.
- In July 2018, the bald eagle nest on the north shore of Lake Lory was occupied by two adults and at least one juvenile.
- Although suitable habitat for osprey is present in the study area, no birds were directly observed in 2014, 2015, 2016, or 2017.
- In May and June 2017, 10 of 15 nests were identified as active in the heron rookery. The great blue heron rookery appears to be robust and unaffected by Mill operations.

A copy of the 2018 Humboldt Mill flora and fauna report is available upon request.

7.5.3. Fisheries and Macro Invertebrate Report

The 2018 Fisheries and Macro-Invertebrate annual surveys were conducted by Advanced Ecological Management (AEM). A total of six stations were surveyed in June 2018, including two stations on the Middle Branch of the Escanaba River (MBER), one station on a tributary of the Middle Branch of the Escanaba, one station on an unnamed tributary of the Black River (WBR), one station in Wetland Complex EE located northeast of the HTDF, and Lake Lory. A map of the survey locations can be found in Appendix N.

__Stream Stations__

A total of 120 fish representing 13 species were collected in 2018 from all stream stations, which is almost double the amount of fish that were observed in 2017. The reason for the dramatic increase in fish totals is due to 57 central mudminnows being detected this year; 27 of them coming from Station MBER1 alone. Last year only 16 of these fish were documented at all stations combined during the study. The Central mudminnow was the most frequently collected species (57) followed by the pearl dace (16). No threatened, endangered, or special concern fish species were observed at any of the stream stations in 2018. The following is a summary of the findings:

- The community composition of fish species was generally consistent over the past five years.
- A beaver dam located near Station 1 that has been observed since 2014, continues to influence the hydrology and potentially the number of fish collected during the surveys at that location.

- The number and species of fish observed at Station 5 has been consistent over the past two years with 14 total fish captured in 2017 and 16 captured in 2018. Even though brook trout were captured during the study last year, none were observed at this station this year.
- Seventy-six fish were collected between MBER1 & 2, which is over triple the amount of fish observed at these locations last year. The central mudminnow was the most frequently observed species at both MBER1 and MBER2 this year.

Using the P-51 protocol, a total of 939 macro-invertebrates, representing 41 taxa, were collected from all four stream stations investigated in 2018. The total number of macro-invertebrates collected in 2018 increased by 242 specimens compared to 2017. Stations 5 and MBER2 both increased by over 100 individuals while Stations 1 and MBER1 remained generally consistent. No threatened, endangered, or special concern macroinvertebrate species were observed at any of the stream stations in 2018.

A summary of the fish, macroinvertebrate, and habitat ratings for the four stream stations are displayed in Table 7.5.3 below. Stream habitat was considered “excellent” in stations MBER1 and MBER2 and “good” at station 1 and 5. The fish community was rated as “poor” at each of the four stations in 2018. The macroinvertebrate community rating at Station 1 changed from “acceptable” in 2016 to “poor” in 2017 but returned to “acceptable” in 2018 due to the increase in the total number of taxa collected during the aquatic survey. Station 1 has exhibited annual variations in macroinvertebrates in both number and taxa since the study began.

Table 7.5.3 2018 Habitat Ratings

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

Lake Lory

A total of 165 fish representing ten taxa were collected from Lake Lory in 2018 which is more than the 152 fish that were captured in 2017. Historically, the community composition has been generally consistent at this location. In 2018, largemouth bass (Micropterus salmoides) and yellow perch (Perca flavescens) were the most frequently collected species followed by Bluegills (Lepomis macrochirus). Many of the fish observed in Lake Lory appear to be in good condition, but similar to previous years, it was found that black spot, which is caused by a natural parasite (larval trematode) that burrows into the skin of the fish, was observed in several species. Review of the Michigan Department of Natural Resources website found that black spot is a common disease in earthen bottom ponds and lakes.

Aquatic macroinvertebrate sampling was conducted on June 7, 2018 within Lake Lory where a total of 157 macroinvertebrates were collected, which is 17 fewer than the total 174 macroinvertebrates that were collected in 2017. Snails, true flies, and dragonflies were the most abundant macroinvertebrates within Lake Lory, and the 2018 community composition was generally consistent with the 2015 through 2017 macroinvertebrate communities. No threatened, endangered, or special concern macroinvertebrate species were observed in Lake Lory.

Lake Lory, June 2018

Wetland EE

Two brook stickleback (Culaea inconstans) were collected from Wetland EE during the 2018 study and zero fish were collected during the 2017 study. In 2016, one juvenile brook stickleback was collected from this location and no fish were collected during the 2015 aquatic survey.

Aquatic macroinvertebrate sampling was conducted on June 6, 2018, where a total of 44 macroinvertebrates were collected, which is less than half of what was detected in 2017 (96 total). A total of 18 macroinvertebrates were Chironomids (true flies known as midges) and 5 aquatic snails comprised over half of the species collected. Predaceous diving beetles (Dytiscidae) and true bugs were also collected during the 2017 aquatic survey. No threatened, endangered, or special concern macroinvertebrate species were observed in Wetland Complex EE. The 2018 aquatic vegetation density appeared to be consistent with the observations made in 2017 in that cattails have grown in most of the areas of Wetland Complex EE that were previously open water. A copy of the 2018 Humboldt Mill Aquatic Survey Report is available upon request.

7.5.4. Fish Tissue Survey

No fish tissue survey was completed in 2018. The next survey will be conducted in 2020.

7.6. Miscellaneous Monitoring

7.6.1. Soil Erosion Control Measures

Soil erosion and sedimentation control (SESC) measures related to the construction of mining facilities now falls under the purview of Part 632. Due to the WTP expansion project, earthwork was needed to be performed on the east side of the existing building. Silt fence and rip-rap was installed where the risk of soil erosion and sedimentation was present, primarily near the adjacent wetland boundary areas. Silt fence remains along the HTDF where additional work on the cut-off wall is scheduled to occur in the future. The Department will be notified in the event that any construction activities occur in which soil erosion measures are necessary and all inspections will be completed as required.

7.6.2. Impermeable Surface Inspections

The Impermeable Surface Inspection and Surface Repair Plan outlines the requirements of integrity monitoring of surfaces exposed to site storm water and areas of ore, concentrate and chemical handling/storage. Areas inspected in 2018 included sumps and floors of the coarse ore storage area, concentrator building, concentrate load out facility, and WTP. Monitoring was conducted monthly as required by the plan.

Floors are inspected for cracks and overall general condition and the sumps are evaluated for any areas of cracking, pitting, 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 Mill Services Building. 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. Other than minor, superficial cracks within the Concentrator building, no notable issues were identified in 2018.

7.6.3. Tailings Line Inspection

In accordance with Mining Permit Condition E-12, the double-walled HDPE pipeline is monitored by mill operators and Environmental Department staff. Any concerns identified during the inspections would be immediately reported to the Mill operations and maintenance departments who would complete any necessary repairs. The following items were identified in 2017:

- Weekly inspections of the tailings lines found that in cold weather months minor amounts of water was introduced into the sump located in the shore vault building. Similar to previous years, this likely results from condensation which builds up within the outer pipe and not the result of a leak in the tailings lines.
- In July of 2018, a routine inspection found that two threaded plugs were missing from inspection ports along one of the tailings lines. These inspection ports are approximately one inch in diameter and located on the outside piping. These are opened periodically so that the Maintenance Dept can inspect the inner piping. Shortly after discovering that the plugs were missing, the Maintenance Dept was notified and the plugs were reinstalled.

7.6.4. Geochemistry Program

In accordance with Permit Condition F-1, Eagle continued implementation of the comprehensive HTDF geochemistry monitoring program which was prepared by Hatch Associates in 2015. In 2018, the monitoring program included collecting high resolution physiochemical profiles, limnological modeling, water quality monitoring, characterization of watershed input chemistry, and interpretation of the effects of changes in water management, water treatment, and tailings deposition on the chemistry and layer dynamics within the facility.

Between January and August 2018, Eagle continued to conduct physiochemical monitoring of the HTDF using a multiparameter probe lowered over the side of the boat (or through the ice) to multiple depths. In August 2018 Eagle commissioned a new auto-profiling device moored to a buoy in the center of the HTDF. The auto-profiler enables automatic readings at high resolutions over the entire water column four times per day. The device chosen, was a YSI EXO 1, that measures temperature, specific conductance, pH, dissolved oxygen, oxidation-reduction potential, turbidity, blue-green algae, chlorophyll a, and fluorescent dissolved organic matter (FDOM) which is a proxy for total dissolved carbon. This profiling device provided a more detailed understanding of the lake processes at a faster rate than previous methods. The device was removed from the HTDF in November to prevent damage from ice formation during the winter months but will be used annually during ice-off conditions.

YSI EXO 1 Auto-profiler located on the HTDF, August 2018

Geochemists studied the profiles extensively along with historical profile data and found and/or confirmed that the HTDF exhibits three distinct layers: 1) a mixolimnion seasonally divided into and epilimnion and a hypolimnion; 2) an upper convection cell, and 3) a lower convection cell. Two transitional boundary layers are present between the layers; an upper and lower chemocline. The lower convection cell is driven by warm buoyant tailings slurry. The upper convection cell was first observed in late 2017, convection in this layer stopped in the May-June timeframe, and profiles in late 2018 indicated the re-formation of the convection cell going into winter ice conditions. It is plausible that the transient nature of the convection cell is due to downward mixing of cold water during spring turnover, the re-start of tailings deposition at depth along the perimeter of the HTDF (rather than in the center), or related to the relocation of reclaim water and water treatment intake and brine return lines to deeper points within the HTDF. The convection cells will be studied further in 2019.

The planned changes in water treatment which were implemented in 2018 to lower the chemocline were effective. The elevation of the tailings convection cell dropped over 10 feet following the implementation of these management changes, though the top of the chemocline remained at a similar elevation from the fall 2017 and 2018 turnover events. Importantly, the chemocline did not rise while the concentration of dissolved solids was increased at a greater depth.

The HTDF continued to be stratified in 2018. As previously experienced, in the spring and fall there were thermodynamically driven shallow turnover events within the mixolimnion with some partial erosion of the upper layer of the chemocline, but complete mixing of the entire water body did not occur. Limnological models predict that the HTDF will remain stratified in 2019.

During the fall 2018 turnover event, sulfur gas odors were detected. These sulfur gasses were previously measured and monitored in the HTDF for potential health and safety concerns, but those concerns were ruled out due to low concentrations of the sulfur gasses, however, the sulfur gasses are notably odorous at low concentrations and are noticed most readily on low barometric pressure days when fall turnover is occurring. The YSI EXO 1 buoy was installed on the HTDF during these events, and the profiler detected anomalies in FDOM and turbidity in the chemocline coincident with these events, possibly indicating the exsolution of carbon dioxide from the chemocline. Consultants studying this phenomenon believe that biogenic production of sulfur gas species may become liberated when carbon dioxide is released from the chemocline. A more detailed study is being conducted in early 2019. Odor events are expected during operations in turnover timeframes. When the HTDF re-stratifies seasonally, these events are not expected to occur.

Similar to previous years, water chemistry profile samples were collected on August 8, 2018 from one location within the HTDF at multiple depths to monitor changes in total concentrations and constituents of interest (COI) over time. All water samples collected were sent to a certified lab for analysis.

The geochemist made the following observations regarding water quality:

- Fe, Al, As, Cr, Co, Cu, and Ni are believed to be actively removed in the water column through inorganic reactions.
- Sb, Ba, B, Cd, Ca, Cl, Pb, Li, Mg, Mn, Mo, K Se, Na, Sr, and Zn are considered to be present in dissolved form.
- TDS, K, Na, Sulfate, B, Carbonate, and total organic carbon are increasing and increase with depth.
- Mn, Ba, As, Mg, and P increased in specific layers compared to 2017 observations.
- Cl, Fe, Ni, Hg, Cu, Cd, Cr, Pb, Li, Mo, Sr, and Zn are showing little change over time, but generally increase in concentration with depth.
- Sb, Se, Co, and Ca are decreasing in concentration over time.
- The layer containing tailings slurry exhibits high chemical oxidation demand.
- Nitrogen is steadily depleted over time from 2010 to present.
- Ammonia levels have remained constant over time.
- Thiosulfate concentrations decreased while sulfide increased in the chemocline and convection cell.
- Laboratory interferences with the matrix may be causing erroneous results for chloride. This will be rectified to ensure accurate mass and charge balancing for modeling purposes.

Late in 2017, Eagle commissioned a specialty laboratory to conduct biomass sampling of the HTDF for characterization of the microbiological communities in various layers of the HTDF. The laboratory was selected for their specialty in conducting DNA sequencing of these bacteria to determine the speciation, abundance, and biochemical reactions that the microbiota may contribute based on the layer chemistry. In 2018, the consultant provided results of the study. The study found sulfate reducing bacteria (SRB) at depth and indicated that both thiosalts and sulfur gas species detected previously in Eagle's studies may be biogenic in nature. Sulfate oxidizing bacteria (SOB) were found at the surface of the HTDF which could be used to oxidize sulfide to elemental sulfur. Finally, the study found a high abundance of the bacteria *Xanthomonas*, which oxidize xanthate used in the beneficiation process. These bacteria can contribute to biodegradation of xanthate to alcohols and other sulfur species. This information is useful to engineers studying water treatment processes which may have the ability to complete this biodegradation process.

The microbiological consultant was again onsite in late 2018 to study biofouling present in the water treatment plant and within the mill process where water from the deep part of the HTDF is being used as process water, seal water, or is undergoing water treatment processing. Heavy biofouling of membrane systems in the plant hindered throughput from the water treatment plant in the second half of the year despite modifications to membrane cleaning methods and cleaning additives. The microbiologist is studying the organisms that are present in residues on the plant equipment and is using bench testing to determine whether changes in redox chemistry or routine equipment cleaning additives can better control the biofouling of these systems. Importantly, the study determined that while bacteria were abundant and could readily form biofilms that are resistant to cleaning, they were low in diversity, which is often associated with mineral deposits, and therefore may be simpler to target with control methods. There were no pathogenic bacteria found in any sampling in the study. Recommendations for biofilm control are expected by summer 2019.

Additional studies completed included an update to the tailings deposition model based on the 2018 life of mine schedule including Eagle East as currently delineated. The consultant generated a deposition plan designed to maximize tailings storage through the end of operation in 2023. Based on the May 2018 life of mine, the HTDF was predicted to have sufficient volume to store all tailings expected to be produced at Eagle and Eagle East. Additionally, consultants partnered to evaluate several options for long term water treatment given the life of mine schedule. Eagle is in the process of upgrading systems in the water treatment facility to accomplish near term water treatment needs and will phase in long term water treatment processes as operations continue in 2019.

Eagle also commenced studies regarding the geochemistry of the watershed contributors to the HTDF to improve the accuracy of this input in modeling. This included collecting snowmelt samples from within the catchment area. Precipitation sampling began to establish a baseline for atmospheric deposition of metals being added to the HTDF, specifically mercury.

Further modeling attention was placed on using the updated conceptual model to determine likely closure scenarios for water treatment, so that long-term water treatment decisions could be made in appropriate timeframes. The consultants partnered to produce a new PHREEQC model for the HTDF to be used for closure related modeling. This will be completed in 2019.

8. Reclamation Activities

No reclamation activities occurred in 2018 and there are currently no plans to conduct any reclamation activities in 2019. The Department will be notified, in advance, if any activities do commence in 2019.

Closure planning continued in 2018 and included detailed planning and commencement of technical studies needed to support closure planning for the facility. This process was initiated in 2017 due of the Lundin corporate requirement to have a written closure plan in place five years in advance of anticipated closure. The closure plan will remain flexible to support change or growth within the business.

9. Contingency Plan Update

One element of the contingency plan is to test the effectiveness on an annual basis. Testing is comprised of two components. The first component is participation in adequate training programs for individuals involved in responding to emergencies and the second component is a mock field test.

In 2015, the Humboldt Mill Emergency Response Team (ERT) was formed to assist in emergency response situations should they arise. This team is not required by the Mine Safety Health Administration (MSHA) but was established to help ensure the safety of employees while at work. The team is comprised of 13 individuals that are divided into four teams each of which includes two licensed emergency medical technicians (EMT) and two National Fire Protection Association (NFPA) certified firefighter. Training occurs on a monthly basis and in 2018 included first aid, rapid trauma assessments, assisting with fire drills, extrication from various facilities and equipment, triaging multiple patients and completion of a 40-hour high angle rescue and confined space rescue technician training. The monthly trainings have at minimum two scenarios that facilitate response from the Emergency Response Team.

In addition to the ERT, security personnel are EMTs and paramedics who are trained in accordance with state and federal regulations. This allows for immediate response to medical emergency situations.

Two mock field tests were completed in 2018. The first occurred in June 2018 and involved the emergency response team, security personnel, and local emergency responders. The drill involved multiple staged patients with different injuries to test the response, effectiveness, and interagency coordination of the local Emergency Medical Services, Fire Departments, Marquette County Emergency Management, Marquette County Central Dispatch, Humboldt Mill Security, and Humboldt Mill ERT.

Interagency exercise, June 2018

The second mock field test was conducted in May 2018 and was a desktop exercise which tested the emergency response measures of the contingency plan and crisis management plan in place at Eagle Mine. With the assistance of Eagle Mine employees, a third-party consultant developed an emergency scenario. The scenario generally involves a situation in which both safety and environmental risks are considered and in 2018 the emergency was related to fires, and associated emissions, in the concentrator building at the mill and equipment fire underground at the mine. The crisis management team was aware that a test would occur but were unaware of the nature of the emergency. Two rooms were utilized during the exercise, the first contained the crisis management team and the second contained the “actors” playing roles of employees, regulators, local politicians, media outlets, and concerned citizens and family members. The actors had a loose script developed by the consultant which ensured that certain elements were included and that the scenario progressed at a pre-determined pace. During the crisis management exercise, the third-party consultant observed the activity to identify strengths, weaknesses and opportunities for improvement. Once the exercise was complete, the consultant and crisis management team held a debrief session to capture feedback from each participant. Following this session, the consultant captured the overall feedback and prepared a report with actions for improvement. Throughout the following 12-month period, the crisis management team meets on a quarterly basis to review and update the status on those actions in preparation for the annual exercise.

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

10. Financial Assurance Update

A detailed review of closure costs was completed in 2018 with the information used to update the financial assurance cost estimate. Updated reclamation costs can be found in Appendix P. It is understood that the MDEQ will notify Eagle if these updated costs require re-negotiation of the current bond for financial assurance.

11. Organizational Information

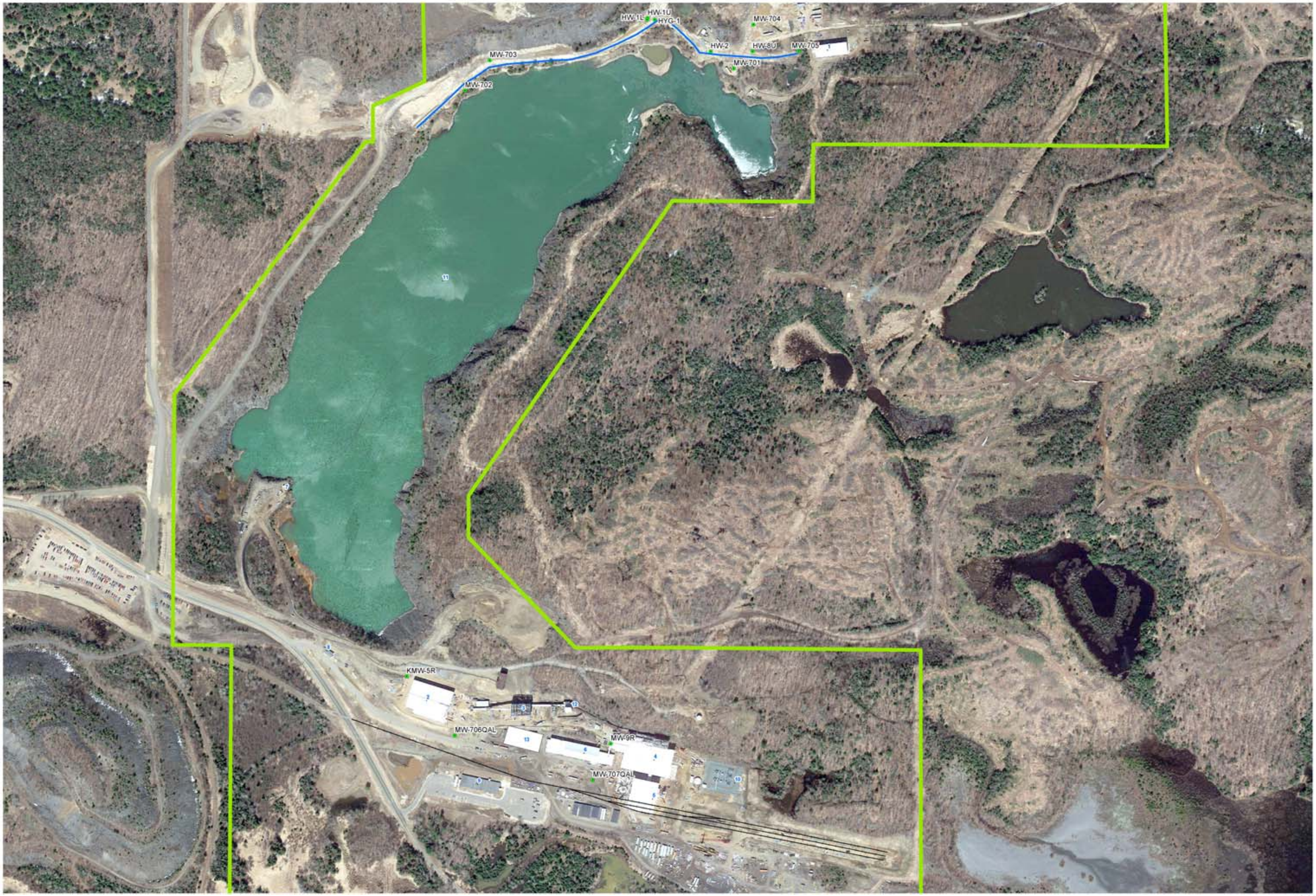
An updated organization report can be found in Appendix Q.

Appendix A

Humboldt Mill

Site Map

Eagle Mine LLC Humboldt Mill Monitoring Map



Date: 2/4/2016

Legend

- RailSpur
- 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
- 13 - Cold Storage Building

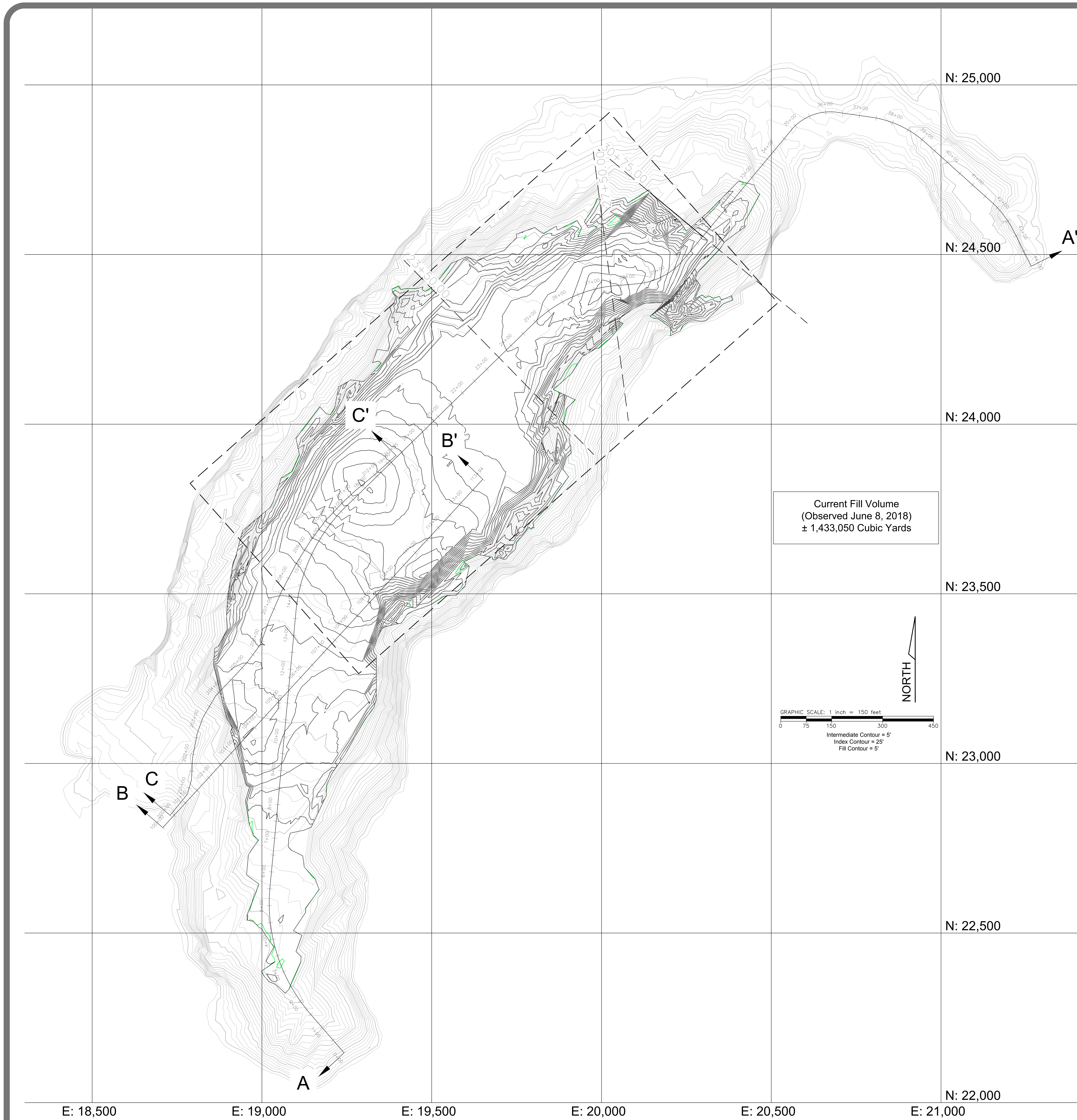
0 0.05 0.1 0.2 0.3 0.4 0.5 Miles

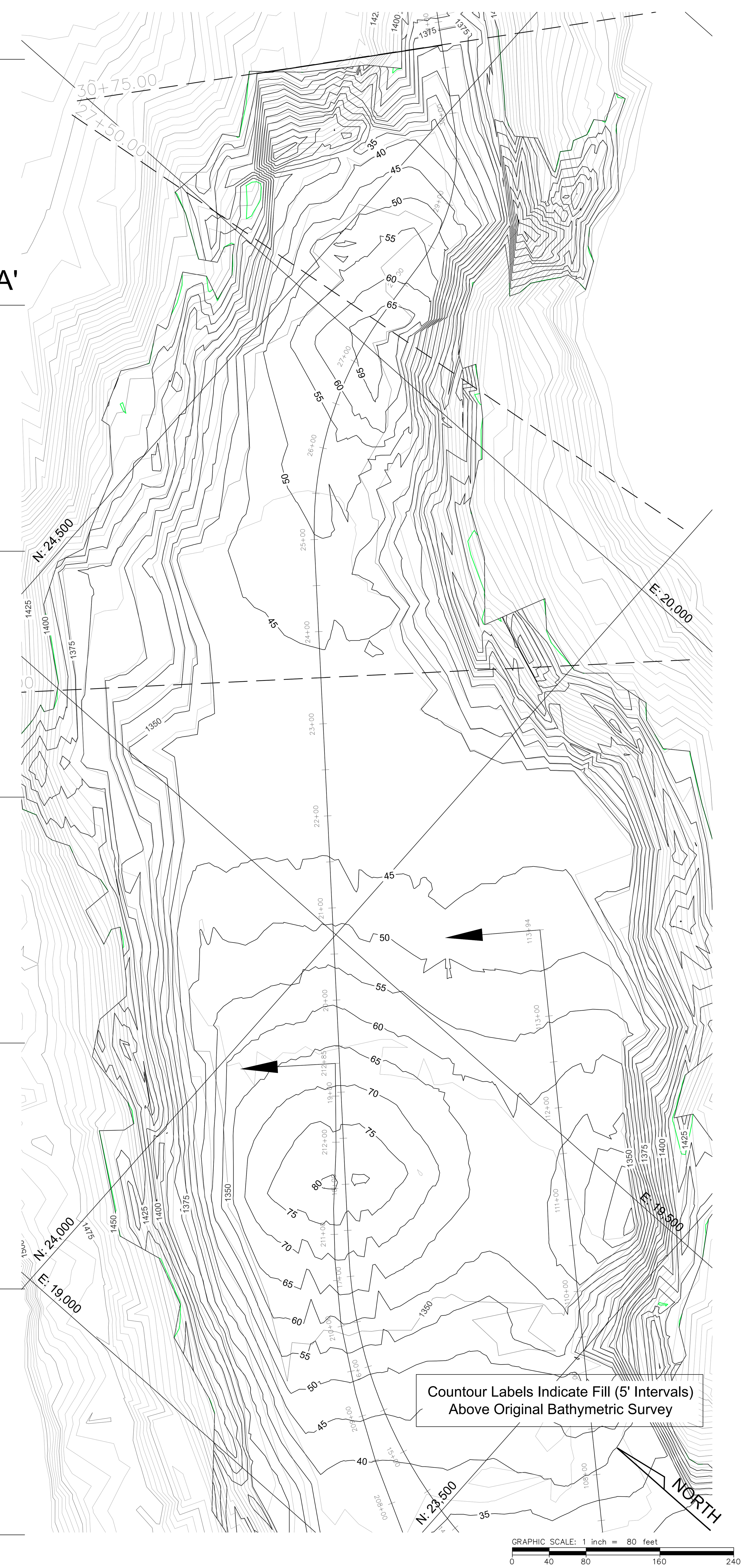
N W E S

Appendix B

Humboldt Mill

Bathymetry Maps





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
June 8, 2018 Bathymetric Survey
Champion, MI

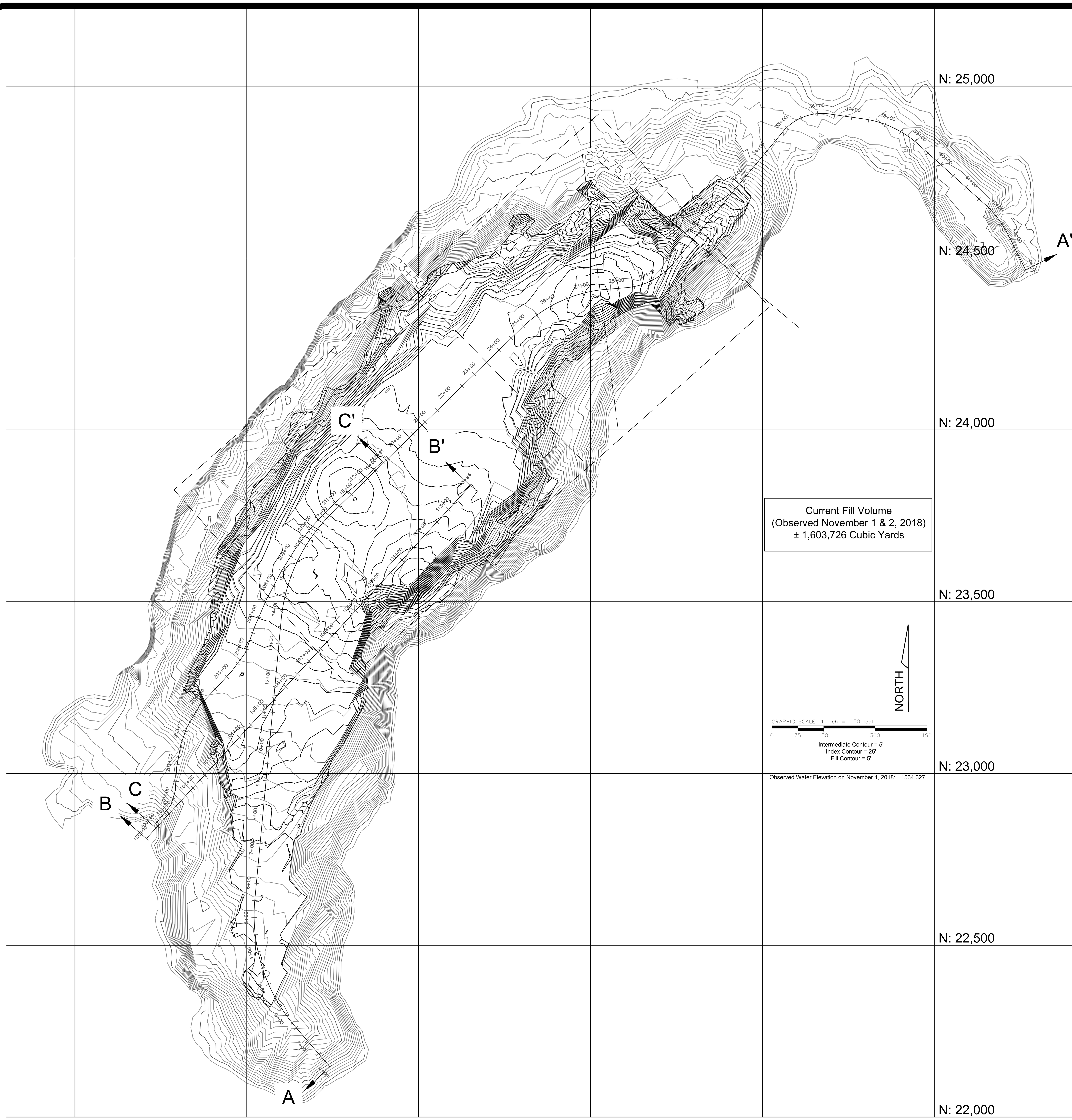
DATE	DESCRIPTION	ISSUED

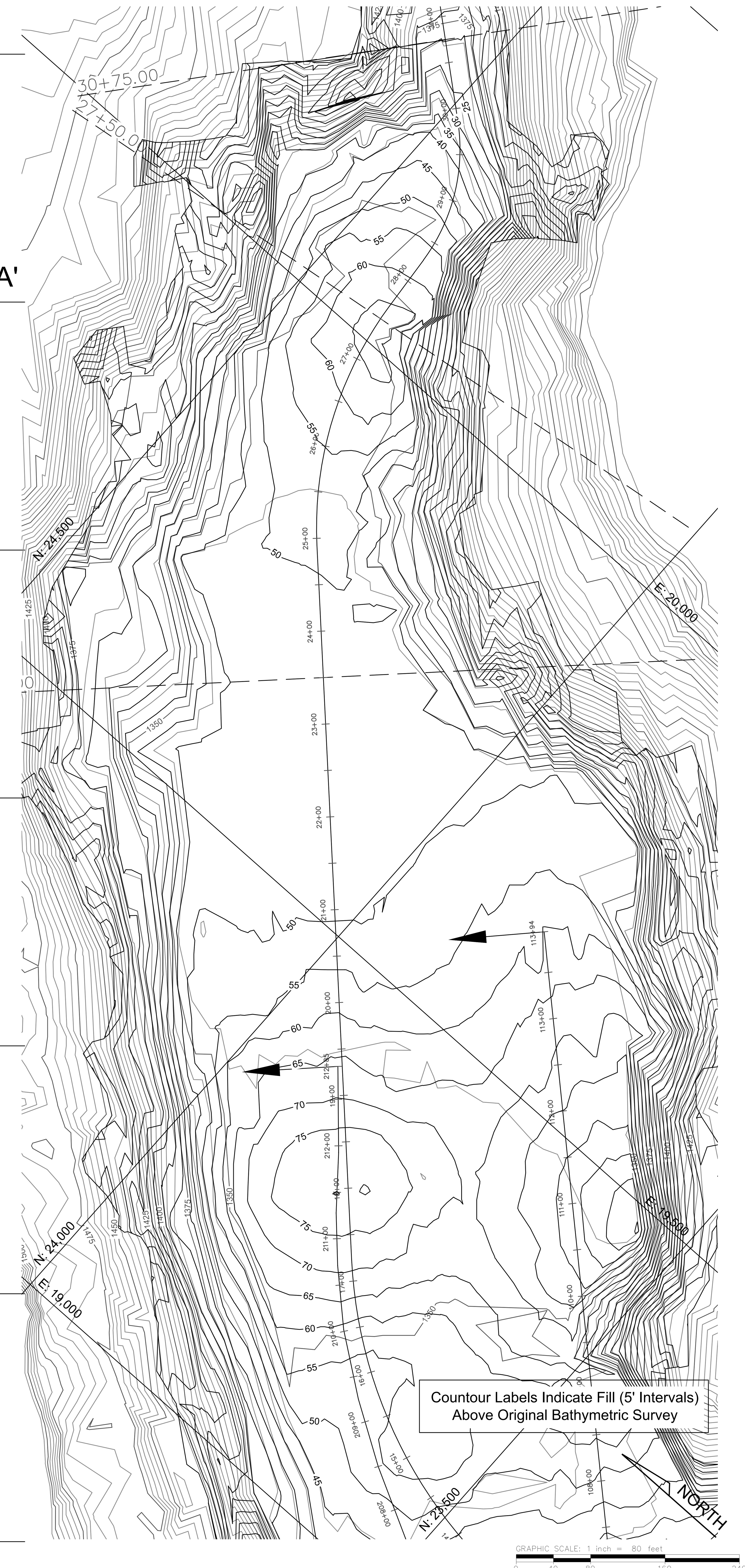
DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
Product Fill Map

SHEET NUMBER:
1.0





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
November 1 & 2, 2018 Bathymetric Survey
Champion, MI

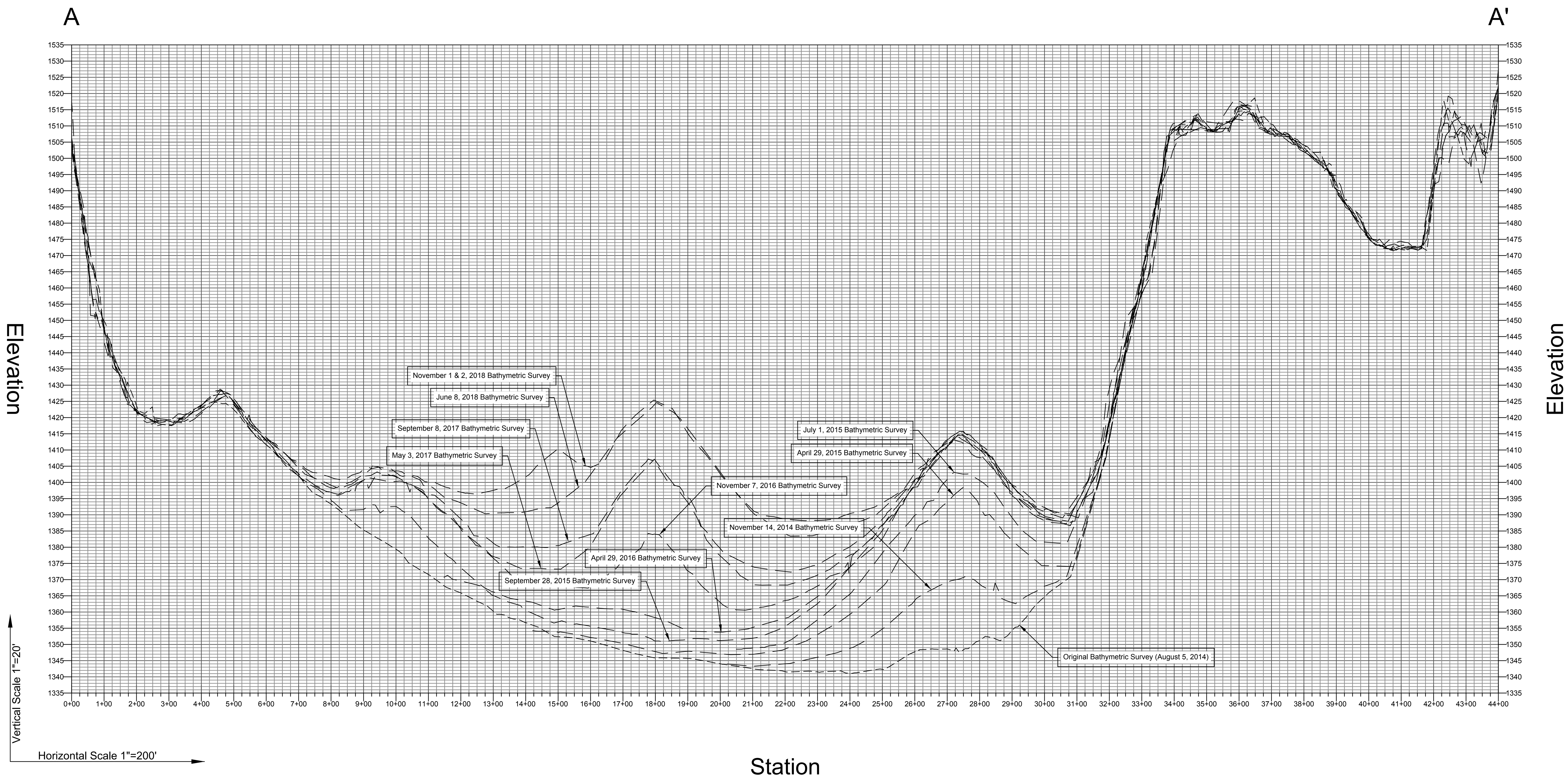
DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
Product Fill Map

SHEET NUMBER:
1.0



C:\Users\mmetcalf\Desktop\PROJECTS\2014\2014-100\2014-100 Humboldt Tailings Basin CutFill 11022018 With Gridlines_Current.dwg

TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
November 1 & 2, 2018 Bathymetric Survey
Champion, MI

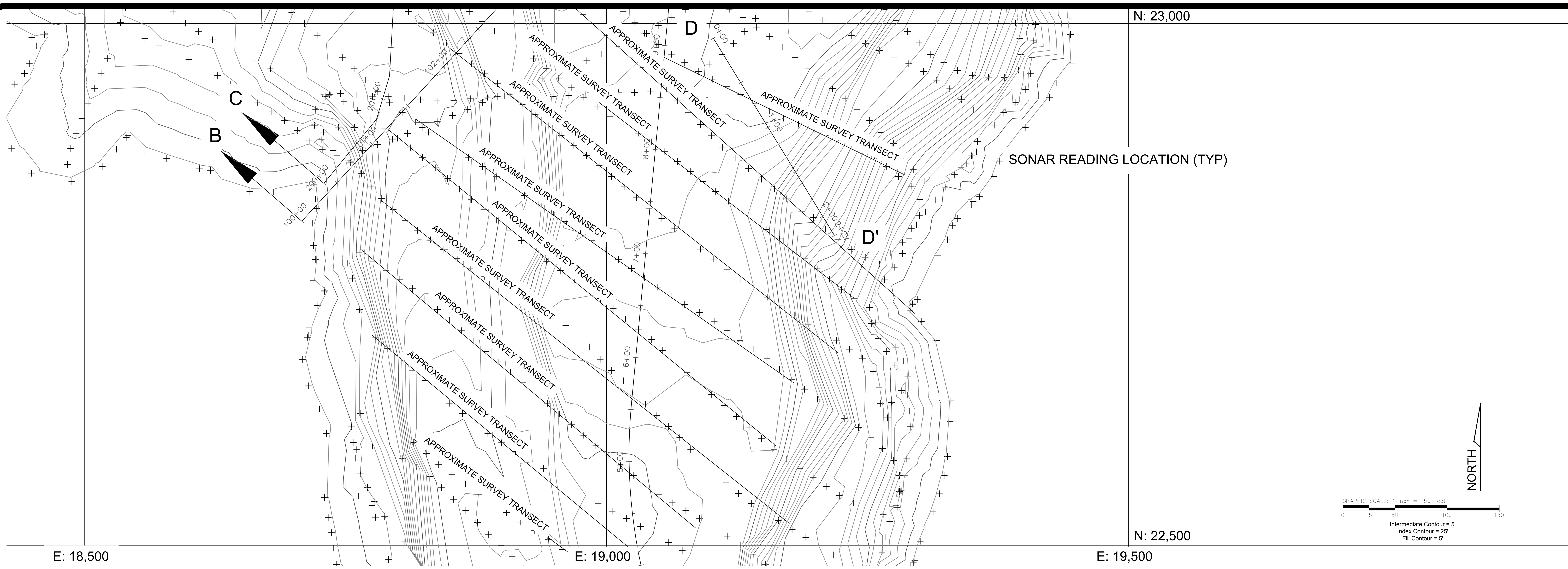
ISSUED		
DATE	DESCRIPTION	

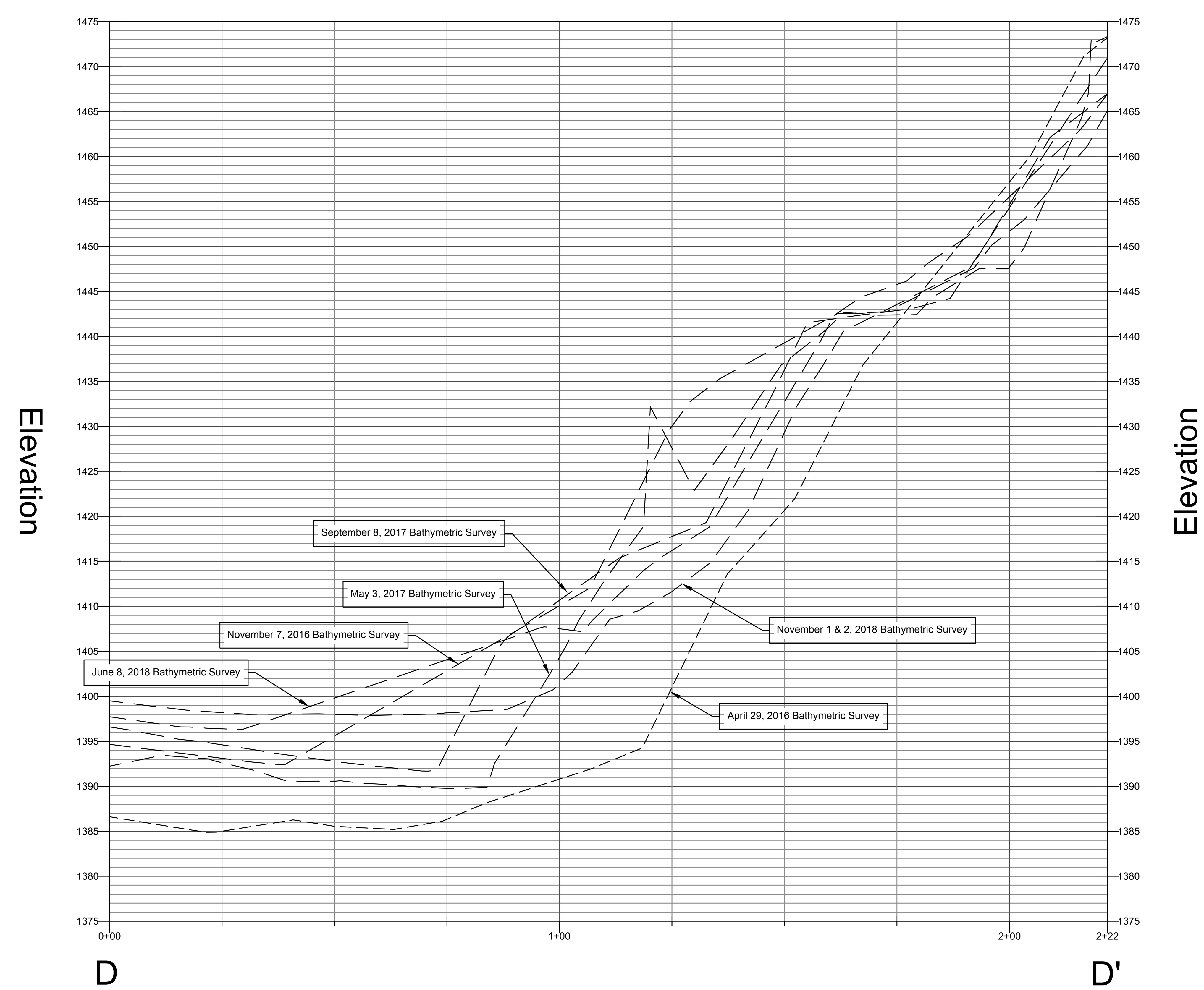
DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin 2018 Profile (Cross Section A)

SHEET NUMBER:
2.0





TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Eagle Mine - Humboldt Mill
November 1 & 2, 2018 Bathymetric Survey
Champion, MI

DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
2018
Cross Section D

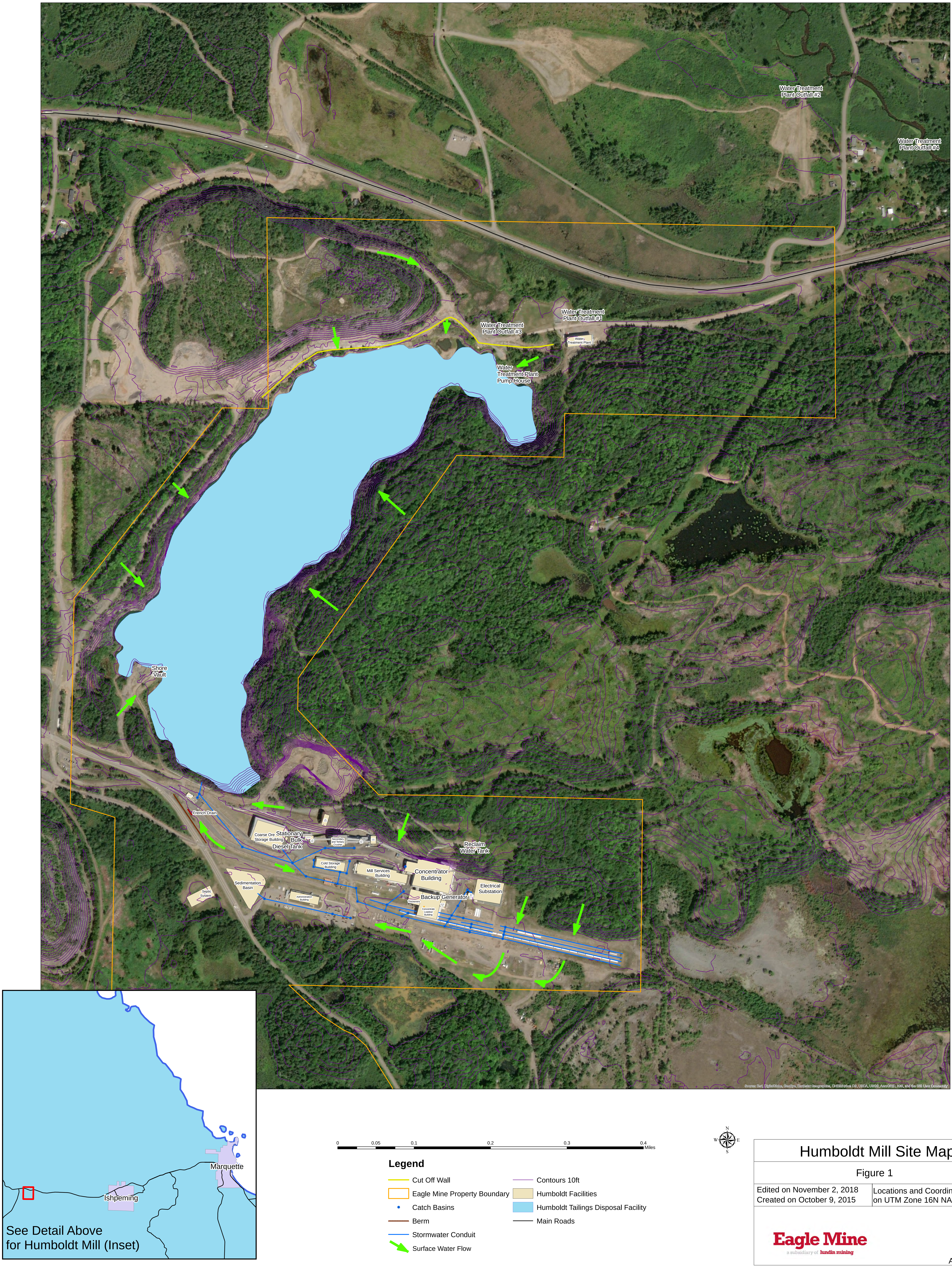
SHEET NUMBER:
5.0

C:\Users\mmetcalf\Desktop\PROJECTS\2014\2014-100\2014-100 Humboldt Tailings Basin DD Cross Section_11022018.dwg

Appendix C

Humboldt Mill

Storm Water Drainage Map



Humboldt Mill Site Map

Figure 1

Edited on November 2, 2018 Created on October 9, 2015	Locations and Coordinates based on UTM Zone 16N NAD83

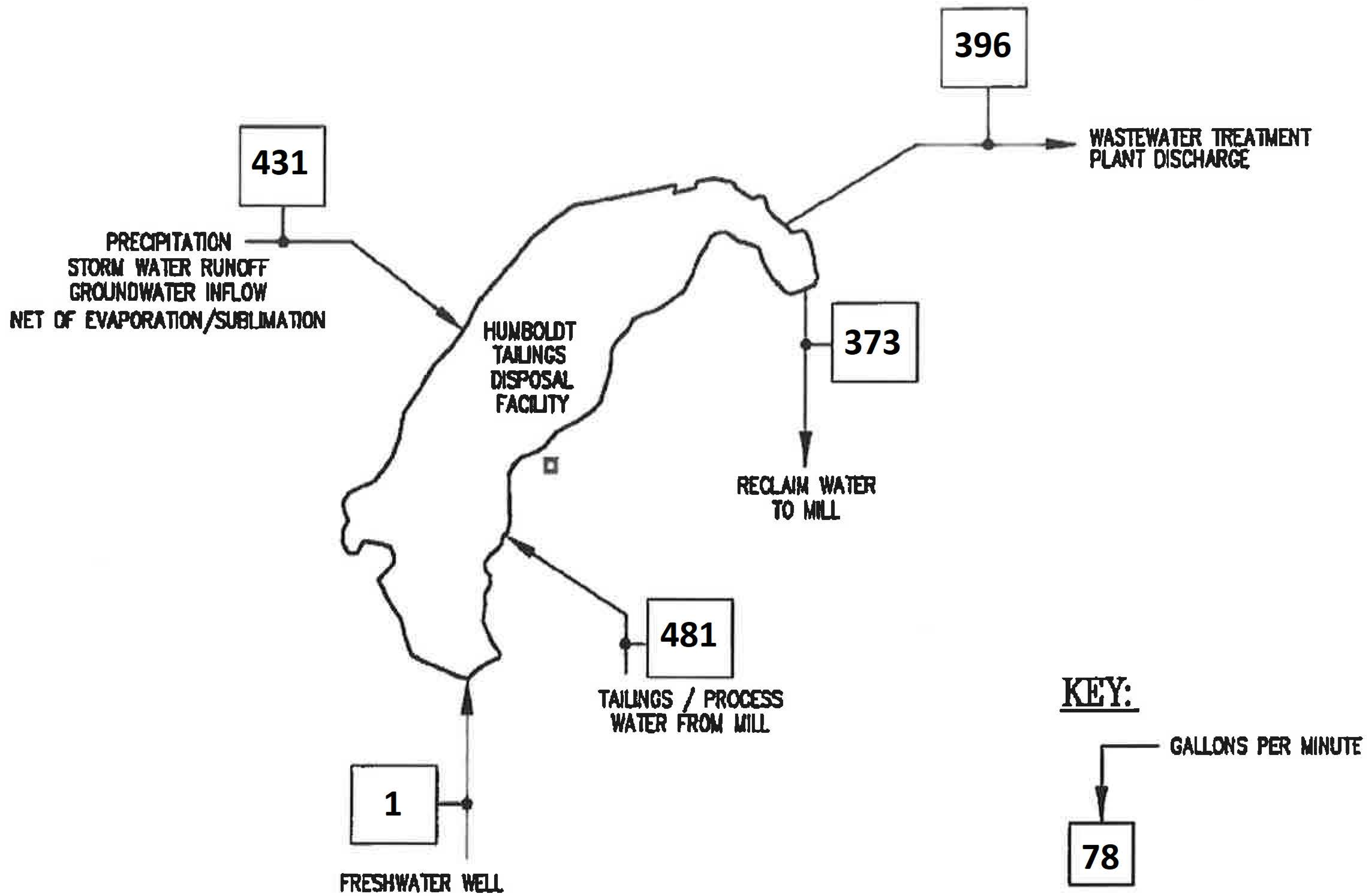
Eagle Mine
a subsidiary of lundin mining

Author: JRE

Appendix D

Humboldt Mill

Water Balance Diagrams



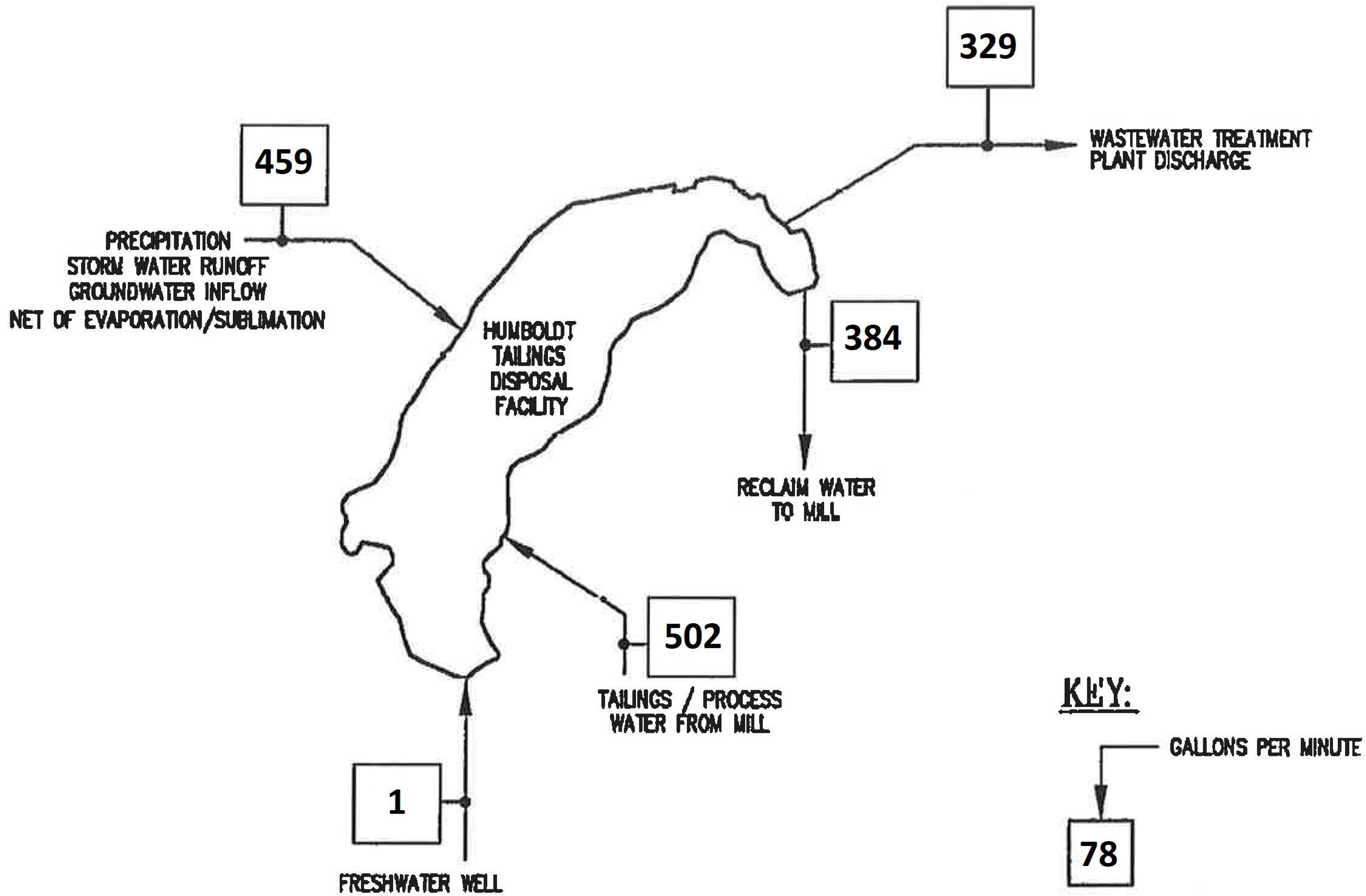
Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pure water balance.

PROJECT NUMBER: KEX–0102

Eagle Mine, LLC - Humboldt Mill Facility
Humboldt Township, Marquette County, Michigan

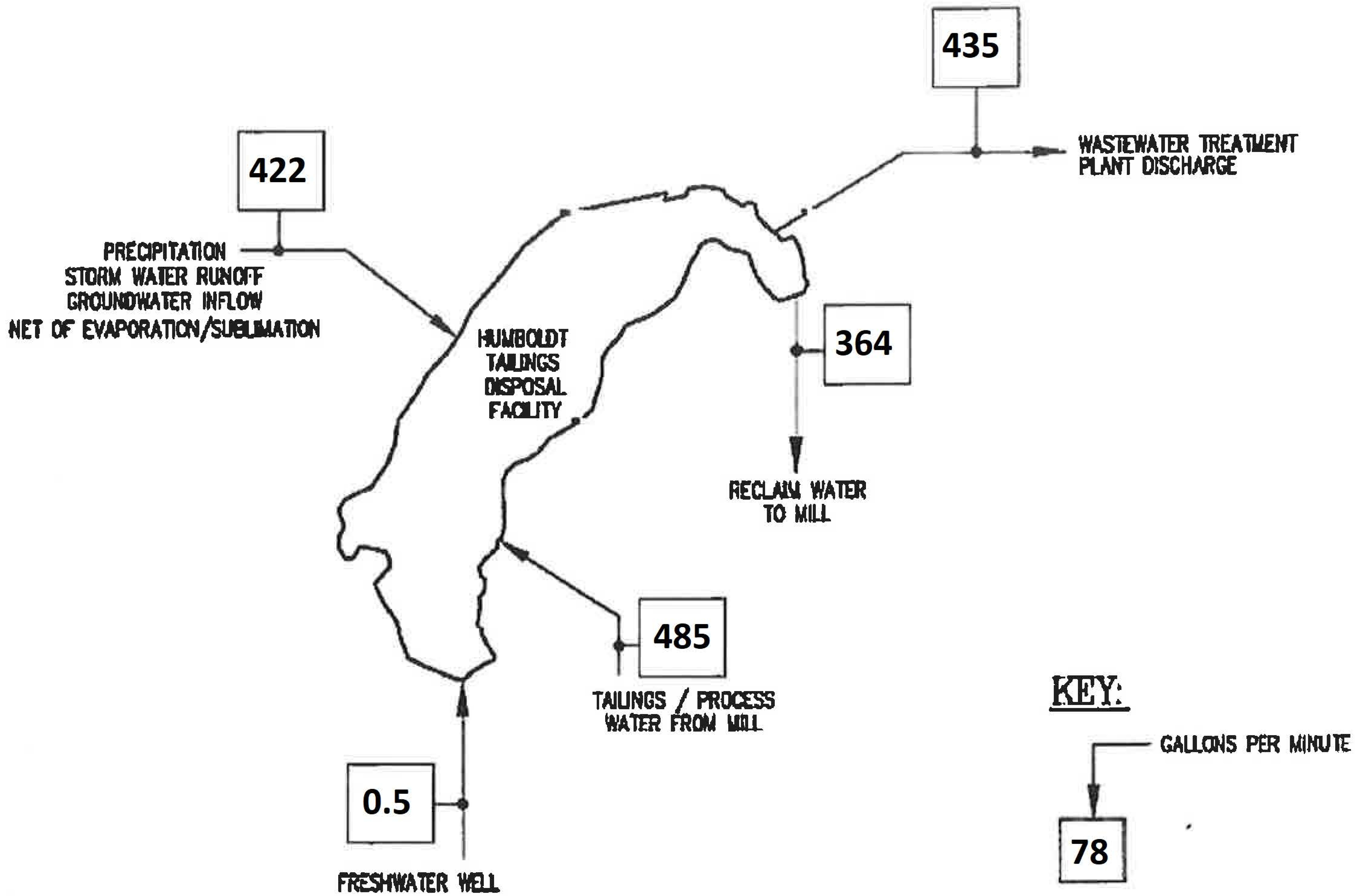
WATER BALANCE
HUMBOLDT TAILINGS DISPOSAL FACILTY
(January 1 - March 31, 2018)

FIGURE: 1



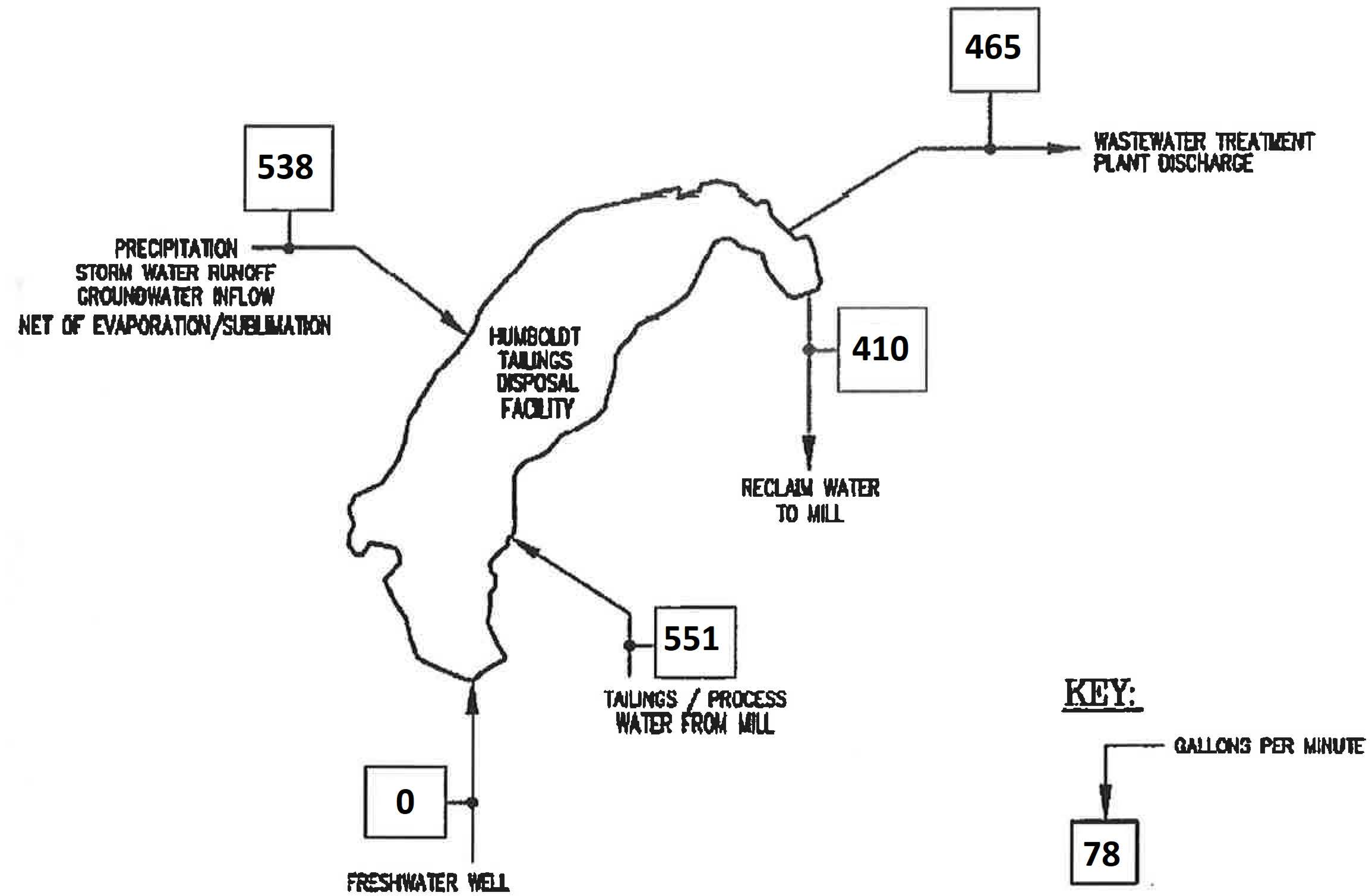
Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pure water balance.

	PROJECT NUMBER: KEX–0102
Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan	FIGURE:
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (April 1 - June 30, 2018)	1



Tailings total includes the dry tailings volume. As such, this diagram illustrates a volume balance rather than a pore water balance.

Eagle Mine, LLC - Humboldt Mill Facility Humboldt Township, Marquette County, Michigan	PROJECT NUMBER: KEx-0102
WATER BALANCE HUMBOLDT TAILINGS DISPOSAL FACILTY (July 1 - September 30, 2018)	FIGURE: 1



PROJECT NUMBER: KEX-0102

Eagle Mine, LLC - Humboldt Mill Facility
Humboldt Township, Marquette County, Michigan

WATER BALANCE
HUMBOLDT TAILINGS DISPOSAL FACILTY
(October 1 - December 31, 2018)

FIGURE: 1

Appendix E

Humboldt Mill

Groundwater 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

Path: C:\Users\CStacey\Documents\Eagle\1401484 Eagle Mill Monitoring\GIS\Eagle Mill MW Location Map Portrait.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

Humboldt Mill
2018 Mine Permit Groundwater Monitoring
Benchmark Comparison Summary

Location	Location Classification	Q1	Q2	Q3	Q4
HW-1L	Monitoring				
HW-1U LLA	Monitoring	**pH,** lead, alkalinity carbonate**, chloride**, **nitrogen ammonia**, calcium, magnesium, **sodium**			
HW-1U UFB	Monitoring		alkalinity bicarbonate		
HW-2	Monitoring	**sodium**	pH, **sodium**	**sodium**	pH, sulfide, **sodium**
HW-8U	Monitoring	chloride, **sulfate**	**chloride**, **sulfate,** sodium	arsenic, **chloride**, **sulfate, sodium**	**chloride**, **sulfate,** calcium, potassium, **sodium**
HYG-1	Monitoring	copper, **manganese**	**manganese**	antimony, nitrogen nitrite	manganese, mercury
KMW-5R	COSA	arsenic, **copper,** iron, **mercury**, zinc, sodium	arsenic, **copper**, **iron**, **mercury**, **sodium**	**aluminum, sodium**	**sodium**
MW-701 QAL	Leachate			chloride, calcium, magnesium, sodium	**chloride, calcium, magnesium,** potassium, **sodium,** hardness
MW-701 UFB	Leachate	hardness		calcium	
MW-702 QAL	Leachate	**pH**		pH	**pH**
MW-702 UFB	Leachate		alkalinity bicarbonate		
MW-703 QAL	Compliance	**pH, nitrogen nitrate**	**pH**	**pH**, nitrogen nitrate	**pH**
MW-703 UFB	Compliance				
MW-703-LLA	Compliance				
MW-703-DBA	Compliance	sulfate	pH	**pH**	**pH**
MW-704 QAL	Compliance	sulfate	nitrogen ammonia, **sulfate**	**sulfate**	arsenic, nitrogen ammonia, potassium
MW-704 UFB	Compliance		iron, sulfate	chloride, **sulfate,** magnesium	**chloride, sulfate, magnesium**
MW-704 LLA	Compliance	hardness	**hardness**	manganese, alkalinity bicarbonate, calcium, **hardness**	
MW-704 DBA	Compliance	alkalinity bicarbonate, hardness	**alkalinity bicarbonate**		alkalinity bicarbonate
MW-705 QAL	Cut-off Wall Key in Well	alkalinity bicarbonate		chloride, nitrogen ammonia, sodium	**chloride, sodium**
MW-705 UFB	Cut-off Wall Key in Well	**manganese**, calcium, **magnesium**, **hardness**		chloride, calcium, magnesium	**calcium**, **magnesium**
MW-706 QAL	Mill Services Building/Secondary Crusher	alkalinity bicarbonate			
MW-707 QAL	Concentrator/CLO	**hardness**			
MW-9R	Concentrator				

Parameters listed in this table had values reported that were equal to or greater than a site-specific benchmark. Parameters in BOLD are instances in which the Department was notified because benchmark deviations were identified at compliance monitoring locations for two consecutive quarters. N/A means there were no parameters outside of benchmark values for that quarter. If the location is classified as background, Department notification is not required for an exceedance. Blank data cells indicate that no benchmark deviations occurred at the location during the specified sampling quarter.

2018
Mine Permit Groundwater Quality Monitoring Data
HW-1L (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]	Q2 2018[T]	Q3 2018[D]	Q4 2018[T]
Field						
D.O.	ppm	-	**0.75**	**0.45**	**1.3**	**1.3**
ORP	mV	-	**275**	-299	-284	-292
pH	SU	**8.14-9.14**	**8.49**	**8.48**	**8.33**	**8.54**
Specific Conductance	uS/cm	-	**383**	**385**	**378**	**390**
Temperature	C	-	**7.9**	**9.7**	**9.0**	**8.1**
Turbidity	NTU	-	**3.5**	**3.0**	**4.7**	**1.9**
Water Elevation	ft MSL	-	**1458.45**	**1512.15**	-	**1446.68**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.18**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**745**	-	-	**621**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	<0.10	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**1187**	**446**	**831**	**795**	**861**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**23**	-	-	**16**	-
Manganese	ug/L	**200**	<50.0	<50.0	<1.1	<50.0
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.17**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	**-**	-	-	<1.4	-
Zinc	ug/L	**40**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**109**	**80**	**80**	**82**	**83**
Alkalinity, Carbonate	mg/L	**7.8**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**57**	**45**	**45**	**44**	**42**
Fluoride	mg/L	**2.5**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.10**	<0.03	<0.03	<0.004	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.01**	<0.10
Sulfate	mg/L	**33**	**25**	**27**	**25**	**28**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.01	<0.20
Major Cations						
Calcium	mg/L	**34**	**25**	**26**	**28**	**26**
Magnesium	mg/L	**15**	**10**	**11**	**11**	**11**
Potassium	mg/L	**6.2**	**1.8**	**1.8**	**1.8**	**1.8**
Sodium	mg/L	**28**	**22**	**23**	**23**	**23**
General						
Hardness	mg/L	**156**	**139**	**120**	**114**	**111**

2018
Mine Permit Groundwater Quality Monitoring Data
HW-1U LLA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[D]	Q3 2018[D]	Q4 2018[D]
Field						
D.O.	ppm	-	**0.68**	**0.54**	**1.3**	**1.6**
ORP	mV	-	-91	-183	-216	-238
pH	SU	**8.06-9.06**	**9.43**	**8.95**	**8.31**	**8.42**
Specific Conductance	uS/cm	-	**523**	**449**	**433**	**449**
Temperature	C	-	**6.4**	**10**	**9.3**	**6.8**
Turbidity	NTU	-	**893**	**126**	**4.5**	**7.0**
Water Elevation	ft MSL	-	**1521.55**	**1475.83**	**1490.34**	**1478.88**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<2.0	-
Arsenic	ug/L	**9.6**	**8.6**	<5.0	<0.10	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	<8.4	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.99**	-
Cobalt	ug/L	**80**	-	-	<20	-
Copper	ug/L	**8.6**	**7.7**	<4.0	<4.0	<4.0
Iron	ug/L	**56770**	**45200**	<200	<13	**262**
Lead	ug/L	**15**	**87**	<3.0	<0.10	<3.0
Lithium	ug/L	**17**	**-**	-	**13**	-
Manganese	ug/L	**673**	**455**	<50	<1.1	<50
Mercury	ng/L	**14**	**4.0**	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	**-**	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.78**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.20	-
Thallium	ug/L	**2.0**	-	-	<2.0	-
Vanadium	ug/L	-	-	-	<1.4	-
Zinc	ug/L	**44**	**34**	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**157**	**49**	**94**	**111**	**116**
Alkalinity, Carbonate	mg/L	**64**	**83**	**22**	<2.0	<2.0
Chloride	mg/L	**61**	**90**	**21**	**21**	**18**
Fluoride	mg/L	**2.5**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.30**	**0.57**	**0.27**	**0.18**	**0.16**
Nitrogen, Nitrate	mg/L	**0.57**	**0.13**	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.78**	<0.10	**0.12**	**0.01**	<0.10
Sulfate	mg/L	**395**	**299**	**85**	**58**	**56**
Sulfide	mg/L	**0.80**	<5.0	<1.0	<0.01	<0.20
Major Cations						
Calcium	mg/L	**61**	**64**	**6.5**	**25**	**25**
Magnesium	mg/L	**26**	**26**	**2.0**	**9.3**	**8.9**
Potassium	mg/L	**17**	**5.3**	**3.4**	**3.6**	**3.0**
Sodium	mg/L	**134**	**136**	**80**	**43**	**43**
General						
Hardness	mg/L	**171**	**30**	**28**	**101**	**99**

2018
Mine Permit Groundwater Quality Monitoring Data
HW-1U UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]	Q2 2018[D]	Q3 2018[D]	Q4 2018[D]
Field						
D.O.	ppm	-	**0.48**	**0.52**	**1.2**	**1.2**
ORP	mV	-	-281	-291	-365	-354
pH	SU	**8.4-9.4**	**8.94**	**8.67**	**8.77**	**8.70**
Specific Conductance	uS/cm	**-**	**183**	**159**	**202**	**244**
Temperature	C	**-**	**5.7**	**9.0**	**11**	**8.0**
Turbidity	NTU	**-**	**4.7**	**29**	**5.1**	**7.8**
Water Elevation	ft MSL	-	**1531.72**	**1532.65**	**1533.35**	**1534.85**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**9.3**	<5.0	<5.0	**0.37**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**52**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.44**	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**1364**	<200	<200	**344**	**449**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**17**	-	-	<4.6	-
Manganese	ug/L	**80**	<50	**79**	**55**	<50
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20	<20	**0.31**	<20
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	**-**	-	-	<1.4	-
Zinc	ug/L	**40**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**122**	**81**	**141**	**71**	**102**
Alkalinity, Carbonate	mg/L	**17**	<2.0	<2.0	**8.0**	<2.0
Chloride	mg/L	**96**	<10.0	<10.0	<0.72	<10.0
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.06**	<1.0
Nitrogen, Ammonia	mg/L	**0.10**	**0.03**	<0.03	<0.004	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.01**	<0.10
Sulfate	mg/L	**72**	**2.1**	**1.5**	<0.86	**1.4**
Sulfide	mg/L	**2.5**	<0.20	<0.20	**0.02**	<0.20
Major Cations						
Calcium	mg/L	**34**	**15**	**15**	**20**	**25**
Magnesium	mg/L	**16**	**5.5**	**4.3**	**5.4**	**6.8**
Potassium	mg/L	**21**	**3.4**	**2.9**	**3.1**	**3.6**
Sodium	mg/L	**68**	**7.7**	**6.0**	**5.8**	**5.5**
General						
Hardness	mg/L	**147**	**88**	**56**	**71**	**90**

2018
Mine Permit Groundwater Quality Monitoring Data
HW-2 (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]		Q2 2018[D]		Q3 2018[D]		Q4 2018[D]	
Field										
D.O.	ppm	-	**0.49**		**1.4**		**1.4**		**1.4**	
ORP	mV	-	-232		-227		-244		-256	
pH	SU	**7.29-8.29**	**8.07**		**8.29**		**8.21**		**8.72**	
Specific Conductance	uS/cm	-	**699**		**675**		**613**		**595**	
Temperature	C	-	**10**		**10**		**9.4**		**8.5**	
Turbidity	NTU	-	**356**		**29**		**20**		**80**	
Water Elevation	ft MSL	-	**1533.17**		**1534.04**		**1534.96**		**1536.18**	
Metals										
Aluminum	ug/L	**200**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		**0.25**		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**100**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		**0.42**		-	
Cobalt	ug/L	**80**	-		-		<0.40		-	
Copper	ug/L	**16**	<4.0		<4.0		<0.20		<4.0	
Iron	ug/L	**2595**	**912**		**426**		**683**		<200	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**40**	-		-		<4.6		-	
Manganese	ug/L	**333**	**304**		**282**		**284**		**136**	
Mercury	ng/L	**4.0**	<1.0		<1.0		<1.0		<1.0	
Molybdenum	ug/L	**200**	-		-		<0.20		-	
Nickel	ug/L	**80**	<20.0		<20.0		**0.36**		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	-	-		-		<1.4		-	
Zinc	ug/L	**40**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**141**	**99**		**96**		**89**		**87**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**35**	**34**		**33**		**29**		**27**	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.09**		<1.0	
Nitrogen, Ammonia	mg/L	**0.08**	<0.03		<0.03		<0.004		**0.04**	
Nitrogen, Nitrate	mg/L	**0.40**	<0.10		<0.10		<0.01		<0.10	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		<0.004		<0.10	
Sulfate	mg/L	**175**	**135**		**169**		**154**		**163**	
Sulfide	mg/L	**0.52**	<0.20		<0.20		<0.20		**0.54**	
Major Cations										
Calcium	mg/L	**72**	**57**		**56**		**55**		**48**	
Magnesium	mg/L	**26**	**23**		**23**		**21**		**20**	
Potassium	mg/L	**6.1**	**5.1**		**4.6**		**4.3**		**4.4**	
Sodium	mg/L	**30**	**34**		**31**		**35**		**38**	
General										
Hardness	mg/L	**297**	**161**		**246**		**221**		**202**	

2018
Mine Permit Groundwater Quality Monitoring Data
HW-8U (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]	Q2 2018[T]	Q3 2018[T]	Q4 2018[D]
Field						
D.O.	ppm	-	**2.9**	**2.1**	**1.6**	**1.5**
ORP	mV	-	-86	-83	-97	-117
pH	SU	**6.40-7.40**	**6.84**	**6.80**	**6.60**	**6.75**
Specific Conductance	uS/cm	-	**455**	**430**	**475**	**486**
Temperature	C	-	**6.1**	**9.0**	**9.5**	**8.5**
Turbidity	NTU	-	**7.4**	**3.0**	**2.4**	**4.3**
Water Elevation	ft MSL	-	**1533.04**	**1534.72**	**1534.5**	-
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**8.8**	**8.5**	**8.3**	**9.9**	**8.2**
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**30**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.59**	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**22049**	**8810**	**9490**	**9740**	**9820**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**14**	-	-	<4.6	-
Manganese	ug/L	**6268**	**5820**	**6220**	**6040**	**5940**
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	<0.10	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	-	-	-	<1.4	-
Zinc	ug/L	**27**	<10.0	<10.0	**3.4**	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**214**	**154**	**154**	**160**	**170**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**18**	**19**	**19**	**20**	**21**
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.09**	<1.0
Nitrogen, Ammonia	mg/L	**0.04**	<0.03	<0.03	**0.04**	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	<0.004	<0.10
Sulfate	mg/L	**12**	**13**	**13**	**14**	**16**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.01	<0.20
Major Cations						
Calcium	mg/L	**46**	**40**	**43**	**45**	**47**
Magnesium	mg/L	**19**	**13**	**13**	**13**	**14**
Potassium	mg/L	**3.6**	**3.1**	**3.5**	**3.4**	**3.6**
Sodium	mg/L	**4.3**	**4.2**	**4.5**	**4.5**	**4.6**
General						
Hardness	mg/L	**203**	**157**	**188**	**168**	**173**

2018
Mine Permit Groundwater Quality Monitoring Data
HYG-1 (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[T]	Q3 2018[T]	Q4 2018[T]
Field						
D.O.	ppm	-	**0.66**	**0.51**	**1.3**	**0.27**
ORP	mV	-	**33**	**20**	-31	**92**
pH	SU	**6.29-7.29**	**6.81**	**6.76**	**6.79**	**6.72**
Specific Conductance	uS/cm	-	**761**	**714**	**567**	**621**
Temperature	C	-	**7.6**	**7.6**	**9.3**	**8.7**
Turbidity	NTU	-	**1.1**	**1.4**	**1.6**	**0.95**
Water Elevation	ft MSL	-	**1532.87**	**1533.26**	**1534.55**	**1531.03**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	**8.9**	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.37**	<5.0
Barium	ug/L	**400**	-	-	**68**	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**83**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.22**	-
Cobalt	ug/L	**80**	-	-	**0.98**	-
Copper	ug/L	**9.2**	**12**	<4.0	**4.0**	<4.0
Iron	ug/L	**482**	<200	<200	<13.0	<200
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**40**	-	-	<4.6	-
Manganese	ug/L	**627**	**671**	**653**	**587**	**647**
Mercury	ng/L	**37**	**8.0**	**22**	**36**	**39**
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.55**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	**0.04**	-
Vanadium	ug/L	**-**	-	-	<1.4	-
Zinc	ug/L	**25**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**373**	**259**	**253**	**177**	**189**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**22**	**11**	**13**	**16**	**17**
Fluoride	mg/L	**2.5**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.56**	**0.33**	**0.31**	**0.27**	**0.22**
Nitrogen, Nitrate	mg/L	**0.08**	<0.10	<0.10	**0.24**	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.01**	<0.10
Sulfate	mg/L	**137**	**122**	**78**	**88**	**105**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.01	<0.20
Major Cations						
Calcium	mg/L	**65**	**58**	**48**	**48**	**49**
Magnesium	mg/L	**34**	**28**	**24**	**23**	**26**
Potassium	mg/L	**13**	**11**	**11**	**9.8**	**10**
Sodium	mg/L	**80**	**49**	**55**	**29**	**30**
General						
Hardness	mg/L	**322**	**284**	**234**	**213**	**227**

2018
Mine Permit Groundwater Quality Monitoring Data
KMW-5R (COSA)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[T]	Q3 2018[T]	Q3 2018[D]	Q4 2018[T]
Field							
D.O.	ppm	-	**5.1**	**2.9**	**7.6**	**7.6**	**4.9**
ORP	mV	-	**14**	**85**	**132**	**132**	**184**
pH	SU	**6.67-7.67**	**7.15**	**6.98**	**6.99**	**6.99**	**7.02**
Specific Conductance	uS/cm	-	**869**	**906**	**848**	**848**	**898**
Temperature	C	-	**7.7**	**14**	**15**	**15**	**7.9**
Turbidity	NTU	-	**2077**	**762**	**90**	**90**	**255**
Water Elevation	ft MSL	-	**1554.17**	**1557.56**	**1560.68**	**1560.68**	**1562.48**
Metals							
Aluminum	ug/L	**200**	-	-	**623**	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	<0.80	-
Arsenic	ug/L	**7.5**	**18**	**16**	<0.10	<0.10	<5.0
Barium	ug/L	**400**	-	-	<0.10	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<1.0	<0.10	-
Boron	ug/L	**1200**	-	-	**96**	**100**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	<0.10	-
Chromium	ug/L	**40**	-	-	**0.86**	**0.13**	-
Cobalt	ug/L	**80**	**-**	**-**	<0.40	**0.42**	-
Copper	ug/L	**28**	**52**	**44**	<4.0	**0.42**	<4.0
Iron	ug/L	**52956**	**91200**	**129000**	**3940**	<13	**1560**
Lead	ug/L	**9.0**	**6.4**	**6.1**	**0.31**	<0.10	<3.0
Lithium	ug/L	**31**	**-**	**-**	**11**	**14**	-
Manganese	ug/L	**2789**	**2330**	**2070**	**1200**	**1190**	**1010**
Mercury	ng/L	**15**	**24**	**18**	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	**-**	**-**	<0.20	<0.20	-
Nickel	ug/L	**80**	**47**	**49**	<20.0	<0.10	<20.0
Selenium	ug/L	**20**	-	-	<1.0	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	<0.10	-
Thallium	ug/L	**2.0**	-	-	<2.0	<0.04	-
Vanadium	ug/L	**-**	-	-	<4.0	<1.4	-
Zinc	ug/L	**24**	**34**	**23**	**1.9**	**1.8**	<10.0
Major Anions							
Alkalinity, Bicarbonate	mg/L	**481**	**372**	**384**	**386**	-	**394**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	-	<2.0
Chloride	mg/L	**192**	<10.0	<10.0	<0.72	-	<10.0
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.05**	-	<1.0
Nitrogen, Ammonia	mg/L	**0.06**	<0.03	<0.03	<0.004	-	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	**0.03**	-	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.01**	-	<0.10
Sulfate	mg/L	**139**	**87**	**91**	**85**	-	**75**
Sulfide	mg/L	**0.80**	<0.62	<1.0	<0.01	-	<0.20
Major Cations							
Calcium	mg/L	**166**	**123**	**115**	**119**	**-**	**111**
Magnesium	mg/L	**65**	**55**	**63**	**44**	**-**	**40**
Potassium	mg/L	**8.3**	**7.8**	**8.2**	**7.1**	**-**	**7.2**
Sodium	mg/L	**7.7**	**8.5**	**8.2**	**8.9**	**-**	**9.3**
General							
Hardness	mg/L	**757**	**490**	**512**	**479**	**-**	**443**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-701 QAL (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018T	Q2 2018T	Q3 2018T	Q4 2018T
Field						
D.O.	ppm	-	**4.2**	**6.3**	**6.0**	**3.7**
ORP	mV	-	**180**	**272**	**208**	**156**
pH	SU	-	**6.11**	**5.92**	**5.58**	**5.53**
Specific Conductance	uS/cm	-	**222**	**131**	**884**	**1905**
Temperature	C	-	**4.2**	**8.6**	**11**	**7.0**
Turbidity	NTU	-	**2.6**	**1.5**	**1.8**	**1.8**
Water Elevation	ft MSL	-	**1531.67**	**1533.00**	**1533.69**	**1534.91**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.32**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**17**	-
Cadmium	ug/L	**3.0**	-	-	**0.15**	-
Chromium	ug/L	**40**	-	-	**0.80**	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	**0.53**	<4.0
Iron	ug/L	**498**	<200	<200	<13.0	<200
Lead	ug/L	**9.0**	<3.0	<3.0	<3.0	<3.0
Lithium	ug/L	**40**	-	-	<4.6	-
Manganese	ug/L	**5263**	**50**	<50.0	<1.1	<50.0
Mercury	ng/L	**8.4**	**1.3**	<1.0	<1.0	**1.6**
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	<0.10	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	**0.05**	-
Vanadium	ug/L	-	-	-	<1.4	-
Zinc	ug/L	**40**	<10.0	<10.0	<10.0	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**118**	**59**	**36**	**35**	**34**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**23**	**13**	<10.0	**243**	**602**
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.07**	<1.0
Nitrogen, Ammonia	mg/L	**0.40**	<0.03	<0.03	<0.004	<0.03
Nitrogen, Nitrate	mg/L	**1.9**	**0.78**	**0.65**	**0.78**	**0.90**
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.004**	<0.10
Sulfate	mg/L	**86**	**20**	**15**	**11**	**12**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.20	<0.20
Major Cations						
Calcium	mg/L	**43**	**19**	**8.9**	**69**	**91**
Magnesium	mg/L	**19**	**7.3**	**4.0**	**29**	**36**
Potassium	mg/L	**9.0**	**3.0**	**2.1**	**6.2**	**13**
Sodium	mg/L	**12**	**7.2**	**6.3**	**47**	**251**
General						
Hardness	mg/L	**199**	**106**	**40**	**292**	**373**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-701 UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]		Q2 2018[D]		Q3 2018[D]		Q4 2018[D]	
Field										
D.O.	ppm	-	**0.50**		**0.81**		**1.3**		**1.3**	
ORP	mV	-	-207		-212		-220		-221	
pH	SU	**6.71-7.71**	**7.48**		**7.41**		**7.41**		**7.52**	
Specific Conductance	uS/cm	-	**388**		**414**		**402**		**410**	
Temperature	C	-	**6.7**		**8.8**		**8.5**		**7.3**	
Turbidity	NTU	-	**76**		**17**		**36**		**37**	
Water Elevation	ft MSL	-	**1532.06**		**1533.38**		**1533.88**		**1534.72**	
Metals										
Aluminum	ug/L	**200**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	< 5.0		< 5.0		**0.14**		<5.0	
Barium	ug/L	**157**	-		-		**141**		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**53.5**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		**0.14**		-	
Cobalt	ug/L	**80**	-		-		<0.40		-	
Copper	ug/L	**45**	<4.0		<4.0		<0.20		<4.0	
Iron	ug/L	**24958**	**15000**		**14800**		**14300**		**19400**	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**13**	-		-		**7.9**		-	
Manganese	ug/L	**4677**	**2260**		**2170**		**2030**		**1880**	
Mercury	ng/L	**4.0**	<1.0		<1.0		<1.0		<1.0	
Molybdenum	ug/L	**200**	-		-		<0.20		-	
Nickel	ug/L	**80**	<20.0		<20.0		<0.10		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	**-**	-		-		<1.4		-	
Zinc	ug/L	**14**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**162**	**145**		**147**		**157**		**150**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**49**	<10.0		**11**		**11**		**15**	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.09**		<1.0	
Nitrogen, Ammonia	mg/L	**1.8**	<0.03		<0.03		**0.01**		<0.03	
Nitrogen, Nitrate	mg/L	**0.40**	<0.10		<0.10		<0.01		<0.10	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		**0.004**		<0.10	
Sulfate	mg/L	**52**	**20**		**14**		**11**		**7.1**	
Sulfide	mg/L	**1.9**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**39**	**35**		**36**		**39**		**37**	
Magnesium	mg/L	**16**	**15**		**15**		**15**		**14**	
Potassium	mg/L	**8.5**	**2.7**		**3.4**		**3.3**		**3.7**	
Sodium	mg/L	**33**	**4.5**		**5.1**		**5.1**		**5.6**	
General										
Hardness	mg/L	**163**	**176**		**154**		**158**		**151**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-702 QAL (Leachate)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]		Q2 2018[D]		Q3 2018[D]		Q4 2018[T]	
Field										
D.O.	ppm	-	**1.3**		**1.9**		**1.8**		**0.58**	
ORP	mV	-	-47		**112**		-55		**226**	
pH	SU	**8.81-9.91**	**9.96**		**9.82**		**8.15**		**7.19**	
Specific Conductance	uS/cm	-	**422**		**426**		**366**		-	
Temperature	C	-	**6.8**		**7.4**		**7.8**		-	
Turbidity	NTU	-	**1.8**		**4.2**		**34**		-	
Water Elevation	ft MSL	-	**1530.82**		**1531.72**		-		-	
Metals										
Aluminum	ug/L	**123**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	< 5.0		**5.3**		<0.10		<5.0	
Barium	ug/L	**196**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**22.6**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		**0.65**		-	
Cobalt	ug/L	**80**	-		-		<0.40		-	
Copper	ug/L	**16**	<4.0		<4.0		<0.20		<4.0	
Iron	ug/L	**800**	<200		<200		<13.0		<200	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**40**	-		-		<4.6		-	
Manganese	ug/L	**546**	<50.0		<50.0		<1.1		<50.0	
Mercury	ng/L	**3.6**	**1.5**		**1.9**		**2.1**		**2.3**	
Molybdenum	ug/L	**200**	-		-		<0.20		-	
Nickel	ug/L	**80**	<20.0		<20.0		**0.88**		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	**-**	-		-		**3.2**		-	
Zinc	ug/L	**40**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**160**	**76**		**36**		**111**		**110**	
Alkalinity, Carbonate	mg/L	**41**	**8.1**		**39**		<2.0		<2.0	
Chloride	mg/L	**18**	<10.0		<10.0		<10.0		<10.0	
Fluoride	mg/L	**2.5**	<1.0		<1.0		<1.0		<1.0	
Nitrogen, Ammonia	mg/L	**0.04**	<0.03		<0.03		<0.03		<0.03	
Nitrogen, Nitrate	mg/L	**1.2**	**1.1**		**0.84**		**0.35**		**0.27**	
Nitrogen, Nitrite	mg/L	**0.18**	**0.13**		**0.10**		<0.10		<0.10	
Sulfate	mg/L	**133**	**60**		**58**		**54**		**55**	
Sulfide	mg/L	**0.80**	<0.20		<0.20		<0.20		<0.20	
Major Cations										
Calcium	mg/L	**79**	**29**		**23**		**24**		**23**	
Magnesium	mg/L	**14**	**6.2**		**3.9**		**6.5**		**8**	
Potassium	mg/L	**22**	**14**		**15**		**10**		**7.8**	
Sodium	mg/L	**60**	**40**		**58**		**35**		**31**	
General										
Hardness	mg/L	**251**	**114**		**80**		**87**		**90**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-702 UFB (Leachate)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]	Q2 2018[D]	Q3 2018[D]	Q4 2018[D]
Field						
D.O.	ppm	-	**1.3**	**2.4**	**2.3**	**1.4**
ORP	mV	-	-194	-176	186	-216
pH	SU	**7.11-8.11**	**8.06**	**8.06**	**7.69**	**7.97**
Specific Conductance	uS/cm	-	**260**	**269**	**181**	**280**
Temperature	C	-	**7.0**	**14**	**8.9**	**6.7**
Turbidity	NTU	-	**5.0**	**12**	**12**	**18**
Water Elevation	ft MSL	-	**1518.19**	**1522.42**	**1519.93**	**1512.39**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.15**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**98**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	<0.10	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**1328**	**623**	**954**	**1240**	**791**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**13**	-	-	**4.9**	-
Manganese	ug/L	**118**	**89**	**90**	**98**	**84**
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.11**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	-	-	-	<1.4	-
Zinc	ug/L	**76**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**112**	**97**	**181**	**90**	**88**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**40**	<10.0	<10.0	<0.72	<10.0
Fluoride	mg/L	**2.5**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.09**	<0.03	<0.03	<0.03	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.007**	<0.10
Sulfate	mg/L	**36**	**33**	**31**	**29**	**29**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.01	<0.20
Major Cations						
Calcium	mg/L	**39**	**28**	**29**	**29**	**29**
Magnesium	mg/L	**12**	**8.8**	**9.2**	**9.2**	**9.3**
Potassium	mg/L	**11**	**2.7**	**3.0**	**3.3**	**3.0**
Sodium	mg/L	**5.2**	**2.8**	**3.0**	**3.0**	**3.0**
General						
Hardness	mg/L	**140**	**139**	**116**	**110**	**110**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-703 QAL (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]		Q2 2018[T]		Q3 2018[T]		Q4 2018[T]	
Field										
D.O.	ppm	-	**6.0**		**5.8**		**6.2**		**8.8**	
ORP	mV	-	**229**		**260**		**111**		**353**	
pH	SU	**6.30-7.30**	**6.19**		**6.29**		**6.10**		**5.68**	
Specific Conductance	uS/cm	-	**199**		**203**		**206**		**180**	
Temperature	C	-	**5.9**		**7.0**		**7.5**		**5.9**	
Turbidity	NTU	-	**1.5**		**1.5**		**1.6**		**1.6**	
Water Elevation	ft MSL	-	**1533.96**		**1533.42**		**1533.02**		**1533.14**	
Metals										
Aluminum	ug/L	**200**	-		-		<50.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		<5.0		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		<300		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		<0.10		-	
Cobalt	ug/L	**80**	-		-		<20.0		-	
Copper	ug/L	**16**	<4.0		<4.0		**0.37**		<4.0	
Iron	ug/L	**287**	<200		<200		<200		<200	
Lead	ug/L	**9.0**	<3.0		<3.0		<3.0		<3.0	
Lithium	ug/L	**40**	-		-		<4.6		-	
Manganese	ug/L	**107**	<50.0		<50.0		<50.0		<50.0	
Mercury	ng/L	**4.0**	<1.0		<1.0		**1.4**		<1.0	
Molybdenum	ug/L	**200**	-		-		**0.23**		-	
Nickel	ug/L	**80**	<20.0		<20.0		<0.10		<20.0	
Selenium	ug/L	**20**	-		-		**1.1**		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	**-**	-		-		<1.4		-	
Zinc	ug/L	**40**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**92**	**55**		**55**		**54**		**53**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**40**	<10.0		<10.0		<0.72		<10.0	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.06**		<1.0	
Nitrogen, Ammonia	mg/L	**0.08**	<0.03		<0.03		<0.03		<0.03	
Nitrogen, Nitrate	mg/L	**1.8**	**1.8**		**1.3**		**2.0**		**1.7**	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		<0.004		<0.10	
Sulfate	mg/L	**41**	**29**		**29**		**28**		**26**	
Sulfide	mg/L	**0.80**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**31**	**19**		**19**		**20**		**17**	
Magnesium	mg/L	**9.8**	**7.9**		**7.9**		**8.4**		**8.0**	
Potassium	mg/L	**2.6**	**1.6**		**1.5**		**1.5**		**1.4**	
Sodium	mg/L	**7.7**	**2.0**		**1.9**		**2.0**		**1.9**	
General										
Hardness	mg/L	**116**	**106**		**84**		**83**		**76**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-703 UFB (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018 T		Q2 2018 T		Q3 2018 T		Q4 2018 T	
Field										
D.O.	ppm	-	**2.6**		**0.87**		**1.6**		**1.3**	
ORP	mV	-	-232		-234		-235		-289	
pH	SU	**7.44-8.44**	**8.19**		**8.16**		**8.04**		**8.41**	
Specific Conductance	uS/cm	-	**293**		**292**		**288**		**309**	
Temperature	C	-	**5.1**		**11**		**8.7**		**6.1**	
Turbidity	NTU	-	**2.3**		**2.6**		**2.0**		**0.9**	
Water Elevation	ft MSL	-	**1532.09**		**1528.14**		**1512.14**		**1530.71**	
Metals										
Aluminum	ug/L	**200**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		**0.29**		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**42**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		**0.15**		-	
Cobalt	ug/L	**80**	-		-		<0.40		-	
Copper	ug/L	**16**	<4.0		<4.0		<0.20		<4.0	
Iron	ug/L	**1903**	**1630**		**1640**		**1420**		**1820**	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**40**	-		-		<4.6		-	
Manganese	ug/L	**200**	**189**		**157**		**116**		**165**	
Mercury	ng/L	**4.0**	<1.0		<1.0		**2.3**		<1.0	
Molybdenum	ug/L	**200**	-		-		<0.20		-	
Nickel	ug/L	**80**	<20.0		<20.0		**0.16**		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	-	-		-		<1.4		-	
Zinc	ug/L	**40**	<10.0		<10.0		**2.8**		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**111**	**83**		**82**		**80**		**81**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**40**	<10.0		<10.0		<0.72		<10.0	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.08**		<1.0	
Nitrogen, Ammonia	mg/L	**0.75**	<0.03		<0.03		<0.03		<0.03	
Nitrogen, Nitrate	mg/L	**0.40**	<0.10		<0.10		<0.01		<0.10	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		**0.004**		<0.10	
Sulfate	mg/L	**49**	**46**		**46**		**42**		**45**	
Sulfide	mg/L	**0.80**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**43**	**31**		**32**		**30**		**30**	
Magnesium	mg/L	**14**	**10**		**11**		**11**		**10**	
Potassium	mg/L	**4.2**	**2.3**		**2.4**		**2.2**		**2.2**	
Sodium	mg/L	**17**	**2.8**		**3.0**		**3.0**		**3.0**	
General										
Hardness	mg/L	**173**	**147**		**130**		**119**		**118**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-703 LLA (Monitoring)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[D]	Q3 2018[D]	Q4 2018[T]
Field						
D.O.	ppm	-	**0.42**	**0.52**	**1.2**	**1.3**
ORP	mV	-	-289	-298	-259	-276
pH	SU	**8.08-9.08**	**8.43**	**8.31**	**8.13**	**8.48**
Specific Conductance	uS/cm	-	**280**	**281**	**277**	**299**
Temperature	C	-	**6.3**	**8.8**	**9.2**	**6.4**
Turbidity	NTU	-	**2.9**	**18**	**3.7**	**5.8**
Water Elevation	ft MSL	-	**1530.84**	*	**1534.52**	**1535.74**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.16**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	<8.4	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	0.19	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**2082**	**817**	**699**	**715**	**597**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**28**	-	-	**7.4**	-
Manganese	ug/L	**95**	**81**	**92**	**81**	**60**
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.14**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	**-**	-	-	<1.4	-
Zinc	ug/L	**40**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**92**	**81**	**79**	**81**	**79**
Alkalinity, Carbonate	mg/L	**10**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**97**	**11**	**10**	**12**	**11**
Fluoride	mg/L	**2.5**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.08**	<0.03	<0.03	<0.03	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	<0.004	<0.10
Sulfate	mg/L	**43**	**33**	**32**	**33**	**32**
Sulfide	mg/L	**0.80**	<0.20	<0.20	**0.03**	<0.20
Major Cations						
Calcium	mg/L	**34**	**25**	**27**	**27**	**24**
Magnesium	mg/L	**12**	**10**	**10**	**10**	**11**
Potassium	mg/L	**7.7**	**3**	**2.9**	**2.7**	**2.9**
Sodium	mg/L	**51**	**6.3**	**5.9**	**6.4**	**7.5**
General						
Hardness	mg/L	**135**	**131**	**118**	**110**	**104**

*- Diver failed on 3/22/18, replaced 5/16/18

2018
Mine Permit Groundwater Quality Monitoring Data
MW-703 DBA (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[T]	Q3 2018[T]	Q4 2018[T]
Field						
D.O.	ppm	-	**0.89**	**0.90**	**1.5**	**1.5**
ORP	mV	-	-256	-240	-270	-226
pH	SU	**8.89-9.89**	**8.98**	**8.38**	**8.81**	**8.41**
Specific Conductance	uS/cm	-	**300**	**308**	**294**	**316**
Temperature	C	-	**5.7**	**10.0**	**8.5**	**5.8**
Turbidity	NTU	-	**1.1**	**3.0**	**2.1**	**1.3**
Water Elevation	ft MSL	-	**1531.35**	**1532.32**	**1533.21**	**1534.40**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.31**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	<8.4	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.27**	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**861**	<200	<200	**257**	<200
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**20**	-	-	**10**	-
Manganese	ug/L	**200**	<50.0	<50.0	<1.1	<50.0
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.18**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	-	-	-	<1.4	-
Zinc	ug/L	**26**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**88**	**82**	**82**	**69**	**84**
Alkalinity, Carbonate	mg/L	**39**	<2.0	<2.0	**8.0**	<2.0
Chloride	mg/L	**20**	**15**	**16**	**16**	**16**
Fluoride	mg/L	**2.5**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.12**	<0.03	**0.04**	<0.03	<0.03
Nitrogen, Nitrate	mg/L	**0.86**	<0.10	<0.10	<0.10	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	<0.10	<0.10
Sulfate	mg/L	**73**	**100**	**34**	**31**	**31**
Sulfide	mg/L	**1.3**	<0.20	**0.33**	<0.20	**0.62**
Major Cations						
Calcium	mg/L	**27**	**25**	**15**	**26**	**24**
Magnesium	mg/L	**17**	**11**	**6.2**	**10**	**11**
Potassium	mg/L	**30**	**7.6**	**25**	**8.1**	**7.4**
Sodium	mg/L	**16**	**7.5**	**13**	**7.9**	**7.2**
General						
Hardness	mg/L	**140**	**137**	**80**	**108**	**105**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-704 QAL (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]	Q2 2018[D]	Q3 2018[D]	Q4 2018[T]
Field						
D.O.	ppm	-	**0.76**	**1.7**	**1.2**	**0.41**
ORP	mV	-	**148**	**138**	**154**	**-30**
pH	SU	**5.43-6.43**	**5.85**	**5.83**	**5.75**	**6.26**
Specific Conductance	uS/cm	-	**372**	**384**	**389**	**690**
Temperature	C	-	**5.2**	**11**	**11**	**8.7**
Turbidity	NTU	-	**18**	**5.2**	**8.5**	**1.5**
Water Elevation	ft MSL	-	**1533.29**	**1534.52**	**1534.57**	**1534.54**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.27**	**8.5**
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**26**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	<0.10	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	**0.94**	<4.0
Iron	ug/L	**84519**	<200	3590	<13.0	78600
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**40**	-	-	<4.6	-
Manganese	ug/L	**8783**	**689**	**1900**	**594**	**5000**
Mercury	ng/L	**35**	< 1.0	**2.9**	**1.2**	**4.6**
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	<0.10	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	**16**	-	-	<1.4	-
Zinc	ug/L	**38**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**264**	**79**	**94**	**62**	**199**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**24**	**17**	**14**	**20**	<10.0
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.04**	<1.0
Nitrogen, Ammonia	mg/L	**0.19**	<0.03	**0.29**	<0.004	**2.5**
Nitrogen, Nitrate	mg/L	**1.5**	**1.2**	**0.72**	**0.88**	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	<0.004	<0.10
Sulfate	mg/L	**45**	**55**	**52**	**84**	**29**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.01	<0.20
Major Cations						
Calcium	mg/L	**47**	**33**	**34**	**35**	**41**
Magnesium	mg/L	**15**	**12**	**12**	**12**	**14**
Potassium	mg/L	**6.1**	**2.3**	**3.2**	**2.5**	**7.4**
Sodium	mg/L	**32**	**11**	**14**	**13**	**22**
General						
Hardness	mg/L	**191**	**167**	**130**	**139**	**158**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-704 UFB (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018D		Q2 2018D		Q3 2018D		Q4 2018T	
Field										
D.O.	ppm		**1.0**		**0.81**		**1.4**		**0.29**	
ORP	mV		**-108**		**-143**		**-138**		**-165**	
pH	SU	**6.40-7.40**	**6.81**		**7.00**		**6.82**		**7.23**	
Specific Conductance	uS/cm		**599**		**647**		**576**		**610**	
Temperature	C		**7.4**		**7.6**		**9.3**		**8.4**	
Turbidity	NTU		**40**		**6.5**		**3.3**		**17**	
Water Elevation	ft MSL		**1533.89**		**1535.11**		**1535.21**		**1535.07**	
Metals										
Aluminum	ug/L	**5824**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		**0.18**		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**28**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		<0.10		-	
Cobalt	ug/L	**80**	-		-		**0.59**		-	
Copper	ug/L	**16**	<4.0		<4.0		<0.20		<4.0	
Iron	ug/L	**44052**	**42900**		**47800**		**42300**		**36600**	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**30**	-		-		<4.6		-	
Manganese	ug/L	**1384**	**906**		**990**		**815**		**789**	
Mercury	ng/L	**1.4**	<1.0		<1.0		**1.0**		<1.0	
Molybdenum	ug/L	**200**	-		-		<0.20		-	
Nickel	ug/L	**80**	<20.0		<20.0		**0.70**		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	**16**	-		-		<1.4		-	
Zinc	ug/L	**40**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**198**	**158**		**154**		**131**		**144**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**24**	**22**		**24**		**26**		**26**	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.04**		<1.0	
Nitrogen, Ammonia	mg/L	**0.78**	<0.03		<0.03		<0.004		<0.03	
Nitrogen, Nitrate	mg/L	**0.40**	<0.10		<0.10		<0.01		<0.10	
Nitrogen, Nitrite	mg/L	**0.18**	<0.10		<0.10		**0.009**		<0.10	
Sulfate	mg/L	**45**	**44**		**47**		**71**		**73**	
Sulfide	mg/L	**0.49**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**67**	**53**		**56**		**51**		**57**	
Magnesium	mg/L	**14**	**13**		**14**		**15**		**16**	
Potassium	mg/L	**5.3**	**2.7**		**2.8**		**2.8**		**3.3**	
Sodium	mg/L	**43**	**11**		**13**		**14**		**17**	
General										
Hardness	mg/L	**226**	**216**		**184**		**188**		**205**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-704 LLA (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]	Q2 2018[D]	Q3 2018[D]	Q4 2018[D]
Field						
D.O.	ppm	-	**0.54**	**0.44**	**1.2**	**1.3**
ORP	mV	-	-260	-318	-257	-321
pH	SU	-	**8.34**	**8.58**	**8.24**	**8.56**
Specific Conductance	uS/cm	-	**328**	**268**	**354**	**317**
Temperature	C	-	**4.1**	**10**	**10**	**8.6**
Turbidity	NTU	-	**3.6**	**23**	**37**	**12**
Water Elevation	ft MSL	-	**1533.36**	**1534.97**	**1531.72**	**1531.95**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	**0.76**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	**48**	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	<0.10	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**3309**	**1130**	**2070**	**925**	**771**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**28**	-	-	**14**	-
Manganese	ug/L	**95**	**83**	<50.0	**101**	<50.0
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.11**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	**16**	-	-	<1.4	-
Zinc	ug/L	**40**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**153**	**135**	**111**	**157**	**119**
Alkalinity, Carbonate	mg/L	**13**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**40**	<10.0	<10.0	**11**	<10.0
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.08**	<1.0
Nitrogen, Ammonia	mg/L	**0.10**	<0.03	<0.03	**0.03**	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.0089	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.007**	<0.10
Sulfate	mg/L	**21**	**10**	**8.3**	**9.9**	**7.3**
Sulfide	mg/L	**0.80**	<0.20	<0.20	**0.02**	<0.20
Major Cations						
Calcium	mg/L	**33**	**30**	**21**	**37**	**24**
Magnesium	mg/L	**16**	**14**	**14**	**16**	**15**
Potassium	mg/L	**12**	**5.9**	**6.8**	**5.4**	**6.1**
Sodium	mg/L	**15**	**4.5**	**4.8**	**4.7**	**4.6**
General						
Hardness	mg/L	**157**	**161**	**252**	**157**	**120**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-704 DBA (Compliance)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[D]	Q3 2018[D]	Q4 2018[D]
Field						
D.O.	ppm	-	**0.99**	**0.67**	**1.2**	**2.0**
ORP	mV	-	-259	-251	-304	-225
pH	SU	**8.13-9.13**	**8.46**	**8.40**	**8.46**	**8.46**
Specific Conductance	uS/cm	-	**263**	**262**	**266**	**272**
Temperature	C	-	**6.5**	**9.1**	**9.7**	**8.0**
Turbidity	NTU	-	**2.0**	**123**	**50**	**5.9**
Water Elevation	ft MSL	-	*	**1529.82**	**1529.52**	**1529.94**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**8.0**	-	-	<0.80	-
Arsenic	ug/L	**20**	<5.0	<5.0	**0.34**	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**4.0**	-	-	<0.10	-
Boron	ug/L	**1480**	-	-	<8.4	-
Cadmium	ug/L	**4.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.15**	-
Cobalt	ug/L	**80**	-	-	<0.40	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**9645**	**830**	**684**	**865**	**779**
Lead	ug/L	**12**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**40**	-	-	**12**	-
Manganese	ug/L	**58**	<50.0	<50.0	<1.1	<50.0
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	<0.20	-
Nickel	ug/L	**80**	<20.0	<20.0	**0.14**	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**8.0**	-	-	<0.04	-
Vanadium	ug/L	**16**	-	-	<1.4	-
Zinc	ug/L	**11**	<10.0	<10.0	<1.7	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**129**	**132**	**132**	**127**	**142**
Alkalinity, Carbonate	mg/L	**32**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**40**	<10.0	<10.0	<0.72	<10.0
Fluoride	mg/L	**4.0**	<1.0	<1.0	<0.03	<1.0
Nitrogen, Ammonia	mg/L	**0.04**	<0.03	<0.03	<0.004	<0.03
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	**0.01**	<0.10
Sulfate	mg/L	**6.0**	<1.0	<1.0	<0.86	<1.0
Sulfide	mg/L	**0.80**	<0.20	<0.20	**0.02**	<0.20
Major Cations						
Calcium	mg/L	**27**	**22**	**21**	**22**	**23**
Magnesium	mg/L	**14**	**11**	**11**	**11**	**11**
Potassium	mg/L	**4.0**	**2.4**	**2.6**	**2.5**	**2.6**
Sodium	mg/L	**14**	**9.9**	**10**	**10**	**11**
General						
Hardness	mg/L	**111**	**125**	**110**	**102**	**103**

* - Diver failed 9/6/17, replaced 3/15/18

2018
Mine Permit Groundwater Quality Monitoring Data
MW-705 QAL (Cut-off Wall Key in Well)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]		Q2 2018[T]		Q3 2018[T]		Q4 2018[T]	
Field										
D.O.	ppm	-	0.63		0.63		1.8		1.5	
ORP	mV	-	-92		-10		-12		-30	
pH	SU	5.67-6.67	6.66		6.14		5.87		6.17	
Specific Conductance	uS/cm	-	231		199		379		371	
Temperature	C	-	5.1		5.6		12		7.8	
Turbidity	NTU	-	7.5		2.5		2.2		1.1	
Water Elevation	ft MSL	-	1533.76		1536.47		1535.61		1535.96	
Metals										
Aluminum	ug/L	200	-		-		<31.0		-	
Antimony	ug/L	4.0	-		-		<0.80		-	
Arsenic	ug/L	7.5	<5.0		<5.0		<0.10		<5.0	
Barium	ug/L	400	-		-		<0.10		-	
Beryllium	ug/L	2.5	-		-		<0.10		-	
Boron	ug/L	1200	-		-		32		-	
Cadmium	ug/L	3.0	-		-		<0.10		-	
Chromium	ug/L	40	-		-		0.35		-	
Cobalt	ug/L	80	-		-		<0.40		-	
Copper	ug/L	16	<4.0		<4.0		0.44		<4.0	
Iron	ug/L	12957	7440		4870		10300		9710	
Lead	ug/L	9.0	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	40	-		-		<4.6		-	
Manganese	ug/L	1535	651		523		<55.0		<2500	
Mercury	ng/L	1.8	<1.0		1.0		<1.0		1.1	
Molybdenum	ug/L	200	-		-		0.24		-	
Nickel	ug/L	80	<20.0		<20.0		<0.10		<20.0	
Selenium	ug/L	20	-		-		<1.0		-	
Silver	ug/L	0.80	-		-		<0.10		-	
Thallium	ug/L	2.0	-		-		<0.04		-	
Vanadium	ug/L	16	-		-		<1.4		-	
Zinc	ug/L	283	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	85	110		46		40		49	
Alkalinity, Carbonate	mg/L	8.0	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	52	25		21		65		64	
Fluoride	mg/L	2.5	<1.0		<1.0		0.06		<1.0	
Nitrogen, Ammonia	mg/L	0.13	0.10		0.07		0.15		0.12	
Nitrogen, Nitrate	mg/L	0.40	<0.10		<0.10		<0.01		<0.10	
Nitrogen, Nitrite	mg/L	0.40	<0.10		<0.10		0.006		<0.10	
Sulfate	mg/L	21	2.4		7.6		2.9		2.7	
Sulfide	mg/L	0.80	<0.20		<0.20		0.02		<0.20	
Major Cations										
Calcium	mg/L	24	12		12		20		18	
Magnesium	mg/L	11	5.6		5.4		8.5		8.3	
Potassium	mg/L	3.0	2.1		1.9		2.8		2.6	
Sodium	mg/L	17	12		12		18		19	
General										
Hardness	mg/L	110	74		54		84		80	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-705 UFB (Cut-off Wall Key in Well)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[D]		Q2 2018[D]		Q3 2018[T]		Q4 2018[D]	
Field										
D.O.	ppm	-	**0.91**		**0.62**		**1.3**		**1.4**	
ORP	mV	-	-117		-146		-128		-95	
pH	SU	**6.59-7.59**	**6.96**		**7.01**		**6.88**		**7.04**	
Specific Conductance	uS/cm	-	**388**		**338**		**345**		**366**	
Temperature	C	-	**6.2**		**10**		**11**		**6.4**	
Turbidity	NTU	-	**172**		**6.4**		**2.9**		**9.8**	
Water Elevation	ft MSL	-	**1533.53**		**1536.76**		**1535.34**		**1537.91**	
Metals										
Aluminum	ug/L	**200**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		**0.39**		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**31**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		**0.62**		-	
Cobalt	ug/L	**80**	-		-		<0.40		-	
Copper	ug/L	**16**	<4.0		<4.0		**0.74**		<4.0	
Iron	ug/L	**13309**	**3960**		**9340**		**12100**		**7310**	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**13**	-		-		<4.6		-	
Manganese	ug/L	**973**	**1440**		**955**		**936**		**875**	
Mercury	ng/L	**4.0**	<1.0		<1.0		<1.0		<1.0	
Molybdenum	ug/L	**200**	-		-		**0.45**		-	
Nickel	ug/L	**80**	<20.0		<20.0		**0.76**		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	**16**	-		-		<1.4		-	
Zinc	ug/L	**34**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**118**	**101**		**84**		**80**		**88**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**36**	**31**		**32**		**36**		**35**	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.08**		<1.0	
Nitrogen, Ammonia	mg/L	**0.10**	**0.03**		<0.03		<0.004		<0.03	
Nitrogen, Nitrate	mg/L	**0.40**	<0.10		<0.10		<0.01		<0.10	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		<0.004		<0.10	
Sulfate	mg/L	**14**	**4.7**		**3.9**		**2.5**		**3.8**	
Sulfide	mg/L	**0.80**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**26**	**29**		**25**		**27**		**27**	
Magnesium	mg/L	**13**	**16**		**13**		**14**		**13**	
Potassium	mg/L	**4.0**	**3.4**		**3.1**		**3.5**		**3.8**	
Sodium	mg/L	**3.4**	**3.0**		**2.7**		**2.9**		**3.2**	
General										
Hardness	mg/L	**127**	**172**		**120**		**125**		**121**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-706 QAL (Mill Services Building/Secondary Crusher)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]	Q2 2018[T]	Q3 2018[D]	Q4 2018[T]
Field						
D.O.	ppm	-	**0.94**	**1.8**	**2.6**	**1.7**
ORP	mV	-	**64**	**76**	**66**	**75**
pH	SU	**5.74-6.74**	**6.02**	**5.93**	**5.75**	**5.88**
Specific Conductance	uS/cm	-	**991**	**1002**	**863**	**839**
Temperature	C	-	**7.8**	**9.2**	**9.5**	**7.9**
Turbidity	NTU	-	**2.9**	**2.5**	**3.5**	**3.0**
Water Elevation	ft MSL	-	**1559.45**	**1558.81**	**1559.33**	**1561.11**
Metals						
Aluminum	ug/L	**200**	-	-	<31.0	-
Antimony	ug/L	**4.0**	-	-	<0.80	-
Arsenic	ug/L	**7.5**	<5.0	<5.0	<0.10	<5.0
Barium	ug/L	**400**	-	-	<0.10	-
Beryllium	ug/L	**2.5**	-	-	<0.10	-
Boron	ug/L	**1200**	-	-	<8.4	-
Cadmium	ug/L	**3.0**	-	-	<0.10	-
Chromium	ug/L	**40**	-	-	**0.26**	-
Cobalt	ug/L	**31**	-	-	**23**	-
Copper	ug/L	**16**	<4.0	<4.0	<0.20	<4.0
Iron	ug/L	**8029**	**3490**	**3410**	**2970**	**2990**
Lead	ug/L	**9.0**	<3.0	<3.0	<0.10	<3.0
Lithium	ug/L	**17**	-	-	<4.6	-
Manganese	ug/L	**23484**	**15000**	**13600**	**14100**	<25000
Mercury	ng/L	**4.0**	<1.0	<1.0	<1.0	<1.0
Molybdenum	ug/L	**200**	-	-	**0.57**	-
Nickel	ug/L	**27**	**23**	<20.0	<0.10	<20.0
Selenium	ug/L	**20**	-	-	<1.0	-
Silver	ug/L	**0.80**	-	-	<0.10	-
Thallium	ug/L	**2.0**	-	-	<0.04	-
Vanadium	ug/L	**4.8**	-	-	<1.4	-
Zinc	ug/L	**77**	<10.0	<10.0	**5.6**	<10.0
Major Anions						
Alkalinity, Bicarbonate	mg/L	**132**	**145**	**76**	**71**	**74**
Alkalinity, Carbonate	mg/L	**8.0**	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	**165**	**126**	**117**	**105**	**100**
Fluoride	mg/L	**2.5**	<1.0	<1.0	**0.04**	<1.0
Nitrogen, Ammonia	mg/L	**0.88**	**0.42**	**0.41**	**0.43**	**0.37**
Nitrogen, Nitrate	mg/L	**0.40**	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	**0.40**	<0.10	<0.10	<0.004	<0.10
Sulfate	mg/L	**434**	**186**	**192**	**179**	**175**
Sulfide	mg/L	**0.80**	<0.20	<0.20	<0.01	<0.40
Major Cations						
Calcium	mg/L	**133**	**80**	**76**	**69**	**68**
Magnesium	mg/L	**44**	**29**	**29**	**27**	**26**
Potassium	mg/L	**5.6**	**4.3**	**4.5**	**4.3**	**4.6**
Sodium	mg/L	**140**	**45**	**44**	**42**	**42**
General						
Hardness	mg/L	**619**	**29**	**168**	**285**	**278**

2018
Mine Permit Groundwater Quality Monitoring Data
MW-707 QAL (Concentrator/CLO)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018[T]		Q2 2018[T]		Q3 2018[T]		Q4 2018[D]	
Field										
D.O.	ppm	-	**0.61**		**4.2**		**1.7**		**2.0**	
ORP	mV	-	-132		-123		-123		-116	
pH	SU	**6.43-7.43**	**7.26**		**7.16**		**6.93**		**7.10**	
Specific Conductance	uS/cm	-	**343**		**350**		**332**		**334**	
Temperature	C	-	**4.2**		**10**		**9.6**		**7.1**	
Turbidity	NTU	-	**1.2**		**1.8**		**1.8**		**5.9**	
Water Elevation	ft MSL	-	**1582.09**		**1582.94**		**1581.96**		**1582.69**	
Metals										
Aluminum	ug/L	**200**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		<0.10		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**20**		-	
Cadmium	ug/L	**3.0**	-		-		<0.10		-	
Chromium	ug/L	**40**	-		-		**0.19**		-	
Cobalt	ug/L	**80**	-		-		<0.40		-	
Copper	ug/L	**16**	<4.0		<4.0		<0.20		<4.0	
Iron	ug/L	**7115**	**4800**		**3410**		**4440**		**3700**	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**40**	-		-		<4.6		-	
Manganese	ug/L	**1128**	**976**		**716**		**841**		**747**	
Mercury	ng/L	**4.0**	<1.0		<1.0		<1.0		<1.0	
Molybdenum	ug/L	**200**	-		-		**0.89**		-	
Nickel	ug/L	**80**	<20.0		<20.0		<0.10		<20.0	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	**16**	-		-		<1.4		-	
Zinc	ug/L	**29**	<10.0		<10.0		<1.7		<10.0	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**168**	**166**		**163**		**165**		**162**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**40**	<10.0		<10.0		<0.72		<10.0	
Fluoride	mg/L	**2.5**	<1.0		<1.0		<0.03		<1.0	
Nitrogen, Ammonia	mg/L	**0.32**	**0.26**		**0.17**		**0.03**		**-**	
Nitrogen, Nitrate	mg/L	**0.40**	<0.10		<0.10		**0.02**		<0.10	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		<0.004		<0.10	
Sulfate	mg/L	**9.4**	**3.2**		**2.7**		<0.86		<1.0	
Sulfide	mg/L	**0.80**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**46**	**43**		**42**		**45**		**42**	
Magnesium	mg/L	**13**	**11**		**12**		**12**		**11**	
Potassium	mg/L	**2.9**	**2.1**		**2.2**		**2.3**		**2.4**	
Sodium	mg/L	**3.6**	**3.0**		**2.8**		**2.9**		**3.0**	
General										
Hardness	mg/L	**162**	**176**		**156**		**160**		**150**	

2018
Mine Permit Groundwater Quality Monitoring Data
MW-9R (Concentrator)
Humboldt Mill

Parameter	Unit	Recommended Benchmark 2018	Q1 2018^T		Q2 2018^D		Q3 2018^T		Q4 2018^D	
Field										
D.O.	ppm	-	**1.8**		**1.6**		**3.1**		**3.0**	
ORP	mV	-	**216**		**161**		**171**		**136**	
pH	SU	**5.40-6.40**	**5.89**		**6.11**		**5.87**		**6.04**	
Specific Conductance	uS/cm	-	**364**		**239**		**435**		**405**	
Temperature	C	-	**5.8**		**11**		**13**		**11**	
Turbidity	NTU	-	**2.6**		**4.0**		**2.1**		**3.6**	
Water Elevation	ft MSL	-	**1595.96**		**1597.1**		**1595.05**		**1596.77**	
Metals										
Aluminum	ug/L	**200**	-		-		<31.0		-	
Antimony	ug/L	**4.0**	-		-		<0.80		-	
Arsenic	ug/L	**7.5**	<5.0		<5.0		<0.10		<5.0	
Barium	ug/L	**400**	-		-		<0.10		-	
Beryllium	ug/L	**2.5**	-		-		<0.10		-	
Boron	ug/L	**1200**	-		-		**76**		-	
Cadmium	ug/L	**3.0**	-		-		**0.10**		-	
Chromium	ug/L	**40**	-		-		<0.10		-	
Cobalt	ug/L	**80**	-		-		**0.73**		-	
Copper	ug/L	**39**	**5.4**		<4.0		<0.20		<4.0	
Iron	ug/L	**4099**	<200		<200		**16**		<200	
Lead	ug/L	**9.0**	<3.0		<3.0		<0.10		<3.0	
Lithium	ug/L	**40**	-		-		<4.6		-	
Manganese	ug/L	**1376**	**124**		<50		**66**		**53**	
Mercury	ng/L	**10**	<1.0		<1.0		<1.0		<1.0	
Molybdenum	ug/L	**200**	-		-		<0.20		-	
Nickel	ug/L	**186**	**116**		**76**		**66**		**87**	
Selenium	ug/L	**20**	-		-		<1.0		-	
Silver	ug/L	**0.80**	-		-		<0.10		-	
Thallium	ug/L	**2.0**	-		-		<0.04		-	
Vanadium	ug/L	-	-		-		<1.4		-	
Zinc	ug/L	**38**	**37**		**31**		**18**		**21**	
Major Anions										
Alkalinity, Bicarbonate	mg/L	**85**	**29**		**28**		**79**		**46**	
Alkalinity, Carbonate	mg/L	**8.0**	<2.0		<2.0		<2.0		<2.0	
Chloride	mg/L	**185**	**20**		**12**		**13**		**31**	
Fluoride	mg/L	**2.5**	<1.0		<1.0		**0.10**		<1.0	
Nitrogen, Ammonia	mg/L	**0.22**	<0.03		<0.03		<0.004		<0.03	
Nitrogen, Nitrate	mg/L	**3.8**	**0.95**		**0.36**		**0.28**		**0.68**	
Nitrogen, Nitrite	mg/L	**0.40**	<0.10		<0.10		<0.004		<0.10	
Sulfate	mg/L	**335**	**135**		**47**		**98**		**96**	
Sulfide	mg/L	**0.80**	<0.20		<0.20		<0.01		<0.20	
Major Cations										
Calcium	mg/L	**116**	**36**		**18**		**47**		**42**	
Magnesium	mg/L	**41**	**13**		**6.8**		**16**		**14**	
Potassium	mg/L	**5.2**	**2.6**		**1.6**		**3.0**		**2.7**	
Sodium	mg/L	**48**	**6.7**		**6.5**		**11**		**9.3**	
General										
Hardness	mg/L	**479**	**161**		**76**		**185**		**162**	

2018

Mine Permit Groundwater Monitoring Data

Abbreviations and Data Qualifiers

Humboldt Mill

Notes:
Benchmarks are calculated based on guidance from Eagle 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.
NM = Not mesured during the sampling event.
^{T} = Sample was not filtered and all values are total concentrat
^{D} = Sample for metals and major cation parameters was filtered and values are dissolved concentrations.

Appendix G

Humboldt Mill

Groundwater Trend Analysis Summary

2018
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Man-Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
HW-1L	Monitoring	Alkalinity, Bicarbonate	mg/L	18	0	76.8	106.53	82	14.86	0.19	-3.71	20	84	69	0.1667	Positive
HW-1L	Monitoring	Calcium	mg/L	18	0	23.78	34	5	5.11	0.21	-3.21	5	28	72	0.34	Positive
HW-1L	Monitoring	Chloride	mg/L	18	0	46.27	55.66	5	4.69	0.1	-0.67	34	53	-23	-0.1286	Negative
HW-1L	Monitoring	Hardness	mg/L	18	0	108.06	156.31	24.5	24.13	0.22	-2.87	22	139	87	1.0769	Positive
HW-1L	Monitoring	Iron	µg/L	18	1	728.35	1160.52	27.9	216.09	0.3	0.35	420	1100	31	17.5714	Positive
HW-1L	Monitoring	Magnesium	mg/L	18	0	10.24	14.34	43.3	2.05	0.2	-3.66	2	11	73	0.05	Positive
HW-1L	Monitoring	Potassium	mg/L	18	0	2.38	5.61	124	1.61	0.68	3.09	2	8	-61	-0.0125	Negative
HW-1L	Monitoring	Sodium	mg/L	18	0	24.34	27.73	758.5	1.7	0.07	0.66	22	28	-42	-0.1111	Negative
HW-1L	Monitoring	Sulfate	mg/L	18	0	21.27	34.15	3	6.44	0.3	-1.99	2	28	135	0.75	Positive
HW-1L	Monitoring	pH	SU	17	0	8.62	8.1-9.1	11.1	-	-	0.46	8	10	-59	-0.0554	Negative
HW-1U LLA	Monitoring	Alkalinity, Carbonate	mg/L	15	5	26.98	81.9	12	27.46	1.02	1.01	2	83	38	1.5	Positive
HW-1U LLA	Monitoring	Chloride	mg/L	15	0	35.34	75.41	6.8	20.03	0.57	1.83	21	90	25	1	Positive
HW-1U LLA	Monitoring	Hardness	mg/L	15	0	83.05	166.88	41	41.91	0.5	-0.31	10	158	-38	-5.5	Negative
HW-1U LLA	Monitoring	Iron	µg/L	15	10	23780	64722.05	23.55	20471.03	0.86	-0.42	470	45200	20	0	Positive
HW-1U LLA	Monitoring	Lead	µg/L	15	11	65.97	8	27	43.8	0.66	-0.79	8	110	12	0	Positive
HW-1U LLA	Monitoring	Magnesium	mg/L	15	1	11.32	27.68	10	8.18	0.72	1.07	2	26	-22	-0.3667	Negative
HW-1U LLA	Monitoring	Nitrogen, Nitrite	mg/L	15	11	151.59	749.5	9.8	298.95	1.97	2.00	0	600	-40	-7.2308	Negative
HW-1U LLA	Monitoring	Potassium	mg/L	15	0	4.75	15.41	200	5.33	1.12	3.20	1	23	-43	-0.3	Negative
HW-1U LLA	Monitoring	Sodium	mg/L	15	0	68.53	142.48	101.5	36.97	0.54	0.65	31	136	60	5.3333	Positive
HW-1U LLA	Monitoring	Sulfate	mg/L	15	0	129.13	389.8	3	130.34	1.01	1.61	41	434	63	7	Positive
HW-1U LLA	Monitoring	pH	SU	16	0	8.64	8.1-9.1	29.65	-	-	0.07	8	9	14	0.016	Positive
HW-1U UFB	Monitoring	Alkalinity, Bicarbonate	mg/L	20	0	90.64	129.91	87.5	19.63	0.22	0.81	62	141	-52	-1.3955	Negative
HW-1U UFB	Monitoring	Alkalinity, Carbonate	mg/L	20	5	8.33	16.74	55.9	4.21	0.51	1.66	4	20	-39	-0.1744	Negative
HW-1U UFB	Monitoring	Chloride	mg/L	20	11	45.11	96.09	5	25.49	0.57	0.64	22	88	-126	-2.0542	Negative
HW-1U UFB	Monitoring	Hardness	mg/L	20	0	76.7	140.14	13.55	31.72	0.41	1.60	45	165	-18	-0.7063	Negative
HW-1U UFB	Monitoring	Iron	µg/L	20	15	462.6	1085.28	15.4	311.34	0.67	1.87	224	1000	39	0	Positive
HW-1U UFB	Monitoring	Magnesium	mg/L	20	0	7.14	14.56	10	3.71	0.52	1.42	4	16	-62	-0.28	Negative
HW-1U UFB	Monitoring	Nitrogen, Ammonia	mg/L	18	13	42.61	103.51	1	30.45	0.71	-0.46	0	74	-51	-1.4691	Negative
HW-1U UFB	Monitoring	Potassium	mg/L	20	0	7.42	19.28	72	5.93	0.8	1.14	2	19	-125	-0.5143	Negative
HW-1U UFB	Monitoring	Sodium	mg/L	20	0	25.85	64.39	200	19.27	0.75	0.68	6	66	-148	-2.54	Negative
HW-1U UFB	Monitoring	Sulfate	mg/L	20	3	22.85	68.13	3	22.64	0.99	1.02	1	73	-155	-2.8181	Negative
HW-1U UFB	Monitoring	Sulfide	mg/L	20	15	0.78	2.33	3	0.77	0.99	1.06	0	2	-71	0	Negative
HW-1U UFB	Monitoring	pH	SU	18	0	8.93	8.4-9.4	5	-	-	0.48	9	9	-39	-0.0112	Negative
HW-2	Monitoring	Alkalinity, Bicarbonate	mg/L	22	0	112.98	142.41	120	14.72	0.13	-0.56	87	130	-89	-1.3556	Negative
HW-2	Monitoring	Calcium	mg/L	22	0	53.25	70.45	5	8.6	0.16	-1.12	34	65	37	0.2222	Positive
HW-2	Monitoring	Chloride	mg/L	22	0	22.25	37.64	5	7.7	0.35	-0.05	12	34	176	1.0667	Positive
HW-2	Monitoring	Hardness	mg/L	22	0	234.77	297.79	62.5	31.51	0.13	-0.63	161	284	35	1.2	Positive
HW-2	Monitoring	Iron	µg/L	22	3	1284.26	2514.51	56	615.12	0.48	0.34	426	2400	-57	-42.8571	Negative
HW-2	Monitoring	Magnesium	mg/L	22	0	23.07	26.41	30.85	1.67	0.07	-0.46	20	26	-74	-0.0909	Negative
HW-2	Monitoring	Manganese	µg/L	22	3	193.32	356.58	10.21	81.63	0.42	0.34	77	320	80	5.6	Positive
HW-2	Monitoring	Nitrogen, Ammonia	mg/L	20	9	37.38	94.74	1	28.68	0.77	0.01	0	87	-60	-1.6648	Negative
HW-2	Monitoring	Potassium	mg/L	22	0	4.55	6	261.5	0.72	0.16	0.27	3	6	-16	-0.0143	Negative
HW-2	Monitoring	Sodium	mg/L	22	0	21.23	37.45	395	8.11	0.38	0.67	13	38	174	1.0909	Positive
HW-2	Monitoring	Sulfate	mg/L	22	0	136.64	180.61	3	21.99	0.16	-0.05	97	170	122	2.5	Positive
HW-2	Monitoring	Sulfide	mg/L	21	17	0.38	0.65	3	0.13	0.34	0.38	0	1	-28	0	Negative
HW-8U	Monitoring	Alkalinity, Bicarbonate	mg/L	22	0	156.91	209.32	150	26.2	0.17	1.10	127	220	-52	-1.4286	Negative
HW-8U	Monitoring	Arsenic	µg/L	22	10	7.93	6	2	1.39	0.18	-0.29	5	10	131	0.1889	Positive
HW-8U	Monitoring	Calcium	mg/L	22	0	36.77	48.74	5	5.99	0.16	0.68	29	49	33	0.25	Positive
HW-8U	Monitoring	Chloride	mg/L	22	12	15.93	23.26	8.25	3.66	0.23	-0.17	10	20	148	0.46	Positive
HW-8U	Monitoring	Iron	mg/L	22	0	12071.36	20900.26	31	4414.45	0.37	1.29	7000	23000	-152	-500	Negative
HW-8U	Monitoring	Magnesium	mg/L	22	0	13.38	18.13	19.45	2.38	0.18	1.56	11	19	-59	-0.125	Negative
HW-8U	Monitoring	Manganese	µg/L	22	1	4854.76	6750.12	10.295	947.68	0.2	-0.49	3000	6220	79	63.3333	Positive
HW-8U	Monitoring	Potassium	mg/L	22	0	3.04	3.76	155.5	0.36	0.12	0.76	2	4	42	0.0182	Positive
HW-8U	Monitoring	Sodium	mg/L	22	0	3.6	4.73	8900	0.56	0.16	0.33	3	5	78	0.0476	Positive
HW-8U	Monitoring	Sulfate	mg/L	22	4	8.31	16.21	3	3.95	0.48	0.27	2	16	215	0.7	Positive
HW-8U	Monitoring	Zinc	µg/L	22	17	14.08	28.82	14	7.37	0.52	-0.77	3	21	-62	0	Negative
HW-8U	Monitoring	pH	SU	18	0	6.88	6.4-7.4	12	-	-	-1.51	6	7	-19	-0.0069	Negative

2018
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Man-Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
HYG-1	Monitoring	Alkalinity, Bicarbonate	mg/L	19	0	224.79	358.86	215	67.04	0.3	0.53	140	370	60	6.5	Positive
HYG-1	Monitoring	Antimony	µg/L	7	0	7.23	5.5	2	0.97	0.13	0.39	6	9	12	0.35	Positive
HYG-1	Monitoring	Calcium	mg/L	19	0	49.37	64.24	5	7.43	0.15	0.07	35	61	35	0.2727	Positive
HYG-1	Monitoring	Hardness	mg/L	19	0	237.58	316.59	49.5	39.51	0.17	0.35	170	310	25	1.6667	Positive
HYG-1	Monitoring	Magnesium	mg/L	19	0	25.41	33.43	12.75	4.01	0.16	0.25	19	33	24	0.15	Positive
HYG-1	Monitoring	Manganese	µg/L	19	3	358.06	816.79	20	229.36	0.64	0.28	81	688	120	35.2857	Positive
HYG-1	Monitoring	Mercury	ng/L	19	0	18.61	41.8	4	11.59	0.62	0.30	4	39	93	1.33	Positive
HYG-1	Monitoring	Nitrogen, Ammonia	mg/L	17	0	231.31	606.06	1	187.38	0.81	0.15	0	570	-27	-12.4755	Negative
HYG-1	Monitoring	Potassium	mg/L	19	0	9.36	13.01	234	1.83	0.2	0.22	7	13	78	0.2273	Positive
HYG-1	Monitoring	Sodium	mg/L	19	0	38.86	77.53	282.5	19.34	0.5	0.01	12	78	78	1.8	Positive
HYG-1	Monitoring	Sulfate	mg/L	19	0	86.1	137.75	3	25.83	0.3	-0.09	48	128	34	1.7273	Positive
HYG-1	Monitoring	pH	SU	17	0	6.79	6.3-7.3	26.8	-	-	0.01	7	7	-11	-0.0025	Negative
KMW-5R	COSA	Alkalinity, Bicarbonate	mg/L	21	0	355.14	477.39	370	61.12	0.17	-3.78	104	400	139	3	Positive
KMW-5R	COSA	Arsenic	µg/L	21	17	12.08	6	2	6.31	0.52	-0.58	4	18	42	0	Positive
KMW-5R	COSA	Calcium	mg/L	21	0	1751.14	16621.11	5	7434.99	4.25	4.58	93	34200	-96	-1.8875	Negative
KMW-5R	COSA	Chloride	mg/L	21	7	87.61	191.74	2.55	52.06	0.59	-0.23	4	160	-93	-5.5818	Negative
KMW-5R	COSA	Copper	µg/L	21	15	23.72	1.3	70.6	19.83	0.84	0.59	2	52	79	0	Positive
KMW-5R	COSA	Hardness	mg/L	20	0	513.85	726.59	130	106.37	0.21	-1.61	220	634	-66	-6.5724	Negative
KMW-5R	COSA	Iron	µg/L	21	7	25262.14	106233.61	125	40485.74	1.6	1.81	240	129000	51	75.7895	Positive
KMW-5R	COSA	Lead	µg/L	21	17	3.55	8	84.5	3.15	0.89	-0.09	0	6	30	0	Positive
KMW-5R	COSA	Lithium	µg/L	9	1	16.35	30.27	155	6.96	0.43	1.46	9	31	20	1.42	Positive
KMW-5R	COSA	Magnesium	mg/L	21	0	892.9	8594.9	10	3851	4.31	4.58	40	17700	-57	-0.5725	Negative
KMW-5R	COSA	Manganese	µg/L	21	2	1908.95	2838.82	11.7	464.94	0.24	-0.49	1010	2700	-59	-33.3333	Negative
KMW-5R	COSA	Mercury	ng/L	21	14	10.52	26.8	10.95	8.14	0.77	0.68	1	24	47	0	Positive
KMW-5R	COSA	Nickel	µg/L	21	17	34.25	66.49	4	16.12	0.47	-0.07	18	49	60	0	Positive
KMW-5R	COSA	Nitrogen, Ammonia	mg/L	19	9	25.51	63.79	1	19.14	0.75	-0.38	0	54	-23	-0.0012	Negative
KMW-5R	COSA	Potassium	mg/L	21	0	219.1	2157.94	380.5	969.42	4.42	4.58	7	4450	-42	-0.0218	Negative
KMW-5R	COSA	Sodium	mg/L	21	0	900.52	9103.09	6700	4101.29	4.55	4.58	3	18800	136	0.3369	Positive
KMW-5R	COSA	Sulfate	mg/L	21	0	94.73	133.77	3	19.52	0.21	0.40	67	130	48	1.2373	Positive
KMW-5R	COSA	Zinc	µg/L	21	13	16.94	35.89	52.5	9.48	0.56	0.35	2	34	12	0	Positive
MW-701 QAL	Leachate	Alkalinity, Bicarbonate	mg/L	21	0	52.32	110.38	34	29.03	0.55	0.35	29	150	-113	-2.3705	Negative
MW-701 QAL	Leachate	Calcium	mg/L	21	0	24.34	67.91	5	21.79	0.9	1.96	8	91	-85	-0.95	Negative
MW-701 QAL	Leachate	Hardness	mg/L	21	0	108.86	291.5	24	91.32	0.84	1.74	36	373	-77	-5.0417	Negative
MW-701 QAL	Leachate	Magnesium	mg/L	21	0	10.2	27.78	422.5	8.79	0.86	1.83	4	36	-82	-0.31	Negative
MW-701 QAL	Leachate	Manganese	µg/L	21	13	2130.05	5246.98	20	1558.47	0.73	-0.09	50	4100	-135	-131.1812	Negative
MW-701 QAL	Leachate	Mercury	ng/L	21	10	2.72	7.74	4	2.51	0.92	2.12	1	9	-87	-0.0471	Negative
MW-701 QAL	Leachate	Nitrogen, Ammonia	mg/L	19	13	152.17	402.21	1	125.02	0.82	0.05	25	300	-114	-4.1625	Negative
MW-701 QAL	Leachate	Nitrogen, Nitrate	µg/L	21	0	666.24	5	1	607	0.91	1.45	0	2400	-70	-42	Negative
MW-701 QAL	Leachate	Potassium	mg/L	21	0	4.95	10.3	44	2.68	0.54	1.21	2	12	-120	-0.3	Negative
MW-701 QAL	Leachate	Sodium	mg/L	21	0	21.12	127.89	200	53.39	2.53	4.40	5	251	-71	-0.1854	Negative
MW-701 QAL	Leachate	Sulfate	mg/L	21	0	33.62	80.27	3	23.32	0.69	1.29	11	91	-181	-2.9056	Negative
MW-701 QAL	Leachate	pH	SU	18	0	5.96	5.5-6.5	4.7	-	-	-0.38	5	7	-36	-0.025	Negative
MW-701 UFB	Leachate	Alkalinity, Bicarbonate	mg/L	22	0	144.23	162.33	140	9.05	0.06	-0.38	120	160	36	0	Positive
MW-701 UFB	Leachate	Barium	µg/L	9	3	120.17	162.51	50	21.17	0.18	0.57	100	150	20	6.75	Positive
MW-701 UFB	Leachate	Calcium	mg/L	22	0	33.39	39.76	5	3.18	0.1	-0.44	26	39	64	0.2583	Positive
MW-701 UFB	Leachate	Hardness	mg/L	22	0	152.23	168.19	37	7.98	0.05	0.87	141	176	37	0.1875	Positive
MW-701 UFB	Leachate	Iron	mg/L	22	0	15464.09	24280.8	30	4408.36	0.29	-2.16	210	21000	13	21.4286	Positive
MW-701 UFB	Leachate	Magnesium	mg/L	22	0	14.36	16.09	11.15	0.86	0.06	-0.34	13	16	-14	0	Negative
MW-701 UFB	Leachate	Manganese	µg/L	22	2	2400.5	4384.56	10.07	992.03	0.41	1.90	180	5900	-96	-33.3333	Negative
MW-701 UFB	Leachate	Nitrogen, Ammonia	mg/L	20	16	465.75	1748.26	1	641.25	1.38	1.69	40	1400	-91	-2.0012	Negative
MW-701 UFB	Leachate	Potassium	mg/L	22	0	3.99	8.01	146.5	2.01	0.5	2.60	3	11	-103	-0.0917	Negative
MW-701 UFB	Leachate	Sodium	mg/L	22	0	9.22	30.59	16500	10.68	1.16	2.89	4	48	-108	-0.1538	Negative
MW-701 UFB	Leachate	Sulfate	mg/L	22	0	21.07	48.87	3	13.9	0.66	2.46	7	71	-91	-1	Negative
MW-701 UFB	Leachate	Sulfide	mg/L	22	18	0.7	1.86	3	0.58	0.83	1.21	0	2	-79	0	Negative

2018
Groundwater Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Man-Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-702 QAL	Leachate	Alkalinity, Bicarbonate	mg/L	21	1	88.56	157.34	58.5	34.39	0.39	-0.01	25	160	32	1.4667	Positive
MW-702 QAL	Leachate	Alkalinity, Carbonate	mg/L	21	7	15.54	43.7	22	14.08	0.91	1.40	2	49	-40	-0.1909	Negative
MW-702 QAL	Leachate	Calcium	mg/L	21	0	42.81	76.46	5	16.82	0.39	1.30	23	93	-174	-2.0958	Negative
MW-702 QAL	Leachate	Chloride	mg/L	21	12	13	17.58	2.7	2.29	0.18	1.20	10	18	-49	0	Negative
MW-702 QAL	Leachate	Hardness	mg/L	21	0	150.1	247.7	53.5	48.8	0.33	0.64	80	270	-183	-6.8348	Negative
MW-702 QAL	Leachate	Magnesium	mg/L	21	0	8.73	13.84	10	2.56	0.29	0.37	4	14	-98	-0.2806	Negative
MW-702 QAL	Leachate	Manganese	µg/L	21	11	229.8	545.68	20	157.94	0.69	0.98	60	550	-118	-14.2857	Negative
MW-702 QAL	Leachate	Mercury	ng/L	21	14	2.03	3	4	0.48	0.24	-0.35	1	3	101	0.0318	Positive
MW-702 QAL	Leachate	Nitrogen, Nitrate	mg/L	21	0	532.92	5	1	408.75	0.77	0.18	0	1200	-45	-25.1224	Negative
MW-702 QAL	Leachate	Nitrogen, Nitrite	mg/L	21	14	95.75	231.71	175.5	67.98	0.71	-0.89	0	170	-48	0	Negative
MW-702 QAL	Leachate	Potassium	mg/L	21	0	9.83	21.54	90	5.86	0.6	1.73	5	28	-32	-0.2083	Negative
MW-702 QAL	Leachate	Sodium	mg/L	21	0	34.96	61.09	200	13.07	0.37	0.36	17	60	72	1.1231	Positive
MW-702 QAL	Leachate	Sulfate	mg/L	21	0	88.95	134.93	3	22.99	0.26	0.09	54	130	-177	-3.5	Negative
MW-702 QAL	Leachate	pH	SU	18	0	9.38	8.9-9.9	9.7	-	-	-0.85	7	11	-27	-0.0509	Negative
MW-702 UFB	Leachate	Alkalinity, Bicarbonate	mg/L	21	0	94.71	138.84	90	22.06	0.23	2.81	49	181	26	0.119	Positive
MW-702 UFB	Leachate	Calcium	mg/L	21	0	28.5	37.92	5	4.71	0.17	-3.42	10	34	-14	-0.0101	Negative
MW-702 UFB	Leachate	Iron	µg/L	21	1	806.7	1343.43	29.65	268.37	0.33	2.23	540	1700	36	7.3214	Positive
MW-702 UFB	Leachate	Magnesium	mg/L	21	0	9.03	11.49	5.36	1.23	0.14	-3.45	4	10	22	0.02	Positive
MW-702 UFB	Leachate	Manganese	µg/L	21	1	89.66	115.47	20	12.91	0.14	1.73	75	130	-34	-0.4042	Negative
MW-702 UFB	Leachate	Potassium	mg/L	21	0	3.8	10.33	118	3.27	0.86	4.52	3	18	-54	-0.025	Negative
MW-702 UFB	Leachate	Sodium	mg/L	21	0	3.2	4.95	774	0.87	0.27	4.13	3	7	-11	0	Negative
MW-702 UFB	Leachate	Sulfate	mg/L	21	0	32.88	36.59	3	1.85	0.06	-0.81	29	36	-34	-0.0581	Negative
MW-702 UFB	Leachate	pH	SU	17	0	7.66	7.2-8.2	9.75	-	-	-1.23	4	10	-35	-0.0606	Negative
MW-703 DBA	Compliance	Alkalinity, Bicarbonate	mg/L	21	0	61.68	94.41	81	16.36	0.27	-0.02	30	91	66	1.241	Positive
MW-703 DBA	Compliance	Alkalinity, Carbonate	mg/L	21	3	17.92	38.09	25	10.09	0.56	0.59	4	38	-67	-0.6696	Negative
MW-703 DBA	Compliance	Calcium	mg/L	21	0	15.32	29.78	5	7.23	0.47	0.04	4	26	17	0.1444	Positive
MW-703 DBA	Compliance	Chloride	mg/L	21	0	17.48	20.14	2.655	1.33	0.08	-0.31	15	19	-151	-0.192	Negative
MW-703 DBA	Compliance	Iron	µg/L	21	15	349.17	799.9	14.35	225.37	0.65	2.20	210	798	-15	0	Negative
MW-703 DBA	Compliance	Lithium	µg/L	8	2	14.28	20.09	18	2.91	0.2	-0.87	10	17	10	0.7083	Positive
MW-703 DBA	Compliance	Magnesium	mg/L	21	0	10.2	16.72	15.75	3.26	0.32	-0.07	4	15	-59	-0.2366	Negative
MW-703 DBA	Compliance	Nitrogen, Ammonia	mg/L	19	13	51.51	122.68	1	35.59	0.69	0.00	0	100	-59	-1.665	Negative
MW-703 DBA	Compliance	Potassium	mg/L	21	0	17.12	30.26	75	6.57	0.38	0.23	7	29	-12	-0.1639	Negative
MW-703 DBA	Compliance	Sodium	mg/L	21	0	11.59	16.5	200	2.46	0.21	-0.57	7	15	-88	-0.2573	Negative
MW-703 DBA	Compliance	Sulfate	mg/L	21	1	30.86	83.52	3	26.33	0.85	1.29	2	100	11	0.3679	Positive
MW-703 DBA	Compliance	Sulfide	mg/L	21	9	0.56	1.21	3	0.32	0.57	1.77	0	1	17	0	Positive
MW-703 DBA	Compliance	pH	SU	18	0	9.31	8.8-9.8	9.4	-	-	0.89	8	11	-10	-0.0053	Negative
MW-703 LLA	Compliance	Alkalinity, Bicarbonate	mg/L	21	0	79.53	90.92	86	5.69	0.07	-0.71	66	87	45	0.2701	Positive
MW-703 LLA	Compliance	Calcium	mg/L	21	0	26.24	32.98	5	3.37	0.13	1.24	20	35	-18	-0.0171	Negative
MW-703 LLA	Compliance	Chloride	mg/L	21	0	33	89.65	2.58	28.33	0.86	1.01	10	100	-174	-3.7102	Negative
MW-703 LLA	Compliance	Hardness	mg/L	21	0	113.05	135.07	22.5	11.01	0.1	0.36	96	135	-36	-0.5357	Negative
MW-703 LLA	Compliance	Iron	µg/L	21	0	851.62	1933.52	25.55	540.95	0.64	2.41	280	2600	-22	-6.1667	Negative
MW-703 LLA	Compliance	Lithium	mg/L	8	1	16.63	28.8	14	6.09	0.37	-0.43	7	23	-21	-2.1976	Negative
MW-703 LLA	Compliance	Magnesium	mg/L	21	0	10.35	12.08	11.2	0.87	0.08	-0.07	8	12	12	0	Positive
MW-703 LLA	Compliance	Manganese	µg/L	21	2	74.02	96.73	20	11.36	0.15	-0.36	50	94	30	0.3806	Positive
MW-703 LLA	Compliance	Nitrogen, Ammonia	mg/L	19	14	48.8	75.54	1	13.37	0.27	1.55	38	71	-47	-1.4691	Negative
MW-703 LLA	Compliance	Potassium	mg/L	21	0	4.33	7.43	119	1.55	0.36	0.84	3	8	-174	-0.2074	Negative
MW-703 LLA	Compliance	Sodium	mg/L	21	0	17.48	47.28	628	14.9	0.85	1.14	6	53	-159	-1.9463	Negative
MW-703 LLA	Compliance	Sulfate	mg/L	21	0	28.83	43.18	3	7.17	0.25	-1.29	10	38	11	0.0333	Positive
MW-703 LLA	Compliance	pH	SU	18	0	8.56	8.1-9.1	11	-	-	0.20	8	9	-64	-0.05	Negative
MW-703 QAL	Compliance	Alkalinity, Bicarbonate	mg/L	21	0	63.42	89.06	57	12.82	0.2	1.06	49	91	-157	-1.7722	Negative
MW-703 QAL	Compliance	Calcium	mg/L	21	0	19.97	29.93	5	4.98	0.25	1.52	13	32	-92	-0.4125	Negative
MW-703 QAL	Compliance	Hardness	mg/L	21	0	84.37	114.72	21	15.18	0.18	1.07	64	119	-59	-1	Negative
MW-703 QAL	Compliance	Manganese	mg/L	21	15	77.17	106.54	20	14.69	0.19	-0.69	57	91	-81	0	Negative
MW-703 QAL	Compliance	Nitrogen, Nitrate	mg/L	21	0	507.06	5	1	583.51	1.15	1.39	1	2020	44	47.3333	Positive
MW-703 QAL	Compliance	Potassium	mg/L	21	0	1.75	2.48	82	0.36	0.21	1.20	1	3	-136	-0.0449	Negative
MW-703 QAL	Compliance	Sodium	mg/L	21	0	3.57	7.32	200	1.88	0.53	1.30	2	8	-192	-0.2	Negative
MW-703 QAL	Compliance	Sulfate	mg/L	21	0	24.8	39.9	3	7.55	0.3	0.24	12	40	-28	-0.3708	Negative
MW-703 QAL	Compliance	pH	SU	17	0	6.73	6.2-7.2	6.35	-	-	0.62	6	8	-76	-0.1167	Negative

2018
Groundwater Trend Analysis Summary
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Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Man-Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-703 UFB	Compliance	Alkalinity, Bicarbonate	mg/L	21	0	79.2	108.67	83.5	14.73	0.19	-4.32	16	91	31	0.1097	Positive
MW-703 UFB	Compliance	Calcium	mg/L	21	0	30.14	41.68	5	5.77	0.19	-4.03	6	35	-13	0	Negative
MW-703 UFB	Compliance	Hardness	mg/L	21	0	119.41	171.51	31	26.05	0.22	-2.76	28	147	38	0.3205	Positive
MW-703 UFB	Compliance	Iron	µg/L	21	1	1201	2052	31.65	425.5	0.35	-0.18	490	1820	62	32.1538	Positive
MW-703 UFB	Compliance	Magnesium	µg/L	21	0	10.07	13.59	5.36	1.76	0.17	-4.00	3	11	41	0.0282	Positive
MW-703 UFB	Compliance	Manganese	mg/L	21	3	155.89	202.18	20	23.15	0.15	-1.22	95	189	99	2.8452	Positive
MW-703 UFB	Compliance	Potassium	mg/L	21	0	2.65	4.04	137	0.69	0.26	3.15	2	5	-158	-0.0333	Negative
MW-703 UFB	Compliance	Sodium	mg/L	21	0	4.4	15.74	1125	5.67	1.29	4.50	3	29	-65	-0.02	Negative
MW-703 UFB	Compliance	Sulfate	mg/L	21	0	44.89	49.03	3	2.07	0.05	0.86	41	51	61	0.1183	Positive
MW-703 UFB	Compliance	pH	SU	18	0	7.96	7.5-8.5	11	-	-	-0.37	5	10	-26	-0.0218	Negative
MW-704 DBA	Compliance	Alkalinity, Bicarbonate	mg/L	20	0	116.05	162.32	125	23.14	0.2	-2.12	39	142	130	2.453	Positive
MW-704 DBA	Compliance	Alkalinity, Carbonate	mg/L	20	5	8.05	22.37	77	7.16	0.89	1.85	2	29	-104	-0.5903	Negative
MW-704 DBA	Compliance	Calcium	mg/L	20	0	20.15	26.49	5	3.17	0.16	-2.62	9	23	55	0.1523	Positive
MW-704 DBA	Compliance	Hardness	mg/L	20	0	100.45	131.8	20.5	15.67	0.16	-1.97	48	125	114	1.6667	Positive
MW-704 DBA	Compliance	Iron	µg/L	20	2	666.56	971.22	20	152.33	0.23	-0.52	340	888	116	26.6692	Positive
MW-704 DBA	Compliance	Magnesium	µg/L	20	0	10.48	13.34	10	1.43	0.14	-1.80	6	12	44	0.0542	Positive
MW-704 DBA	Compliance	Manganese	mg/L	20	16	52.5	54.95	10.075	1.23	0.02	0.00	51	54	17	0	Positive
MW-704 DBA	Compliance	Potassium	mg/L	20	0	2.66	3.19	110	0.26	0.1	1.67	2	4	-61	-0.0174	Negative
MW-704 DBA	Compliance	Sodium	mg/L	20	0	10.67	12.58	800	0.96	0.09	0.60	9	13	-55	-0.04	Negative
MW-704 DBA	Compliance	Sulfate	mg/L	20	13	2.93	5.34	3	1.21	0.41	-0.10	1	4	-118	-0.0816	Negative
MW-704 DBA	Compliance	pH	SU	18	0	8.61	8.1-9.1	12	-	-	-0.79	8	9	-46	-0.0291	Negative
MW-704 LLA	Compliance	Alkalinity, Bicarbonate	mg/L	22	0	108.45	159.95	55	25.75	0.24	0.06	55	157	41	1	Positive
MW-704 LLA	Compliance	Alkalinity, Carbonate	mg/L	22	10	6.62	13.35	62.4	3.36	0.51	1.20	2	14	-75	-0.1647	Negative
MW-704 LLA	Compliance	Hardness	mg/L	22	0	115.91	200	22	42.05	0.36	1.62	66	252	38	1.6667	Positive
MW-704 LLA	Compliance	Iron	µg/L	22	4	968	3153.03	28	1092.51	1.13	3.31	230	5000	29	13	Positive
MW-704 LLA	Compliance	Lithium	µg/L	9	2	17.03	27.2	10	5.08	0.3	1.17	13	26	14	0.745	Positive
MW-704 LLA	Compliance	Magnesium	µg/L	22	0	12.52	16.26	10.5	1.87	0.15	-0.13	9	16	26	0.0529	Positive
MW-704 LLA	Compliance	Potassium	mg/L	22	0	6.58	11.41	116.5	2.42	0.37	0.55	4	11	46	0.0882	Positive
MW-704 LLA	Compliance	Sodium	mg/L	22	0	5.59	14.35	690	4.38	0.78	4.53	4	25	13	0.0083	Positive
MW-704 LLA	Compliance	Sulfate	mg/L	22	0	9.57	19.61	3	5.02	0.52	0.90	2	22	-109	-0.6	Negative
MW-704 LLA	Compliance	pH	SU	18	0	8.63	8.1-9.1	10	-	-	-0.29	8	9	-64	-0.0425	Negative
MW-704 QAL	Compliance	Alkalinity, Bicarbonate	mg/L	22	0	131.66	257.58	170	62.96	0.48	0.82	60	283	22	0.9	Positive
MW-704 QAL	Compliance	Arsenic	µg/L	22	12	14.79	6	2	7.45	0.5	-0.59	0	25	-48	0	Negative
MW-704 QAL	Compliance	Calcium	mg/L	22	0	32.32	47.12	5	7.4	0.23	-0.61	18	42	77	0.7	Positive
MW-704 QAL	Compliance	Chloride	mg/L	22	6	16.98	23.34	6.75	3.18	0.19	2.27	14	27	42	0.18	Positive
MW-704 QAL	Compliance	Hardness	mg/L	22	0	130.23	192.63	27	31.2	0.24	-0.22	71	192	104	3.3333	Positive
MW-704 QAL	Compliance	Iron	µg/L	22	4	25677.56	89287.16	42	31804.8	1.24	1.52	506	103000	-18	-50	Negative
MW-704 QAL	Compliance	Magnesium	µg/L	22	0	9.67	15.56	16.95	2.94	0.3	0.29	6	15	171	0.3889	Positive
MW-704 QAL	Compliance	Manganese	mg/L	22	3	3327.53	8328.33	10.05	2500.4	0.75	0.10	520	7200	-16	-20	Negative
MW-704 QAL	Compliance	Mercury	ng/L	22	6	9.08	31.6	4	11.26	1.24	2.85	1	47	40	0.079	Positive
MW-704 QAL	Compliance	Nitrogen, Ammonia	mg/L	20	9	59.64	187.44	1	63.9	1.07	2.03	0	230	-29	-0.9928	Negative
MW-704 QAL	Compliance	Nitrogen, Nitrate	mg/L	22	11	439.57	5	1	517.43	1.18	0.83	0	1500	-26	0	Negative
MW-704 QAL	Compliance	Potassium	mg/L	22	0	3	6.56	171	1.78	0.59	2.67	2	9	89	0.0692	Positive
MW-704 QAL	Compliance	Sodium	mg/L	22	0	14.91	31	44100	8.05	0.54	0.01	2	29	63	0.5187	Positive
MW-704 QAL	Compliance	Sulfate	mg/L	22	1	26.82	66.34	3	19.76	0.74	1.46	8	84	124	2.1267	Positive
MW-704 QAL	Compliance	pH	SU	18	0	5.92	5.4-6.4	11	-	-	0.95	6	6	-36	-0.0143	Negative
MW-704 UFB	Compliance	Alkalinity, Bicarbonate	mg/L	22	0	145.64	194.01	140	24.19	0.17	-0.52	91	188	61	1.6667	Positive
MW-704 UFB	Compliance	Calcium	mg/L	22	0	40.73	69.81	5	14.54	0.36	-0.75	10	57	159	1.9947	Positive
MW-704 UFB	Compliance	Chloride	mg/L	22	7	19.07	28.43	5	4.68	0.25	0.13	12	26	159	0.8	Positive
MW-704 UFB	Compliance	Hardness	mg/L	22	0	147.55	242.7	34.5	47.58	0.32	-0.45	68	216	184	7	Positive
MW-704 UFB	Compliance	Iron	µg/L	22	0	20480.91	53861.52	47	16690.31	0.81	0.26	210	47800	155	2104.5	Positive
MW-704 UFB	Compliance	Magnesium	µg/L	22	0	8.82	16.77	25	3.97	0.45	-0.09	2	16	205	0.5733	Positive
MW-704 UFB	Compliance	Manganese	mg/L	22	2	710.1	1371.79	10.05	330.84	0.47	-0.47	89	1300	124	41.6667	Positive
MW-704 UFB	Compliance	Nitrogen, Ammonia	mg/L	20	7	61.93	184.15	1	61.11	0.99	1.66	0	200	-125	-3.9982	Negative
MW-704 UFB	Compliance	Potassium	mg/L	22	0	2.9	5.05	186	1.08	0.37	-0.66	1	5	49	0.0571	Positive
MW-704 UFB	Compliance	Sodium	mg/L	22	0	15.13	40.19	24000	12.53	0.83	1.77	5	50	-43	-0.35	Negative
MW-704 UFB	Compliance	Sulfate	mg/L	22	0	26.87	67.12	3	20.12	0.75	0.98	5	73	115	2.1381	Positive
MW-704 UFB	Compliance	Sulfide	mg/L	21	17	0.31	0.49	3	0.09	0.29	-0.34	0	0	-56	0	Negative

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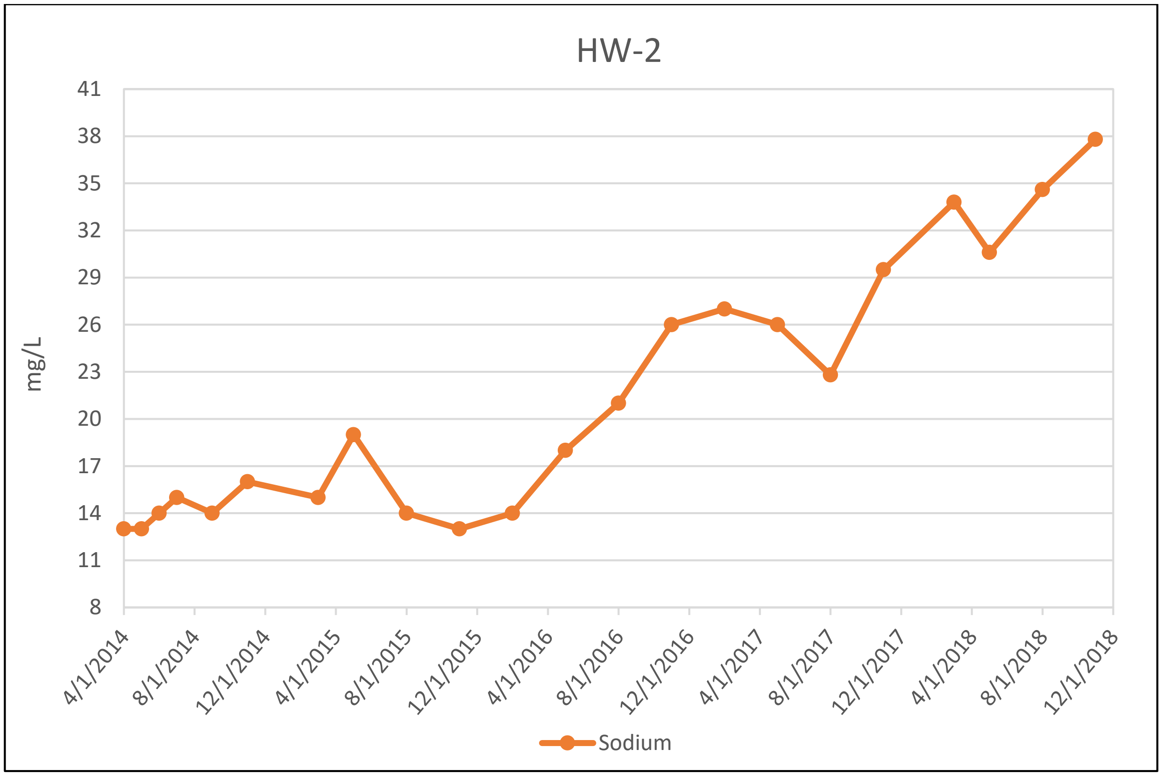
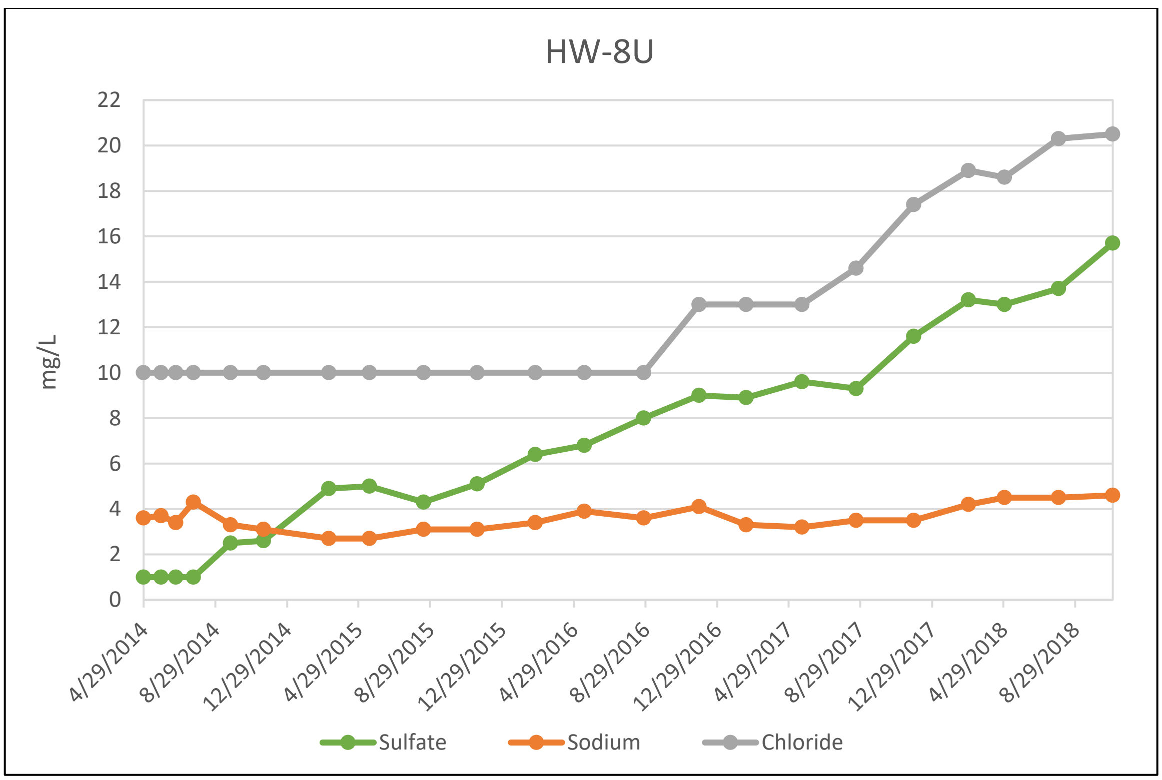
Groundwater Trend Analysis Summary
Humboldt Mill

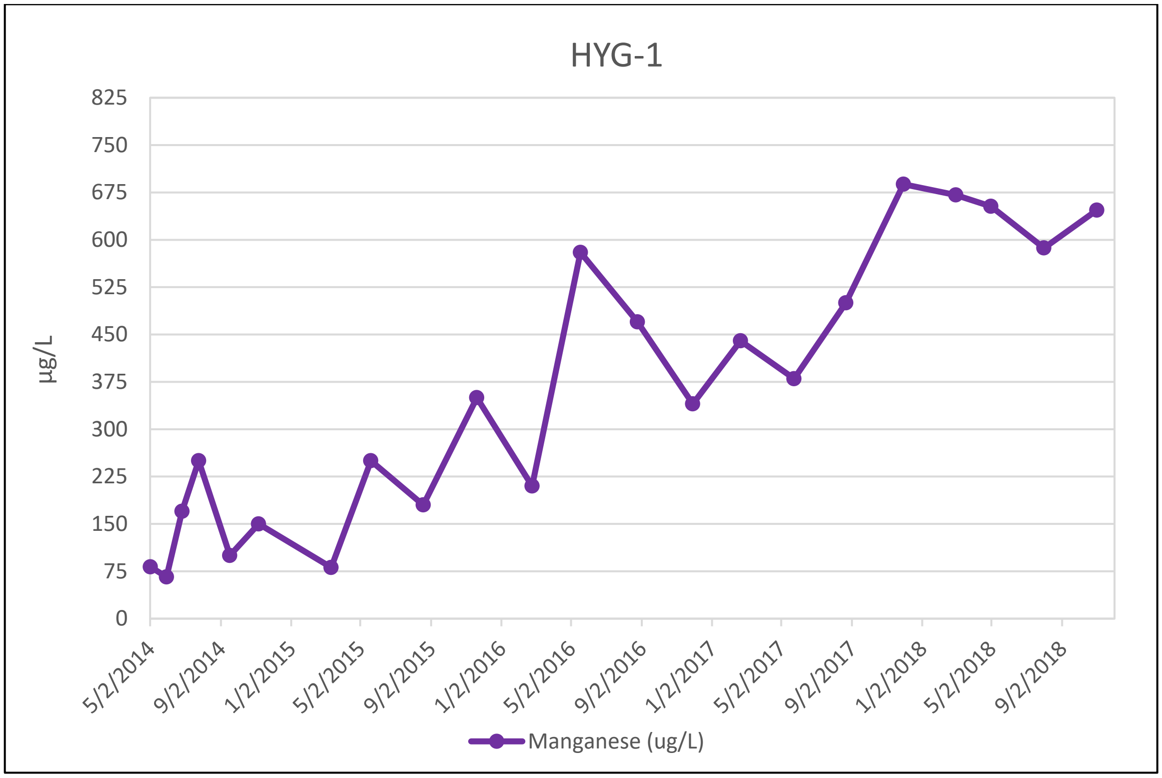
Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Man-Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MW-705 QAL	Compliance	Alkalinity, Bicarbonate	mg/L	22	0	58.99	93.68	41	17.34	0.29	1.37	35	110	-93	-1.1364	Negative
MW-705 QAL	Compliance	Calcium	mg/L	22	0	17.05	23.79	5	3.37	0.2	0.51	12	24	-125	-0.4	Negative
MW-705 QAL	Compliance	Chloride	mg/L	22	0	35.55	61.06	5	12.75	0.36	1.04	19	65	-15	-0.1846	Negative
MW-705 QAL	Compliance	Hardness	mg/L	22	0	78.38	107.67	19	14.65	0.19	0.54	54	109	-117	-1.6667	Negative
MW-705 QAL	Compliance	Iron	µg/L	22	0	8340.45	12853.58	13	2256.56	0.27	-0.94	1900	12000	-39	-100	Negative
MW-705 QAL	Compliance	Magnesium	µg/L	22	0	7.6	10.78	42.8	1.59	0.21	0.83	5	11	-122	-0.1667	Negative
MW-705 QAL	Compliance	Manganese	mg/L	22	5	867.94	1495.41	10.175	313.73	0.36	0.43	280	1500	-127	-37.6111	Negative
MW-705 QAL	Compliance	Mercury	ng/L	22	17	1.2	1.62	4	0.21	0.18	1.27	1	2	45	0	Positive
MW-705 QAL	Compliance	Nitrogen, Ammonia	mg/L	20	0	60.97	144.71	1	41.87	0.69	-0.32	0	130	-23	-0.5256	Negative
MW-705 QAL	Compliance	Potassium	mg/L	22	0	2.49	3.06	59.5	0.29	0.12	-0.28	2	3	-41	-0.0125	Negative
MW-705 QAL	Compliance	Sodium	mg/L	22	0	12.18	18.17	5300	3	0.25	-0.18	4	19	118	0.3	Positive
MW-705 QAL	Compliance	Sulfate	mg/L	22	0	6.42	19.57	3	6.58	1.02	3.44	2	33	43	0.1364	Positive
MW-705 UFB	Compliance	Alkalinity, Bicarbonate	mg/L	22	0	90.95	115.7	85	12.37	0.14	3.20	80	140	-92	-0.6	Negative
MW-705 UFB	Compliance	Calcium	mg/L	22	0	22.67	28.33	5	2.83	0.12	0.51	18	29	118	0.3375	Positive
MW-705 UFB	Compliance	Chloride	mg/L	22	8	25.72	41.2	5	7.74	0.3	-0.41	12	36	199	1.4867	Positive
MW-705 UFB	Compliance	Hardness	mg/L	22	0	111.41	146.19	21	17.39	0.16	2.16	92	172	115	1.5	Positive
MW-705 UFB	Compliance	Iron	µg/L	22	0	8122.27	13470.74	23	2674.23	0.33	-1.27	680	12100	81	166.6667	Positive
MW-705 UFB	Compliance	Magnesium	µg/L	22	0	11.51	14.65	34.2	1.57	0.14	0.79	9	16	125	0.1588	Positive
MW-705 UFB	Compliance	Manganese	mg/L	22	1	801.86	1182.23	10.31	190.18	0.24	1.74	530	1440	125	14.3333	Positive
MW-705 UFB	Compliance	Potassium	mg/L	22	0	3.5	4.01	120.5	0.25	0.07	0.68	3	4	29	0.0059	Positive
MW-705 UFB	Compliance	Sodium	mg/L	22	0	2.86	3.37	9850	0.25	0.09	-0.01	2	3	53	0.0125	Positive
MW-705 UFB	Compliance	Sulfate	mg/L	22	0	6.56	13.49	3	3.47	0.53	0.77	2	13	-173	-0.475	Negative
MW-706 QAL	Building/Second	Alkalinity, Bicarbonate	mg/L	21	0	91.72	136.99	77.5	22.64	0.25	1.19	71	145	-142	-2.5	Negative
MW-706 QAL	Building/Second	Arsenic	µg/L	21	12	8.3	6	2	2.58	0.31	1.46	6	14	-137	-0.22	Negative
MW-706 QAL	Building/Second	Calcium	mg/L	21	0	89.65	128.49	5.7	19.42	0.22	1.41	57	150	-136	-2	Negative
MW-706 QAL	Building/Second	Chloride	mg/L	21	0	115.76	160.21	2.55	22.22	0.19	0.41	86	150	75	1.6962	Positive
MW-706 QAL	Building/Second	Cobalt	µg/L	8	1	24.9	30.82	150	2.96	0.12	0.60	21	30	11	1	Positive
MW-706 QAL	Building/Second	Hardness	mg/L	21	0	220.62	583.99	103.5	181.69	0.82	0.17	6	503	-63	-11.2396	Negative
MW-706 QAL	Building/Second	Iron	µg/L	21	0	4767.62	7790.43	80.4	1511.4	0.32	0.43	2200	7800	-141	-232.1875	Negative
MW-706 QAL	Building/Second	Magnesium	µg/L	21	0	32.12	42.38	102.5	5.13	0.16	0.54	20	47	-62	-0.316	Negative
MW-706 QAL	Building/Second	Manganese	mg/L	21	4	16264.71	22699.35	23	3217.32	0.2	-0.60	8000	22000	-11	0	Negative
MW-706 QAL	Building/Second	Nickel	µg/L	21	7	23.59	26.89	4	1.65	0.07	-0.07	21	26	27	0.0733	Positive
MW-706 QAL	Building/Second	Nitrogen, Ammonia	mg/L	19	0	362.75	938.55	1	287.9	0.79	0.98	0	1200	-79	-32.4598	Negative
MW-706 QAL	Building/Second	Potassium	mg/L	21	0	4.67	5.53	87	0.43	0.09	2.02	4	6	-47	-0.0182	Negative
MW-706 QAL	Building/Second	Sodium	mg/L	21	0	49.86	129.33	3930	39.73	0.8	2.72	24	190	-14	-0.2088	Negative
MW-706 QAL	Building/Second	Sulfate	mg/L	21	0	247.48	413.31	3	82.92	0.34	1.27	175	430	-168	-9.7188	Negative
MW-706 QAL	Building/Second	pH	SU	18	0	6.21	5.7-6.7	35	-	-	0.50	6	7	-89	-0.0567	Negative
MW-707 QAL	Concentrator/CLO	Alkalinity, Bicarbonate	mg/L	21	0	157.76	170.23	155	6.24	0.04	-0.04	150	170	113	0.6833	Positive
MW-707 QAL	Concentrator/CLO	Calcium	mg/L	21	0	40.93	46.3	5	2.69	0.07	-1.05	33	45	75	0.2194	Positive
MW-707 QAL	Concentrator/CLO	Hardness	mg/L	21	0	154.33	167.81	39.5	6.74	0.04	1.53	145	176	137	0.75	Positive
MW-707 QAL	Concentrator/CLO	Iron	µg/L	21	0	5359.05	7241.76	43.05	941.35	0.18	-0.21	3410	7200	-173	-132.0513	Negative
MW-707 QAL	Concentrator/CLO	Magnesium	µg/L	21	0	11.81	13.29	5.36	0.74	0.06	1.32	11	14	-22	0	Negative
MW-707 QAL	Concentrator/CLO	Manganese	mg/L	21	3	942.39	1154.68	20	106.14	0.11	-0.75	716	1100	-68	-10	Negative
MW-707 QAL	Concentrator/CLO	Nitrogen, Ammonia	mg/L	19	0	204.27	457.94	1	126.84	0.62	-1.08	0	320	-86	-10	Negative
MW-707 QAL	Concentrator/CLO	Potassium	mg/L	21	0	2.44	2.89	157	0.23	0.09	1.86	2	3	-63	-0.0125	Negative
MW-707 QAL	Concentrator/CLO	Sodium	mg/L	21	0	3.03	3.55	4955	0.26	0.09	2.14	3	4	-61	-0.0091	Negative
MW-707 QAL	Concentrator/CLO	Sulfate	mg/L	21	2	6.39	9.81	3	1.71	0.27	-0.52	3	10	-118	-0.2646	Negative
MW-707 QAL	Concentrator/CLO	Zinc	µg/L	21	17	16	29.27	13	6.63	0.41	1.10	11	25	-43	0	Negative
MW-707 QAL	Concentrator/CLO	pH	SU	18	0	6.96	6.5-7.5	12	-	-	0.25	7	7	58	0.0238	Positive
MW-9R	Concentrator	Alkalinity, Bicarbonate	mg/L	19	0	43.66	85.65	54.5	20.99	0.48	0.31	6	82	-13	-0.34	Negative
MW-9R	Concentrator	Calcium	mg/L	19	0	54.7	109.24	5	27.27	0.5	0.81	18	120	-64	-2.7071	Negative
MW-9R	Concentrator	Chloride	mg/L	19	1	51.74	166.03	5	57.15	1.1	1.57	10	190	-83	-2.5	Negative
MW-9R	Concentrator	Copper	µg/L	19	14	11.18	1.3	300	11.83	1.06	2.06	4	32	-27	0	Negative
MW-9R	Concentrator	Hardness	mg/L	19	0	230.26	452.75	52	111.25	0.48	0.72	76	473	-71	-12.1429	Negative
MW-9R	Concentrator	Iron	µg/L	19	11	1728.19	4134.33	32.55	1203.07	0.7	0.44	16	3800	-76	-46.125	Negative
MW-9R	Concentrator	Magnesium	µg/L	19	0	20.07	39.25	10	9.59	0.48	0.64	7	42	-66	-1	Negative
MW-9R	Concentrator	Manganese	mg/L	19	4	445.76	1280.31	20	417.27	0.94	0.98	53	1400	-98	-38	Negative
MW-9R	Concentrator	Nickel	µg/L	19	4	65.26	178.58	1	56.66	0.87	2.31	22	240	46	1.7778	Positive
MW-9R	Concentrator	Nitrogen, Ammonia	mg/L	17	12	75.22	216.87	1	70.83	0.94	1.23	0	190	-86	-3.1349	Negative
MW-9R	Concentrator	Nitrogen, Nitrate	mg/L	19	3	956.02	5	291	1177.13	1.23	1.42	0	4000	-42	-13.9367	Negative
MW-9R	Concentrator	Potassium	mg/L	19	0	3.17	5.03	1531	0.93	0.29	0.12	2	5	-79	-0.1	Negative
MW-9R	Concentrator	Sodium	mg/L	19	0	18.36	44.13	200	12.88	0.7	1.14	6	47	-116	-1.66	Negative
MW-9R	Concentrator	Sulfate	mg/L	19	0	151.35	314.14	3	81.39	0.54	0.79	47	320	-53	-8.4909	Negative
MW-9R	Concentrator	Zinc	µg/L	19	0	22.66	39.43	19.5	8.39	0.37	1.31	13	41	36	0.35	Positive

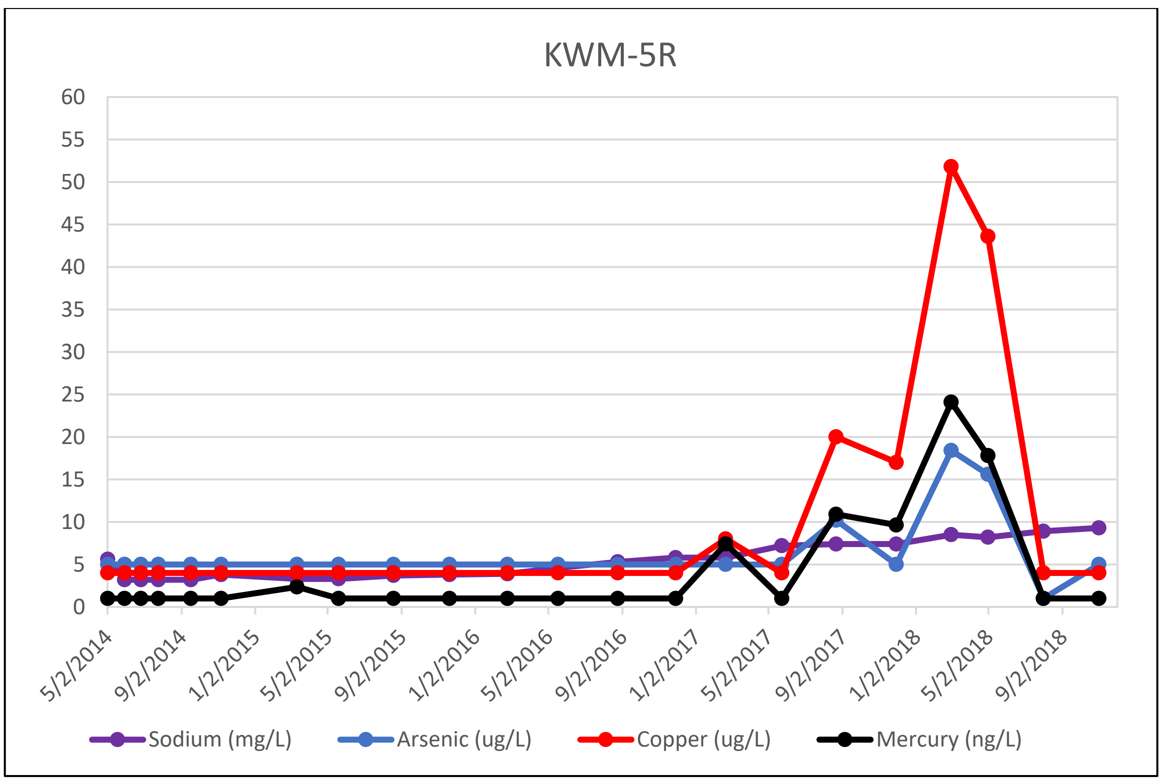
2018
Groundwater Trend Analysis Summary Charts
Humboldt Mill



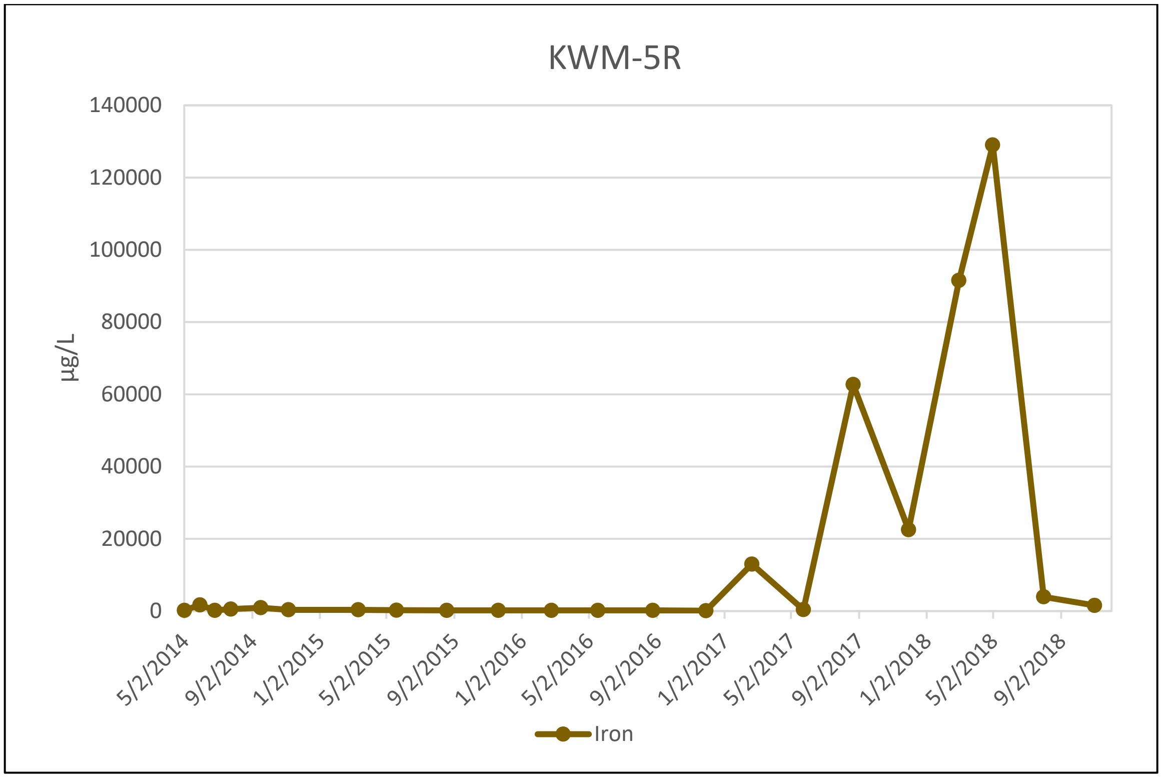


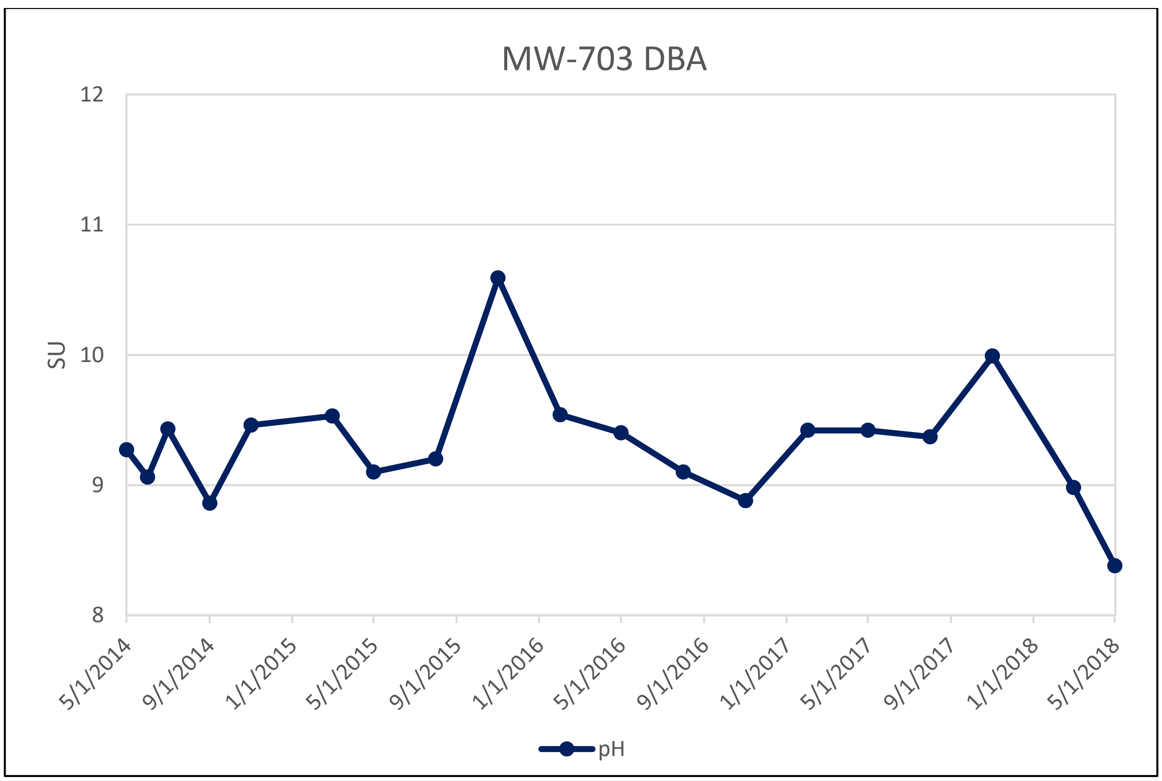
2018
Groundwater Trend Analysis Summary Charts
Humboldt Mill



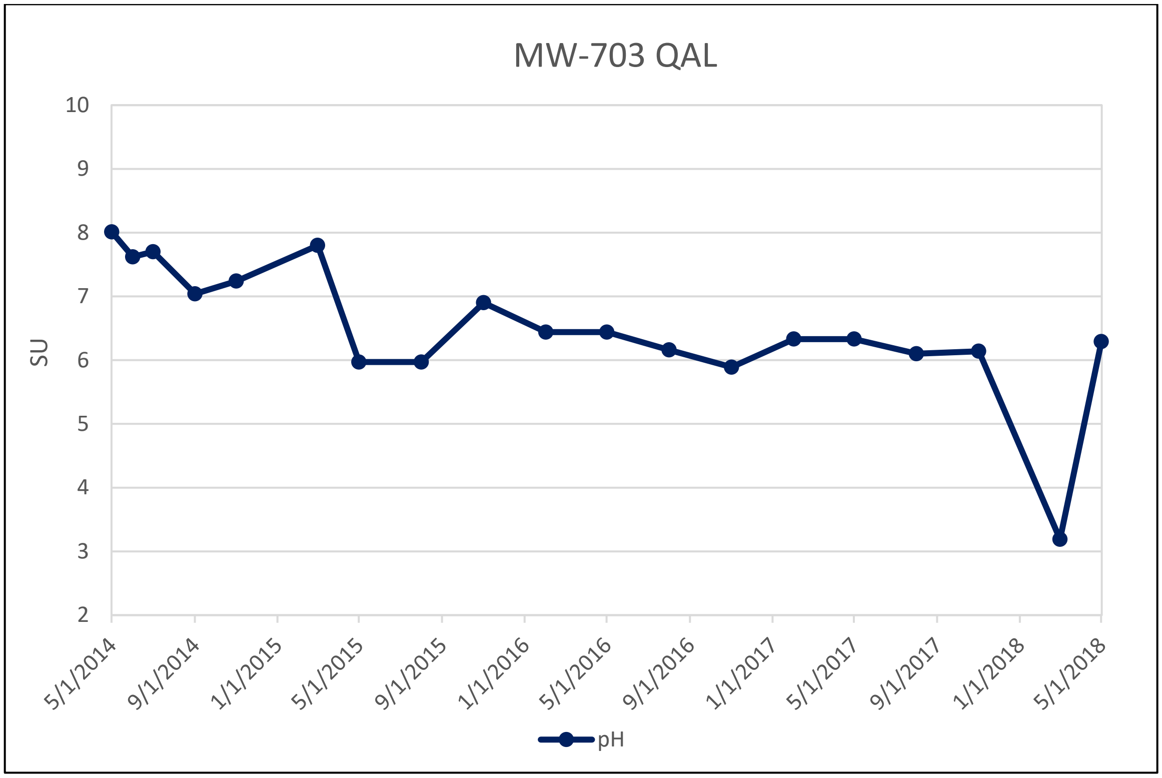


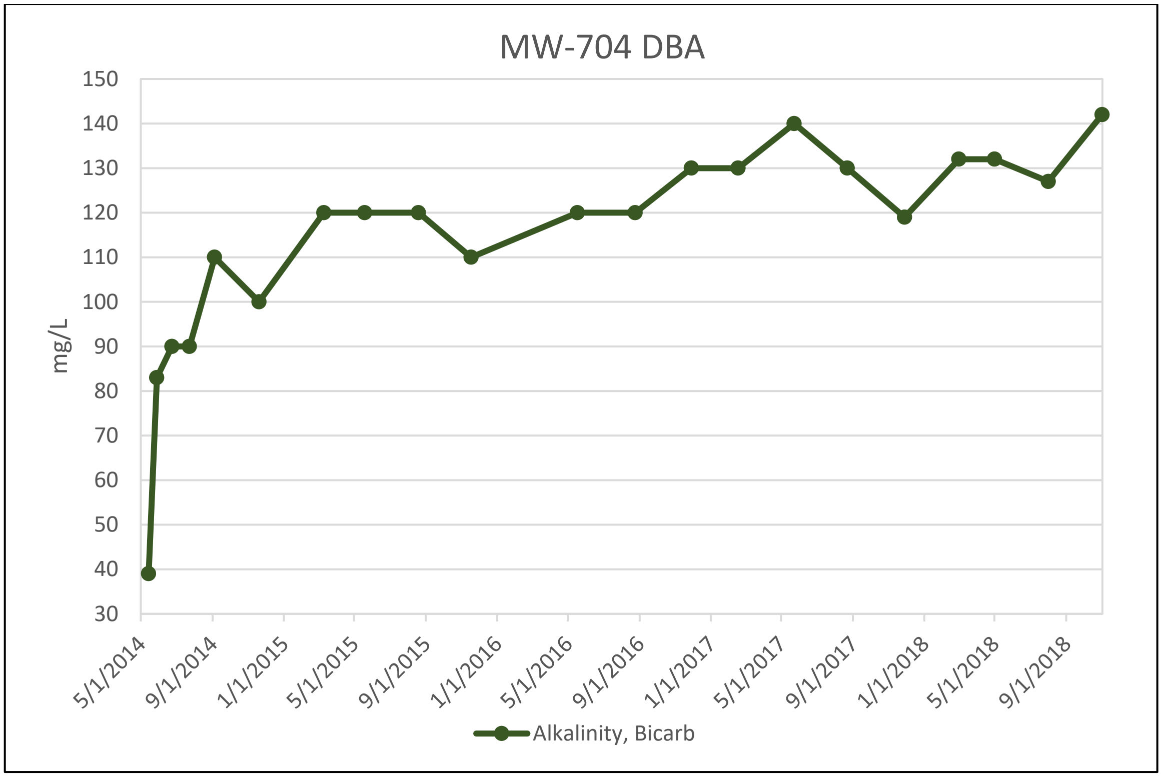
2018
Groundwater Trend Analysis Summary Charts
Humboldt Mill



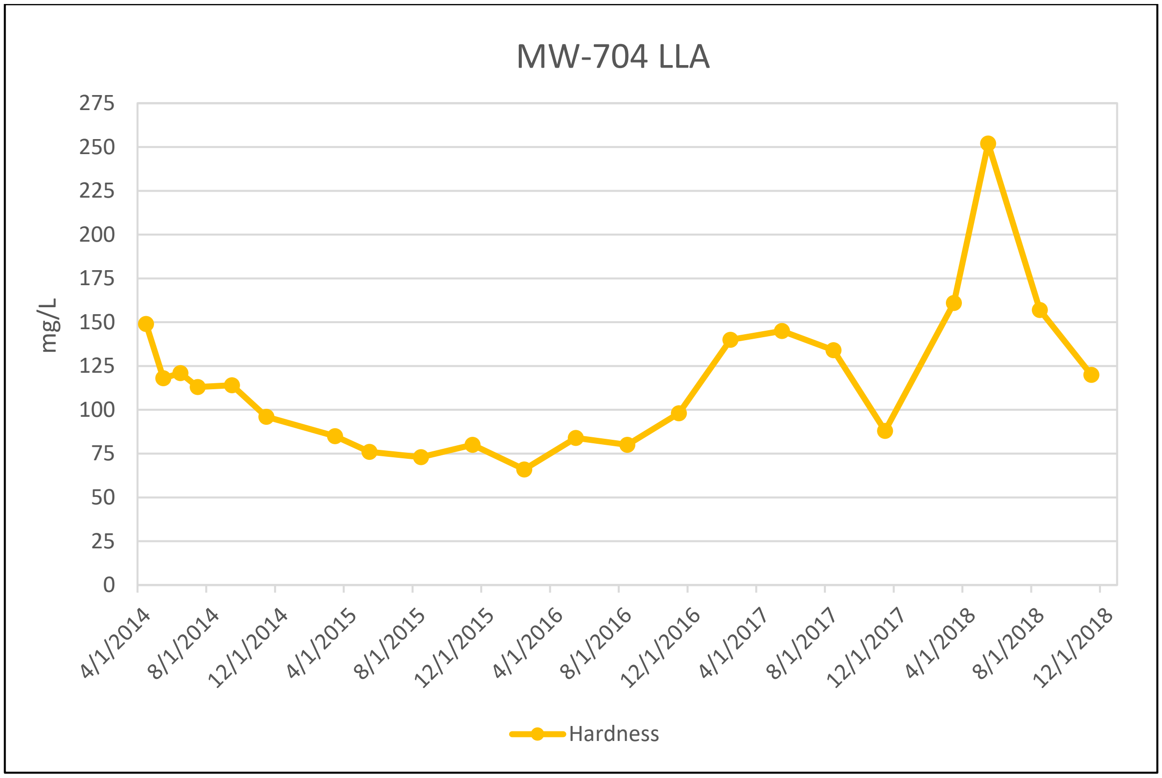


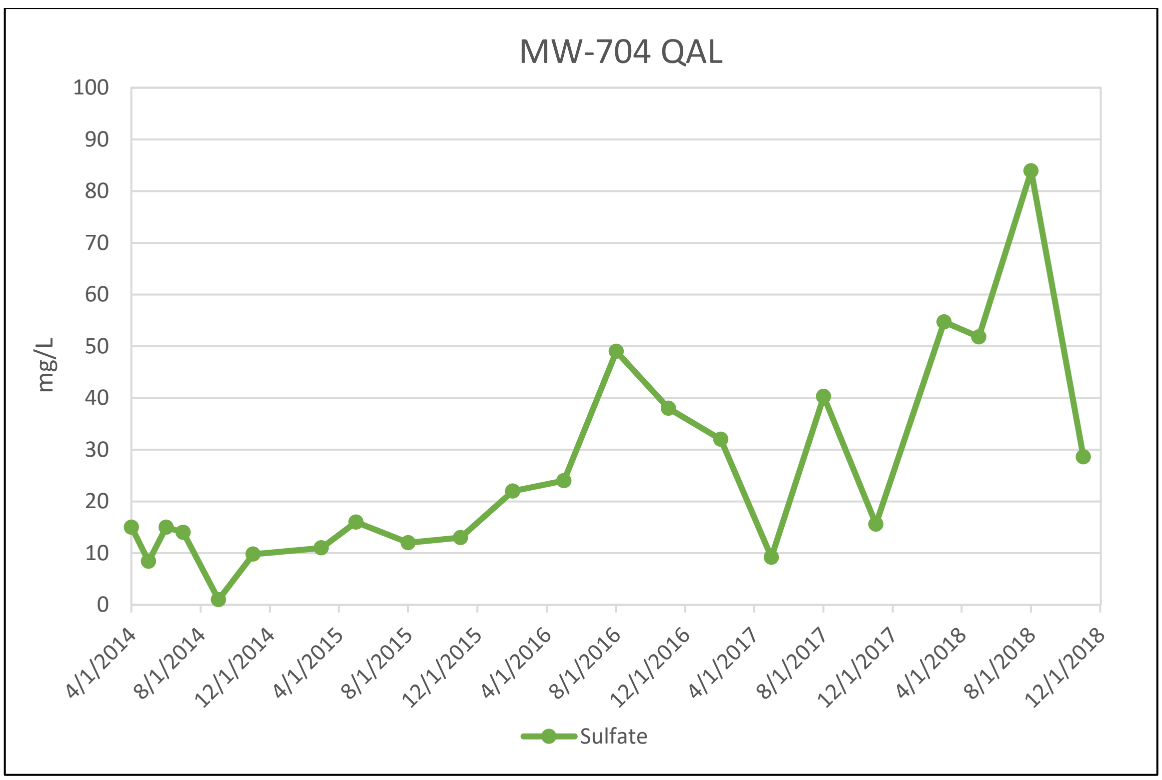
2018
Groundwater Trend Analysis Summary Charts
Humboldt Mill





2018
Groundwater Trend Analysis Summary Charts
Humboldt Mill





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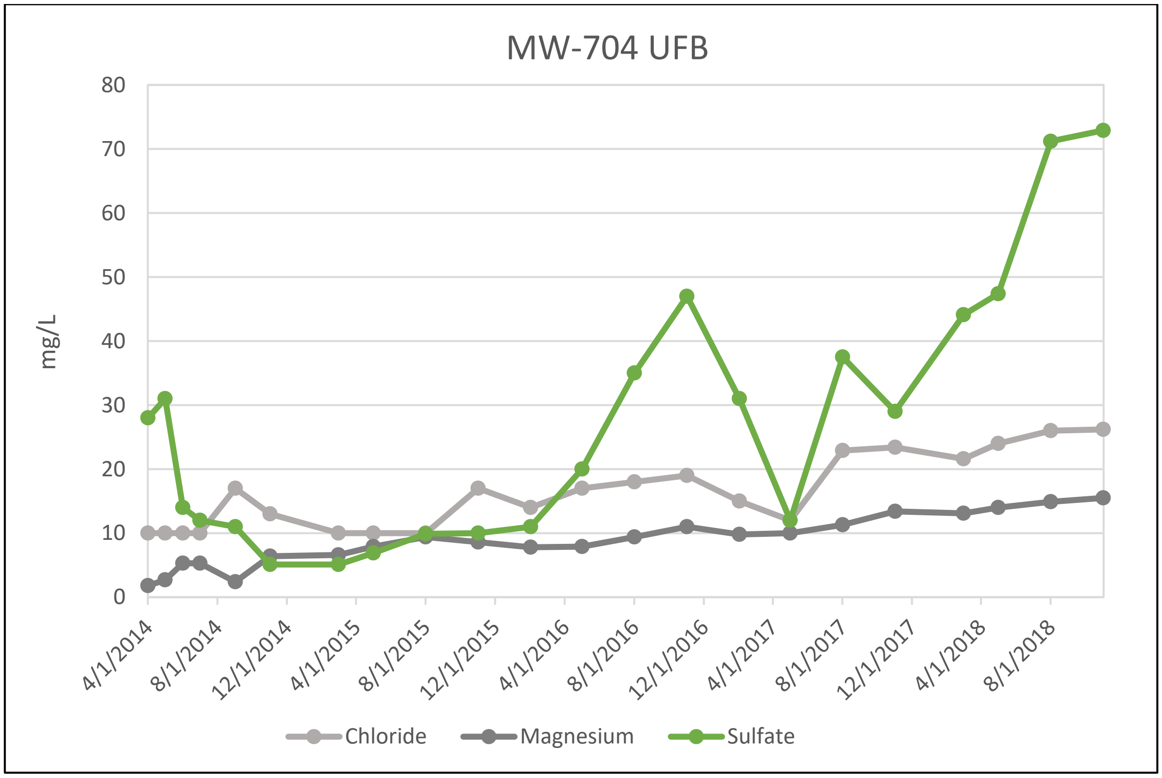
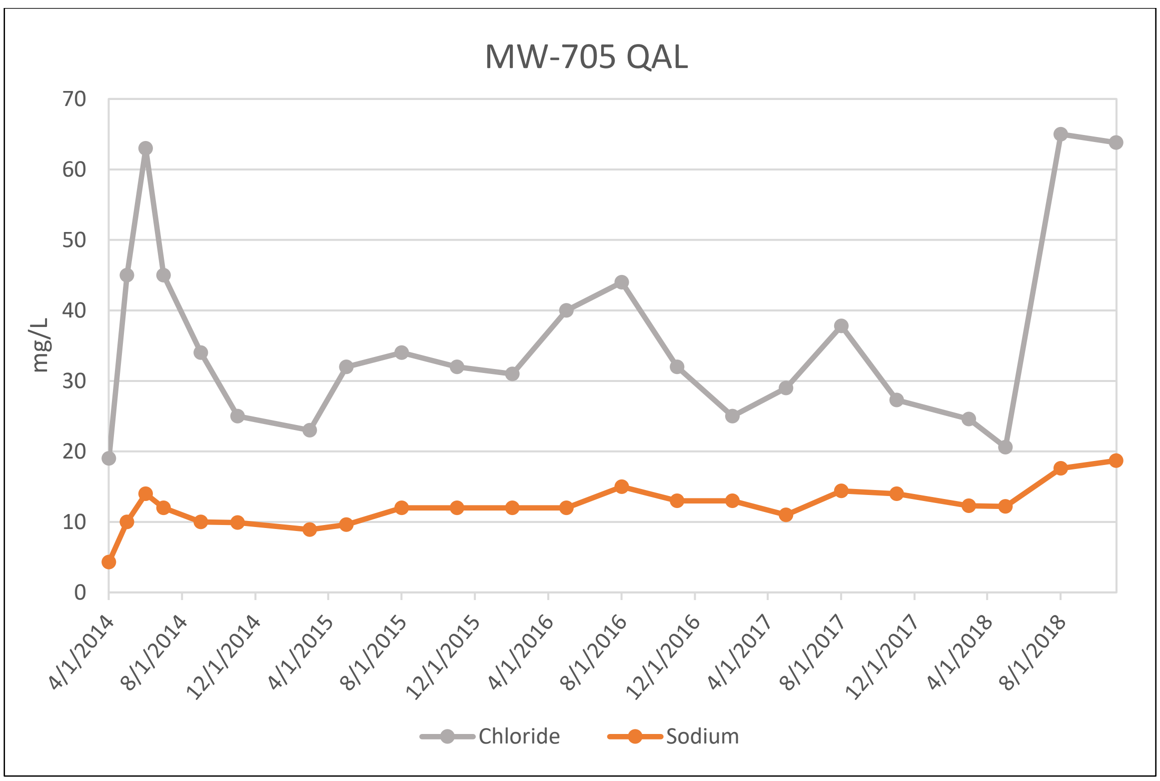
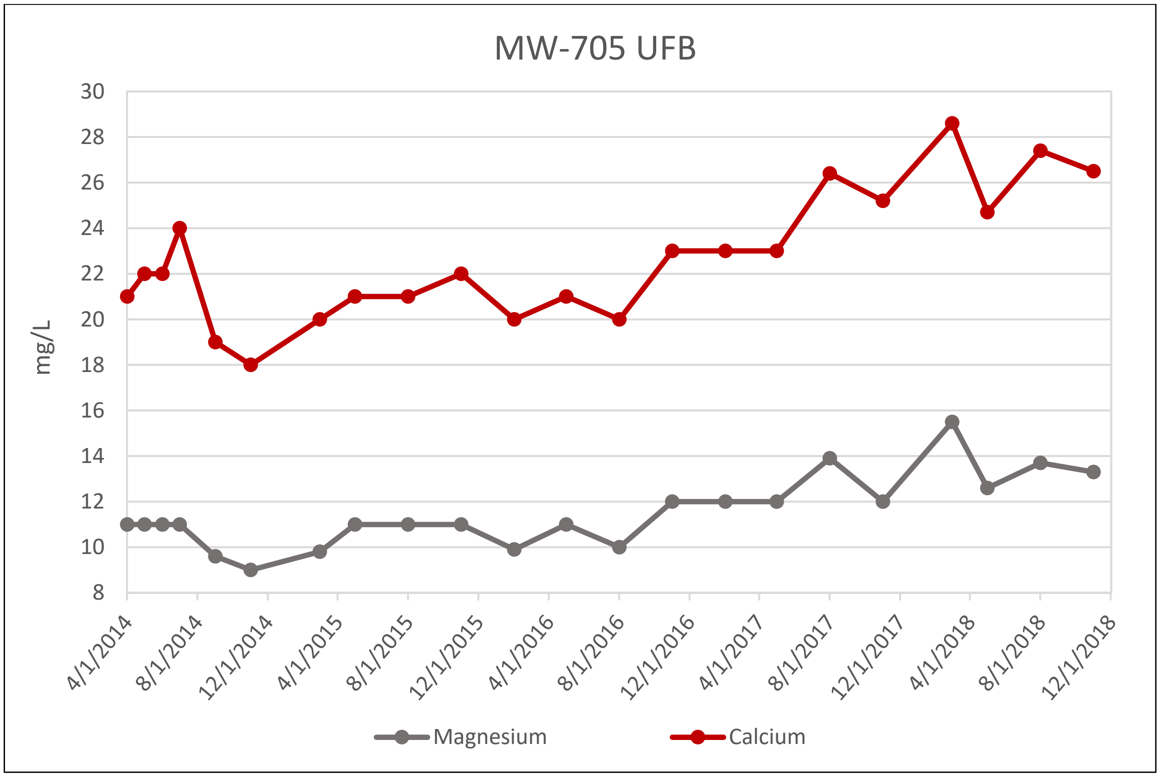
Groundwater Trend Analysis Summary Charts
Humboldt Mill





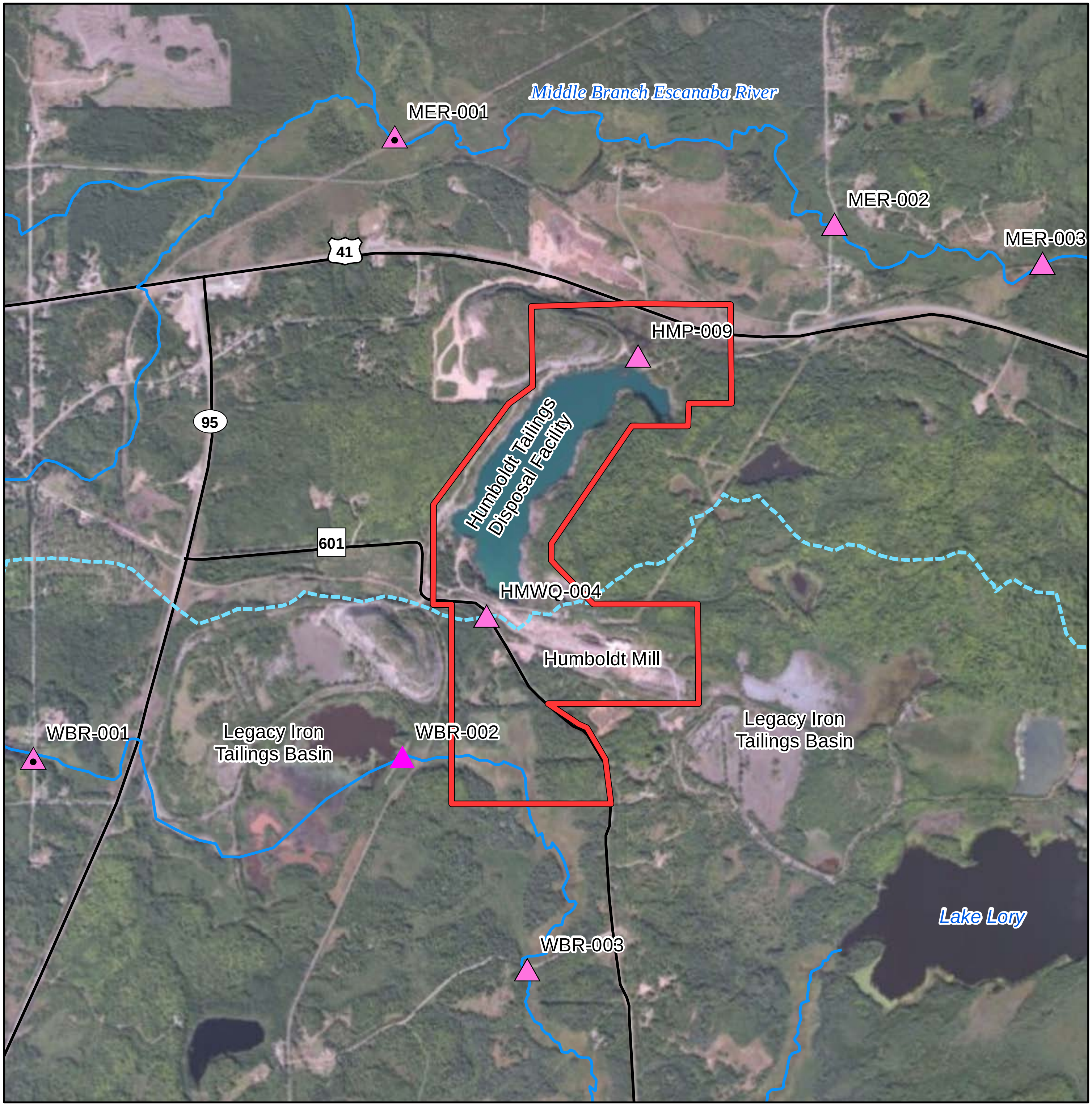
2018
Groundwater Trend Analysis Summary Charts
Humboldt Mill



Appendix H

Humboldt Mill

Surface Water Map



**HUMBOLDT MILL
PROPOSED SURFACE WATER AND
SEDIMENT MONITORING LOCATIONS**

Legend

- Reference Monitoring Station
- 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 I

Humboldt Mill

Surface Water Results

&

Benchmark Summary Table

2018
Mine Permit Surface Water Quality Monitoring Data
Benchmark Summary Table

Location	Location Classification	Q1	Q2	Q3	Q4
HMWQ-004	Compliance - Mill Subwatershed	NM	NM	NM	NM
HMP-009	Compliance - HTDF Subwatershed	NM	mercury, zinc, chloride, sulfate, sodium, TDS, TSS	boron, **mercury**, **sodium,** hardness	NM
MER-001	Reference - HTDF Subwatershed		manganese, **nickel,** TDS		pH
MER-002	Compliance - HTDF Subwatershed	zinc	arsenic, potassium, TDS	pH	
MER-003	Compliance - HTDF Subwatershed	pH	**pH**, nickel	**pH**, boron, copper, lead, nickel, alkalinity bicarbonate	pH
WBR-001	Reference - Mill Subwatershed	pH, **alkalinity bicarbonate**, hardness	manganese, alkalinity bicarbonate	aluminum	
WBR-002	Compliance - Mill Subwatershed	lead, TSS	arsenic, copper, iron, lead, manganese, mercury, nickel, magnesium		
WBR-003	Compliance - Mill Subwatershed		arsenic, mercury, TDS	**boron, copper,** TSS	

Parameters listed in this table had values reported that were equal to or greater than a site-specific benchmark. Parameters in BOLD are instances in which the Department was notified because benchmarks deviations were identified at compliance monitoring locations for two consecutive seasonal (e.g. Q1 2013 and Q1 2014) sampling events. If the location is classified as background or reference, Department notification is not required for an exceedance.
Blank data cells indicate that no benchmark deviations occurred at the location during the specified sampling quarter.
NM = Not measured during the sampling event due to insufficient water volume or frozen conditions.

2018
Mine Permit Surface Water Quality Monitoring Data
HMWQ-004 (Compliance - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	HMWQ-004 Seasonal Benchamrk				HMWQ-004 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							03/15/18	05/22/18	09/04/18	11/28/18
Field										
D.O.	ppm	-	-	-	-	-	NM	NM	NM	NM
ORP	mV	-	-	-	-	-	NM	NM	NM	NM
pH	SU	-	-	-	-	-	NM	NM	NM	NM
Specific Conductance	uS/cm	-	-	-	-	-	NM	NM	NM	NM
Temperature	C	-	-	-	-	-	NM	NM	NM	NM
Turbidity	NTU	-	-	-	-	-	NM	NM	NM	NM
Flow	cfs	-	-	-	-	-	NM	NM	NM	NM
Metals										
Aluminum	ug/L	-	-	-	-	-	NM	NM	NM	NM
Antimony	ug/L	-	-	-	-	-	NM	NM	NM	NM
Arsenic	ug/L	-	-	-	-	-	NM	NM	NM	NM
Barium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Beryllium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Boron	ug/L	-	-	-	-	-	NM	NM	NM	NM
Cadmium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Chromium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Cobalt	ug/L	-	-	-	-	-	NM	NM	NM	NM
Copper	ug/L	-	-	-	-	-	NM	NM	NM	NM
Iron	ug/L	-	-	-	-	-	NM	NM	NM	NM
Lead	ug/L	-	-	-	-	-	NM	NM	NM	NM
Lithium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Manganese	ug/L	-	-	-	-	-	NM	NM	NM	NM
Mercury	ng/L	-	-	-	-	-	NM	NM	NM	NM
Molybdenum	ug/L	-	-	-	-	-	NM	NM	NM	NM
Nickel	ug/L	-	-	-	-	-	NM	NM	NM	NM
Selenium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Silver	ug/L	-	-	-	-	-	NM	NM	NM	NM
Thallium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Vanadium	ug/L	-	-	-	-	-	NM	NM	NM	NM
Zinc	ug/L	-	-	-	-	-	NM	NM	NM	NM
Major Anions										
Alkalinity, Bicarbonate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Alkalinity, Carbonate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Chloride	mg/L	-	-	-	-	-	NM	NM	NM	NM
Fluoride	mg/L	-	-	-	-	-	NM	NM	NM	NM
Nitrogen, Ammonia	mg/L	-	-	-	-	-	NM	NM	NM	NM
Nitrogen, Nitrate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Nitrogen, Nitrite	mg/L	-	-	-	-	-	NM	NM	NM	NM
Sulfate	mg/L	-	-	-	-	-	NM	NM	NM	NM
Sulfide	mg/L	-	-	-	-	-	NM	NM	NM	NM
Major Cations										
Calcium	mg/L	-	-	-	-	-	NM	NM	NM	NM
Magnesium	mg/L	-	-	-	-	-	NM	NM	NM	NM
Potassium	mg/L	-	-	-	-	-	NM	NM	NM	NM
Sodium	mg/L	-	-	-	-	-	NM	NM	NM	NM
General										
Hardness	mg/L	-	-	-	-	-	NM	NM	NM	NM
Total Dissolved Solids	mg/L	-	-	-	-	-	NM	NM	NM	NM
Total Suspended Solids	mg/L	-	-	-	-	-	NM	NM	NM	NM

2018
Mine Permit Surface Water Quality Monitoring Data
HMP-009 (Compliance - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	HMP-009 Seasonal Benchmark	HMP-009 Data (Q1-Q4 2018)			
				Q1 2018	Q2 2018	Q3 2018	Q4 2018
				Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
				03/15/18	05/22/18	09/04/18	11/28/18
Field							
D.O.	ppm	-	-	NM	**6.8**	**7.3**	NM
ORP	mV	-	-	NM	**279**	**124**	NM
pH	SU	-	**7.0-8.0**	NM	**6.60**	**7.02**	NM
Specific Conductance	uS/m	-	-	NM	**705**	**203**	NM
Temperature	C	-	-	NM	**12**	**19**	NM
Turbidity	NTU	-	-	NM	**1.8**	**3.9**	NM
Flow	cfs	-	-	NM	**NM**	**NM**	NM
Metals							
Aluminum	ug/L	**50**	**200 (p)**	NM	-	**39**	NM
Antimony	ug/L	**1.0**	**12**	NM	-	<0.80	NM
Arsenic	ug/L	**1.0**	**2.2**	NM	<1.0	**1.2**	NM
Barium	ug/L	**1.0**	**27**	NM	-	**5.8**	NM
Beryllium	ug/L	**1.0**	**0.67**	NM	-	<0.10	NM
Boron	ug/L	**1.0**	**113**	NM	-	**122**	NM
Cadmium	ug/L	**0.02**	**0.10**	NM	-	<0.01	NM
Chromium	ug/L	**1.0**	**1.3**	NM	-	**0.32**	NM
Cobalt	ug/L	**0.10**	**3.0**	NM	-	**0.16**	NM
Copper	ug/L	**0.05**	**7.9**	NM	**7.6**	**1.8**	NM
Iron	ug/L	**10**	**1620**	NM	**613**	**1230**	NM
Lead	ug/L	**0.05**	**1.0**	NM	**0.21**	**0.15**	NM
Lithium	ug/L	**8.0**	**5.3**	NM	-	<4.6	NM
Manganese	ug/L	**1.0**	**337**	NM	**82**	**34**	NM
Mercury	ng/L	**0.50**	**1.1**	NM	**3.1**	**5.1**	NM
Molybdenum	ug/L	**1.0**	**13**	NM	-	**1.7**	NM
Nickel	ug/L	**0.20**	**17**	NM	**1.5**	**3.0**	NM
Selenium	ug/L	**0.07**	**0.36**	NM	-	**0.13**	NM
Silver	ug/L	**0.20**	**0.12**	NM	-	<0.10	NM
Thallium	ug/L	**1.0**	**0.68**	NM	-	<0.04	NM
Vanadium	ug/L	**1.0**	**1.7**	NM	-	<1.4	NM
Zinc	ug/L	**0.50**	**6.1**	NM	**7.5**	**0.49**	NM
Major Anions							
Alkalinity, Bicarbonate	mg/L	**2.0**	**124**	NM	**50**	**31**	NM
Alkalinity, Carbonate	mg/L	**2.0**	**2.0**	NM	<2.0	<2.0	NM
Chloride	mg/L	**1.0**	**15**	NM	**22**	**11**	NM
Fluoride	mg/L	**0.10**	**0.41**	NM	<0.10	**0.06**	NM
Nitrogen, Ammonia	mg/L	**0.50**	**2.0 (p)**	NM	<0.03	<0.004	NM
Nitrogen, Nitrate	mg/L	**0.50**	**2.5**	NM	<0.10	**0.03**	NM
Nitrogen, Nitrite	mg/L	**0.50**	**0.34**	NM	<0.10	<0.004	NM
Sulfate	mg/L	**1.0**	**138**	NM	**205**	**31**	NM
Sulfide	mg/L	**0.50**	**3.0**	NM	<0.20	**0.02**	NM
Major Cations							
Calcium	mg/L	**0.50**	**68**	NM	**27**	**9.1**	NM
Magnesium	mg/L	**0.50**	**26**	NM	**14**	**3.0**	NM
Potassium	mg/L	**0.50**	**9.4**	NM	**7.8**	**1.5**	NM
Sodium	mg/L	**0.50**	**15**	NM	**80**	**20**	NM
General							
Hardness	mg/L	**2.0**	**251**	NM	**134**	**349**	NM
Total Dissolved Solids	mg/L	**50**	**361**	NM	**462**	**156**	NM
Total Suspended Solids	mg/L	**3.3**	**13**	NM	**64**	**2.8**	NM

* - Recommended Benchmarks are for 2014 - Insufficient Data to Revise Benchmarks

2018
Mine Permit Surface Water Quality Monitoring Data
MER-001 (Reference - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	MER-001 Seasonal Benchmark				MER-001 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							3/19/18	5/22/18	9/4/18	11/28/18
Field										
D.O.	ppm	-	-	-	-	-	12	8.5	7.6	12
ORP	mV	-	-	-	-	-	68	231	144	94
pH	SU	-	6.20-7.20	5.70-6.70	6.10-7.10	5.40-6.40	6.91	6.66	6.78	7.60
Specific Conductance	uS/cm	-	-	-	-	-	100	72	114	100
Temperature	C	-	-	-	-	-	0.29	14	17	0.05
Turbidity	NTU	-	-	-	-	-	2.9	1.2	5.3	1.5
Flow	cfs	-	-	-	-	-	-	-	-	-
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	61	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<0.80	-
Arsenic	ug/L	1.0	3.6	4.0	2.8	1.8	1.1	<1.0	1.5	<1.0
Barium	ug/L	-	-	-	11	-	-	-	9.1	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<0.10	-
Boron	ug/L	-	-	-	40	-	-	-	7.0	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	<0.01	-
Chromium	ug/L	-	-	-	1.1	-	-	-	0.30	-
Cobalt	ug/L	-	-	-	0.38	-	-	-	0.19	-
Copper	ug/L	0.05	0.62	0.98	0.68	1.6	0.39	0.73	0.65	0.55
Iron	ug/L	10.0	2413	1206	3532	2136	1610	1070	1640	911
Lead	ug/L	0.05	0.21	0.18	0.35	0.66	0.15	0.14	0.24	0.14
Lithium	ug/L	-	-	-	32	-	-	-	<4.6	-
Manganese	ug/L	1.0	149	101	242	124	123	1900	90	40
Mercury	ng/L	0.50	5.8	6.9	8.1	4.6	2.3	3.6	3.3	3.0
Molybdenum	ug/L	-	-	-	4.0	-	-	-	0.23	-
Nickel	ug/L	0.20	1.1	0.68	1.5	0.74	0.52	0.70	0.69	0.62
Selenium	ug/L	-	-	-	0.13	-	-	-	0.09	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.10	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<0.04	-
Vanadium	ug/L	-	-	-	4.0	-	-	-	<1.4	-
Zinc	ug/L	0.50	39	9.3	5.5	6.3	1.9	2.4	0.93	2.6
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	41	26	48	24	28	20	24	15
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	13	8.4	16	14	6.7	4.9	7.2	4.0
Fluoride	mg/L	0.10	0.40	0.40	0.40	0.40	<0.10	<0.10	0.09	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.07	<0.03	<0.03	<0.03
Nitrogen, Nitrate	mg/L	0.50	0.17	2.0	2.0	2.0	0.11	<0.10	0.04	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	<0.10	<0.10	<0.004	<0.10
Sulfate	mg/L	1.0	9.0	4.0	4.0	6.4	1.6	<1.0	<1.7	<2.0
Sulfide	mg/L	5.0	20	20	20	20	<0.20	<0.10	0.02	<0.20
Major Cations										
Calcium	mg/L	0.50	14	7.6	15	10	8.9	6.1	8.3	5.5
Magnesium	mg/L	0.50	3.8	2.4	4.1	3.0	2.5	1.9	2.2	1.6
Potassium	mg/L	0.50	0.93	0.69	1.1	1.4	0.68	0.68	0.74	0.50
Sodium	mg/L	0.50	6.7	5.1	8.5	6.7	3.6	3.0	4.1	2.4
General										
Hardness	mg/L	2.0	51	31	59	44	48	26	30	21
Total Dissolved Solids	mg/L	50	106	113	200	200	<50	116	110	<50
Total Suspended Solids	mg/L	3.3	3.4	7.6	13	20	<3.3	<3.3	3.6	<3.3

2018
Mine Permit Surface Water Quality Monitoring Data
MER-002 (Compliance - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	MER-002 Seasonal Benchamrk				MER-002 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							3/19/18	5/22/18	9/4/18	11/28/18
Field										
D.O.	ppm	-	-	-	-	-	12	8.4	7.7	12
ORP	mV	-	-	-	-	-	43	147	172	260
pH	SU	-	6.20-7.20	5.70-6.70	5.90-6.90	5.30-6.30	7.06	6.67	7.11	6.00
Specific Conductance	uS/cm	-	-	-	-	-	116	91	133	65
Temperature	C	-	-	-	-	-	0.30	14	16	0.07
Turbidity	NTU	-	-	-	-	-	3.5	1.8	5.4	1.3
Flow	cfs	-	-	-	-	-	-	-	-	-
Metals										
Aluminum	ug/L	-	-	-	461	-	-	-	63	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<0.80	-
Arsenic	ug/L	1.0	2.8	0.59	5.3	2.1	1.4	1.3	1.8	<1.0
Barium	ug/L	-	-	-	21	-	-	-	9.9	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<0.10	-
Boron	ug/L	-	-	-	40	-	-	-	23	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	<0.01	-
Chromium	ug/L	-	-	-	4.0	-	-	-	0.45	-
Cobalt	ug/L	-	-	-	0.40	-	-	-	0.28	-
Copper	ug/L	0.05	1.1	0.97	1.4	0.72	0.40	0.66	0.58	0.55
Iron	ug/L	10.0	3081	1679	6901	2831	2010	1300	2030	998
Lead	ug/L	0.05	0.34	0.19	0.34	0.15	0.13	0.13	0.21	0.14
Lithium	ug/L	-	-		1.4	-	-	-	<4.6	-
Manganese	ug/L	1.0	212	134	628	347	169	125	138	60
Mercury	ng/L	0.50	5.1	6.6	7.5	4.3	2.0	3.3	2.4	3.0
Molybdenum	ug/L	-	-		4.0	-	-	-	0.29	-
Nickel	ug/L	0.20	1.2	0.71	2.1	0.82	0.58	0.70	0.77	0.68
Selenium	ug/L	-	-		0.80	-	-	-	0.12	-
Silver	ug/L	-	-		0.80	-	-	-	<0.10	-
Thallium	ug/L	-	-		4.0	-	-	-	<0.04	-
Vanadium	ug/L	-	-		4.7	-	-	-	<1.4	-
Zinc	ug/L	0.50	6.3	7.6	2.0	5.3	8.3	2.0	0.91	2.7
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	46	25	54	31	32	23	25	16
Alkalinity, Carbonate	mg/L	2.0	8.0	4.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	14	7.4	17	18	7.8	6.5	6.6	4.9
Fluoride	mg/L	0.10	0.40	0.40	0.40	0.40	<0.10	<0.10	0.11	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.08	<0.03	<0.03	<0.03
Nitrogen, Nitrate	mg/L	0.50	0.52	0.21	2.0	2.0	0.11	<0.10	0.03	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	<0.10	<0.10	0.004	<0.10
Sulfate	mg/L	1.0	14	7.9	16	4.0	5.1	3.3	6.0	<1.0
Sulfide	mg/L	5.0	20	20	20	20	<0.20	<0.20	0.02	<0.20
Major Cations										
Calcium	mg/L	0.50	17	9.2	18	15	10	7.3	8.5	6.0
Magnesium	mg/L	0.50	4.6	2.7	5.2	4.1	2.9	2.3	2.4	1.7
Potassium	mg/L	0.50	1.3	0.68	1.4	1.6	0.75	0.77	0.83	0.56
Sodium	mg/L	0.50	8.5	5.1	9.9	9.1	4.7	4.2	5.8	3.2
General										
Hardness	mg/L	2.0	60	34	70	53	42	26	31	22
Total Dissolved Solids	mg/L	50	210	104	200	200	120	120	113	<50.0
Total Suspended Solids	mg/L	3.3	5.6	7.8	21	123	<3.3	<3.3	3.7	<3.3

2018
Mine Permit Surface Water Quality Monitoring Data
MER-003 (Compliance - HTDF Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	MER-003 Seasonal Benchamrk				MER-003 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							3/19/18	5/22/18	9/4/18	11/28/18
Field										
D.O.	ppm	-	-	-	-	-	11	8.4	7.6	12
ORP	mV	-	-	-	-	-	12	115	135	90
pH	SU	-	6.30-7.30	5.60-6.60	5.70-6.70	5.40-6.40	7.42	6.78	7.22	7.35
Specific Conductance	uS/cm	-	-	-	-	-	125	121	152	130
Temperature	C	-	-	-	-	-	0.09	13	16	0.26
Turbidity	NTU	-	-	-	-	-	3.4	2.6	5.2	1.9
Flow	cfs	-	-	-	-	-	-	-	-	-
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	69	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<0.80	-
Arsenic	ug/L	1.0	2.6	1.8	2.6	2.7	1.5	1.3	1.7	<1.0
Barium	ug/L	-	-	-	15	-	-	-	9.8	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<0.10	-
Boron	ug/L	-	-	-	18	-	-	-	26	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	<0.01	-
Chromium	ug/L	-	-	-	4.0	-	-	-	0.31	-
Cobalt	ug/L	-	-	-	0.40	-	-	-	0.26	-
Copper	ug/L	0.05	2.9	0.97	0.65	0.67	0.37	0.66	0.65	0.55
Iron	ug/L	10.0	3007	1873	3749	3493	2040	1450	2020	1070
Lead	ug/L	0.05	0.35	0.24	0.18	1.9	0.13	0.15	0.21	0.13
Lithium	ug/L	-	-	-	32	-	-	-	<4.6	-
Manganese	ug/L	1.0	223	157	273	326	178	137	138	70
Mercury	ng/L	0.50	5.2	6.7	7.2	7.0	2.1	3.8	3.2	2.5
Molybdenum	ug/L	-	-	-	4.0	-	-	-	0.29	-
Nickel	ug/L	0.20	1.5	1.2	1.8	1.5	0.78	1.2	1.9	0.82
Selenium	ug/L	-	-	-	0.28	-	-	-	0.11	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.10	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<0.04	-
Vanadium	ug/L	-	-	-	4.0	-	-	-	<1.4	-
Zinc	ug/L	0.50	7.5	8.5	2.7	13	2.0	2.2	0.69	2.4
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	50	31	58	33	32	25	105	18
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	15	11	23	21	8.7	8.7	8.6	6.9
Fluoride	mg/L	0.10	0.20	0.50	0.40	0.40	<0.10	<0.10	0.11	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.09	<0.03	<0.004	0.03
Nitrogen, Nitrate	mg/L	0.50	0.18	2.0	2.0	2.0	0.11	<0.10	0.03	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	<0.10	<0.10	0.004	<0.10
Sulfate	mg/L	1.0	17	15	21	26	9.9	7.9	8.0	8.4
Sulfide	mg/L	5.0	20	20	20	20	<0.20	<0.20	0.02	<0.20
Major Cations										
Calcium	mg/L	0.50	17	11	18	13	11	7.5	8.5	6.3
Magnesium	mg/L	0.50	4.7	3.3	5.8	4.2	3.1	2.5	2.5	1.9
Potassium	mg/L	0.50	1.3	0.94	1.7	1.7	0.85	0.88	0.90	0.63
Sodium	mg/L	0.50	8.8	7.4	12	9.3	5.7	7.0	7.3	6.7
General										
Hardness	mg/L	2.0	63	38	78	57	42	22	31	23
Total Dissolved Solids	mg/L	50	134	54	200	200	62	86	<83	70
Total Suspended Solids	mg/L	3.3	4.0	9.8	13	20	<3.3	<3.3	3.7	<3.3

2018
Mine Permit Surface Water Quality Monitoring Data
WBR-001 (Reference - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	WBR-001 Seasonal Benchamrk				WBR-001 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							3/19/18	5/22/18	9/4/18	11/28/18
Field										
D.O.	ppm	-	-	-	-	-	11	7.0	6.4	10
ORP	mV	-	-	-	-	-	139	231	205	316
pH	SU	-	4.97-5.97	4.70-5.70	5.70-6.70	4.60-5.60	6.55	5.49	6.42	5.29
Specific Conductance	uS/cm	-	-	-	-	-	97	103	92	73
Temperature	C	-	-	-	-	-	0.11	19	17	0.21
Turbidity	NTU	-	-	-	-	-	44	0.38	1.7	1.6
Flow	cfs	-	-	-	-	-	-	-	-	-
Metals										
Aluminum	ug/L	-	-	-	200	-	-	-	239	-
Antimony	ug/L	-	-	-	3.5	-	-	-	<0.80	-
Arsenic	ug/L	1.0	6.6	1.8	3.2	1.5	1.8	1.4	1.6	<1.0
Barium	ug/L	-	-	-	17	-	-	-	10	-
Beryllium	ug/L	-	-	-	2.5	-	-	-	<0.10	-
Boron	ug/L	-	-	-	40	-	-	-	6.0	-
Cadmium	ug/L	-	-	-	0.08	-	-	-	0.03	-
Chromium	ug/L	-	-	-	1.6	-	-	-	0.67	-
Cobalt	ug/L	-	-	-	0.40	-	-	-	0.28	-
Copper	ug/L	0.05	3.3	1.1	1.4	0.66	0.97	0.77	0.59	1.1
Iron	ug/L	10.0	11518	1759	4873	1900	3460	1320	2010	1610
Lead	ug/L	0.05	4.3	1.1	2.3	1.3	2.2	0.80	0.82	0.70
Lithium	ug/L	-	-	-	32	-	-	-	<4.6	-
Manganese	ug/L	1.0	363	106	770	122	277	135	95	111
Mercury	ng/L	0.50	15	11	16	11	8.8	7.1	4.8	5.2
Molybdenum	ug/L	-	-	-	4.0	-	-	-	<0.20	-
Nickel	ug/L	0.20	3.1	0.97	3.0	0.98	0.94	0.93	0.94	0.65
Selenium	ug/L	-	-	-	0.28	-	-	-	0.16	-
Silver	ug/L	-	-	-	0.80	-	-	-	<0.10	-
Thallium	ug/L	-	-	-	1.5	-	-	-	<0.04	-
Vanadium	ug/L	-	-	-	1.7	-	-	-	<1.4	-
Zinc	ug/L	0.50	16	12	13	8.2	7.8	5.9	4.0	5.4
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	9.1	5.1	16	5.8	10	5.5	7.0	4.0
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	24	25	28	23	19	22	9.2	15
Fluoride	mg/L	0.10	0.40	0.40	0.40	0.40	<0.10	<0.10	0.08	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.26	<0.03	<0.004	0.03
Nitrogen, Nitrate	mg/L	0.50	0.24	2.0	2.0	2.0	<0.10	<0.10	0.02	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	<0.10	<0.10	0.01	<0.10
Sulfate	mg/L	1.0	11	4.0	4.0	4.0	<10.0	<2.0	<4.3	<5.0
Sulfide	mg/L	5.0	20	20	20	20	<0.20	<0.20	<0.01	<0.20
Major Cations										
Calcium	mg/L	0.50	7.6	4.8	7.9	5.6	4.9	3.7	4.4	3.7
Magnesium	mg/L	0.50	3.0	1.9	3.1	2.5	2.0	1.6	1.7	1.4
Potassium	mg/L	0.50	2.7	0.94	1.6	1.6	0.87	0.86	0.62	0.65
Sodium	mg/L	0.50	11	12	13	11	8.4	9.7	4.5	6.8
General										
Hardness	mg/L	2.0	37	21	39	30	60	12	18	15
Total Dissolved Solids	mg/L	50	211	211	200	200	52	86	103	60
Total Suspended Solids	mg/L	3.3	55	13	13	13	6.9	20	3.2	<3.3

* - Lowest achievable Reporting Limit by laboratory due to matrix interference

2018
Mine Permit Surface Water Quality Monitoring Data
WBR-002 (Compliance - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	WBR-002 Seasonal Benchamrk				WBR-002 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							3/19/18	5/22/18	9/4/18	11/28/18
Field										
D.O.	ppm	-	-	-	-	-	1.5	8.5	7.1	10
ORP	mV	-	-	-	-	-	5.3	236	226	264
pH	SU	-	5.90-6.90	6.04-6.94	6.20-7.20	5.40-6.40	6.23	6.44	6.35	5.80
Specific Conductance	uS/cm	-	-	-	-	-	253	146	203	153
Temperature	C	-	-	-	-	-	0.74	20	19	2.0
Turbidity	NTU	-	-	-	-	-	42	56	29	62
Flow	cfs	-	-	-	-	-	-	-	-	-
Metals										
Aluminum	ug/L	-			200	-	-	-	<31.0	-
Antimony	ug/L	-			3.5	-	-	-	<0.80	-
Arsenic	ug/L	1.0	7.1	3.0	7.2	4.6	5.1	3.2	2.7	1.7
Barium	ug/L	-			16	-	-	-	8.5	-
Beryllium	ug/L	-			2.5	-	-	-	<0.10	-
Boron	ug/L	-			18	-	-	-	13	-
Cadmium	ug/L	-			0.08	-	-	-	<0.01	-
Chromium	ug/L	-			4.0	-	-	-	0.26	-
Cobalt	ug/L	-			0.69	-	-	-	0.25	-
Copper	ug/L	0.05	1.4	2.5	1.9	2.0	0.84	3.1	0.48	1.1
Iron	ug/L	10.0	16421	4819	12928	9112	12600	6380	6930	3980
Lead	ug/L	0.05	0.44	0.55	0.49	0.61	0.47	1.1	0.24	0.20
Lithium	ug/L	-			32	-	-	-	<4.6	-
Manganese	ug/L	1.0	1550	262	709	458	875	271	188	106
Mercury	ng/L	0.50	4.5	3.6	3.0	4.7	4.0	5.7	0.99	2.4
Molybdenum	ug/L	-			4.0	-	-	-	0.35	-
Nickel	ug/L	0.20	3.3	2.5	2.6	3.2	1.7	3.2	1.4	3.0
Selenium	ug/L	-			0.28	-	-	-	0.12	-
Silver	ug/L	-			0.80	-	-	-	<0.10	-
Thallium	ug/L	-			1.5	-	-	-	<0.04	-
Vanadium	ug/L	-			4.0	-	-	-	<1.4	-
Zinc	ug/L	0.50	20	25	2.5	4.8	4.0	9.7	0.45	2.9
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	105	18	38	20	35	16	28	16
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	60	42	48	59	47	28	36	32
Fluoride	mg/L	0.10	0.29	0.40	0.40	0.40	<0.10	<0.10	0.10	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.44	0.04	0.005	0.03
Nitrogen, Nitrate	mg/L	0.50	2.0	2.0	2	2.0	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	<0.10	<0.10	0.007	<0.10
Sulfate	mg/L	1.0	10	9.1	4.0	4.0	<10.0	<1.0	<0.86	<5.0
Sulfide	mg/L	5.0	20	20	20	20	<0.20	<0.20	0.02	<0.20
Major Cations										
Calcium	mg/L	0.50	13	7.0	9.7	9.8	11	5.4	8.3	6.4
Magnesium	mg/L	0.50	5.9	3.5	4.5	5.1	5.2	2.9	4.0	2.9
Potassium	mg/L	0.50	2.6	2.0	1.4	2.1	1.8	2.1	1.2	1.4
Sodium	mg/L	0.50	28	22	25	27	23	15	18	16
General										
Hardness	mg/L	2.0	57	33	46	44	44	26	37	28
Total Dissolved Solids	mg/L	50	170	278	200	200	142	106	127	90
Total Suspended Solids	mg/L	3.3	13	13	32	16	14	12	4.4	3.7

* - Lowest achievable Reporting Limit by laboratory due to matrix interference

2018
Mine Permit Surface Water Quality Monitoring Data
WBR-003 (Compliance - Mill Subwatershed)
Humboldt Mill

Parameter	Unit	Permit RL	WBR-003 Seasonal Benchamrk				WBR-003 Data (Q1-Q4 2018)			
			Q1	Q2	Q3	Q4	Q1 2018	Q2 2018	Q3 2018	Q4 2018
			Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain	Winter Baseflow	Spring Snowmelt & Runoff	Summer Baseflow	Fall Rain
							3/19/18	5/22/18	9/4/18	11/28/18
Field										
D.O.	ppm	-				-	3.5	4.4	3.5	6.9
ORP	mV	-				-	33	188	56	284
pH	SU	-	5.80-6.80	5.80-6.80	6.20-7.20	4.90-5.90	6.35	6.26	6.60	5.87
Specific Conductance	uS/m	-				-	250	126	199	137
Temperature	C	-				-	0.03	17	17	0.06
Turbidity	NTU	-				-	28	10	54	6.8
Flow	cfs	-				-	-	-	-	-
Metals										
Aluminum	ug/L	-			200	-	-	-	34	-
Antimony	ug/L	-			3.5	-	-	-	<0.80	-
Arsenic	ug/L	1.0	4.0	1.7	6.3	2.1	3.5	2.0	4.8	<1.0
Barium	ug/L	-			27	-	-	-	19	-
Beryllium	ug/L	-			2.5	-	-	-	<0.10	-
Boron	ug/L	-			13	-	-	-	14	-
Cadmium	ug/L	-			0.08	-	-	-	<0.01	-
Chromium	ug/L	-			4.0	-	-	-	0.27	-
Cobalt	ug/L	-			2.6	-	-	-	1.1	-
Copper	ug/L	0.05	0.67	0.74	0.20	1.1	0.53	0.63	0.23	0.73
Iron	ug/L	10.0	12988	5033	19898	4248	10700	4430	13400	2780
Lead	ug/L	0.05	0.40	0.26	0.29	0.28	0.26	0.17	0.11	0.15
Lithium	ug/L	-			32	-	-	-	<4.6	-
Manganese	ug/L	1.0	2261	374	2794	235	1000	324	1030	45
Mercury	ng/L	0.50	6.1	3.4	5.7	6.9	2.6	3.4	1.8	1.3
Molybdenum	ug/L	-			4.0	-	-	-	0.22	-
Nickel	ug/L	0.20	3.5	1.8	2.4	1.7	1.5	1.5	1.1	1.1
Selenium	ug/L	-			0.28	-	-	-	0.11	-
Silver	ug/L	-			0.80	-	-	-	<0.10	-
Thallium	ug/L	-			1.5	-	-	-	<0.04	-
Vanadium	ug/L	-			4.0	-	-	-	<1.4	-
Zinc	ug/L	0.50	17	15	4.5	18	3.5	2.7	2.4	2.2
Major Anions										
Alkalinity, Bicarbonate	mg/L	2.0	51	34	88	22	46	28	45	17
Alkalinity, Carbonate	mg/L	2.0	8.0	8.0	8.0	8.0	<2.0	<2.0	<2.0	<2.0
Chloride	mg/L	1.0	43	32	42	37	38	16	22	26
Fluoride	mg/L	0.10	0.30	0.34	0.19	0.40	<0.10	0.13	0.10	<0.10
Nitrogen, Ammonia	mg/L	0.50	2.0	2.0	2.0	2.0	0.44	0.06	0.03	0.03
Nitrogen, Nitrate	mg/L	0.50	0.26	2.0	2.0	2.0	<0.10	<0.10	<0.01	<0.10
Nitrogen, Nitrite	mg/L	0.50	2.0	2.0	2.0	2.0	<0.10	<0.10	0.006	<0.10
Sulfate	mg/L	1.0	17	20	4.0	4.0	<10.0*	<1.0	<4.3	<1.0
Sulfide	mg/L	5.0	20	20	20	20	<0.20	<0.20	0.02	<0.20
Major Cations										
Calcium	mg/L	0.50	15	11	24	8.4	13	7.2	11	6.2
Magnesium	mg/L	0.50	6.1	4.5	9.6	3.9	5.6	3.3	4.5	2.9
Potassium	mg/L	0.50	2.2	1.7	2.3	2.7	1.6	1.3	1.4	1.1
Sodium	mg/L	0.50	20	15	22	20	17	8.0	11	13
General										
Hardness	mg/L	2.0	64	43	109	36	48	24	47	28
Total Dissolved Solids	mg/L	50	177	120	200	200	175	130	153	72
Total Suspended Solids	mg/L	3.3	19	9.8	27	13	12	8.3	27	<3.3

* - Lowest achievable Reporting Limit by laboratory due to matrix interference

2018
Mine Permit Surface Water Quality Monitoring Data
Data and Abbreviations
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 established for the parameter or the parameter was not required to be collected during the sampling quarter.
NM = Not measured during the sampling event due to insufficient water or frozen conditions.

Appendix J

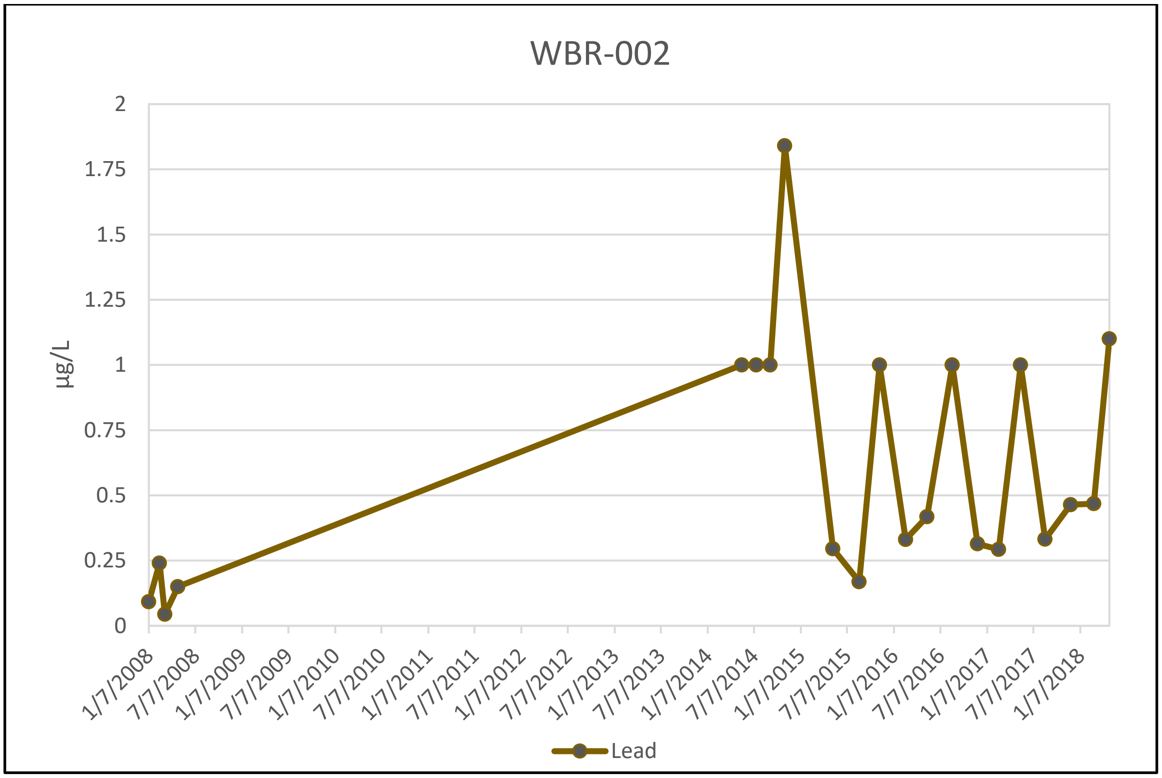
Humboldt Mill

Surface Water Trend Analysis Summary

2018
Surface Water Trend Analysis Summary
Humboldt Mill

Location	Classification	Parameter	Unit	Count (n)	Number of Non-Detects	Mean	UCL	Median	Standard Deviation	Coefficient of Variation	Skewness	Minimum	Maximum	Man-Kendall S	Sen Slope	Positive or Negative Trend (Minimum 95% Confidence)
MER-001 Q1	Monitoring	Hardness	mg/L	7	0	38.8	53.69	11.7	7.44	0.19	1.24	34	51	10	0.50	Positive
MER-001 Q1	Monitoring	Nickel	µg/L	7	0	0.66	1.03	0.415	0.19	0.29	1.18	1	1	-11	-0.05	Negative
MER-001 Q1	Monitoring	Potassium	mg/L	7	0	0.64	0.92	41	0.14	0.22	1.07	0	1	10	0.03	Positive
MER-001 Q1	Monitoring	Sulfate	mg/L	7	1	4.15	8.77	0.112	2.31	0.56	0.07	2	7	-13	-1.08	Negative
MER-001 Q2	Monitoring	Iron	µg/L	6	0	811.67	1284.35	6.1	236.34	0.29	-1.40	380	1070	14	95.00	Positive
MER-001 Q2	Monitoring	Manganese	µg/L	6	0	357.75	1869.55	0.137	755.9	2.11	2.44	12	1900	13	22.83	Positive
MER-001 Q3	Monitoring	Hardness	mg/L	6	0	5018.15	29397.29	8.5	12189.57	2.43	2.45	32	29900	11	8.00	Positive
MER-001 Q4	Monitoring	Iron	µg/L	5	0	1239.2	2034.22	8.9	397.51	0.32	1.55	911	1900	-10	-178.75	Negative
MER-001 Q4	Monitoring	Lead	µg/L	5	0	0.24	0.61	0.42	0.18	0.75	2.18	0	1	-10	-0.03	Negative
MER-002 Q1	Monitoring	Chloride	mg/L	7	0	8.67	13.58	6.4	2.46	0.28	2.56	7	14	-10	-0.15	Negative
MER-002 Q2	Monitoring	Alkalinity, Bicarbonate	mg/L	6	0	16.47	27.04	21	5.29	0.32	-0.33	9	23	12	2.80	Positive
MER-002 Q2	Monitoring	Chloride	mg/L	6	0	5.63	7.55	1.3	0.96	0.17	-1.16	4	6	11	0.48	Positive
MER-002 Q2	Monitoring	Iron	µg/L	6	0	992.83	1725.86	7.3	366.51	0.37	-1.38	337	1300	13	160.00	Positive
MER-002 Q2	Monitoring	Manganese	µg/L	6	0	71.65	155.44	1	41.89	0.58	-0.39	11	125	13	22.82	Positive
MER-002 Q2	Monitoring	Mercury	ng/L	6	0	4.64	6.65	0.6575	1.01	0.22	-0.19	3	6	-11	-0.49	Negative
MER-002 Q2	Monitoring	Sodium	mg/L	6	0	3.42	5.25	1300	0.91	0.27	-1.52	2	4	11	0.47	Positive
MER-003 Q1	Monitoring	Chloride	mg/L	7	0	10.04	14.75	6.85	2.35	0.23	2.11	8	15	-13	-0.37	Negative
MER-003 Q1	Monitoring	Manganese	µg/L	7	0	152.43	224.58	0.395	36.07	0.24	-0.45	100	200	13	6.00	Positive
MER-003 Q2	Monitoring	Arsenic	µg/L	6	3	1.01	1.86	2	0.42	0.42	-1.62	1	1	12	0.10	Positive
MER-003 Q2	Monitoring	Iron	µg/L	6	0	1044.83	1949.55	7.5	452.36	0.43	-0.73	349	1500	13	265.00	Positive
MER-003 Q2	Monitoring	Manganese	µg/L	6	0	79.33	177.31	0.175	48.99	0.62	-0.41	12	137	14	26.00	Positive
MER-003 Q2	Monitoring	Sodium	mg/L	6	0	4.67	8.35	1475	1.84	0.39	-0.30	2	7	13	0.90	Positive
MER-003 Q3	Monitoring	Boron	µg/L	6	1	15.34	28.18	1.6	6.42	0.42	1.59	10	26	10	2.00	Positive
WBR-001 Q3	Monitoring	Sodium	mg/L	5	0	7.72	12.71	31	2.5	0.32	-0.62	4	10	-10	-1.39	Negative
WBR-002 Q1	Monitoring	Copper	µg/L	6	0	0.83	1.29	7.035	0.23	0.28	0.59	1	1	11	0.12	Positive
WBR-002 Q2	Monitoring	Alkalinity, Bicarbonate	mg/L	6	0	11.4	19.63	12	4.11	0.36	-1.26	4	16	12	1.06	Positive
WBR-002 Q2	Monitoring	Copper	µg/L	6	0	1.68	1.3	5.5	0.85	0.51	0.42	0	3	11	0.44	Positive
WBR-002 Q2	Monitoring	Lead	µg/L	6	2	0.49	1.33	37	0.42	0.86	1.60	0	1	10	0.12	Positive
WBR-002 Q2	Monitoring	Nickel	µg/L	6	0	1.97	3.36	1.585	0.69	0.35	1.23	1	3	11	0.34	Positive
WBR-002 Q2	Monitoring	Total Suspended Solids	mg/L	6	0	7.35	14.7	3.05	3.68	0.5	-0.45	2	12	11	1.75	Positive
WBR-003 Q1	Monitoring	Potassium	mg/L	7	0	1.5	2.17	52	0.34	0.23	-1.37	1	2	12	0.13	Positive
WBR-003 Q2	Monitoring	Arsenic	µg/L	6	0	1.32	2.14	2	0.41	0.31	0.65	1	2	12	0.20	Positive
WBR-003 Q2	Monitoring	Iron	µg/L	6	0	3176.67	5426.38	7.2	1124.86	0.35	0.35	1830	4600	11	500.00	Positive
WBR-003 Q2	Monitoring	Manganese	µg/L	6	0	164.4	431.4	1	133.5	0.81	0.32	22	324	11	60.32	Positive
WBR-003 Q2	Monitoring	Total Suspended Solids	mg/L	6	2	5.4	11.26	3.75	2.93	0.54	-0.86	2	8	12	1.25	Positive

2018
Surface Water Trend Analysis Summary Charts
Humboldt Mill



Appendix K

Humboldt Mill

Sediment Monitoring Results

Humboldt Mill
Sediment Monitoring Data
HMP-009 (Compliance)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**6200**	**10500**
Antimony	--	--	**1.1**	<0.55
Arsenic	9.79	33	**4.6**	**4.0**
Barium	--	--	**28**	**39**
Beryllium	--	--	**0.49**	<0.92
Boron	--	--	**4.0**	**6.8**
Cadmium	0.99	4.98	< 0.19	<0.37
Chromium	43.4	111	**8.6**	**18**
Cobalt	--	--	**4.3**	**9.0**
Copper	31.6	149	**26**	**43**
Iron	--	--	**11000**	**16600**
Lead	35.8	128	**11**	**13**
Lithium	--	--	**5.3**	<18
Manganese	--	--	**330**	**297**
Mercury	0.18	1.06	< 0.05	<0.092
Molybdenum	--	--	< 0.94	<1.8
Nickel	22.7	48.6	**17**	**37**
Selenium	--	--	**0.30**	**5.6**
Silver	--	--	**0.12**	<0.18
Thallium	--	--	< 0.47	<0.92
Vanadium	--	--	**14**	**22**
Zinc	121	459	**27**	**62**
Major Anions				
Sulfide	--	--	< 16	**67**
Major Cations				
Magnesium	--	--	**7200**	**10100**

Humboldt Mill
Sediment Monitoring Data
HMWQ-004 (Compliance)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**2100**	NM
Antimony	--	--	< 0.30	NM
Arsenic	9.79	33	**3.1**	NM
Barium	--	--	**77**	NM
Beryllium	--	--	< 0.47	NM
Boron	--	--	**2.5**	NM
Cadmium	0.99	4.98	**0.36**	NM
Chromium	43.4	111	**3.7**	NM
Cobalt	--	--	**1.6**	NM
Copper	31.6	149	**6.0**	NM
Iron	--	--	**7300**	NM
Lead	35.8	128	**12**	NM
Lithium	--	--	< 0.94	NM
Manganese	--	--	**33**	NM
Mercury	0.18	1.06	< 0.14	NM
Molybdenum	--	--	< 0.94	NM
Nickel	22.7	48.6	**3.6**	NM
Selenium	--	--	**0.80**	NM
Silver	--	--	< 0.094	NM
Thallium	--	--	< 0.47	NM
Vanadium	--	--	**5.5**	NM
Zinc	121	459	**9.4**	NM
Major Anions				
Sulfide	--	--	< 49	NM
Major Cations				
Magnesium	--	--	**1700**	NM

Humboldt Mill
Sediment Monitoring Data
MER-001 (Reference)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**3800**	**5830**
Antimony	--	--	< 0.28	<0.34
Arsenic	9.79	33	**4.3**	**9.6**
Barium	--	--	**9.9**	**26**
Beryllium	--	--	< 0.46	<0.57
Boron	--	--	< 0.92	**2.1**
Cadmium	0.99	4.98	< 0.18	<0.23
Chromium	43.4	111	**11**	**34**
Cobalt	--	--	**3.5**	**7.2**
Copper	31.6	149	**4.2**	**9.5**
Iron	--	--	**8800**	**25000**
Lead	35.8	128	**1.1**	**4.8**
Lithium	--	--	**5.5**	**14**
Manganese	--	--	**71**	**215**
Mercury	0.18	1.06	< 0.05	<0.056
Molybdenum	--	--	< 0.92	<1.1
Nickel	22.7	48.6	**13**	**21**
Selenium	--	--	< 0.18	**2.3**
Silver	--	--	< 0.092	<0.11
Thallium	--	--	< 0.46	<0.57
Vanadium	--	--	**12**	**36**
Zinc	121	459	**26**	**44**
Major Anions				
Sulfide	--	--	< 12	**40**
Major Cations				
Magnesium	--	--	**2000**	**3530**

Humboldt Mill
Sediment Monitoring Data
MER-002 (Compliance)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**6100**	**9020**
Antimony	--	--	< 0.30	<0.34
Arsenic	9.79	33	**3.8**	**11**
Barium	--	--	**12**	**14**
Beryllium	--	--	< 0.50	<0.57
Boron	--	--	**1.9**	**2.5**
Cadmium	0.99	4.98	< 0.20	<0.23
Chromium	43.4	111	**17**	**20**
Cobalt	--	--	**5.5**	**6.2**
Copper	31.6	149	**21**	**32**
Iron	--	--	**19000**	**18600**
Lead	35.8	128	**3.2**	**5.8**
Lithium	--	--	**8.1**	**13**
Manganese	--	--	**130**	**102**
Mercury	0.18	1.06	< 0.05	<0.057
Molybdenum	--	--	< 1.0	<1.1
Nickel	22.7	48.6	**18**	**22**
Selenium	--	--	< 0.20	**1.6**
Silver	--	--	< 0.10	<0.11
Thallium	--	--	< 0.50	<0.57
Vanadium	--	--	**35**	**22**
Zinc	121	459	**30**	**42**
Major Anions				
Sulfide	--	--	< 11	**33**
Major Cations				
Magnesium	--	--	**3400**	**6380**

Humboldt Mill
Sediment Monitoring Data
MER-003 (Compliance)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**3300**	**5210**
Antimony	--	--	**0.44**	<0.33
Arsenic	9.79	33	**6.8**	**2.4**
Barium	--	--	**17**	**19**
Beryllium	--	--	**4.2**	<0.56
Boron	--	--	**2.5**	**2.3**
Cadmium	0.99	4.98	< 0.20	<0.22
Chromium	43.4	111	**6.3**	**20**
Cobalt	--	--	**2.6**	**7.1**
Copper	31.6	149	**5.2**	**132**
Iron	--	--	**28000**	**11700**
Lead	35.8	128	**5.4**	**8.5**
Lithium	--	--	**5.6**	<10
Manganese	--	--	**190**	**203**
Mercury	0.18	1.06	< 0.047	<0.057
Molybdenum	--	--	< 1.0	<1.1
Nickel	22.7	48.6	**12**	**20**
Selenium	--	--	< 0.20	**1.6**
Silver	--	--	< 0.10	<0.11
Thallium	--	--	< 0.50	<0.56
Vanadium	--	--	**18**	**30**
Zinc	121	459	**13**	**25**
Major Anions				
Sulfide	--	--	< 13	**28**
Major Cations				
Magnesium	--	--	**2500**	**3780**

Humboldt Mill
Sediment Monitoring Data
WBR-001 (Reference)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**3800**	**7900**
Antimony	--	--	< 0.30	<0.41
Arsenic	9.79	33	**6.6**	**5.7**
Barium	--	--	**13**	**32**
Beryllium	--	--	< 0.50	<0.69
Boron	--	--	< 1.0	**1.8**
Cadmium	0.99	4.98	< 0.20	<0.28
Chromium	43.4	111	**6.7**	**15**
Cobalt	--	--	**2.2**	**4.8**
Copper	31.6	149	**8.1**	**13**
Iron	--	--	**15000**	**42800**
Lead	35.8	128	**4.3**	**3.8**
Lithium	--	--	**4.1**	<14
Manganese	--	--	**440**	**1240**
Mercury	0.18	1.06	< 0.046	<0.071
Molybdenum	--	--	<1.0	<1.4
Nickel	22.7	48.6	**7.6**	**14**
Selenium	--	--	< 0.20	**1.4**
Silver	--	--	< 0.10	<0.14
Thallium	--	--	< 0.50	<0.69
Vanadium	--	--	**12**	**25**
Zinc	121	459	**18**	**25**
Major Anions				
Sulfide	--	--	< 15	**44**
Major Cations				
Magnesium	--	--	**1800**	**4970**

Humboldt Mill
Sediment Monitoring Data
WBR-002 (Compliance)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**7800**	**2880**
Antimony	--	--	**0.49**	**0.37**
Arsenic	9.79	33	**7.1**	**5.4**
Barium	--	--	**26**	**10**
Beryllium	--	--	**0.89**	<0.61
Boron	--	--	**2.6**	**1.7**
Cadmium	0.99	4.98	< 0.20	<0.24
Chromium	43.4	111	**15**	**6.2**
Cobalt	--	--	**7.3**	**2.8**
Copper	31.6	149	**23**	**7.0**
Iron	--	--	**28000**	**8350**
Lead	35.8	128	**11**	**2.0**
Lithium	--	--	**8.4**	<12
Manganese	--	--	**230**	**62**
Mercury	0.18	1.06	< 0.050	<0.064
Molybdenum	--	--	< 1.0	<1.2
Nickel	22.7	48.6	**21**	**9.0**
Selenium	--	--	**0.24**	**1.2**
Silver	--	--	< 0.10	<0.12
Thallium	--	--	< 0.50	<0.61
Vanadium	--	--	**22**	**17**
Zinc	121	459	**32**	**27**
Major Anions				
Sulfide	--	--	< 16	**22**
Major Cations				
Magnesium	--	--	**2900**	**1350**

Humboldt Mill
Sediment Monitoring Data
WBR-003 (Compliance)
Humboldt Mill

Parameter	Threshold Effects Concentration (mg/kg Dry Wt)	Probable Effects Concentration (mg/kg Dry Wt)	Q3 2016 8/23/16	Q3 2018 9/4/18
Metals				
Aluminum	--	--	**4500**	**6300**
Antimony	--	--	**0.33**	<0.33
Arsenic	9.79	33	**18**	**13**
Barium	--	--	**30**	**15**
Beryllium	--	--	**0.0**	<0.56
Boron	--	--	**2.7**	**1.9**
Cadmium	0.99	4.98	**0.21**	<0.22
Chromium	43.4	111	**11**	**24**
Cobalt	--	--	**4.3**	**4.5**
Copper	31.6	149	**14**	**18**
Iron	--	--	**21000**	**19900**
Lead	35.8	128	**6.3**	**3.0**
Lithium	--	--	**4.8**	<12
Manganese	--	--	**250**	**119**
Mercury	0.18	1.06	**0.055**	<0.058
Molybdenum	--	--	**1.8**	<1.1
Nickel	22.7	48.6	**12**	**21**
Selenium	--	--	**0.73**	**1.4**
Silver	--	--	< 0.10	<0.11
Thallium	--	--	< 0.50	<0.56
Vanadium	--	--	**19**	**21**
Zinc	121	459	**37**	**53**
Major Anions				
Sulfide	--	--	< 31	**26**
Major Cations				
Magnesium	--	--	**1600**	**3290**

Humboldt Mill
Sediment Quality Monitoring Data
Abbreviations & Data Qualifiers
Humboldt Mill

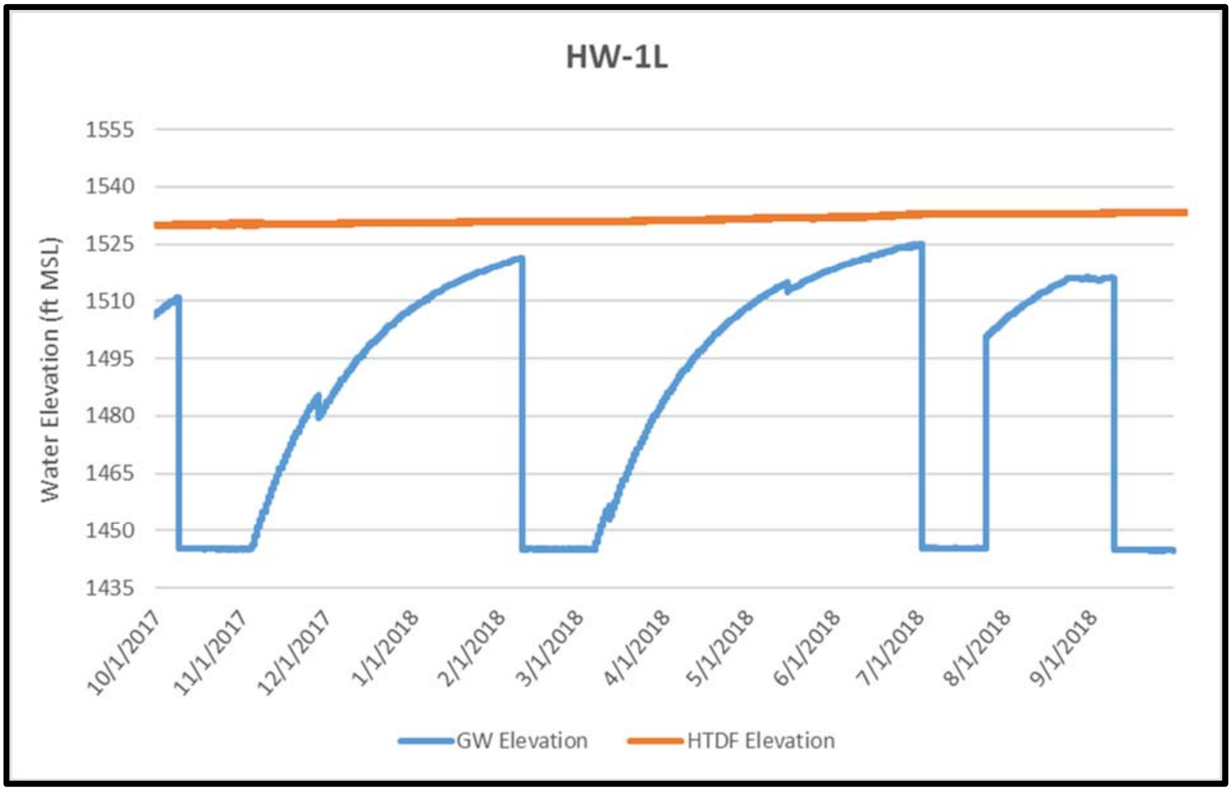
Notes:
Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) are consensus based guidelines developed by D.D. MacDonald, C.G. Inersol, T.A. Berger and published in the Archives of Environmental Contamination and Toxicology, "Development and Evaluation of Consensus Based Sediment Quality Guidelines for Freshwater Ecosystems, " January 2000.
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 greater than the TEC or PEC established for the parameter.
--Denotes no TEC or PEC is established for the parameter
NM = Not measured during the sampling event

Appendix L

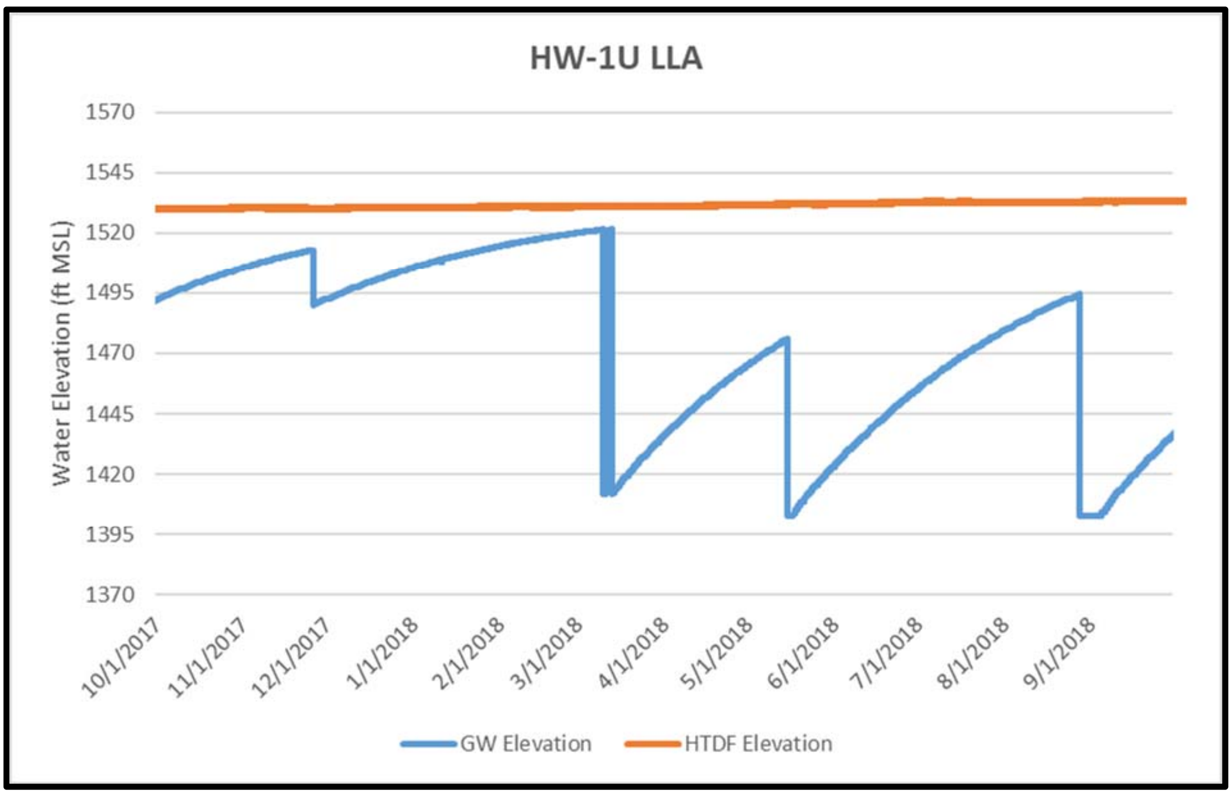
Humboldt Mill

Groundwater Hydrographs

2018 Groundwater Hydrographs
Humboldt Mill

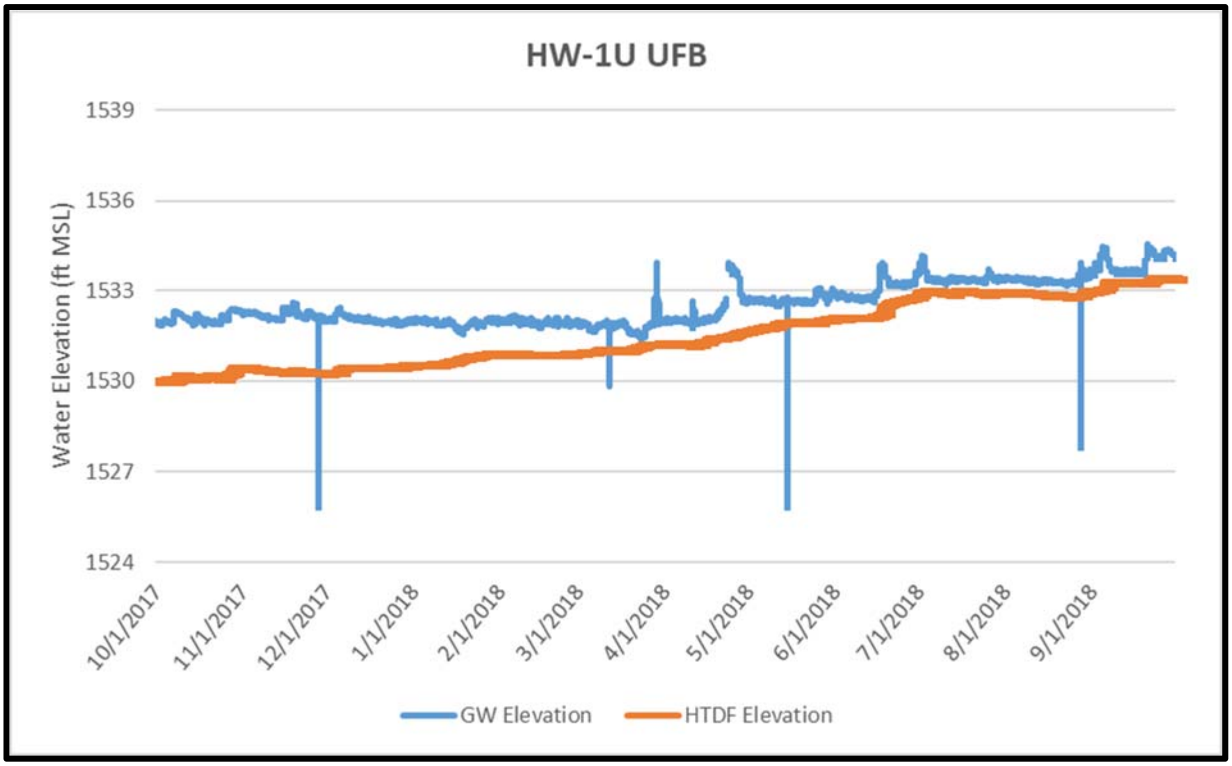


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

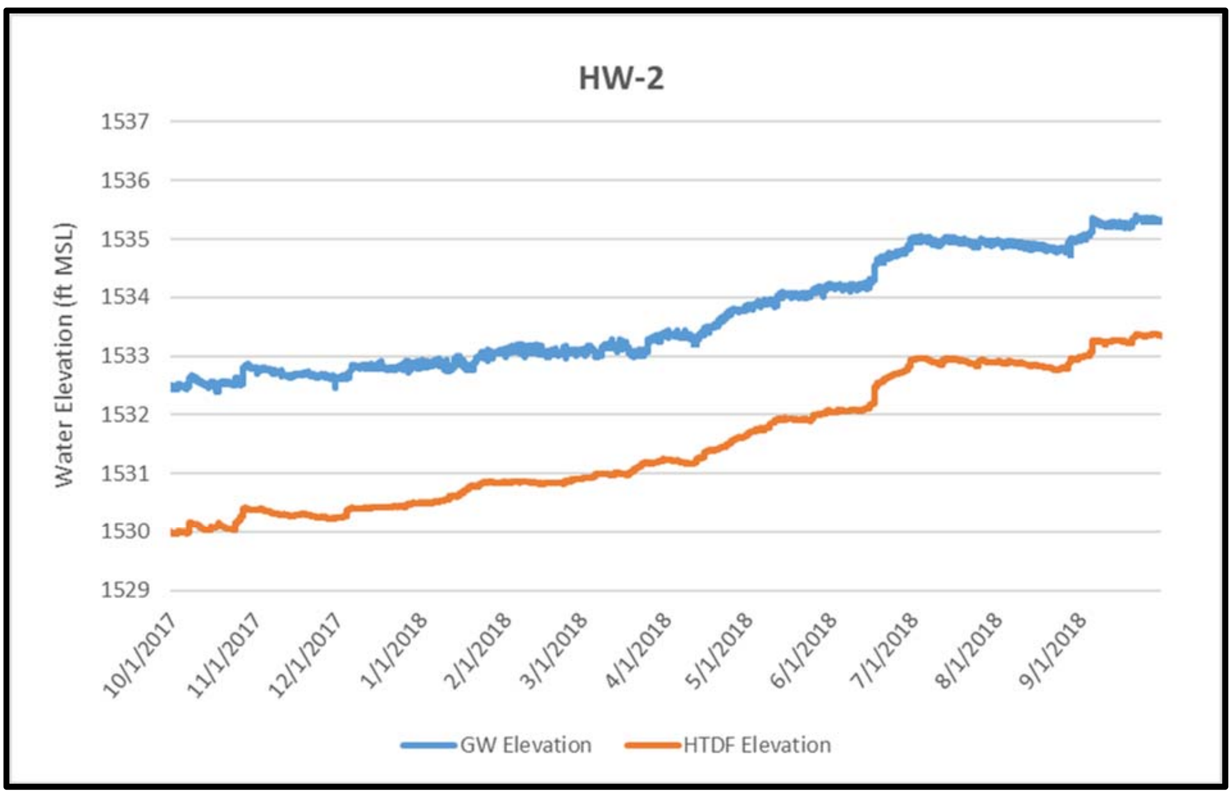


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

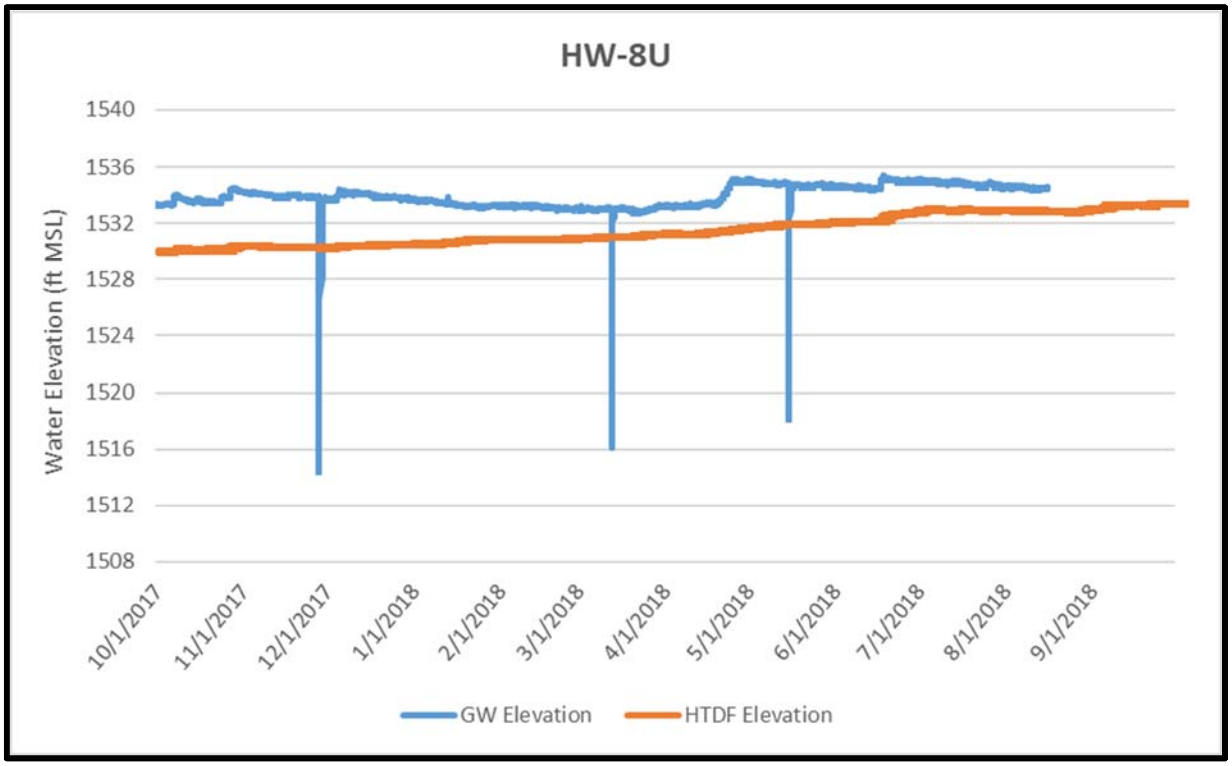
2018 Groundwater Hydrographs
Humboldt Mill



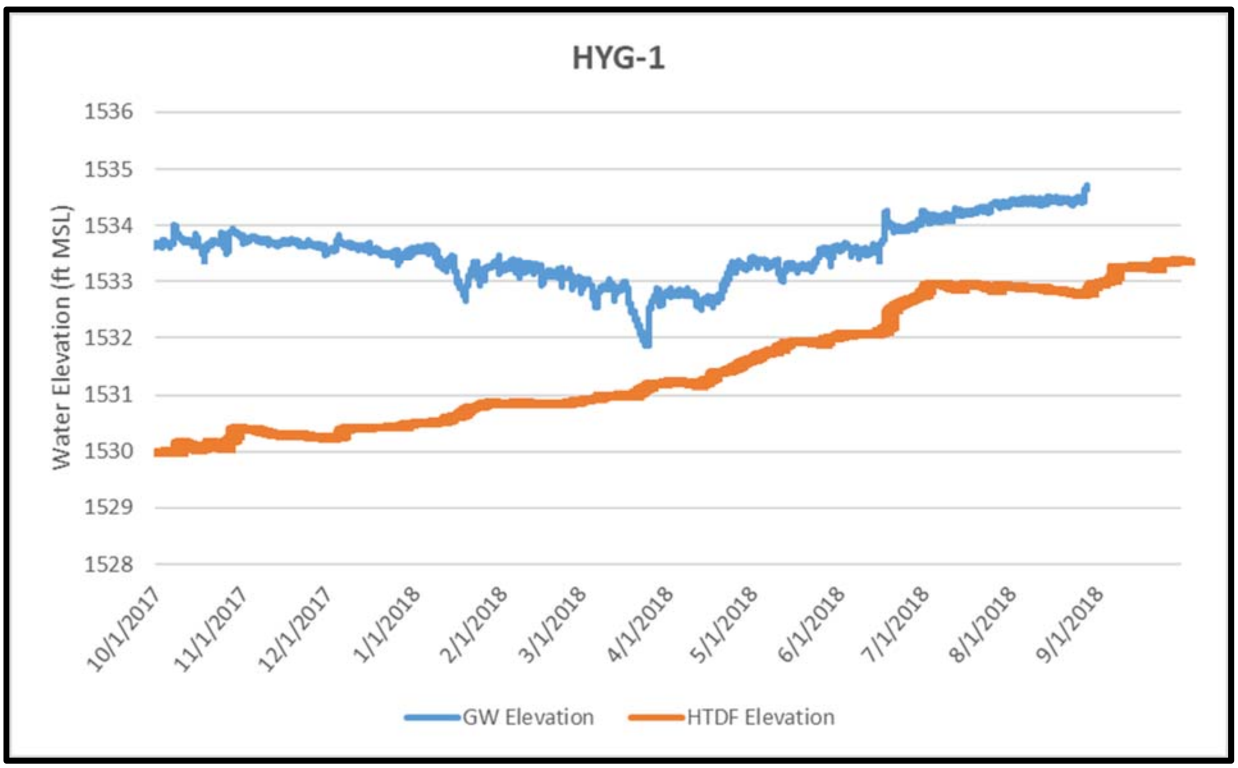
Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.



2018 Groundwater Hydrographs
Humboldt Mill

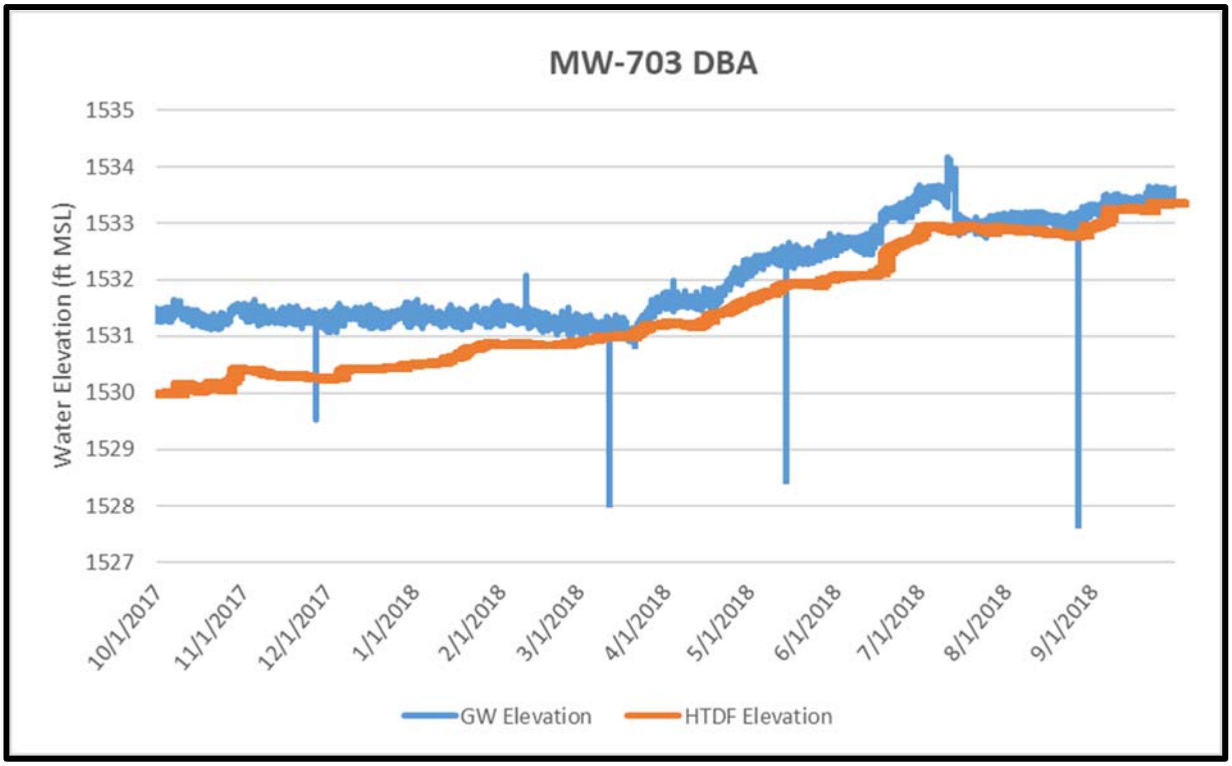


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 08-16-18 through 09-30-18 was unavailable due to internal battery failure.

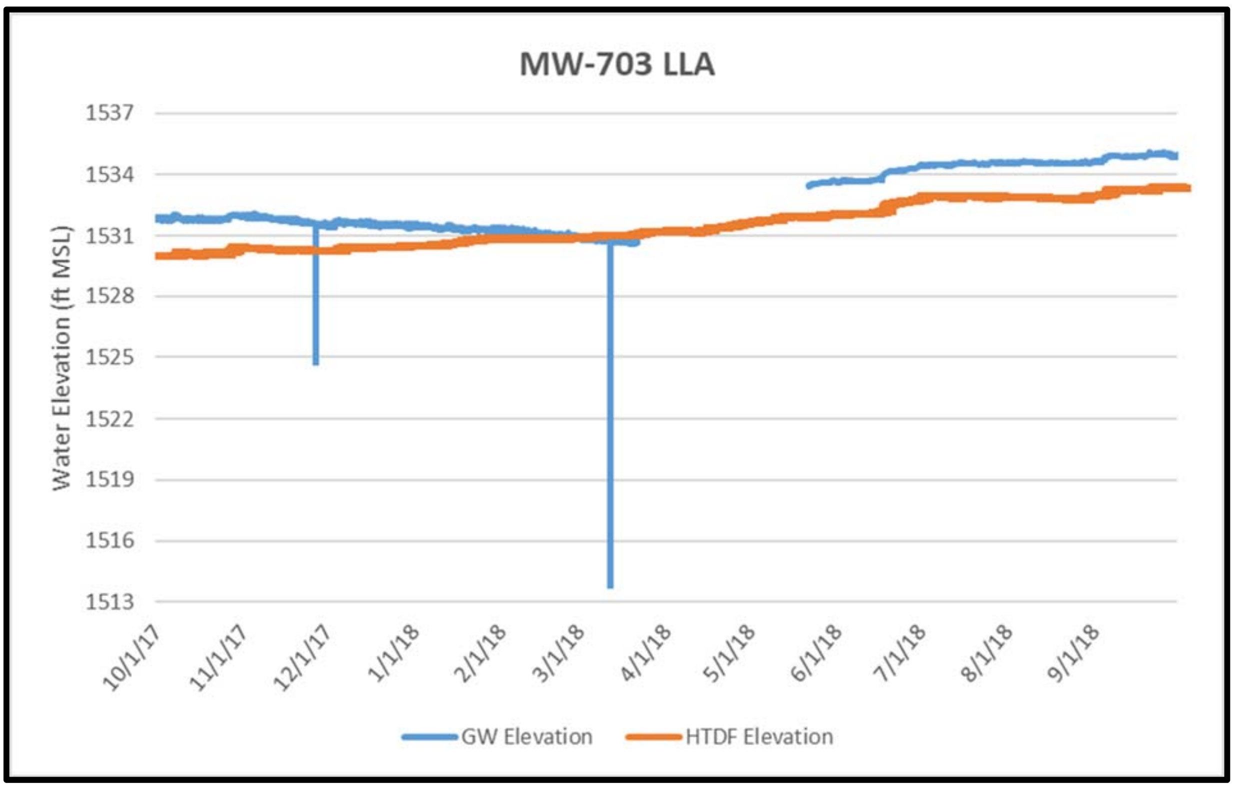


Note: GW elevation data from 08-17-18 through 09-30-18 was unavailable due to equipment malfunction.

2018 Groundwater Hydrographs
Humboldt Mill

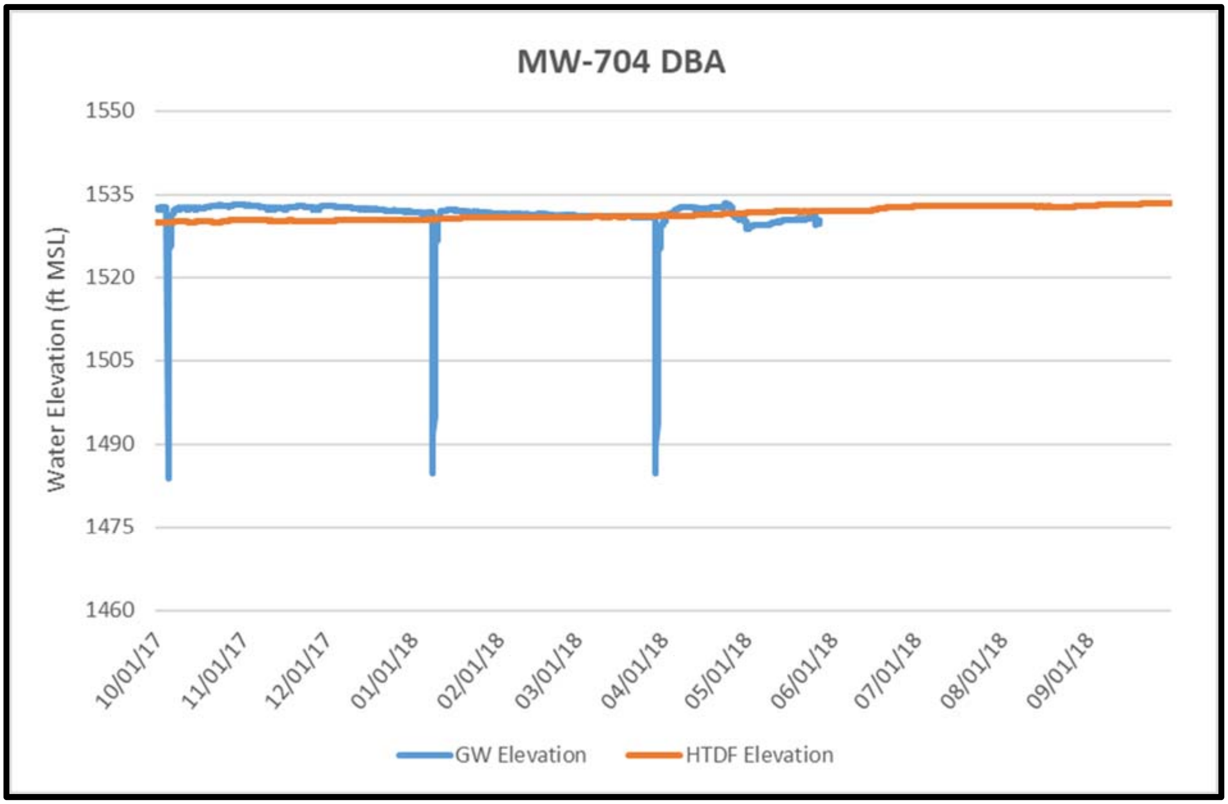


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

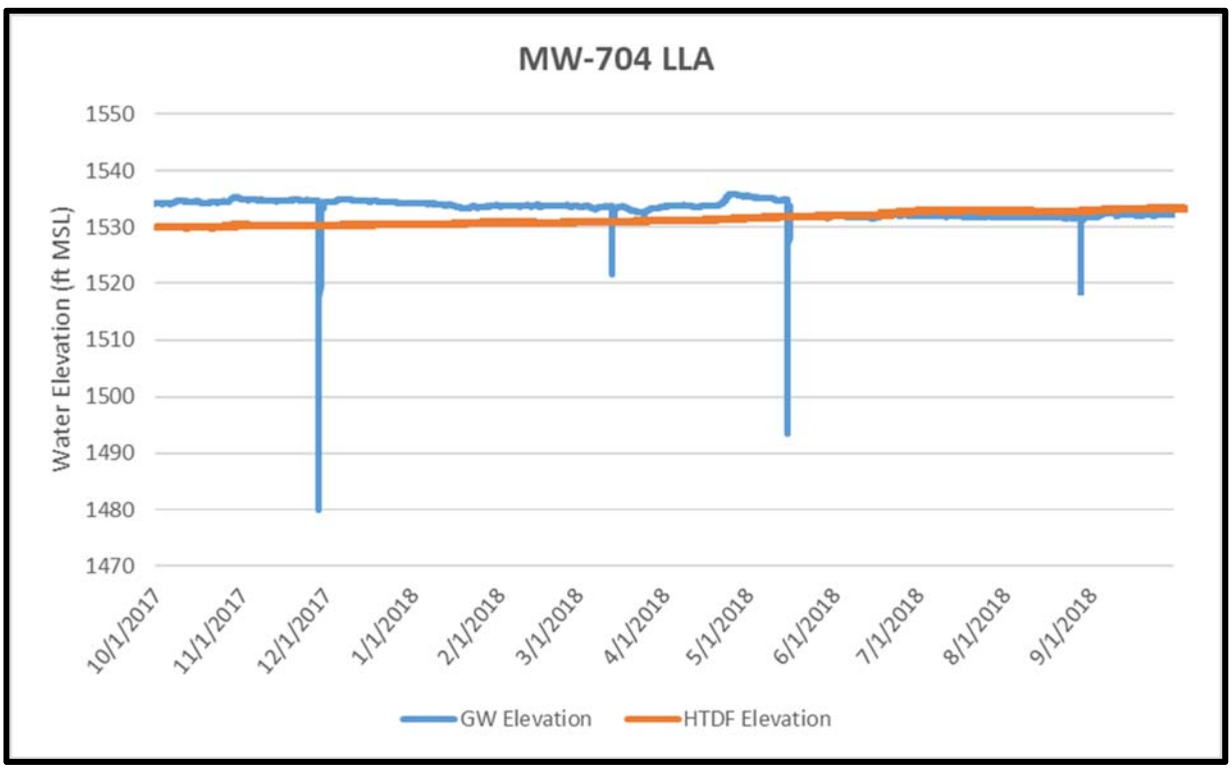


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: Diver failed on 03-22-18 and was replaced on 05-22-18.

2018 Groundwater Hydrographs
Humboldt Mill

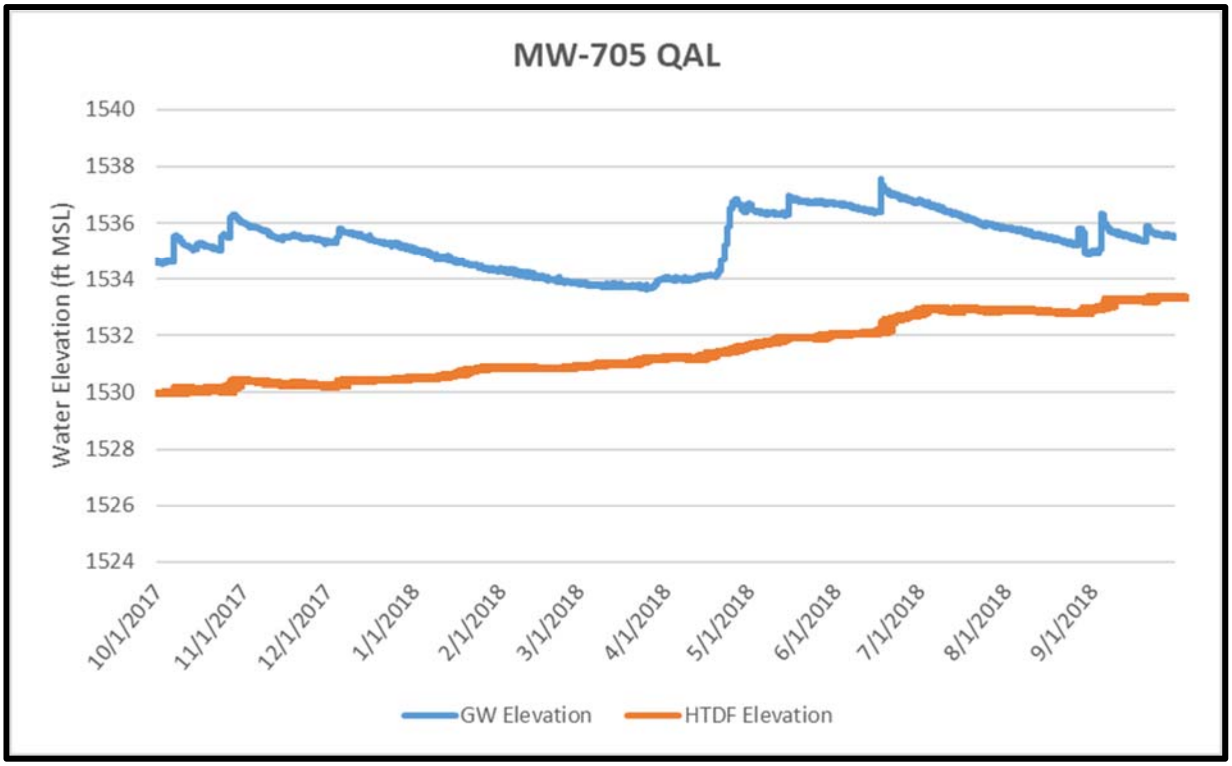


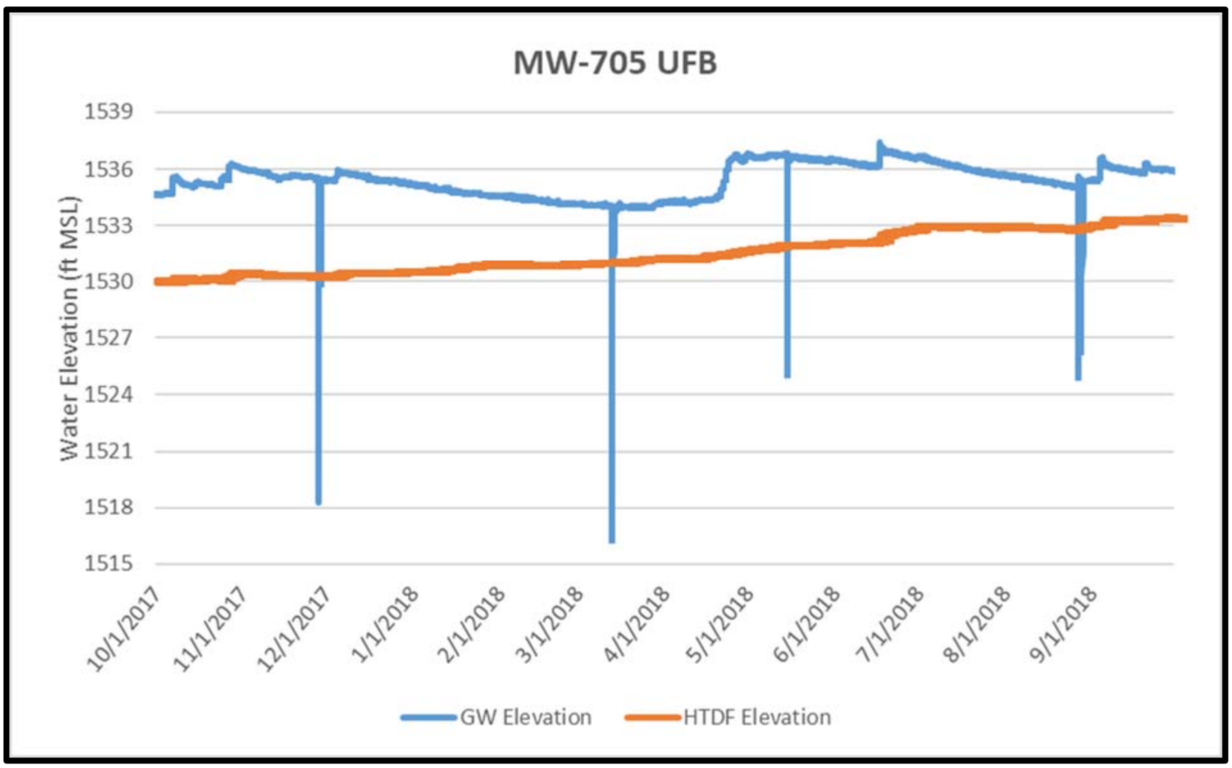
Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.
Note: GW elevation data from 05-27-18 to 09-30-18 was unavailable due to equipment malfunction.



Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

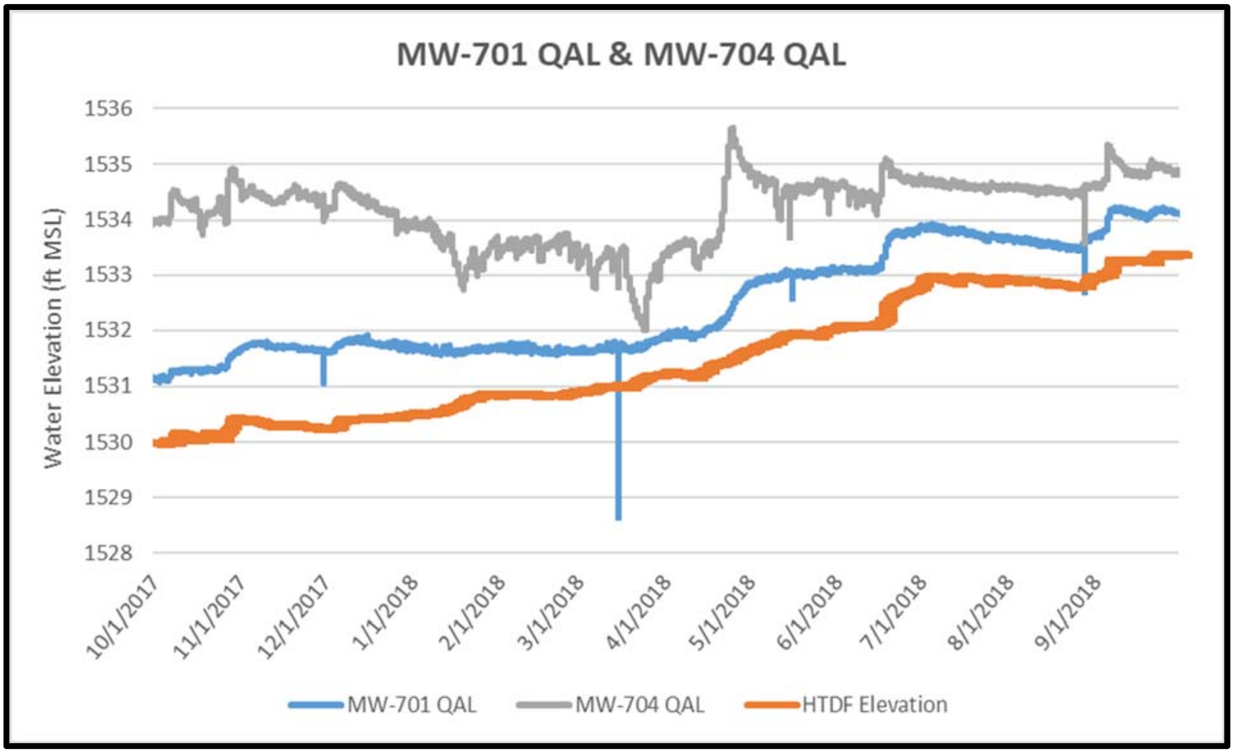
2018 Groundwater Hydrographs
Humboldt Mill



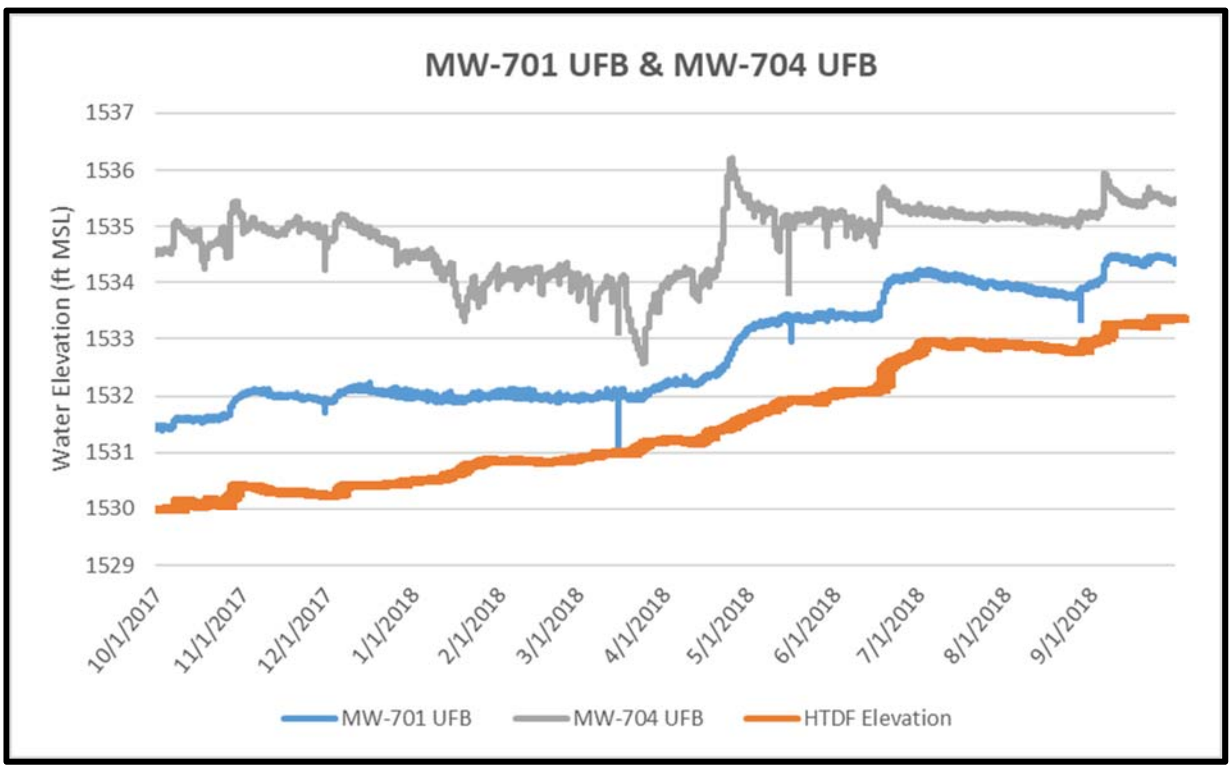


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2018 Groundwater Hydrographs
Humboldt Mill

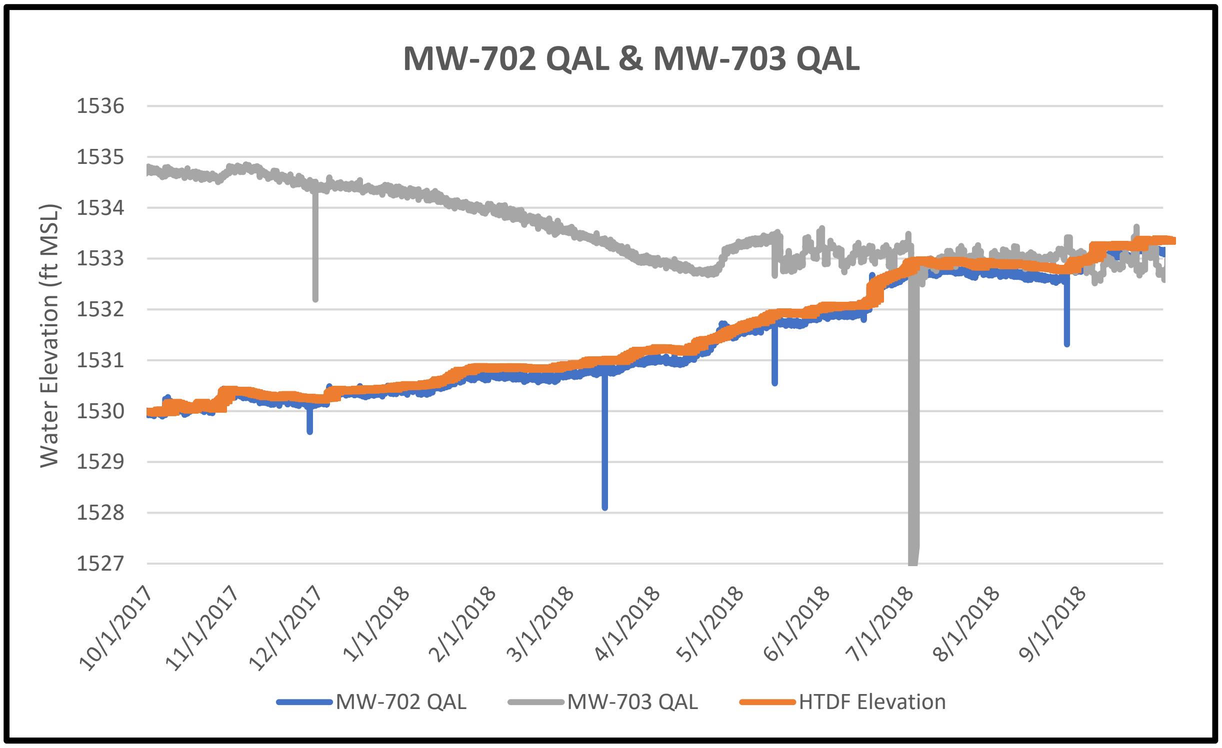


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

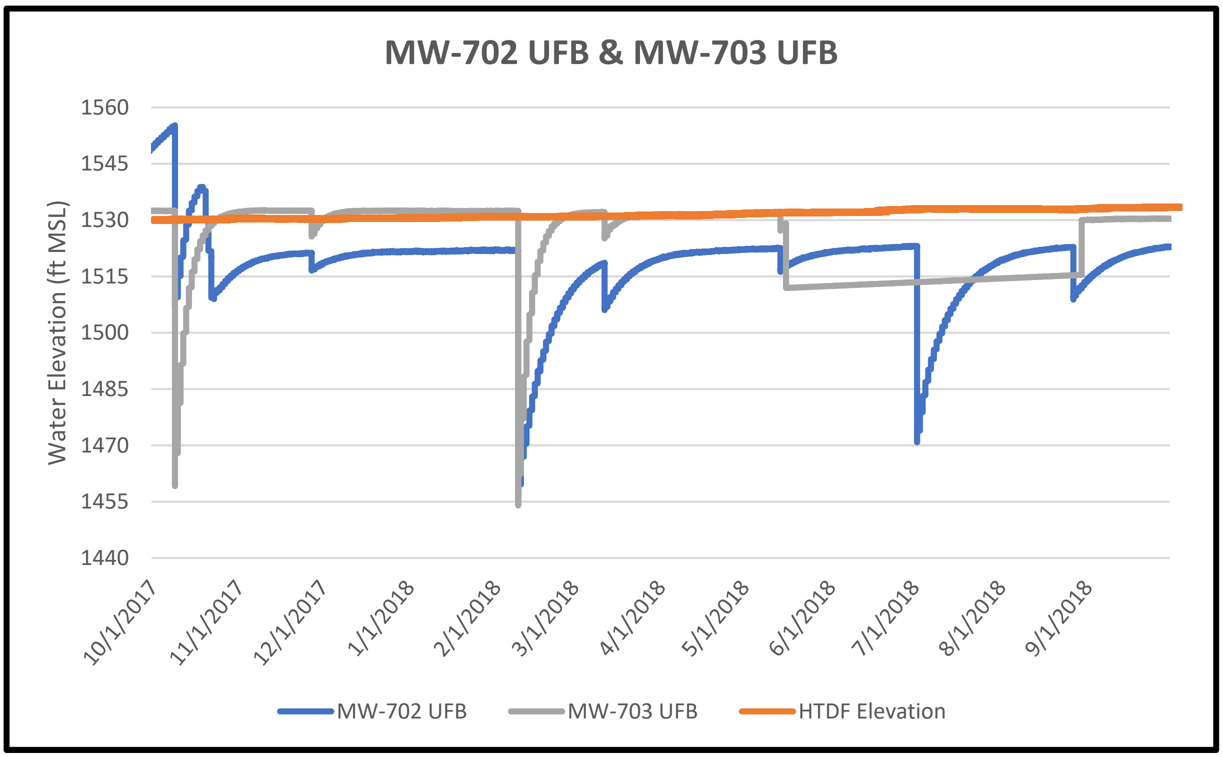


Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

2018 Groundwater Hydrographs
Humboldt Mill



Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.



Note: The large drops in water level are associated with the location being pumped down in preparation of sampling.

Appendix M

Humboldt Mill

Flora & Fauna Survey Location Maps

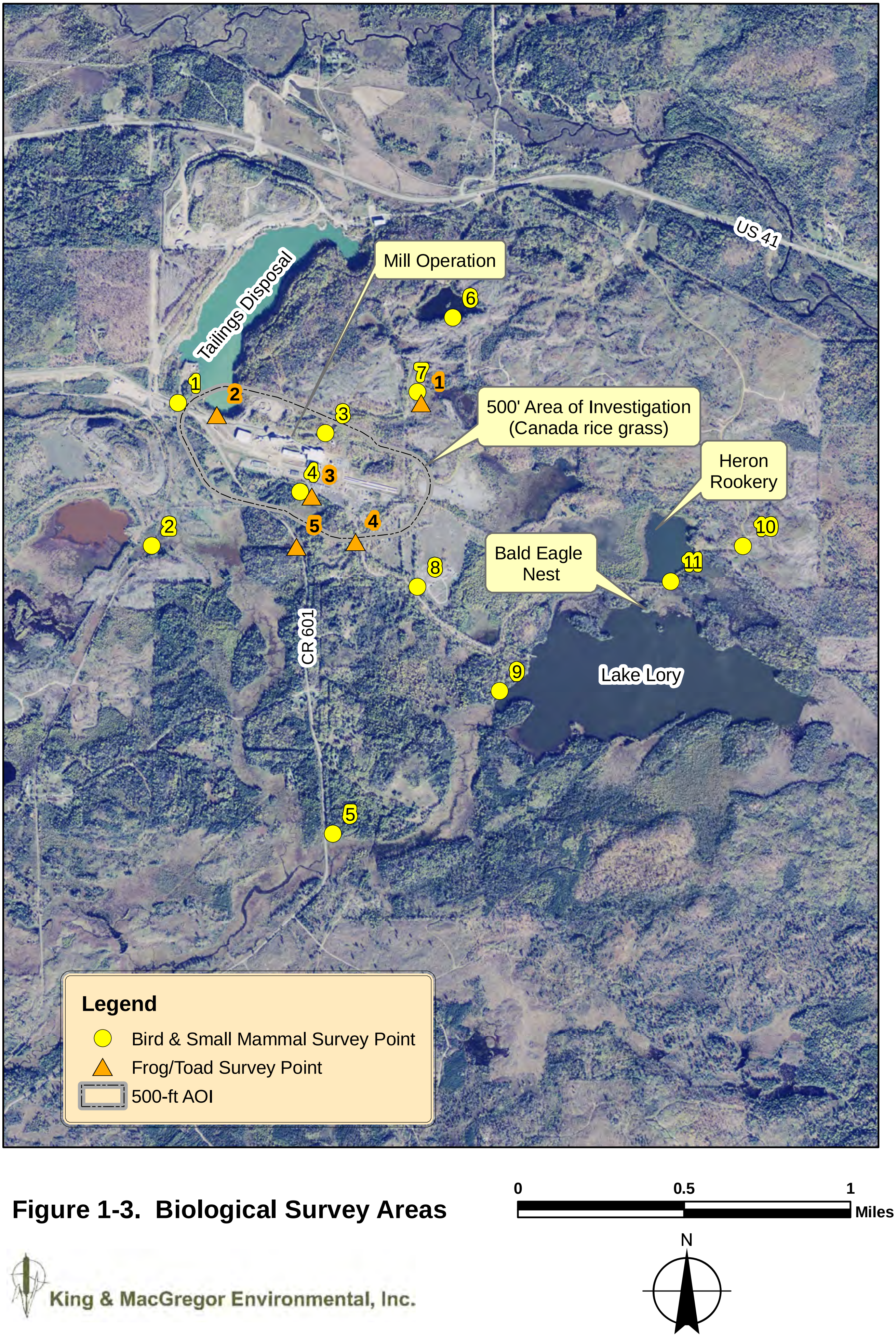


Figure 1-3. Biological Survey Areas

King & MacGregor Environmental, Inc.

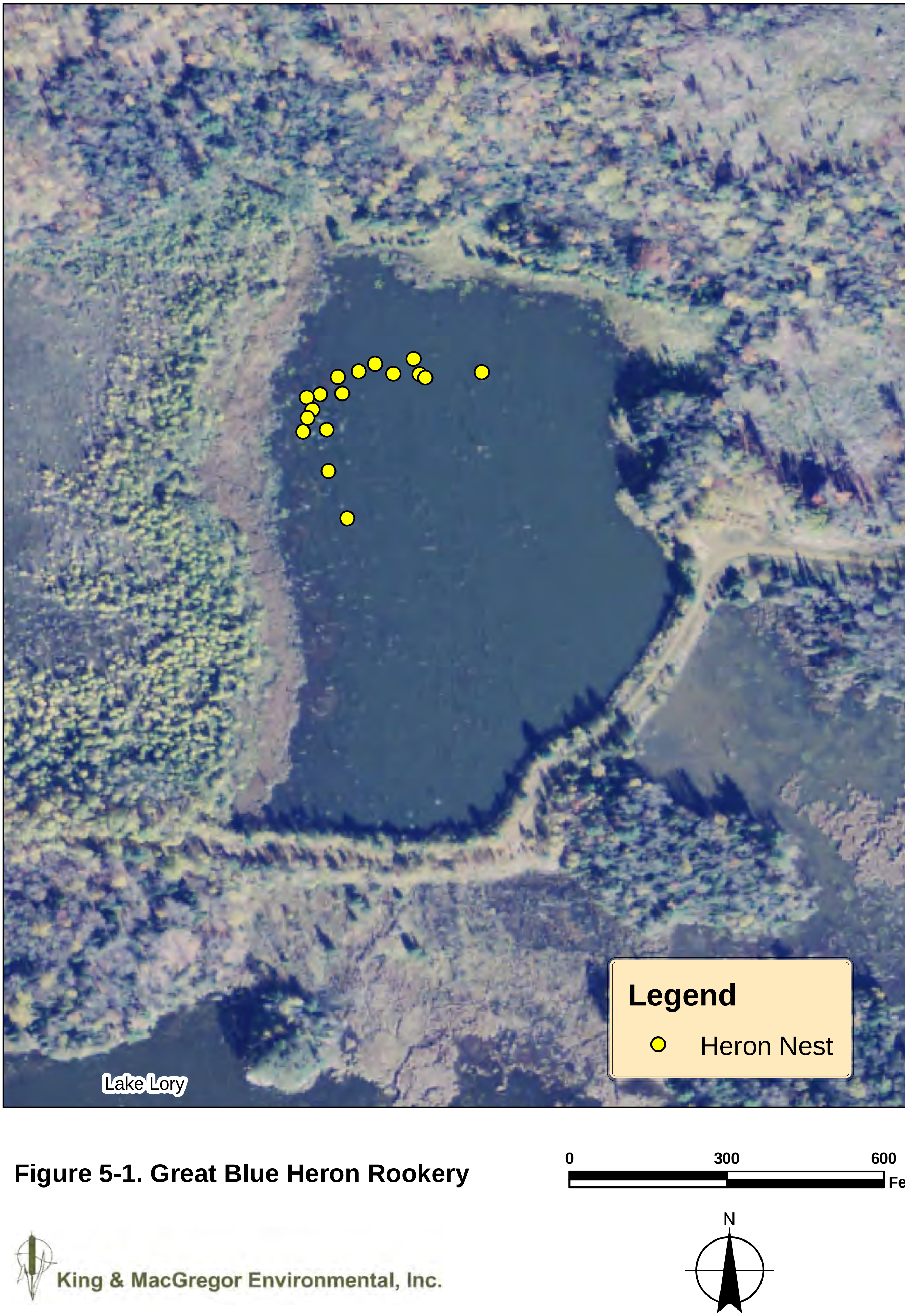


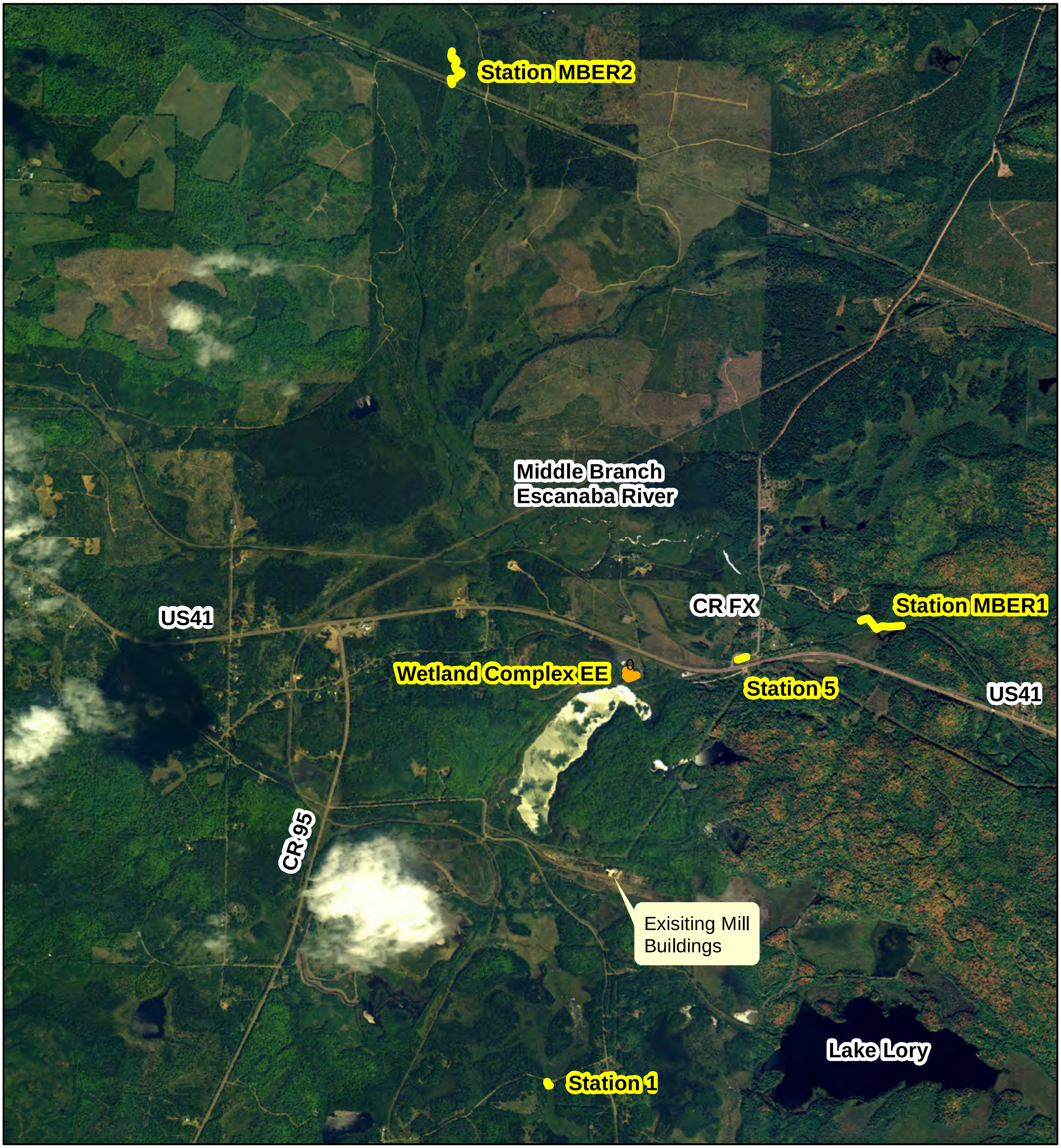
Figure 5-1. Great Blue Heron Rookery

King & MacGregor Environmental, Inc.

Appendix N

Humboldt Mill

Aquatic Survey Location Maps



Legend

Wetland Complex EE Station

Stream Sample Station Locations

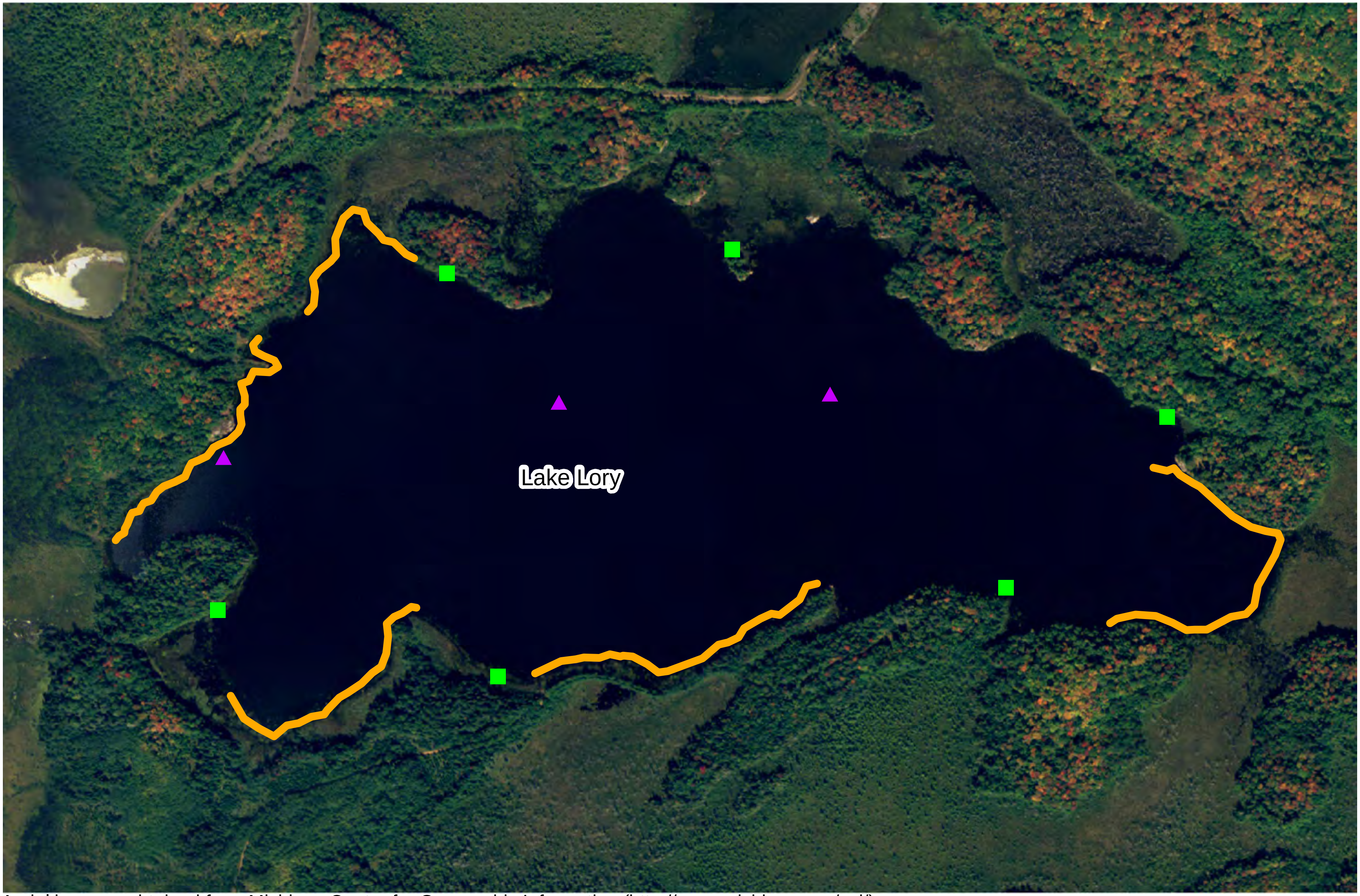
0 875 1,750 3,500 5,250 7,000 Feet

N

Aerial imagery obtained from Michigan Center for Geographic Information (http://www.michigan.gov/cgi/)

AEM ADVANCED ECOLOGICAL MANAGEMENT

PROJECT	Humboldt Mill - Eagle Mine
TITLE	Sample Station Locations
FIGURE	1-2



Aerial imagery obtained from Michigan Center for Geographic Information (http://www.michigan.gov/cgi/)

Legend

- Fyke Net Locations
- Gill Net Locations
- Electroshocker Transect Locations

Feet: 0, 275, 550, 1,100, 1,650, 2,200

N

AeM ADVANCED ECOLOGICAL MANAGEMENT

PROJECT	Humboldt Mill - Eagle Mine
TITLE	Lake Lory Gear Locations
FIGURE	1-3

Appendix O

Humboldt Mill

Contingency Plan Update

Eagle Mine
a subsidiary of lundin mining

1 Contingency Plan – Humboldt Mill

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 at the Humboldt Mill. 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 Mine Safety and Health Administration (MSHA) requirements.

The Humboldt Mill involves processing ore, as well as storing and treating by-products of that process. The milling, storage, and treatment facilities have been designed, constructed, and are 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 keep any water associated with the ore inside the facility. The lower level of the facility is equipped with an epoxy lined sump and any water collected 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 sweeping 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 the facilities standard operating procedures and includes inspecting and removing any residual concentrate from the exterior of the railcars prior to leaving the facility.

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 are 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.

As a further contingency against groundwater seepage from the HTDF, the operating level has been lowered to a level below that of the adjacent wetland creating a reverse gradient that does not facilitate the movement of water from the HTDF to the adjoining wetlands. The lower operating level of the HTDF also provides for additional freeboard in the event of a significant weather event or operational situation that results in the inability to operate the WTP and discharge water.

Eagle will monitor water quality in the HTDF during operations and post-closure. The WTP and associated infrastructure will remain in place after tailings disposal has ceased until water quality meets applicable standards. 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.

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 Safety Data Sheets (SDS). SDS are maintained on-site for all chemicals.

1.1.3 Fuel Storage and Distribution

There is currently one 3,000 gallon stationary bulk diesel tank located onsite. This tank is used to fuel all mobile equipment onsite. A fuel provider refills the tank on an as needed basis. The stationary tank is located on an asphalt surface in which any spills or leaks would be captured in a catch basin and routed to the HTDF.

In addition to the above, other equipment located on site which may contain fuel include a back-up diesel generator (2,000 gallon capacity) located at the northeast corner of the concentrate loadout facility and two refueling tanks located in the beds of pickup trucks (38 and 96 gallon capacities),

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 Pollution Incident Prevention Plan (PIPP) has been prepared which addresses potential spillage of fuels and other polluting materials such as water treatment chemicals and mill processing reagents.

Diesel fuel 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.

Bulk Tank Failure – A release may result from a failure of the stationary diesel tank. This type of release is judged to be low probability as it is inspected on a daily basis prior to use for signs of leakage or potential failure. In addition, as stated above the tank is parked and utilized in a location where asphalt is present and any spills would be directed to to the HTDF and not to an offsite or unprotected surface location. In addition, a spill response trailer is located onsite and contains spill containment and clean-up equipment in the event of a spill. Eagle also has a spill response contractor on call to immediately respond to situations that cannot be handled by onsite personnel.

Mishandling/Leaking Hoses - 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 incidents, 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. In addition, muster points have been established and all employees and visitors are trained on their location. 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. All vehicles/equipment are required to be equipped with fire extinguishers and all personnel trained in their use. In addition, all personnel are required to complete a "hot work" permit whenever work is being performed where an ignition source is present. 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
- 5 stocked and maintained fire equipment cabinets
- 29 occupant-use fire hose stations throughout the facility
- multiple dry chemical fire extinguishers throughout
- a FireWorks system with multiple heat and smoke detectors is installed to notify Security immediately of any fire.

In addition, a Wildfire Response Guideline has been developed in conjunction with Michigan DNR Fire Division to ensure the best possible response to a wildland fire.

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. The temperature of the material is routinely measured and any 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 process water and tailings, groundwater infiltration into the HTDF, precipitation, and storm water runoff. The HTDF is sized to provide wastewater storage and equalization capacity. Water from the HTDF is conveyed to the WTP which is comprised of several unit processes, including: oxidation, metals precipitation, ultra-filtration and reverse-osmosis filtration (when necessary). 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 1.1.9) 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 1.1.7.

1.1.6 Air Emissions

The 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.

1.1.6.1 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 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 transported to the HTDF via slurry 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. Ore transported from the mine site may only be dumped in the COSA when the doors are closed to minimize dust emissions from the building. A sweeping and housekeeping program is in place in the COSA and throughout the crushing circuit including 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 sweeping and watering program has been developed to control potential fugitive sources of dust. If excessive dust emissions should occur, the facility will take appropriate corrective action, which may include intensifying and/or adjusting the sweeping/watering program to properly address the problem.

1.1.6.2 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 that 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.

1.1.7 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 reported under the SARA Tier II Emergency and Hazardous Chemical Inventory that are being used onsite along with the approximate storage volumes and storage location. The storage volume is the calculated volume of chemical within each solution based on percentage.

Table 1.1.7 Chemical Reagents Used at the Water Treatment Plant & Mill Building

Item No.	Chemical Name	Trade Name	CAS No.	Storage Volumes	Storage Areas
1	Hydrochloric Acid/Hydrogen Chloride 31.5%	Muriatic Acid	7647-01-0	1,395 lbs	WTP chemical storage
2	Sodium Bisulfite 38%	Sodium Bisulfite	7631-90-5	1,331 lbs	WTP chemical storage
3	Sodium Hydroxide 25%	Sodium Hydroxide/Caustic Soda	1310-73-2	10,630 lbs	WTP chemical storage
4	Sodium Hypochlorite 12.5%	Chlorine/Bleach	7681-52-9	626 lbs	WTP chemical storage
5	1) Ferric Chloride 35% 2) Hydrochloric Acid 1%	Ferric Chloride	1) 7705-08-0, 2) 7647-01-0	30,660 lbs	WTP Reactor Area (West of WTP)
6	1) Sodium Hydroxide 50% 2) Sodium Chloride 5%	Sodium Hydroxide/Causic Soda	1) 1310-73-2, 2) 7647-14-5	53,466 lbs	WTP chemical storage
7	Sulfuric Acid 93.19%	Sulfuric Acid, 66 Deg	7664-93-9	3,565 lbs	WTP chemical storage
8	Aluminum chloride hydroxide sulphate	Nalco 8136/PAC	39290-78-3	13,213 lbs	WTP chemical storage
9	1) Sodium Chloride 2) Sodium Sulphide, 3) Sodium Hydroxide	Nalmet 1689	1) 7647-14-5, 2) 1313-82-2, 3) 1310-73-2	805 lbs	WTP chemical storage
10	Hydrotreated Light Distillate	Nalclear 7766 Plus/Flocculant	64742-47-8	294 lbs	WTP chemical storage
11	Hydrogen Peroxide 50%	Hydrogen Peroxide	7722-84-1	34,720 lbs	WTP reactor Area
12	1) Tetrasodium ETDA 2) Sodium Hydroxide 3) Sodium Cumenesulfonate 4) Sodium Dodecylbenzenesulphonate	Permaclean PC-97	1) 64-02-8 2) 1310-73-2 3) 28348-53-0 4) 25155-30-0	1,627 lbs	WTP chemical storage

Item No.	Chemical Name	Trade Name	CAS No.	Storage Volumes	Storage Areas
13	Permaclean PC-77	Permaclean PC-77/Reverse osmosis cleaner	unknown	2,706 lbs	WTP chemical storage
14	Permatreat PC-191T	Permatreat PC-191T/Reverse osmosis antiscalant	unknown	3,750 lbs	WTP chemical storage
15	1) Magnesium nitrate 2) 5-Chloro-2Methyl-4-Isothiazolin-3-one 3) 2-Methyl-4-Isothiazolin-3-one	Biocide PC-56	1) 10377-60-3 2) 26172-55-4 2682-20-4	1,400 lbs	WTP chemical storage
16	1) Sodium Carbonate 2) Ethylenediaminetetraacetic Acid 3) Sodium lauryl sulfate 4) Sodium gluconate	Hydrex 4501 (dry)	1) 497-19-8 2) 64-02-8 3) 151-21-3 4) 527-07-1	5,250 lbs	WTP chemical storage
17	Citric Acid (Dry)	Citric Acid (dry)	77-92-9	3,000 lbs	WTP chemical storage
18	Sodium carboxymethyl cellulose	CMC/Depramin C	9004-32-4	20 tons	Reagent storage area
19	Calcium Oxide	High Calcium Quick Lime	1305-78-8	39 tons	Lime silo
20	Optimer 83949	Flocculant	Unknown	2 tons	Reagent storage area
21	Methyl isobutyl carbinol (MIBC)	MIBC/Frother	108-11-2	2.2 tons	MIBC tank
22	Sodium isopropyl xanthane (SIPX)	SIPX	140-93-2	15 tons	Reagent storage area
23	Sodium carbonate	Soda Ash	497-19-8	54 tons	Soda ash silo

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.

1.1.8 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 the section that describes the HTDF. 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 Eagle Mine and Humboldt Mill. 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 is 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.

1.1.9 Power Disruption

Electrical power for the Humboldt Mill is provided by two utility power companies; Wisconsin Electric (WE) Energies and Upper Peninsula Power Company (UPPCO). The mill facility and production buildings are presently served by a 69 kV overhead electric feeder to an on-site UPPCO electrical substation. The substation supplies three underground 13.8 kV feeders; two to our main mill switchgear and one to our fire water system.

The production support buildings and Water Treatment Plant infrastructure for the mill are fed from a WE Energies 25 kV overhead line. These buildings include the Security Building, Administration Building, Mill Services Building, Water Treatment Plant Building which includes Water Treatment Plant Intake Pump Building.

In the unlikely event that power is disrupted, backup generators are installed to ensure mill critical loads remain energized. The buildings where “critical loads” have been identified and generators have been installed are Concentrator Building; which powers essential loads in the Concentrator and Concentrate Load Out Buildings, Coarse Ore Storage Area, Tailings Vault/Reclaim Pump Structure, Administration Building, Mill Services Building, Security Building and Water Treatment Plant.

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. If an incident were to occur, all employees are instructed to contact Security via radio or phone. Security then makes the proper notifications to the facility managers and activates the Eagle Mine Emergency Response Guideline as needed. If personnel on site need to be notified of such an event an emergency toned broadcast via radio and all-call speakers will be made with instructions.

Eagle Mine has adopted an emergency response structure that 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 key individuals is as follows:

- Health & Safety Officer: The facility H&S manager and H&S staff are responsible for monitoring activities in response to any emergencies. During an emergency, H&S representatives 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 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 personnel 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 external relations manager will be responsible for managing all contacts with the public and will coordinate with the safety and environmental officers to provide appropriate information to the general public.

In addition to the emergency response structure cited above, a Crisis Management Team (CMT) has also been established for situations that may result in injuries, loss of life, environmental damage, property or asset loss, or business interruption. If a situation is deemed a “crisis” the CMT immediately convenes to actively manage the situation. The following is a description of the core members and their roles:

Crisis Management Team – Core Members and Roles

Core Members	**Role**
Team Leader	Responsible for strategy and decision making by the CMT during a crisis and maintaining a strategic overview.
Coordinator	Ensures a plan is followed and all logistical/administrative support required is provided.
Administrator	Records key decisions and actions and provides appropriate administrative supports to the CMT.
Information Lead	Gathers, shares, and updates facts on a regular basis.
Emergency Services and Security	Liaises with external response agencies and oversees requests for resources. Maintains a link between the ERT and CMT and oversees and necessary evacuations.
Communications Coordinator	Develops and implements the communications plan with support from an external resource.
Spokesperson	Conducts media interviews and stakeholder briefings.

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 H&S 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. In addition, an Emergency Response Team was formed to assist in emergency response situations should they arise. This team is not required by MSHA but was established to help ensure the safety of employees while at work. The team is comprised of 13 individuals including two licensed EMS professionals and two NFPA certified firefighters. Trainings occur on a monthly basis and may include first aid, evacuation, emergency shutdown procedures for equipment, and vehicle and building extrications.

In addition to the Emergency Response Team, security personnel are EMTs and paramedics who are trained in accordance with state and federal regulations. This allows for immediate response to medical emergency situations.

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

- ABC Rechargeable fire extinguishers
- Fire cabinets located throughout the site containing hose, nozzles, hydrant wrenches, etc.
- Radios
- First aid kits, stretchers, backboards, and appropriate medical supplies
- Gas detection monitors that detect 5 gases and LEL
- High angle rescue ropes
- Self-Contained Breathing Apparatus (SCBA)
- 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.
- A trained Emergency Response Team.

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.

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

- Mill Security: (906) 339-7017
- Local Ambulance Services: UP Health Systems Bell. Contact Security at Extension 7017, or by radio using the Emergency Channel, or by dialing 911.
- Hospitals: Marquette General Hospital – (906) 225-3560
Bell Hospital – (906) 485-2200
- Local Fire Departments: Humboldt Township, Ishpeming Township – 911
- Local Police: Marquette County Central Dispatch – 911
Marquette County Sheriff Department – (906) 225-8435
Michigan State Police – (906) 475-9922
- Trimedia 24-hr emergency spill response: (906) 360-1545
- MDEQ Marquette Office: (906) 228-4853
- Michigan Pollution Emergency Alerting System: (800) 292-4706
- Federal Agencies: EPA Region 5 Environmental Hotline: (800) 621-8431
EPA National Response Center: (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 and the second component is completion of a mock field or desktop exercise.

Training will include participation of the Incident Commander, Safety Officer, Environmental Officer, Public Relations Officer and other individuals designated to respond to emergencies including the Mill ERT. Individuals will receive appropriate training and information with respect to their specific roles, including emergency response procedures and use of applicable emergency response equipment.

The second component of an effective Contingency Plan is to conduct desktop exercises or mock field tests. At least one desktop exercise or mock field test will be performed each year. The Safety Officer will work with the Environmental Officer and Emergency Response Coordinator to first define the situation that will be tested. The types of test situations may include responding to a release of a hazardous substance, fire or 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 crisis management team and emergency response team 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 P

Humboldt Mill

Financial Assurance

EAGLE MINE AND HUMBOLDT MILL CLOSURE

2018 CLOSURE PLAN ESTIMATE - MDEQ

SUMMARY OF THE ESTIMATE (US$)

Description	SLR Estimate 2018	Comments
Functional Currency	USD	
Current Day Cost	2018	
Expected Operations Completion Date	2023	9 years (SLR) (from late 2014 through summer 2023)
Expected Closure Completion Date	2026/27	Provides 2 years for Mine Closure and 3 years for Mill Closure (winter work is avoided)
Expected Post-Closure Completion Date	2027	Provides for an initial post-closure period of 5 years to allow Sites to come to equlibriam.
Post-Closure Monitoring Completion Date	2047	Provides 15 years to demonstrate no further action is required including monitoring.

Phase	Code	Description	Estimated Cost ($1000's)	Contingency ($1000's)	Closure Estimate ($1000's)	Description
Direct Closure		**Closure at Life of Mine**				
	1000	**Eagle Mine and Related Facilities Closure**				
	1100	**Eagle Mine Underground**				
	1110	Underground Mine Equipment	$220,367	$26,444	$246,811	Decontaminate, Prepare for Transport, Load and Haul all Mining Equipment from Site
	1130	Demolition of Underground Infrastructure	$1,097,368	$131,684	$1,229,052	Underground Infrastructure Demolition, Load, Haul to Surface Processing Area
	1160	Backfill of Mine (Backfill of Stopes Complete at Start of Closure)	$105,990	$15,899	$121,889	(The estimate assumes that backfilling of the mine stopes has been completed upon start of closure)
	1170	Closure Elements Construction	$2,485,000	$308,500	$2,793,500	Ramp and Shaft Plugs
	1200	**Surface Facilities and Infrastructure**				
	1210	Mobile Equipment	$17,619	$2,643	$20,262	Allowance for Surface Equipment at 50 percent of the UG Equipment (Excluding Loaders, Haul Units and Drills)
	1220	Building Demolition	$2,876,566	$345,188	$3,221,754	Mine Building Demolition, Load, Haul to Processing Area
	1230	Demolition of Mine Surface Infrastructure	$877,657	$131,648	$1,009,305	Mine Surface Infrastructure Demolition, Load, Haul to Processing Area
	1240	Concrete and Asphalt Demolition	$678,132	$81,376	$759,507	Potential Recycle
	1250	Drainage Facilities and Road Removal	$749,467	$112,420	$861,887	Water Basins, TDRSA, Drainage Channels and Road Removal
	1260	Site Backfill, Grading and Preparation for Revegetation	$1,262,697	$189,405	$1,452,102	Regrade the Site Using Material from Site Berms
	1270	Closure Elements Construction	$636,000	$95,400	$731,400	Permanent Drainage Facilities (provide for drainage channels, sediment basins and drainage infrastructure)
	1280	General Site Planting and Revegetation	$1,277,555	$191,633	$1,469,188	Total Site Area for Revegetation equals Approximately 160 Acres
	2000	**Humboldt Mill Closure**				
	2200	**Surface Facilities and Infrastructure**				
	2210	Mobile Equipment	$17,619	$2,643	$20,262	Decommission, Prepare for Transport and Load Equipment
	2220	Building Demolition	$4,004,980	$480,598	$4,485,577	Mill Building Demolition, Load, Haul to Processing Area
	2230	Demolition of Surface Infrastructure	$1,119,326	$167,899	$1,287,225	Mill Surface Infrastructure Demolition, Load, Haul to Processing Area
	2240	Concrete and Asphalt Demolition	$876,097	$131,414	$1,007,511	Concrete SOG and Foundation Removal and Asphalt
	2250	Drainage Facilities and Road Removal	$111,445	$16,717	$128,162	Fill Stormwater Basins
	2260	Site Backfill, Grading and Preparation for Revegetation	$1,016,951	$122,034	$1,138,985	Import Topsoil
	2270	Closure Elements Construction	$379,375	$45,525	$424,900	Permanent Drainage Facilities (provide for drainage channels, sediment basins and drainage infrastructure)
	2280	General Site Planting and Revegetation	$507,051	$76,058	$583,109	Total Site Area for Revegetation equals Approximately 60 Acres
	2290	Other Miscellaneous Closure Requirements	$896,893	$134,534	$1,031,427	Fencing, signage, soil removal, spillways, increase FS for Rock Face north of mill building
		Subtotal Direct Closure Costs	$21,214,154	$2,809,661	$24,023,816	
	5000	**Contractor's Indirect Costs**				
	5100	Mine Closure	$2,905,814	$372,437	$3,278,251	Engineering Procurement and Construction Management (EPCM) Costs)
	5200	Humboldt Mill Closure	$3,704,897	$462,062	$4,166,958	Engineering Procurement and Construction Management (EPCM) Costs)
		Summary				
		Eagle Mine Subtotal	$15,190,231	$2,004,677	$17,194,908	
		Humboldt Mill Subtotal	$12,634,634	$1,639,483	$14,274,117	
		Total Direct Closure Construction Cost	**$27,824,865**	**$3,644,160**	**$31,469,025**	
	7000	**Site Operations, Maintenance and Monitoring (OM&M)**				
Closure Phase OM&M + Full Years WTP Ops		**Provide OM&M During Active Closure of the Eagle Mine & WTP Operations per estimated years beyond**				
		Eagle Mine OM&M with 5 Years WTP Operation	$5,613,114	$562,464	$6,175,578	Includes Site Care, Monitoring during Closure Phase and 5 years of Mine Water Treatment Operation
		Humboldt Mill OM&M with 3.5 years WTP Operation	$6,961,101	$697,918	$7,659,019	Includes Site Care, Monitoring during Closure Phase and 3.5 years of Mill Water Treatment Operation
Phase I (5 Years)		**Post-Closure Phase I - OM&M**				
		Eagle Mine	$3,500,162	$379,872	$3,880,034	Post-Closure Phase I - Five Year Period Following Completion of Closure Construction
		Humboldt Mill	$1,556,541	$171,435	$1,727,976	Post-Closure Phase I - Five Year Period Following Completion of Closure Construction
Post Closure (25 Years)		**Long Term Care and Maintenance**				
		Eagle Mine	$4,749,120	$579,831	$5,328,951	Post-Closure Phase II - Long Term Care and Maintenance
		Humboldt Mill	$3,922,915	$531,210	$4,454,125	Post-Closure Phase II - Long Term Care and Maintenance
		Eagle Mine Subtotal	$29,052,627	$3,526,844	$32,579,471	
		Humboldt Mill Subtotal	$25,075,191	$3,040,046	$28,115,237	
		Total	$54,127,818	$6,566,890	$60,694,708	
		Grand Total of All Cash Flows - Engineer's Estimate	**$54,127,818**	**$6,566,890**	**$60,694,708**	
	ADD	**ADD** - Fill Open Stopes with CRF & Clear TDRSA of waste material	$2,096,334	$0	$2,096,334	Mine Site Only Costs
		Total for Project before inflation	$56,224,152	$6,566,890	$62,791,041	
		Escalation Factor - Detroit CPI No Adjustment for this estimate as prepared with 2018 year-end dollars	$0	$0	$0	Per Part 632, utilize Detroit Consumer Price Index inflation factor for cost adjustment
		Total for Project including inflation (excludes Contingency)	$56,224,152	$6,566,890	$62,791,041	
		MDEQ Adminstrative Oversight	$5,983,860	$0	$5,983,860	2016 Added by MDEQ as Part 425.301 (b) of the permit notes "The department (MDEQ) may require financial assurance in an amount larger than calculated by operator…" Breakout was $2,589,102 Mill Site and $3,394,758 Mine Site
		Estimate to MDEQ - Total for Project	**$62,208,012**	**$6,566,890**	**$68,774,901**	

Previous Estimate	**$ 53,914,295**
Difference	**$ 14,860,606**

Breakdown by Mine and Mill for Bonding Valuation of Each

Mine Site Total Estimate	$38,070,563
Mill Site Total Estimate	$30,704,339
	$68,774,901

Appendix Q

Humboldt Mill

Organizational Information

Eagle Mine
4547 County Road 601
Champion, MI 49814, USA
Phone: (906) 339-7000
Fax: (906) 339-7005
www.eaglemine.com

Organizational Information

Eagle Mine LLC

January 24, 2019

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

Kristen Mariuzza	4547 County Road 601 Champion, MI 49814
Peter Richardson	4547 County Road 601 Champion, MI 49814
John McGonigle	4547 County Road 601 Champion, MI 49814

Eagle Mine
4547 County Road 601
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Officers

Jinhee Magie	Treasurer	4547 County Road 601 Champion, MI 49814
Annie Laurenson	Secretary	4547 County Road 601 Champion, MI 49814
Kristen Mariuzza	President	4547 County Road 601 Champion, MI 49814
John Kenneth McGonigle	CFO	4547 County Road 601 Champion, MI 49814