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March 12, 2018

Ms. Melanie Humphrey
Michigan Department of Environmental Quality
Office of Oil, Gas, and Minerals
1504 West Washington Street
Marquette, MI 49855

RE: Humboldt Mill Mining Permit Application Amendment Request – Request for Additional Information
Eagle Mine LLC. Mine Permit MP 10 2010

Dear Ms. Humphrey,

Eagle Mine LLC (Eagle) received your letter from 06 February requesting additional information related to the mine permit amendment request for the Humboldt Mill. Please find below, responses to those questions, and note that they have been re-ordered to facilitate the flow of information throughout. Each one has been numbered identically to your original letter.

Q1: Describe the current water treatment (WTP) design, and, if applicable, plans for future process upgrades/modifications to water treatment. Also provide the annual cost to operate the WTP at this time, or as projected at closure if further modifications are anticipated.

A1: As described in the Comprehensive Report on the Chemistry of the Humboldt Tailings Disposal Facility (HTDF) (**Appendix A**) and illustrated in **Figure 1** below, the HTDF was managed from August 2014 until the present time by decanting water from the upper layer for both WTP influent and mill process water requirements while tailings and WTP backwash water were discharged to the deep-water layer of the HTDF. Operating in this manner allowed the deep-water layer and associated transitional boundary (i.e. chemocline) to rise over time.

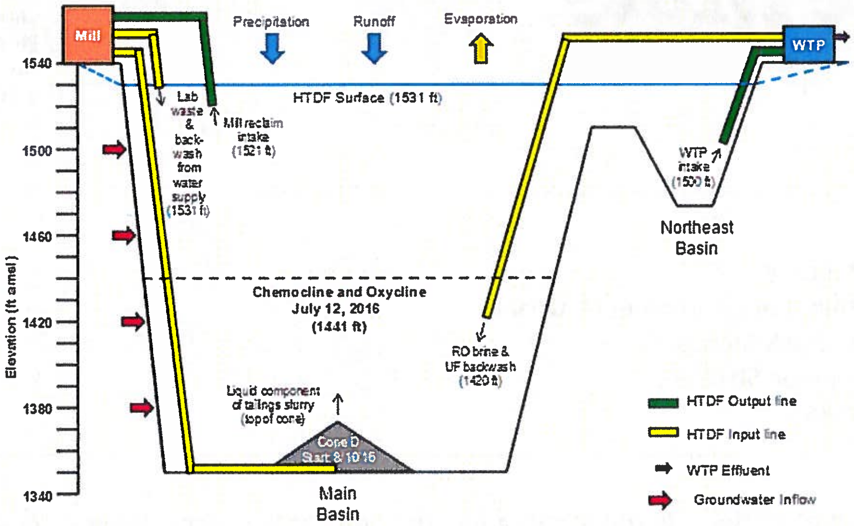

Figure 1. Schematic showing previous water management method. WTP intake water and mill reclaim water were withdrawn from a clean water cap overlying the deep-water water of high TDS tailings slurry.

To stabilize and lower the elevation of the chemocline, operational modifications were made which allow for utilization of the deep-water layer as both the mill process water supply and WTP influent. Please see **Figure 2** below. Due to the water chemistry within the deep-water layer, an oxidation reactor is necessary as the initial step of the WTP process and was installed and commissioned in January 2018. Testing continues, and discharge from the deep-water layer will commence once acceptable results are received from the latest round of studies. In early February 2018, a deep-water layer blend of 70% deep water/30% upper layer water was utilized to fulfill mill process water requirements. Efforts to optimize the use of deep water within the process continue to be explored. The description below includes the additional unit processes that are installed, although not fully operational at this time. A flow chart and more detailed description of the unit processes are attached in **Appendix B.**

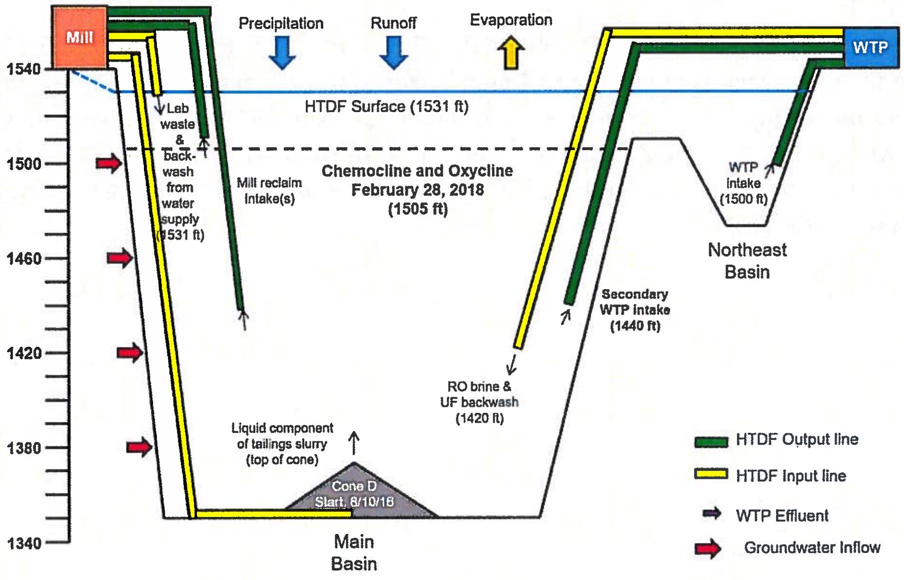

Figure 2. Schematic showing updated water management methods. WTP intake water and mill reclaim water are withdrawn from both a clean water cap overlying the deep-water water of high TDS tailings slurry, as well as within the tailings slurry layer. In doing so, the tailings slurry layer can be reduced in volume and lowered in elevation.

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[1] Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

The modified water treatment plant is described, generally, as follows:

1) Oxidation: The current process begins with an oxidation step utilizing Fenton's reaction to destruct thiosulfates and lower the chemical oxygen demand. Peroxide, sulfuric acid, and ferric chloride are added in this step.

2) Neutralization and Metal Precipitation: Following oxidation, water passes to neutralization and metals precipitation in the coagulation reaction tank. Caustic is used to neutralize the water, and a metals precipitant is added if necessary.

3) Solids Settling: Solid particulates are removed with the aid of a polymer in the lamella clarifier. Solids are collected and dewatered in a filter press before landfill disposal offsite.

4) Filtration: Following the lamella clarifier, water passes through Ultrafiltration (UF) to remove any residual particulates.

5) Reverse Osmosis: After UF, a portion of the water passes through RO to lower TDS. A portion of UF filtrate bypasses the RO and is added to the RO permeate to meet discharge TDS and toxicity limits. RO brine is returned to the bottom of the HTDF, for additional stabilization of the chemocline (see response 2 below for a detailed explanation).

Future process upgrades include a permanent installation of RO at a higher capacity (the RO plant is currently limited at 400 gallons per minute (gpm), and will expand to 600 gpm). Installation of the permanent system is currently scheduled to occur in May 2018.

Eagle is evaluating potential future upgrades including ammonia removal, improved solids settling and removal processes (expanded lamella or UF process), RO brine concentration, RO brine evaporation, and crystallization. These upgrades may not be needed, but are being evaluated for various operational and closure planning purposes.

Current costs to operate the WTP are approximately $3,500,000 per year. This is inclusive of labor, power, and consumables for the current plant and the expanded RO system. Other modifications are not currently anticipated, so no costs can be projected.

Q7: Describe how the proposed tailings disposal elevation of 1515 feet was determined to accommodate the tailings disposal requirements of Eagle mine, including consideration of tailings placement, dispersion, and consolidation, as well as water column depth.

A7: In 2016, Eagle commissioned Hatch USA to conduct a detailed evaluation of tailings deposition for the combined volume of tailings from Eagle and Eagle East, which is approximately 5 million tonnes of tailings (approximately 3.1 million cubic meters). Hatch evaluated the ultimate capacity of the HTDF based on a completely full scenario, as well as at their maximum advised level of tailings, 1515 feet. The table below is excerpted from their deposition plan, which is provided in **Appendix C.** Based on the study, there is significant capacity to accommodate Eagle and Eagle East tailings below an elevation of 1515 feet.

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1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

		Potential Tailings Volume that can be added to the HTDF based on Storage Efficiency (%)			
Final top of tailings	Depth below water surface (1531 ft amsl)	100% Efficiency	90% Efficiency	80% Efficiency	75% Efficiency
ft amsl	ft	million m³	million m³	million m³	million m³
1528	3	7.3	6.6	5.8	5.5
1515	16	6.4	5.8	5.1	4.8

Table 1. Tailings storage capacity of the HTDF below an elevation of 1515 feet is in excess of the resource estimate of 3.1 million m^3 of tailings. Note: the report stated a final water surface elevation of 1531 feet, however, the current closure plan calls for a final water surface elevation at approximately 1536 feet. (Table from Hatch Depositional Plan, Appendix C)

The following tasks were completed by Hatch and are summarized in the Depositional Plan:

- Conducted geotechnical laboratory testing to evaluate the geotechnical characteristics of the tailings slurry, including specific gravity, particle size distribution column settling tests, and slurry consolidation testing.
- Evaluated the existing deposition performance using data from bathymetric surveys and tailings production records.
- Interpreted the results to input them into a depositional model.
- Developed a detailed deposition plan to optimize storage capacity of the HTDF to minimize deposited tailings heights.

Hatch developed a stage-storage relationship for the HTDF to determine the ultimate tailings level dependent on the efficiency of tailings placement (i.e. how uniformly they could be dispersed in horizontal layers). As a worst case, the model assumed that all tailings would be placed with a 74% placement efficiency resulting in tailings being placed beneath an elevation of 1475 feet at final consolidation of tailings. According to the column settling tests, final consolidation could take years to achieve, so allowance for tailings at higher levels initially would be needed. Greater storage efficiency could be achieved, but is not required as there is sufficient capacity to store the tailings from the entire resource.

As stated in the amendment application and in the Hatch Depositional Plan, Eagle's tailings can attain steep beach angles due to the physical characteristics of the tailings. While Eagle is employing multiple tailings placement methods to optimize the deposition of tailings, Eagle believes it is prudent and responsible to apply for a tailings height that could be representative of the highest possible tailings peak that may be placed over the course of operation, which allows the business adequate flexibility for tailings management. Therefore, a maximum height of 1515 feet was chosen, not because tailings would fill the volume completely below this elevation, but because some tailings peaks might reach this height depending on the operational approach. For any tailings peaks that reach a height of 1515 feet, there would be approximately 21 feet of water cap remaining at closure over those tailings.

There is a secondary reason that the final tailings elevation was selected. Following cessation of placement of the Ropes Gold Mine tailings, the HTDF developed a chemical stratification, as is common in tailings disposal facilities or pit lakes. In closure, Eagle will focus on preserving the pre-existing meromictic water body, i.e. a permanently stratified system, where dense brines are stored at depth beneath a clean water cap. The deeper the brine can be stored, and the stronger the density gradient between the clean and saline water, the greater the stability of the water column. To this end, Eagle is

1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

considering methods to engineer tailings placement to leave deeper areas of the HTDF free of tailings – a bowl shaped depression, for example - so that there is a large available volume to store brines deeply. The following figure is a cross-sectional schematic of this tailings management design, though actual tailings would have a much more sloped/smoothed appearance.

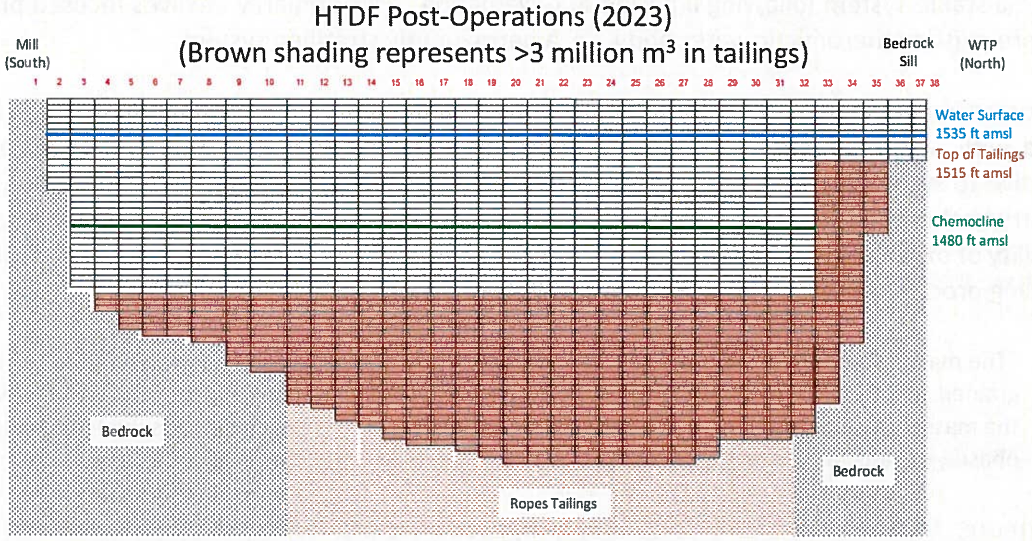

Figure 3. Cross-section of the HTDF showing conceptual deposition of tailings to provide space for brine storage. (Figure from Hatch Geochemisty Report, Appendix A)

Under this scenario, tailings may be built up higher along the perimeter (i.e. an engineered littoral zone) and some may reach final elevations of 1515 feet, though most of the tailings would be placed at lower elevations, likely below an elevation of 1475 feet, leaving a clean water cap of approximately 56 feet in thickness. Therefore, Eagle also selected a final tailings peak elevation of 1515 feet to provide the flexibility to manage tailings in this way, which would provide for the opportunity to have a closure chemocline at a deeper depth.

Q2: Provide information that supports the conclusion that models continue to indicate that the Humboldt Tailings Disposal Facility (HTDF) water quality will stabilize over time, and will meet surface water quality standards to allow for passive discharge back to the environment without treatment after cessation of tailings disposal to the proposed elevation, including details of the updated geochemical and limnological model. This information should clarify the predicted amount of time water treatment will be required after cessation of tailings disposal into the HTDF. Describe any methods or technologies that have been considered to improve water quality in the HTDF post closure as applicable.

A2: Predictive geochemical and limnological models have been continually refined over the past 3 years of operations. This is not only a Best Management Practice for operating and monitoring a facility, but is in line with suggestions and requirements placed forward by MDEQ. MDEQ's former consultant, Lorax, commented:

> "Because the model is generic in design and doesn't aim to represent all relevant processes in the water column, calibration with many field data is particularly important. If the model is going to be used in the future for the prediction of metal concentrations in the water column, its calibration will need to be improved with significantly more and better field data." (Lorax, 2009, p. 3-5)[1]

As such, Eagle collected significant amounts of field data and worked closely with geochemists and

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[1] Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

modelers to improve calibration and prediction of concentrations of key constituents in the HTDF, as well as to improve the understanding of limnological behavior. Attached in **Appendix A**, please find a report of geochemical and limnological modeling for the HTDF which describes the evolution of the modeling approach and the results of the models over the past several years. The important fundamental outcome of the model and empirical data being collected during operations, is that there are closure scenarios that produce a stable system following a period of reclamation. This primarily involves focused preservation of the pre-existing meromictic water body, i.e. a permanently stratified system.

As discussed in the amendment application, though the conceptual model for limnological predictions has evolved with new data, the underlying technical basis for stability at closure has not changed. It is imperative to state that the loading of water contaminants to the system is a function of tailings slurry chemistry, rather than long term release of mass from the tailings, which is short-lived due to the limited availability of oxygen even under shallow water conditions and the rapid dissolution of residual salts from the milling process. Details of this are discussed in **Section 4** of **Appendix A.** Per Hatch:

> "The mass released by tailings to HTDF water is not likely to be governed by the oxidation of fine-grained sulfide minerals because the kinetics of sulfide oxidation under water are slow. Instead, the mass released from tailings can be expected to result from the dissolution of soluble secondary phases, or salts, that form during ore processing in the Mill." (Hatch, 2018, p.21)

Furthermore, MDEQ's consultant Lorax also proposed that pre-existing concentrations of sulfates in bottom waters of the HTDF were not from geochemically reactive tailings, diffusion processes across the sediment/water interface, or from oxidation of the tailings while placed in oxygenated waters (Lorax, 2009). Rather, Lorax stated that the likely explanation for higher concentrations of certain metals in the bottom waters was:

> "...residual process waters from the Callahan operation that are largely isolated from surface waters." (Lorax, 2009, p. 2-2)

The Eagle and Eagle East tailings are expected to behave similarly, in that they are not expected to contribute substantially in comparison to the effect of process water placement in the deep-water layer.

In summary, the HTDF model began as a "Fixed Layer" model for both geochemical and limnological predictions. That model was presented in the original Part 632 permit application, and included key assumptions regarding the injection of solid, consolidated tailings as opposed to tailings slurry water, and a stable chemocline position dependent on a limited elevation of tailings. This model was the starting point for refinement based on regular monitoring of the water body once operations started.

As definition drilling of the Eagle ore body resulted in increases in ore reserves from Eagle alone, consultants began to assess the possibility that tailings may require placement above an elevation of 1420 feet. The modeling effort noted that:

> "The possibility exists that the dissolved solids present in the Eagle Mine tailings slurry might be high enough to cause the formation of a higher TDS layer at the bottom of the HTDF. If this occurs, the increased density resulting from the higher TDS concentration might provide a degree of resistance to turnover." (Hatch, 2018, p. 16)

Indeed, as suspected, density contrasts have been responsible for stratification thus far within the HTDF. Then the geochemical model explored the modeling outcome if dissolved oxygen of 13 mg/L, the

1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

maximum that could dissolve, would diffuse through the water column to a shallower sulfide tailings interface. Based on that model, the dissolved oxygen would be rapidly consumed and penetrate the tailings surface by just 7.5 millimeters (less than half an inch), resulting in negligible changes in pH or metals concentrations due to leaching.

Later, Eagle explored methods to understand the total leachable mass from tailings under shallow, oxygenated conditions, in the form of a long-duration (97-week), saturated column test. Three lab tests were performed on pilot tailings under both oxic and anoxic conditions as described in the amendment application and in **Section 4** of the attached modeling report. Importantly, the column tests confirmed that though the tailings would be a source of mass initially, that steady state conditions could be achieved even under oxygenated conditions, therefore anoxic conditions should not be required for stabilization of the water column in closure. Lorax had also concluded that anoxia at depth was not required:

> "While anoxia at depth in the lake is a welcome condition for subaqueous disposal, maintenance of meromixis need not be a requirement of the disposal permit and is not necessary for the successful storage of tailings in the HTDF." (Lorax, 2009, p.i)
>
> "It should be noted that under a water cover, even when the water is fully oxygenated, oxidation of sulfides is very slow, and in most cases sulfides are considered unreactive in the subaqueous environment." (Lorax, 2009, p. 2-1)

Following startup of the operation, Eagle collected operational data according to the HTDF monitoring program. Results of physiochemical profiling and water column sampling were used to refine the conceptual model, as described in the permit amendment request, and further described in **Section 5** of **Appendix A**. In short, the conceptual model that represents the actual limnological and geochemical behavior of the HTDF is different to the first conceptual model, in that the volume and position of layers are not fixed and the chemocline would migrate upward due to tailings slurry injection simultaneous with surface water decanting. This revised conceptual model has been proven to be true based on observed field conditions and numerical hydrodynamic modeling.

Based on the information derived from field conditions and with confidence in the revised conceptual model, a recent prediction was generated to present a scenario to estimate the complete closure timeframe. In summary, the geochemical model now more accurately predicts geochemical conditions that are occurring in the HTDF. Therefore, the model can be relied upon to predict and/or test future conditions, allowing for conservative assumptions and timeframes. The pertinent outcomes of the model are that the observed changes in shallow water chemistry are not driven by leakage from the chemocline or deep layer due to strong density contrasts. This means that a chemocline can be created at a desired elevation, and incorporated with strategic placement of tailings bathymetry, to produce a long term stable environment.

Today's water quality model assumes the worst case; that complete mixing occurs. Lorax commented that mixing models should assume mixing occurs after a period of time where bottom waters had accumulated large masses of modeled constituents (Lorax, 2009). The current model assumes that complete mixing begins in 2018, or after over 3.5 years of accumulation of mass, and then assumes periodic mixing for the remainder of operations, until tailings placement ceases. Under this circumstance, the model assumes the entire water column would need to be treated to stabilize the total mass of metals and other constituents. To assign a length of time that water treatment could be required to achieve long term stabilization, the modelers need to assume a treatment technology for removal of the mass. **Section**

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1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

7.7 of **Appendix A** discusses the water treatment duration. In summary, the model indicates 11 years will be required to remove trace elements, and up to 18 years to completely remove TDS components. However, this is a very conservative assumption based on the following model inputs:

- Complete leaching of mass from tailings;
- A doubling of sodium and chloride concentrations in the tailings slurry once tailings from the Eagle East ore body are added to the tailings stream in 2020;
- Complete mixing of the water column from 2018 until tailings injection ceases;
- No geochemical or biogeochemical reactions remove mass from the water column.

Based on these conservative assumptions it's likely the treatment timeframe will be reduced in actual closure conditions. Also, the company has several options to expedite the water treatment process including upgrades to the WTP for more capacity in evaporation and crystallization, which are not taken into consideration in this model. The model also excludes the potential for discharge of any dissolved solid components via the company's NPDES permit, since the permit for discharge to the Escanaba River is still under the review by MDEQ.

Q3: Have potential impacts from high wind storm events on the HTDF, both during operations and post closure, been considered in the limnological models?

A3: Yes. Golder analyzed meteorological data to identify the windiest year on record in Negaunee, and used daily wind data from that year (1978) in the limnological model, attached here in and discussed in **Section 6.4** of **Appendix A.** That year included an extreme storm event with wind speeds up to 29.8 m/sec or 67 mph. Under operating conditions, the model showed complete mixing only when there is a weak density gradient. Under post-operations conditions, the current model tested conservative assumptions including a lower TDS in deep lake water than expected (i.e. a weaker density gradient), and wind speeds from the windiest year on record applied each year. The starting position of the chemocline varied from 1480 to 1516. Complete mixing did not occur in any model scenario within 3.6 years of closure. This is discussed in **Appendix A.**

Eagle collected empirical data that supports the validity of this model. Winds in 2017 were some of the highest on record. In the fall of 2017, Marquette measured wind gusts of 70 miles per hour, during which time Eagle was conducting regular weekly monitoring of the limnology of the HTDF. At that time, the chemocline was present at approximately 1505 feet, under a weak relative density gradient, and the HTDF did not completely mix.

Q4: Clarify as to whether complete mixing of the HTDF has been observed during operations and/or is predicted to occur after cessation of tailings disposal to the proposed elevation, and potential impacts of these events. Include any measures that have been considered or are being implemented to mitigate the potential impacts.

A4: Complete mixing has not been observed during operations to date, though we have observed some tailings water reporting to the surface through erosion of the top of the chemocline when the chemocline was situated near 1505 feet. This is discussed in **Section 5.3.4** of **Appendix A.**

The answer to the question of whether complete mixing will occur in closure depends on the closure scenario. To reiterate, it's important to acknowledge that tailings themselves do not produce chemistry perpetually, as explained in the response to Question 2. Rather, it is the remaining tailings slurry water

1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

that contains chemistry that requires treatment to produce a stable condition. Thus, there are two options to consider: 1) The HTDF is completely filled to elevation 1515 feet, and 2) the HTDF is filled such that some tailings may reach 1515 feet, but the majority are stored at greater depths.

Scenario 1, while not projected to occur based on Eagle's resource size, can function as a discussion point. Under this scenario, a limited volume of water will remain above tailings uniformly distributed to 1515 feet. If tailings were filled uniformly to 1515 feet, leaving approximately 20 feet of water cover, then there is a very high probability that the entire water column would completely mix seasonally. The HTDF could still be closed but not as a permanently stratified meromictic lake because there would be limits to the thickness of brine that could be left overlying the tailings and stored beneath a clean water cap. In the short run (reclamation), water treatment technology would need to be employed to completely treat water that remains above the tailings to a homogenous clean water quality. This involves more rigorous use of reverse osmosis, evaporation and crystallization, in the present and future. In the unlikely event that this scenario became a reality, the use of evaporation and crystallization would be utilized earlier, likely during operations, rather than solely in closure to reduce the time needed to obtain water quality stabilization.

Under the second scenario, which is Eagle's intended closure scenario, it is possible to close the lake as a meromictic water body (as it was classified before Eagle operations) and the HTDF would remain permanently stratified. As described above, a depression in the HTDF could be left to keep brines deeper, leaving approximately 56 feet of clean water cover. In the short term, this means dissolved solids need to be concentrated and stored at depth to create the density difference between the clean cap and the deeply stored brines. This is a realistic scenario that is proven to operate well at other closed tailings facilities, and the HTDF has functioned in this way in the past. Under this scenario, complete mixing is not predicted to occur after cessation of tailings placement. Once remaining tailings slurry water is treated to the desired clean water cap quality overlying a dense brine, there is no seasonal turnover or extreme wind-driven mixing event that would be expected to completely mix the water body. Please see the attached modeling report in **Appendix A, Section 6** for more information on the modeling outcome of this scenario.

During operations, it's possible that a complete mixing event could occur. However, Eagle is taking a water management approach as follows:

- Maintain high salinity at depth to create a monimolimnion. A complete turnover could only happen when the surface layer density equals the deep layer density, and this could only happen if the surface layer reaches 1,100-1,200 mg/L TDS. Increasing the salinity of the deep-water layer would increase the pit's stability by increasing the deep-water layer density.
- Increase the freshwater layer at the surface by reducing freshwater reclaim to the mill operation and by developing methods to discharge primarily deep water. An oxidation pre-treatment is being commissioned to treat the deep water in the HTDF. This water contains thiosulfate which has the potential to lower the pH of the water. Following oxidation, the water will be neutralized and passed over ultrafiltration and reverse osmosis membranes to reduce its dissolved solids content.
- Maintain alkaline conditions just above the tailings to minimize oxidation. If thiosulfates become oxygenated during a complete turnover event, the lower pH water may lead to increased oxidation and leaching of tailings. Therefore, pH and dissolved oxygen will be continuously

1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal*.

monitored by an autonomous, floating profiler to be installed in May 2018. An in-pit treatment strategy will be developed to maintain these conditions, as needed.

- Possibly install a separate reverse osmosis system designed to extract deep water for treatment to concentrate and return brine to depth, while placing treated water on the HTDF surface. This will lower the chemocline during operations, increase the density gradient between the upper and lower layers, and reducing the potential for pit turnover.

Q5: Provide information collected per Special Permit Condition F3 as part of this amendment request.

A5: This information is attached as **Appendix D**, Special Permit Condition F3, for conditions a, b, e, and f. Conditions c and d were implemented as a part of the sampling protocol for conditions a, b, e, and f. Condition g is not applicable until closure, and condition h was implemented in the summer of 2011.

Q6: Provide additional information regarding aquatic life in the HTDF and wildlife that may utilize the HTDF, including observations, influent water quality, and measures considered to minimize wildlife use of the HTDF. Has aquatic biota monitoring occurred in the HTDF since operations began, or are there plans to do so?

A6: Eagle does not have additional information regarding aquatic life in the HTDF beyond the information provided in the 2008 Mining Permit Application (MPA) (Appendix D, Volume IA) and the Environmental Impact Assessment (EIA) attached to the 2008 MPA. According to the EIA, historical studies completed in 1984 by Traverse Engineering Surveys, prior to placement of tailings from Ropes Mine, stated that the environment was fully adequate to support the reproduction and growth of some fish, but with no permanent streams entering the pit and because human access is very limited, the fish stock would be severely restricted. Fish and benthos were sparse more than ten years after the HTDF filled with water even prior to Ropes tailing placement. It was stated that the HTDF showed little evidence of primary production and is not a biologically active system.

The most recent fish community survey of the HTDF was completed in June 2007 in advance of the 2008 MPA submittal by Advanced Ecological Management (AEM). The evaluation supported previous conclusions that the HTDF does not provide suitable conditions for the development of an abundant and diverse aquatic macroinvertebrate and fish community. During the 2007 survey, approximately 300 fish were collected, the majority of which were bait fish including white suckers, common shiners, and the fathead minnow, only eight of the 300 fish collected were northern pike. The 2007 study stated that the lack of habitat diversity, such as a well-developed littoral component of submerged and emergent vegetation and woody debris, may account for the lack of diversity of fish sizes and species.

The macroinvertebrate community was also surveyed in 2007 by AEM and only ten macroinvertebrates were collected along the shoreline of the HTDF. AEM concluded in the 2007 memo Aquatic Survey of the Humboldt Tailings Disposal Facility that:

> "The bedrock-dominated habitat in the littoral area of the HTDF and lack of habitat diversity, including few aquatic macrophytes, do not provide suitable conditions for the development of an abundant and diverse aquatic macroinvertebrate community within the HTDF. Low primary productivity, which is often associated with a bedrock dominated aquatic system, may also contribute to low abundance and diversity by limiting the available food supply to macroinvertebrates."

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Due to the designation of the HTDF as a waste storage facility, no aquatic surveys have been completed within the HTDF since 2007 and no surveys are scheduled to occur while the facility is actively used for tailings disposal. However, annual aquatic surveys are conducted on nearby wetlands and rivers in accordance with the Part 632 Mining Permit (MP 01 2010).

Birds and small and large mammals have been observed within the fence line of the mill facility as reported in the annual Flora and Fauna reports completed by King & MacGregor Environmental, Inc. Although large and small mammals are observed onsite it is unlikely they are utilizing the HTDF as a drinking water or food source due to the high wall banks that greatly impede access. Birds are frequently observed at the mill site but have not been observed foraging on the HTDF. A great blue heron rookery is located approximately 1.25 miles east of the HTDF near Lake Lory. No blue herons have been observed on or near the HTDF as they are wading birds and the topography of the HTDF is not conducive to their foraging techniques. A bald eagle nest is also located on the shore of Lake Lory. Although eagles are periodically observed flying over the site, they have not been observed foraging on the HTDF as there are more productive water bodies within the vicinity of their nesting areas that are more suitable for that purpose. In addition, the HTDF is not located within a known migration pathway which is consistent with the limited observations of waterfowl that are made during the late summer/early fall bird surveys conducted by King & MacGregor. Results of the annual aquatic, flora, and fauna surveys that include study areas both inside and outside the mill facility are included in the Annual Mining and Reclamation Reports.

Water samples from the surface waters of the HTDF are currently collected on a weekly basis as a requirement of NPDES Permit MI0058649 (as WTP intake samples). In addition, annual profile sampling is completed which includes all depths across the water column, including the shallow surface waters of the HTDF. **Appendix E**, contains recent surface water quality results for the HTDF for eight quarterly WTP influent samples and two annual shallow surface water sample collected at location HPL-003.

1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

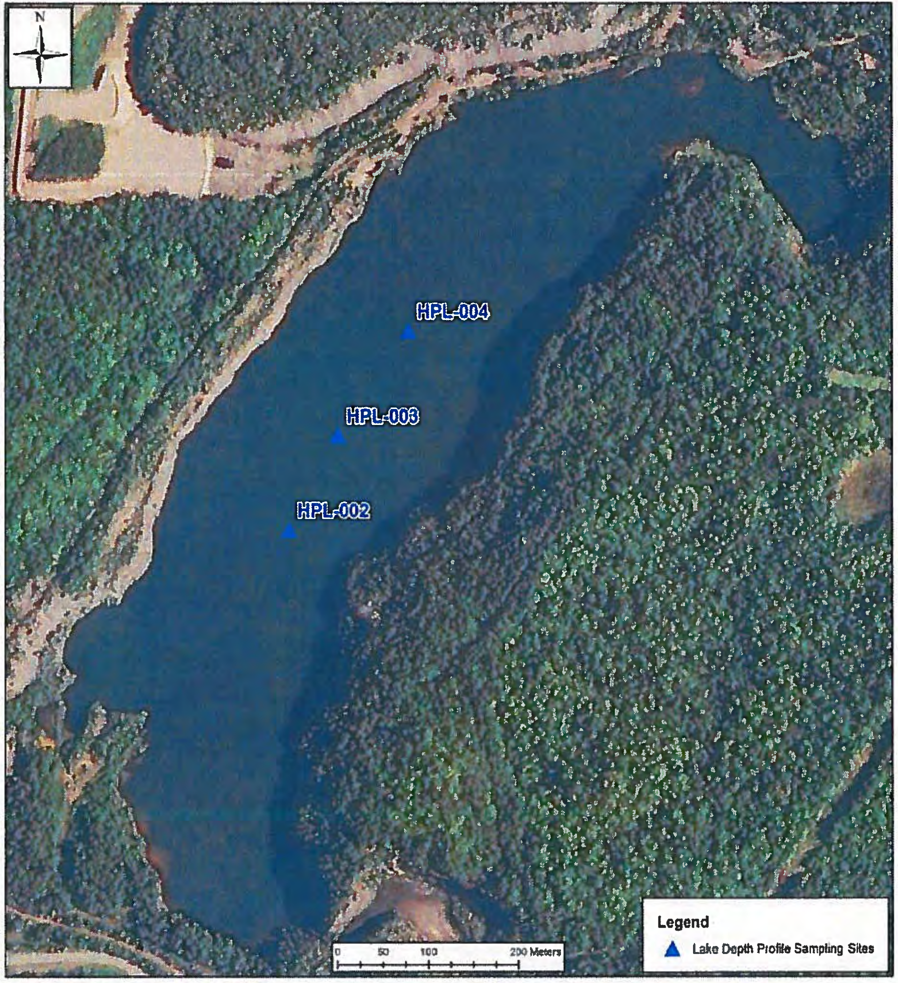

Figure 4. Surface water sampling locations on the HTDF. (Figure from Hatch, Appendix A)

Sample results were compared to the Rule 57 Water Quality Values for wildlife. Water quality values for wildlife are only calculated for bioaccumulative chemicals of concerns for which only mercury applies. Currently surface water results for mercury have consistently been below the wildlife water quality value of 1.3 ng/L (though rainwater has been collected and the concentration of mercury in one sample was 4.7 ng/L). The average pH of the HTDF surface water is currently 7.3 SU which is classified as neutral water quality.

Since the current surface water quality is classified as neutral and does not contain any bioaccumulative chemicals above Rule 57 Water Quality Values for wildlife, and no wildlife has been observed utilizing the HTDF for foraging or during migration, there are currently no additional measures being considered to prevent wildlife from using the HTDF. The existing topographic limitations of the high rock walls, as well as the presence of fences, equipment and workers regularly in the more accessible locations to the north and south also deter wildlife from utilizing the HTDF.

Q8: Have alternatives for tailings disposal been considered/evaluated for Eagle Mine's known mineral resources? If so, describe the alternatives, including rationale for the decision to continue to utilize the HTDF rather than those alternatives.

A8: Prior requesting to be permitted to place tailings in the HTDF, the original owners of the business

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1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

contemplated dry-stacking tailings in a nearby surface facility. This option was ruled out at the time because tailings exposed to air would generate acid rapidly and require perpetual maintenance. Eagle has not pursued any further studies of the option.

Only one alternative tailings disposal option has been evaluated by Lundin for Eagle and Eagle East tailings. In 2016, Hatch USA conducted an initial water treatment-related trade-off study to place tailings back in the underground mine as paste-fill. This would involve pressing tailings slurry at the mill and transferring the supernatant back into the HTDF, while commissioning a method to transfer tailings back to the mine site. Importantly, as has been discussed at length, the tailings themselves are not the primary driver for HTDF water treatment, rather the tailings slurry liquid placed at depth is what drives water treatment. This option did not graduate to a technical study because the requirement to treat dewatered tailings liquid remained, essentially the same situation that exists presently. Since Eagle was already planning for upgrades to treat and manage this tailings slurry water, and the HTDF has the volume capacity for the current mineral resource, it would not make business sense to add additional environmental, permitting, and financial footprint to the concept by shipping tailings back to the mine site. Therefore, the option was not evaluated further. Presently, there are no other tailings disposal options under consideration for Eagle and Eagle East since the resource fits within the confines of the HTDF.

Thank you for your consideration of our response, and please contact me if you need additional information or have any questions.

Respectfully,

Jennifer Nutini, P.E.
Sr. Environmental & Permitting Engineer

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1 Lorax Environmental. 2009. *Geochemical and Limnological Review of the Humboldt Tailings Proposal.*

APPENDIX A

COMPREHENSIVE GEOCHEMICAL REPORT

Comprehensive Report on the Chemistry of the Humboldt Tailings Disposal Facility (HTDF), Champion, Michigan
March 9, 2018

H349392-00000-22A-066-0006

Humboldt Mill, Champion, MI

					CBiederman	
2018-03-09	**0**	**Final**	**Devin Castendyk**	**Siba Patnayak**	**Chris Biederman**	**As Required**
DATE	**REV.**	**STATUS**	**PREPARED BY**	**CHECKED BY**	**APPROVED BY**	**APPROVED BY**
				Discipline Lead	**Functional Manager**	**Choose Approver**

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Executive Summary

The Humboldt Tailings Disposal Facility (HTDF) in Champion, Michigan is a flooded pit which has been used for the permanent disposal of sulfidic tailings from the Eagle Ni-Cu Mine (Eagle) since 2014. Under the existing Part 632 Mine Permit, Eagle is currently limited to deposit tailings below an elevation of 1420 feet mean sea level (ft MSL) within the HTDF, which is approximately 110 ft below the current water surface elevation of 1530 ft MSL. However, revised ore estimates combined with the recent discovery of the East Eagle ore body, show that the predicted volume of tailings that could be produced over the mine life (>3 million m^3) will exceed the storage capacity below 1420 ft MSL.

In order to continue mining, Eagle has two options: (1) develop a new tailings disposal facility, an option that will have associated environmental impacts; or (2) increase the height of tailings in the Main Basin of the HTDF, and thereby, maximize the storage capacity of the basin (>7 million m^3). To minimize potential environmental impacts, Eagle requested an amendment to the Part 632 Mine Permit on August 2, 2017, which, if approved, will increase the maximum elevation of tailings disposal up to 1515 ft MSL.

The purpose of this report is to demonstrate that raising the height of tailings deposition will not affect Eagle's ability to:

- meet applicable effluent water quality guidelines during mining and milling operations;
- continue to meet applicable effluent water quality guidelines following the end of operations using active water treatment methods;
- meet applicable effluent water quality guidelines *prior to* any treatment within an acceptable time frame following the end of operations; and
- ultimately, discontinue water treatment without adverse impacts to the environment.

To achieve these goals, this report synthesizes all studies generated to date related to the future water quality of the HTDF.

The exercise of predicting future water quality is an iterative process that constantly improves the accuracy of previous predictions using new data. The generic word for a prediction is called a "model," each new version of the model is called an "iteration," and the computer software used to generate a prediction is called a "code." Each iteration involves: (1) gathering available data; (2) defining the major processes that influence water quality, called the "conceptual model;" (3) representing each process in the code; (4) generating a prediction; (5) evaluating the accuracy of the model by comparing predicted results to observations; and (6) defining model limitation and additional data requirements.

The first iteration typically occurs before operations during the permitting process based on expected future conditions. Monitoring data collected during operations greatly increases the understanding of the system which reduces the uncertainty in predicted values. Best management practices (BMPs) in the mining industry dictate that models be continually updated as new data become available. Companies that follow BMPs routinely update their models and generate numerous predictions. This leads to new understanding of the system being studied and reduce uncertainty in the predicted water quality. In short, the more iterations a model has been subjected to, the better the prediction.

At the time of writing, Eagle has generated eight iterations of the geochemical prediction of the HTDF: one during permitting in 2013, four in 2016, one in 2017, and two in 2018. The geochemical predictions have been based on water mixing processes defined by three iterations of a hydrodynamic prediction: one in 2013, one in 2016, and one in 2018.

After a comprehensive review of data collected on the HTDF and early model iterations, this report describes a 3.6-year model of the physical limnology of the HTDF that begins shortly after the end of operations in 2024. This model predicts the HTDF will remain a stratified system even under extreme wind conditions. The report also provides a 35-year model of water quality that begins in 2015 and concludes in 2050. The geochemical model predicts that 18 years would be required to treat the water quality to a level where no further treatment would be required. This could be achieved using a combination of clarification, ultrafiltration, reverse osmosis (RO), and zero liquid discharge (ZLD) systems. Both models account for the full volume of tailings generated by both Eagle and Eagle East deposits, and for the creation of a shallow bench composed of tailings up to a maximum elevation of 1515 ft MSL in a small portion of the HTDF.

Regarding treatment methods and treatment times, the predicted water quality presented herein is designated a conservative, or “worst-case” scenario from a water treatment perspective. The assumptions used to generate this prediction consistently favored processes which added the maximum possible mass to the HTDF. As such, the treatment time of 18 years should be considered the “maximum time” required to achieve treatment goals and used as the upper end member for the treatment timeframe. Ongoing efforts by Eagle are exploring alternative treatment options in an effort to optimize water treatment efficiency and reduce treatment times and costs. These efforts are expected to produce a shorter, more realistic, “best-case” scenario(s), and can be used to define a “minimum time” required for treatment and as the lower end member for the treatment timeframe.

1. Introduction

1.1 Overview

Eagle Mine LLC (Eagle), a subsidiary of Lundin Mining Corporation, owns and operates the Humboldt Mill and Humboldt Tailings Disposal Facility (HTDF), 25 miles west of Marquette on the Upper Peninsula of Michigan (Figure 1-1). Since 2015, Eagle has hired Hatch to perform a variety of geochemical services associated with the water quality of the HTDF. This work has included:

- Design of water monitoring programs
- Synthesis and analysis of results from monitoring programs
- Predictive modeling of HTDF physical limnology
- Predictive modeling of HTDF water quality
- Predictive modeling of HTDF tailings deposition
- Trade-off analysis of long-term management options for the HTDF
- Design of ecotoxicology experiments for HTDF effluent
- Design of upgrades to existing water treatment systems

Based on an updated delineation of ore reserves plus the 2016 discovery of the East Eagle Deposit, Eagle has identified more ore than estimated in the original mine plan. Mining of this ore will result in more tailings production than originally estimated.

These facts have motivated Eagle to request approval to dispose tailings to a higher elevation in the HTDF than currently permitted under *Condition F.4* of Mine Permit 012010 issued by the Michigan Department of Environmental Quality (MDEQ). The original permit specifies a maximum tailings elevation of 1420 ft mean sea level (MSL), which is approximately 110 ft below the present water level of the HTDF of 1530 ft MSL. The proposed amendment would allow tailings to be deposited up to 1515 ft MSL, and would provide a 20 to 25 ft water cap above the top of tailings under steady-state conditions after operations. A request was formally submitted by Eagle to MDEQ in a letter titled *Request for Amendment to Condition F.4* on August 2, 2017 (Eagle, 2017).

Figure 1-1: Location map for the HTDF

1.2 Purpose

The purpose of this Comprehensive Geochemistry Report is to provide a synthesis of geochemical studies performed by Hatch and other consultancies. Through a systematic review of these studies, this report demonstrates that tailings placed at higher elevations in the HTDF:

- will have minimal impact on Eagle's present ability to meet effluent discharge guidelines specified under MDEQ (2015) during operation, and
- will have minimal impact on the time and effort required to safely integrate the HTDF with the surrounding watershed following the end of mining operations in 2024.

1.3 Organization

This report is organized as follows:

- Section 2 provides relevant background history on the HTDF property, the limnology of the HTDF prior to Eagle operations, the characteristics of tailings disposed into the HTDF, the nature of total dissolved solids (TDS) in the water column, and the experience from the application of sub-aqueous tailings disposal at other mine sites in North America.
- Section 3 summarizes studies prepared in support of the original Part 632 application prior to operations in 2014. These studies formed the foundation of the original conceptual model (C0) applied to the HTDF and included:
    - Monitoring data
    - An initial limnological model to determine the impact of tailings deposition on stratification
    - A geochemical model that explored the depth of sulfide oxidation within tailings if complete mixing occurred; and
    - An initial geochemical model of HTDF water quality with mass loading from tailings oxidation if complete mixing occurred.
- Section 4 provides the results of 97-week, saturated, column leaching tests on tailings generated by the pre-operations, pilot plant under both oxidized and reduced conditions. These tests predict the maximum mass that can be leached from tailings over time.
- Section 5 reviews the results of three years of monitoring data (2014-2017) within the HTDF which led to revisions of the conceptual model (C1 and C2).
- Section 6 provides the results of a 3.6-year limnology prediction of the HTDF beginning at the end of operations (2024). The model accounts for all tailings produced by Eagle and East Eagle (over 3 million m^3), adds a bench of tailings with a maximum height of 1515 ft MSL, assumes stratified, meromictic conditions at the end of operations with a chemocline at 1480 ft MSL, and uses wind speeds from the windiest year on record (i.e. 1978) recorded at the National Weather Service (NWS) station at the old Marquette County Airport in Negaunee, MI.
- Section 7 provides the results of the most recent geochemical prediction of water quality assuming tailings will be added up to 1515 ft, the HTDF will fully mix annually (a conservative, worst-case assumption), and both reverse osmosis (RO) and zero liquid discharge (ZLD) treatment methods will be employed. The report provides predicted concentrations of TDS, Total Copper, Total Nickel, and Total Selenium over time.
- Section 8 provides a review of sensitivity analyses performed on input groundwater chemistry, tailings water chemistry, and annual rainfall.
- Section 9 concludes the study with a summary of key findings.

2. Background

2.1 History and Pre-Operations Conditions

The HTDF is the current name given to a flooded mine pit located on the northwest slope of Mount Humboldt near Champion in the Upper Peninsula of Michigan. Mining and mine related activities in this area began in the early 1870's and have continued intermittently for nearly 150 years (Hamp, 2013). A map produced by the US Geological Survey prior to 1901 shows the presence of the Edwards, Humboldt, and Barron mines at the present-day location of the HTDF (Warman, 1901). From 1954 to 1979, the Cleveland-Cliffs Iron Company operated an open-pit, iron-ore mine at this location. After mine closure, the pit began to fill with water from groundwater seepage, catchment runoff, and direct precipitation to form a 350 ft deep waterbody. Such permanent, post-mining, hydrologic features are a common product of open pit mining in the United States and around the world (Castendyk and Eary, 2009).

From 1985 to 1989, the Callahan Mining Company used the Humboldt Mill to process ore from the Ropes Gold Mine and disposed of the tailings in the flooded pit. This activity coined the name given to the flooded pit today, Humboldt Tailings Disposal Facility or "HTDF." Although common within the North American mining industry today (Table 2-1), subaqueous tailings disposal in flooded pits was a novel concept in 1985 and the HTDF may be one of the first examples where this technique was applied in the United States.

Based on a physiochemical profile collected in 1984, prior to Ropes tailings injection, the deposition of approximately 160 ft of tailings onto the floor of the HTDF over this period had the following impacts:

- reduced the maximum depth to approximately 190 ft, or an elevation of 1340 ft MSL;
- increased concentrations of TDS in deep waters;
- created a perennially-stratified water column with an isolated water layer below a depth of approximately 110 ft (elevation 1425 ft MSL), as evidenced by changes in dissolved oxygen; and
- smoothed the bottom surface of the water body.

After injection of the Ropes tailings, a management strategy was adopted to improve water quality by nutrient loading. Over a two-year period from 1993 to 1994, nutrients were added to the HTDF and algal blooms were intentionally stimulated. The goal was to produce organic suspended particle matter (SMP) which provides a surface for trace elements to adsorb. Subsequently, these particles would settle to the bottom of the water body, remove trace metals from surface water, and sequester trace elements in sediment. Nutrient loading is reported to have improved surface water quality (Foth, 2007).

Over a 19-year-period from 1995 until 2014, no industrial activities occurred at the HTDF and the water surface stabilized near 1538.5 ft MSL. Owing to the geometry of the original open pit mine, the HTDF contained two distinct water basins; the Main Basin where the Ropes tailings were deposited, and the smaller Northeast Basin which did not receive tailings (Figure 1-1). These basins are separated by a shallow sill with a depth of approximately 15 ft. The Northeast Basin was originally 66 ft deep with a bottom elevation of 1472 ft MSL. Although there was no surface outlet, shallow water discharged through the shallow Quaternary Aquifer at the north end of the Northeast Basin and flowed to an adjacent wetland. This water drained into the Middle Branch of the Escanaba River which flows southeast into Green Bay and ultimately Lake Michigan. Historic aerial images in Google Earth show a relatively constant water elevation between 1992 and 2011. This condition indicates the volume of water received from groundwater, watershed runoff and direct rainfall balanced the volume of water lost to groundwater discharge and evaporation over this period.

2.2 Pre-operations Limnology and Terminology

The steep, submerged walls of the original pit mine, combined with sharp vertical differences in water salinity and density, limited the ability of wind energy to vertically mix the entire water column on a seasonal basis. As a result, the HTDF developed two distinct water layers that did not mix annually. Flooded pits of this nature are called **perennially-stratified** or meromictic. The boundary between these layers, called the ***chemocline***, originally occurred at 110 ft below the pre-operations water surface, or roughly 1425 ft MSL. The 80 ft thick layer below the chemocline, called the ***deep layer***, became depleted in dissolved oxygen due to isolation from the atmosphere and the downward settling and decomposition of organic matter. Conversely, the110 ft thick layer above the chemocline, called the ***shallow layer***, exhibited high oxygen levels (Foth, 2007).

During the summer, the shallow layer would further stratify into a 30-foot-thick ***epilimnion*** layer at the surface and an 80-foot-thick ***hypolimnion*** layer overlying the chemocline. In spring and fall, the epilimnion and hypolimnion would completely mix during ***turnover***, an event lasting several weeks which begins immediately after ice loss in the spring (i.e. mid to late April), and again in the fall (i.e. late November or early December). In the winter, the HTDF would typically be covered by ice between late December and late April, and the shallow layer would stratify over this period.

2.3 Tailings Disposal at the HTDF

In the late 2000’s, Eagle acquired the Eagle Mine which is 20 miles north of the HTDF. In the mine plan, the Eagle Mine would produce Ni-Cu ore which would be trucked to the Humboldt Mill, the Mill would process the ore to produce Ni and Cu concentrates, and the HTDF would be used for the subaqueous tailings disposal.

The acquisition marked the third mine-related use of the Mill and HTDF property since the 1950’s: (1) open pit iron mining and milling, (2) milling and tailings disposal from the Ropes Mine, and (3) milling and tailings disposal from the Eagle Mine. This is a remarkable example of resource reuse and repurposing within the global mining industry.

In 2010, Eagle received a *Part 632 Non-Ferrous Metallic Mining Permit 012010* from the Michigan Department of Environmental Quality (MDEQ). Condition F.4 of this permit states “The surface elevation of tailings shall not exceed elevation 1420 ft MSL.” In other words, Eagle was permitted to dispose tailings in the Main Basin up to the pre-operations chemocline depth. This permit implied that conditions below the chemocline were suitable for permanent tailings disposal.

The tailings consist of a two-phase slurry: a liquid phase that contains elevated levels of sodium and chloride (see Section 2.4, below), and a solid phase mostly consisting of the sulfide mineral pyrrhotite ($Fe_{1-x}S$) plus inert gangue minerals. Initially, the tailings were injected onto the floor of the HTDF via a series of injection pipes. Upon injection, the liquid phase mixed with the deep layer whereas the solid phase settled around the injection point to create several low-angle cones rising above the basin floor.

Prior to the start of operations, Eagle converted the HTDF into a terminal groundwater sink, where groundwater flows into the HTDF but does not flow out. This allowed Eagle to manage all water leaving the HTDF. To achieve this goal, Eagle:

- installed a low hydraulic conductivity grout curtain in the Quaternary alluvial aquifer at the north end of the HTDF to prevent groundwater discharge to the adjacent wetland;
- lowered the surface of the HTDF from ≥1538 to ≤1532 ft MSL. This is below the elevation of the water table in adjacent aquifers, which directs groundwater flow into the pit from all directions; and
- constructed a water treatment plant (WTP). All water leaving the HTDF now passes through the WTP. The WTP currently extracts water from about 30 ft deep (i.e. 1500 ft MSL) within the shallow layer in the Northeast Basin (Figure 2-1).

Effluent water leaving the WTP must comply with discharge limits specified in an Authorization to Discharge Under the National Pollutant Discharge Elimination System, Permit Number MI0058649 (MDEQ, 2015). Treated effluent water is discharged to one of three outfall points where it passes through a wetland and ultimately reports to the Middle Branch of the Escanaba River. To achieve the discharge limits at the outfall, the initial WTP plant used a clarification system to remove metals plus an ultra-filtration system to remove suspended particulates.

Tailings injection and WTP operation began in August 2014. Figure 2-1 provides a conceptual profile view of the HTDF showing the location of all intake and outflow lines to the HTDF in July 2016.

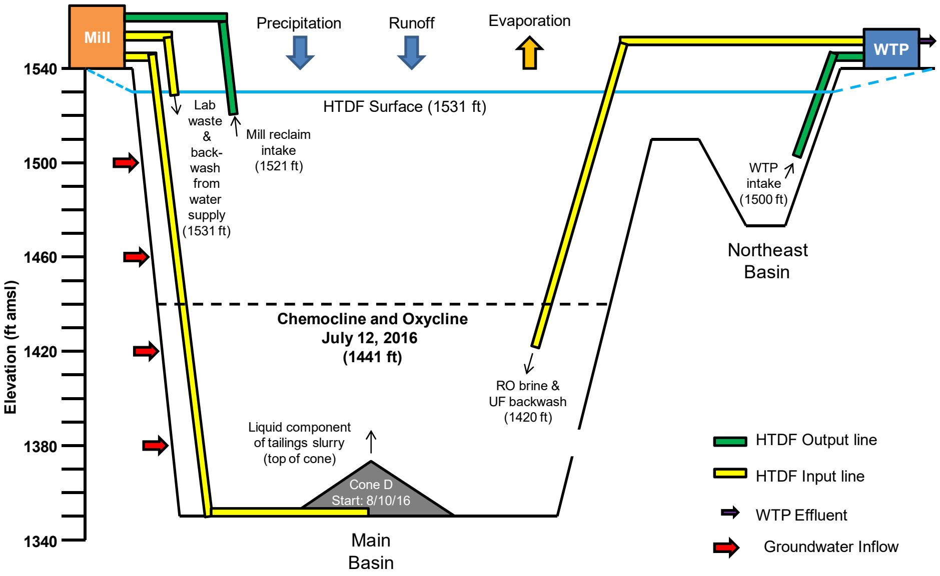

Figure 2-1: Present configuration of inputs and outputs to the HTDF

2.4 Challenges Associated with Total Dissolved Solids

The Eagle Mine exists within Pre-Cambrian age, Canadian Shield bedrock. Water contained in small fractures between the crystals of this bedrock has high concentrations of sodium and chloride characteristic of a Canadian Shield Brine. As a result, the liquid phase of the tailings slurry has elevated sodium and chloride concentrations, which result in a high concentration of TDS in the tailings slurry. Exploration samples from East Eagle show that this deposit has a higher concentration of TDS in pore water compared to the Eagle deposit because of its deeper location. The TDS of the HTDF is further increased by chemicals added in the Mill during ore extraction, storm water from the Mill site, backwash from the WTP, and RO brine from the WTP. The injection of high TDS tailings slurry water below the chemocline has steadily increased the concentration of TDS below the chemocline. As such, Eagle plans to implement water management changes in its treatment processes and discharge methods. Under the existing discharge permit, the monthly average TDS concentration in WTP effluent cannot exceed 500 mg/L (MDEQ, 2015). This is the United States Environmental Protection Agency's, Secondary Drinking Water Standard for TDS (US EPA, 2017). As will be shown in Section 6, the TDS of influent water to the WTP is likely to exceed 500 mg/L in the future. The Best Management Practice (BMP) to remove TDS from WTP effluent is through RO. Eagle is currently using this technology to lower the concentration of TDS in WTP effluent to a non-toxic level prior to discharge.

2.5 Sub-aqueous Tailings Disposal in North America

Water caps are a common approach used in tailings storage facilities for the long-term storage of sulfide-rich tailings in North America. By limiting the supply of oxygen, water caps reduce or eliminate the oxidation of reactive sulfide minerals and thereby eliminate the production of metal-rich, acid mine drainage (AMD). The US-based, Acid Drainage Technology Initiative, Metal Mining Sector (ADTI-MMS) cites water covers as “the most effective technique for limiting air contact with waste rock” (Gusek and Figueroa, 2009).

Importantly, the reactive material must be placed deep enough to prevent entrainment into the water column by wind and wave activity, and the leachability of metals in the submerged mine waste must be quantified (see Section 4). A cover of only 3 ft to 10 ft (1 to 3 m) in thickness may be sufficient to limit oxygen transport and to prevent re-suspension of fine tailings due to wave action (INAP, 2012). MEND (1998b) provides a thorough guide for the design of subaqueous impoundments. The water cover must also endure over long-term changes in the water balance, most notably extensive drought periods expected to occur as a function of global climate change. Table 2-1 provides several examples of effective water covers from North America. Tailings in the HTDF contain 1.5% clay and 48% silt. The low percentage of clay in HTDF tailings indicates that individual grains are less likely to become re-suspended by wave action.

Table 2-1: Examples of Water Covers applied over tailings in North America

Mine Name	Location	Description	Reference
Falconbridge Ni Mine	Ontario, Canada	1 m water cover reduced the oxygen flux to tailings by 99%	Li et al. (2000)
Voisey’s Bay Ni Mine	Labrador, Canada	Active disposal of tailings and PAG rock in an existing, natural lake. Future plans involve flooding the current pit and use it for subaqueous tailings disposal.	Vale, unpublished reports
Louvicourt Cu Mine	Quebec, Canada	Water cover made sulfide oxidation in tailings nearly negligible	Li et al. (2000)
Island Cu Mine	British Columbia, Canada	Tailings added to pit before pit filled with water in 1990’s. Monitoring has shown the method was successful with minor adjustments to management plans over time.	Pelletier et al. (2009)
Kensington Au Mine	Alaska, USA	3 m water cap above the tailings surface is permitted to minimize potential for AMD.	URS, unpublished reports
Centralia Coal Mine	Washington, USA	Washington’s largest coal mine, now in closure. Paste material from fine coal recovery was injected into a pond for final disposal.	Schwedel (2015)

3. Studies Submitted for Original Part 632 Permit

3.1 Monitoring Data

In 2008 and 2010, extensive monitoring of the HTDF was performed in preparation of the Part 632 mine permit application. Three monitoring points in the HTDF (HPL-002, HPL-003, and HPL-004) were regularly studied (Figure 3-1). Table 3-1 lists the monitoring dates and identifies the type of measurements conducted.

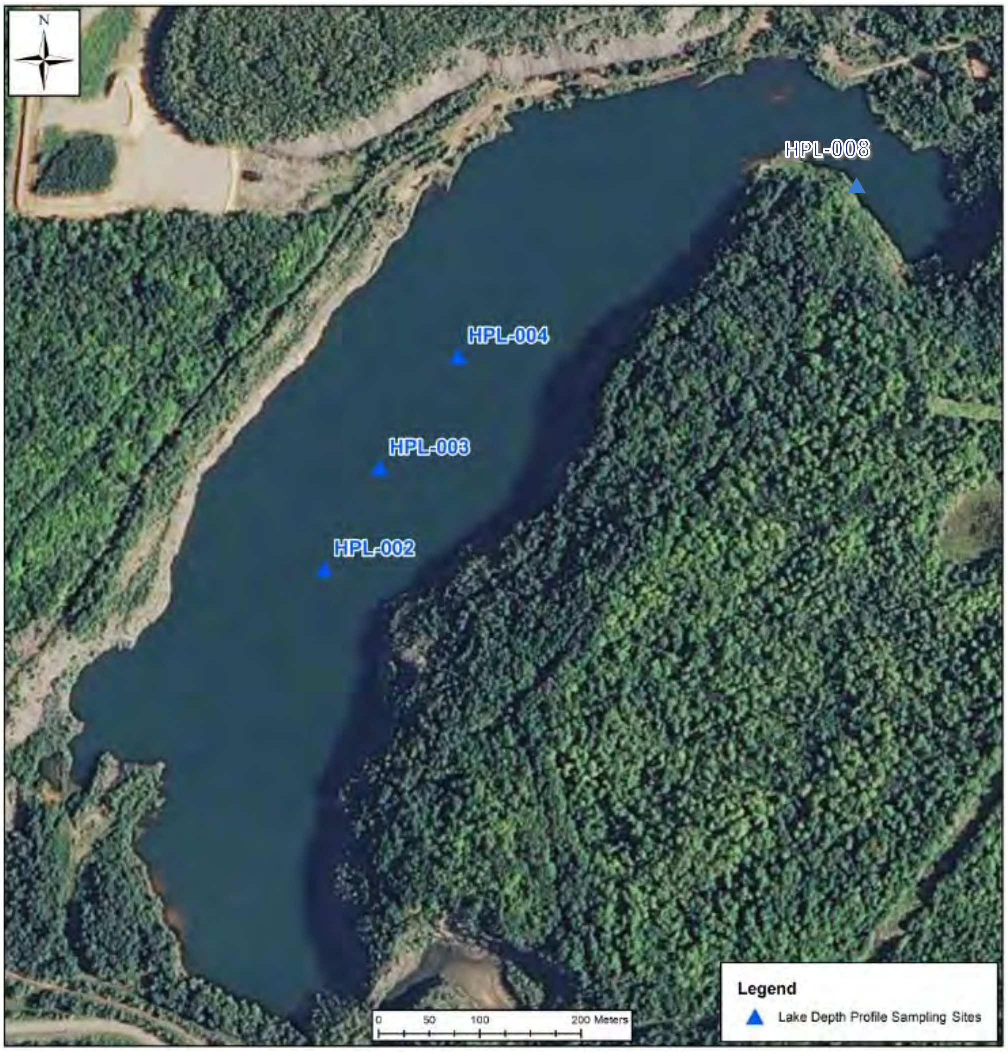

Figure 3-1: Monitoring locations within the HTDF

Table 3-1: Monitoring conducted in 1984, 2008 and 2010

Date	Profile of Physiochemical Parameters	Profile of Water Chemistry	Location(s)
September 21, 1984	X	?	HPL-003 ?
February 28, 2008	X	X	HPL-003, HPL-004
May 8, 2008	X	X	HPL-003, HPL-004
July 8, 2008	X	X	HPL-003, HPL-004
October 20, 2008	X	X	HPL-003, HPL-004
February 25, 2010	X	X	HPL-002
March 17, 2010	X	X	HPL-002
April 29, 2010	X	X	HPL-002
May 18, 2010	X	X	HPL-002
June 25, 2010	X		HPL-002
July 20, 2010	X	X	HPL-002
August 24, 2010	X	X	HPL-002
September 27, 2010	X	X	HPL-002
October 14, 2010	X	X	HPL-002

During each sampling event, *in situ* physiochemical profiles were collected using a multiparameter probe lowered over the side of a boat. Measured parameters included temperature (°C), pH, electrical conductivity (µS/cm), dissolved oxygen (mg/L), and oxidation-reduction potential (mV).

In 2008, water samples were collected from HPL-003 and HPL-004 at depths of 1, 5, 20, 25, and 50 m. In 2010, waters samples were collected from HPL-002 at depths of 1, 3, 5, 10, 20, 28, 30, 35, 40, and 50 m.

Each water sample collected was sent to a certified lab and analyzed for the constituents shown in Table 3-2.

Table 3-2: Common parameters measured in HTDF water samples

Parameter	Symbol	Parameter	Symbol
Total Aluminum	Al, total	Total Strontium	Sr, total
Total Antimony	Sb, total	Total Thallium	Tl, total
Total Arsenic	As, total	Total Uranium	U, total
Total Barium	Ba, total	Total Zinc	Zn, total
Total Beryllium	Be, total	Total Alkalinity	Alk, total
Total Boron	B, total	Bicarbonate Alkalinity	HCO_3
Total Cadmium	Cd, total	Carbonate Alkalinity	CO_3
Total Chromium	Cr, total	Chloride	Cl
Total Cobalt	Co, total	Fluoride	F
Total Copper	Cu, total	Nitrogen in Ammonia	NH_3-N
Total Gold	Au, total	Nitrogen in Nitrate	NO_3-N
Total Iron	Fe, total	Nitrogen in Nitrite	NO_2-N
Total Lead	Pb, total	Total Phosphate	P, total
Total Lithium	Li, total	Sulfate	SO_4
Total Manganese	Mn, total	Calcium	Ca
Total Mercury	Hg, total	Magnesium	Mg
Total Molybdenum	Mo, total	Potassium	K
Total Nickel	Ni, total	Sodium	Na
Total Selenium	Se, total	Total Dissolved Solids	TDS
Total Silver	Ag, total	Total Suspended Solids	TSS

3.2 Pre-operations Monitoring Results

Monitoring data collected prior to operations, showed the HTDF was characterized as a perennially-stratified (meromictic) water body with two distinct water layers separated by a transition zone above tailings from the Ropes Mine. The properties of these layers were described as follows:

- The **deep layer** (monimolimnion) at depth > 105 ft (32 m) exhibited higher density and higher TDS concentrations from 350 to 470 mg/L. This deep layer was permanently stagnant, had very low dissolved oxygen (~0.05 mg/L), had alkalinity from 120 to 160 mg/L, had circumneutral pH (7.0 to 7.6), had low iron (0.07-0.21 mg/L), and had relatively high manganese (1.2 to 3.2 mg/L). At the very bottom of the water column, an approximately 5 m thick layer of settled particles existed that were remnants of the tailings deposited by the Ropes gold mining operations.

- The **chemocline,** or transitional boundary, extended from 82 ft to 105 ft, and exhibited decreasing density and increasing dissolved oxygen in the upward direction.
- The **shallow layer** (mixolimnion) extended from 82 ft (25 m) to the surface and was relatively less dense with a TDS from 270 to 360 mg/L. This layer was oxygenated, had alkalinity of about 110 mg/L, had slightly alkaline pH (7.0 to 8.3), and had low iron and manganese concentrations. This top layer underwent complete turnover each spring and fall, and became seasonally stratified during summer and winter months.

Overall, the HTDF had good water quality due in part to the near absence of oxygen in the deep layer that might otherwise have caused oxidation of the tailings resulting in metal leaching (Foth, 2007).

3.3 Tailings Chemistry

3.3.1 Ropes Mine

From 1985 to 1989, an estimated 1.65 million tonnes of tailings were added to the HTDF from the Ropes Gold Mine, which changed the maximum depth from 350 ft to 190 ft and created perennially-stratified conditions. These tailings had a high sulfide mineral content (41 to 47% as pyritic sulfur). The elevated metal concentrations in the Ropes tailings, particularly Cu and Ni, resulted in elevated dissolved metal concentrations in the pit water (average Cu = 0.042 mg/L and average Ni = 0.665 mg/L). Water quality had significantly improved by 2008 (Interralogic, 2013).

3.3.2 Eagle Mine

Tailings from the Eagle Mine are largely composed of the sulfide mineral pyrrhotite ($F_{x-1}S$). Tailings samples generated in the pilot mill for geochemical studies (See Section 4) had an average sulfide concentration of 24.1% as pyrite (FeS_2). The original mine plan showed that 2.5 million tonnes of tailings would be added to the HTDF over the mine life which would result in a tailings storage volume of 1.8 million m^3 (Interralogic, 2013).

3.4 Potential for Complete Mixing in the HTDF (L0)

3.4.1 Model L0 Purpose

Prior to operations, the key limnology question asked by mine planners was "**Would the addition of Eagle tailings above elevation 1420 ft MSL disrupt stratification in the HTDF?**" Limnological prediction L0 was developed to address this question in 2013.

3.4.2 Model L0 Description

A physical limnology model was created to investigate whether the addition of tailings to an elevation of 1420 ft MSL (433 m) would disrupt perennial stratification in the HTDF, and thereby, transport dissolved oxygen to the tailings-water interface (Interralogic, 2013).

This model was generated in the code CE-QUAL-W2 (Cole and Wells, 2011), a two-dimension hydrodynamic program developed by the US Army Corps of Engineers to manage the water quality of lakes and reservoirs. The physical limnology portion of the model generates profiles for temperature, TDS and dissolved oxygen which can be compared against HTDF observations.

To achieve the modeling objective, CE-QUAL-W2 was used to generate two predictions. In the first prediction, present conditions in the HTDF were modeled starting on February 25, 2010, using weather observations from the National Weather Service (NWS) station at Sawyer International Airport. The top of the Ropes tailings had an elevation of 1355 ft MSL (413 m). This prediction was calibrated using monthly temperature, TDS and dissolved oxygen profiles measured between March and October 2010 (Table 3-1).

Using the calibrated model, the second prediction sequentially removed bottom layers from the HTDF to represent the gradual deposition of tailings. Sequential simulations evaluated the potential for the disruption of the stratified water column, and the development of complete annual mixing between the shallow layer and deep layer. Simulations were performed for modified bottom elevations of 1411 ft MSL (430 m), 1427 ft MSL (435 m), and 1450 ft MSL (442 m), and represented added tailings volumes of approximately 1.18, 1.70, and 2.58 million m^3, respectively.

The “fixed layer” conceptual model (C0) used for this approach is shown in Figure 3-2, and represents the first conceptual model applied to the HTDF.

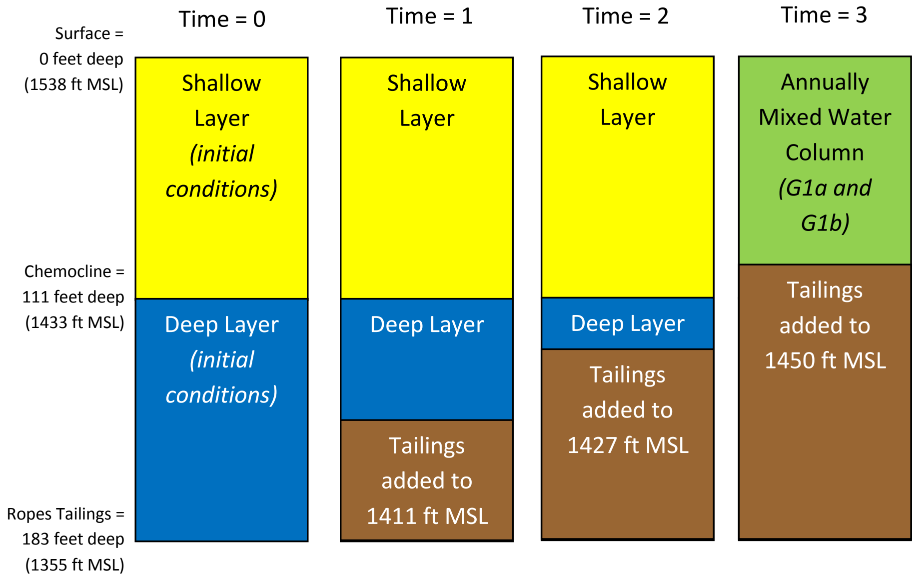

Figure 3-2: Conceptual Model C0, the “fixed layer” conceptual model, used in limnology (L0), and geochemistry (G0a and G0b; Time 3 only) models submitted with initial permit applications.

3.4.3 *Model L0 Results*

The initial limnological model (L0) showed the HTDF would change from a perennially-stratified system to a completely mixed system if the top of tailings was raised above the initial chemocline elevation between 1427 MSL (435 m) and 1444 ft MSL (440 m). Annual mixing would circulate water from the surface of the flooded pit to the top of tailings every spring and fall, and transport dissolved oxygen to this interface (Time 3, Figure 3-2).

This modeling effort noted, “the possibility exists that the dissolved solids present in the Eagle Mine tailings slurry might be high enough to cause the formation of a higher TDS layer at the bottom of the HTDF. If this occurs, the increased density resulting from the higher TDS concentration might provide a degree of resistance to turnover…”

3.4.4 *Model L0 Limitations*

Four key differences separated this model from subsequent limnological models:

- Tailings were deposited uniformly across the floor of the HTDF, and filled all available space at a given depth before being added at a shallower depth.
- Only tailings solids were added to the HTDF; the co-injection of tailings water with a unique salinity and temperature was not considered in the initial model.
- Steady-state tailings conditions were evaluated before and after tailings injection; transient tailings conditions during injection were not evaluated, meaning momentum and convection associated with tailings injection was not included.
- The volume of the deep layer was not increased as a function of the volume of tailings water added. Therefore, vertical displacement of the initial chemocline elevation was not considered.

3.5 Depth of Oxidation of Sulfidic Tailings in a Fully Mixed HTDF (G0a)

3.5.1 *Model G0a Purpose*

Prior to operations, the key geochemical question asked by mine planners was, “**If the HTDF begins to circulate annually as a function of tailings deposition, and dissolved oxygen is transported to the tailings-water interface, how deep into Eagle tailings would sulfide oxidation would occur?”** Geochemical model G1a was developed to answer this question.

3.5.2 *Model G0a Description*

A one-dimension, diffusional transport calculation was developed in the US Geological Survey geochemical model PHREEQC (Parkhurst and Appelo, 1999). In this calculation, dissolved oxygen was allowed to diffuse from the water column into the sulfide tailings while being consumed by reactions with iron sulfide.

Although the primary iron sulfide in Eagle tailings was known to be pyrrhotite ($Fe_{1-x}S$), there are few established kinetic rate laws for pyrrhotite oxidation under circumneutral pH conditions. Hence, the model used pyrite (FeS_2) to represent all oxidizing iron sulfide minerals in the tailings (Interralogic, 2013).

For either type of iron sulfide mineral, the rate limiting parameter under circumneutral pH conditions is the availability of dissolved oxygen. Thus, the model calculated the depth of penetration of dissolved oxygen into the tailings to determine the depth of iron sulfide oxidization. Multiplication of the depth of oxidation by the surface area of the Eagle tailings determined the volume of iron sulfide that would oxidize. This volume was used to determine the potential change in pH and sulfate concentration in the HTDF.

For this calculation, water at the tailings water interface was assumed to have a dissolved oxygen concentration of 13 mg/L. This concentration is the maximum amount of oxygen that water can dissolve under atmospheric conditions at 4°C. In reality, the oxygen concentration assumed in the model was likely to be much higher than actual dissolved oxygen that would be transported to the tailings-water interface owing to the consumption of oxygen within the water column through inorganic reactions (e.g. oxidation of ammonia and dissolved organic carbon) and organic processes (e.g. the decomposition of organic matter which settles on top of the tailings).

A diffusion-only (1-D) transport simulation into tailings was run in PHREEQC for a path length of 60 cm split into 60 cells with lengths of 1-mm each and a time step of 0.1 days.

3.5.3 *Model G0a Results*

The simulation results indicate that a near steady-state profile for dissolved oxygen rapidly occurred due to the high rate of consumption of the dissolved oxygen by oxidation of the iron sulfide. The total depth of penetration of dissolved oxygen was about 7.5 mm or less than half an inch. Dissolved oxygen is completely consumed by this depth. The change in pH due to iron sulfide oxidation was small due to the relatively high alkalinity of the HTDF and the small amount of iron sulfide oxidized. The primary product of iron sulfide oxidation was amorphous ferrihydrite ($FeOH_3$), which increased slowly in mass over time. This mineral could potentially create a cemented ferricrete layer on the topmost surface of the tailings over the long term.

3.5.4 *Model G0a Limitations*

- The model assumed the tailings would be deposited in a uniform, horizontal, planar surface. The actual deposition surface will have more bathymetric variability resulting in a greater surface area.
- Calculations were based on pyrite. Pyrrhotite, pentlandite ($(Fe,Ni)_9S_8$), chalcopyrite ($CuFeS_2$) and other sulfide minerals potentially present in tailings were not considered.

3.6 Water Quality in a Fully Mixed HTDF with Sulfide Oxidation (G0b)

3.6.1 Model G0b Purpose

In parallel to questions regarding sulfide oxidation, another key geochemical question asked by mine planners was, "**If the HTDF begins to circulate annually as a function of tailings deposition, and dissolved oxygen is transported to the tailings-water interface, how would this effect water quality in the HTDF?**" Geochemical model G0b was developed from G0a to answer this question.

3.6.2 Model G0b Description

Model G0b assumed the following conservative conditions (Interralogic, 2013):

- The HTDF was filled with tailings to an elevation of 1444 ft MSL (440 m)
- The HTDF fully mixed above the top of tailings (Time 3; Figure 3-2)
- Dissolved oxygen at 13 mg/L was transported to the tailings-water interface
- Eagle tailings fully oxidized to a depth of 7.5 mm.

Loading rates for sulfate (SO_4) were estimated from the sulfide reaction rate and the volume of water stored in the pore space of the tailings. Loading rates for As, Cu, Co, Ni, Pb, Se, and Zn were based on the ratio of sulfur to each of these elements in tailings samples.

An existing water balance model created in the dynamic simulation code GoldSim (GoldSim Technology Group, 2014) was modified to develop the water quality prediction of the HTDF. This 12-year-prediction assumed six years before the top of tailings rose to a shallow enough depth to cause stratification loss (Time 1 and 2; Figure 3-2), followed by six years of complete turnover and sulfide oxidation (Time 3; Figure 3-2). Hence, the model considered the loading of mass from the liquid fraction of the tailings slurry alone for years 1 to 6, followed by the addition of mass from tailings oxidation for years 7 to 12.

Each year, the resulting water chemistry was imported into PHREEQC. The model allowed oversaturated minerals to precipitate, and trace elements to adsorb onto the surface of freshly precipitated, amorphous ferrihydrite. The resulting water reflected the water chemistry of a fully-mixed HTDF with loading from sulfide oxidation.

In addition to a deterministic model, a probabilistic model was also generated in GoldSim using a Monte Carlo approach.

To address uncertainty in the prediction, the probabilistic model adjusted the following input parameters within the range of uncertainty, and generate a range of future outcomes:

- Groundwater inflow rate
- Liquid tailings inflow rate
- Annual precipitation
- Inflow chemistry composition
- Tailings release rate
- Pyrite oxidation rate

3.6.3 Deterministic Model G0b Results

Results of deterministic model showed that sulfate concentrations increased from 205 mg/L to 703 mg/L between years 6 and 12. Over this period, the mean pH decreased slightly from about 7.6 after 6, and the bicarbonate concentration decrease by about 10 to 15 mg/L due to the additional acidity accompanying the increased sulfate.

This was a conservative approximation involving the addition of metals from pore water as a product of tailings consolidation followed by the addition of metals from some tailings oxidation. For Co, Cu, Ni, Pb, Se, and Zn, concentrations slowly increased over the first six years due to their presence in tailings slurry water, and then increased more rapidly after six years due to sulfide oxidation within tailings. For Ni, Cu, and As:

- Nickel concentrations were predicted to reach a plateau at about 3.9 mg/L, and were controlled by the solubility of nickel-hydroxide [$Ni(OH)_2$].
- Copper concentrations were predicted to reach a maximum of 0.3 mg/L, and were controlled by the solubility of malachite [$Cu_2CO_3(OH)_2$].
- Arsenic concentrations showed a downward trend due to adsorption onto ferrihydrite.

3.6.4 Probabilistic Model G0b Results

Probabilistic model results showed the following:

- pH showed a relatively narrow range of 7.3 to 7.7 between the 5th and 95th percentiles, indicating that the future HTDF should continue to have a near-neutral pH (as it does today) even with the potential effects of oxidation of the sulfidic tailings.
- The decline in pH was very small due to the relatively high concentration of alkalinity (HCO_3) in the HTDF. Caustic materials added to the tailings stream in the Mill will replace some of the alkalinity consumed by acid neutralization reactions.

- The median SO_4 concentration was predicted to increase from 324 mg/L after Year 6, to 463 after Year 12.
- Predicted Ni concentrations ranged from 0.5 mg/L to 2.1 mg/L during Years 1 to 6, and from 3.4 to 5.1 mg/L during Years 7 to 12.
- The predicted Cu concentrations range from 0.2 to 0.3 mg/L.

In summary, only small changes in chemistry were predicted to result from sulfide oxidation in tailings due to the low solubility of dissolved oxygen in water (Interralogic, 2013). This greatly limited the amount of sulfide minerals that oxidized at the bottom of the HTDF even with a fully-mixed, well-oxygenated water column. The context of the term “small changes in chemistry” is meant to be relative to land disposal of sulfide mine wastes where access to atmospheric $O_2(g)$ is potentially unlimited.

3.6.5 Limitations of Model G0b

The geochemical model did not consider the following:

- TDS was not explicitly modeled, including loads of Cl and Na.
- Increased biological activity and productivity within the HTDF.
- Increased total organic carbon following the start of mill operation.
- The precipitation of sulfide minerals in the deep layer under reducing conditions.
- Production of hydrogen sulfide from sulfate reduction under reducing conditions.

4. 97-Week Column Leachate Tests on Eagle Tailings

4.1 Description

The mass released by tailings to HTDF water is not likely to be governed by the oxidation of fine-grained sulfide minerals because the kinetics of sulfide oxidation under water are slow. Instead, the mass released from tailings can be expected to result from the dissolution of soluble secondary phases, or salts, that form during ore processing in the Mill.

To quantify this mass load, saturated, static column tests were conducted on three tailings samples collected from the pilot mill prior to the start of operations. Tests were for performed by CHEMAC Environmental Services in Centennial, Colorado for 679 days (97 weeks), beginning on February 18, 2014 and concluding on December 28, 2015.

4.2 Objectives

The purposes of the saturated, static column tests were:

1. to quantify the total mass available to be leached from tailings; and
2. to measure the time required until tailings stop releasing mass.

4.3 Methods

Three tailings samples were collected from the Eagle pilot mill and labeled EMCT#1, EMCT#2, and EMCT#3. Twenty-two pounds (10 kg, dry weight) of each sample were placed into a 2-foot-long (63.5 cm), 0.5-foot-wide (16.2 cm) plastic column and submerged with 1 foot (30 cm) of water collected from the HTDF. An aquarium stone was placed on top of the tailings. Samples EMCT#1 and EMCT#2 were aerated for the full 679 days, whereas sample EMCT#3 was only aerated for 56 days to simulate unmixed conditions.

Each week, a volume of water was collected from the supernatant water above the tailings, filtered through a 0.45 µm filter, and analyzed for a full suite of dissolved constituents. An equal volume of HTDF water was added to each column following sample collection.

To calculate the mass leached from tailings on a weekly basis, the mass present in the HTDF water was subtracted from the mass present in the weekly sample.

The total leachable mass (mg/kg) was equal to the cumulative mass (mg) from all weekly samples divided by 10 kg.

4.4 Results

4.4.1 Supernatant pH

The pH of supernatant water in the aerated columns (EMCT#1 and EMCT#2) decreased from the original pH of 8.3, to 6.9 and 5.2, respectively. These data indicate the potential for oxidation reactions to occur in the presence of a continuous supply of oxygen, such as complete mixing.

Sample EMCT#3 did not have a consistent supply of oxygen apart from diffusion through the water column. After 679 days, this sample had a pH of 7.6 suggesting less sulfide oxidation occurred under unmixed conditions.

4.4.2 *Mass Loading*

The cumulative concentrations of the following species increased in each column over time:

- Major Cations: Na, K, Mg, Ca
- Major Anions: Cl, SO_4
- Nutrients: NO_2, P
- Trace Elements: B, Ba, Co, Cu, Li, Mn, Hg, Ni, Se, Sr

The experiment suggests that tailings are a potential source for these constituents. Most likely this increase occurred as a function of salt dissolution paired with some sulfide oxidation and desorption from hydroxide minerals. As a consequence of these reactions, the concentration of total dissolved solids (TDS) increased with time.

The concentration of the following species were either below detection in sample waters or present at concentrations below the concentrations found in the HTDF water:

- Major Anions: HCO3
- Nutrients: NH3, NO3
- Trace elements: Al, Sb, As, Cd, Cr, F, Fe, Pb, Mo, Ag, U, V, Zn

The experiments suggest that tailings are not a potential source for these constituents. Because bicarbonate is not added from tailings, carbonated mineral dissolution did not occur.

4.4.3 *Reaction Time*

In most cases, species achieved steady-state conditions within 500 days of the start of the experiment. There were two elements that continued to be released from tailings at the conclusion of the experiment: Cl and Mn. However, these conditions only occurred in one of three columns.

Based on these data, we can conclude that tailings will be a source of mass to the HTDF, however, the effect on the HTDF will be short lived. Following mine closure in 2024, fresh tailings will no longer be added to the HTDF. These data suggest that tailings will only add mass to the HTDF for two years beyond the last addition of tailings. Effluent water will be treated during this period such that there will be no impact on long-term discharge water quality.

4.5 Integration into Predictive Modeling

By dividing the total mass (mg) leached from tailings by the initial mass of tailings in the column test (kg), we calculated the leachable mass per unit mass of tailings (mg/kg). For each of the leachable elements and compounds listed above, the average leachable mass per unit mass of tailings was calculated from the three column tests.

In the updated geochemical prediction (G2) described in Section 6, this leachable mass was assumed to react instantly with the deep layer as soon as tailings were injected. This approach most likely overestimates mass loading to the HTDF as not all leachable mass stored in tailings may react with HTDF water prior to burial by subsequent tailings.

5. HTDF Monitoring Program

Data have been consistently collected from the HTDF. This section reviews the results of three years of monitoring (2014-2017) within the HTDF which led to revised versions of the conceptual model (Conceptual Models 1 and Conceptual Model 2).

5.1 Ongoing Monitoring of the HTDF

Water quality data has been consistently collected from the HTDF since the summer of 2015. The dates of the collection of physiochemical profiles and water chemistry profiles are shown in Table 5-1. The spatial locations of sample points are shown in Figure 3-1.

Table 5-1: Recent Monitoring in the HTDF

Date	Profile of Physiochemical Parameters	Profile of Water Chemistry	Location(s)
June 18, 2015	X	X	HPL-003
November 23, 2015	X		HPL-003
April 28, 2016	X		HPL-003, HPL-008
July 12, 2016	X	X	HPL-003, HPL-008
October 6, 2016	X		HPL-003, HPL-008
February 20, 2017	X		HPL-003, HPL-008
April 26, 2017	X		HPL-003, HPL-008
May 11, 2017	X		HPL-003, HPL-008
July 20, 2017	X	X	HPL-003, HPL-008
September 28, 2017	CTD		HPL-002, HPL-003, HPL-004, HPL-008
October 6, 2017	CTD		HPL-002, HPL-003, HPL-004
October 12, 2017	CTD		HPL-002, HPL-003, HPL-004
October 18, 2017	CTD		HPL-002, HPL-003, HPL-004
October 25, 2017	CTD		HPL-002, HPL-003, HPL-004

Until September 2017, *in situ* physiochemical profiles were collected using a multiparameter probe lowered over the side of a boat to 0, 3, 5, 10, 13, 15, 20, 24, 27, 30, 33, 40, 50, and 55 m depth. Measured parameters included temperature (°C), pH, electrical conductivity (μS/cm), dissolved oxygen (mg/L), and oxidation-reduction potential (mV).

From September to November 2017, a conductivity-temperature-depth (CTD) probe was used to measure high-resolution temperature (°C), electrical conductivity (μS/cm), and water density (kg/m^3) profiles. This device free-falls through the water column and samples at 5 times per second, to produce continuous profiles of the entire water column.

From January 2018 to present, a new multiparameter probe has been used on a weekly basis to measure pH, temperature, electrical conductivity, and dissolved oxygen profiles. The probe was lowered and held at the following depths to generate high-resolution profiles across the chemocline: 0, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 24, 27, 30, 33 and 40 m. Each water sample collected was sent to a certified lab and analyzed for the constituents shown in Table 3-2 at a minimum.

5.2 Additional monitoring programs

In addition to the water quality stored in the HTDF, the following aspect of the HTDF have been monitored:

- **Daily air temperature and rainfall depth** measured on site by Eagle and by the National Weather Service meteorological station at Clarksburg, 2.4 miles to the northeast.
- **HTDF water level** (ft MSL) measured daily by Eagle.
- **HTDF water balance** measured by Eagle (see Figure 2-1). Data include:
  - Mill reclaim water (outflow, gal/day)
  - WTP intake (outflow, gal/day)
  - Tailings injection rate (liquid plus solid) (inflow, gal/day)
  - WTP effluent to outfall (outflow, gal/day)
  - WTP backwash to HTDF (inflow, gal/day)
  - Mill area storm water (inflow, gal/day)
  - The following flows have also been calculated by various models:
    - Groundwater inflow (inflow, gal/day)
    - Watershed runoff (inflow, gal/day)
    - Direct evaporation (outflow, gal/day)
- **Tailings slurry water chemistry** measured by Eagle from the tailings thickener tank underflow (last point prior to slurry injection). Turbid samples are allowed to settle prior to the collection of supernatant water for analysis of total and dissolved parameters. Eight samples have been collected on the following dates:
  - November 10, 2015
  - March 2, 2016
  - May 19, 2016
  - July 12, 2016
  - October 6, 2016

  - February 20, 2017
  - May 11, 2017
  - July 20, 2017

- **Upgradient groundwater chemistry** has been measured in monitoring wells sampled by Eagle. Four monitoring wells near the Mill (KMW-5R; MW-706QAL; MW-707QAL; and MW-9R) were sampled on the following dates:
  - May 30, 2014
  - June 25, 2014
  - July 24, 2014
  - September 24, 2014
  - November 20, 2014
  - March 13, 2015
  - May 20, 2015
  - August 20, 2015
  - November 23, 2015
  - February 26, 2016
  - May 19, 2016
  - August 26, 2016
  - November 30, 2016
  - February 20, 2017
  - May 26, 2017
  - August 23, 2017
  - December 4, 2017
- **Rain water chemistry** was measured on site on October 17, 2017.
- **WTP influent chemistry** is sampled weekly by Eagle.
- **WTP effluent chemistry** is sampled weekly by Eagle.
- **HTDF bathymetry** is measured three or four times each year by Eagle. These indicate where tailings have accumulated on the floor of the pit. A prediction of future bathymetry resulting from the addition of tailings from East Eagle was generated in 2016.
- **Thiosulfate** (S_2O_3) concentrations were measured in the deep layer and in the tailing slurry on July 2017.

5.3 Major Findings

Monitoring data collected since the start of operations in 2014 has led to the following significant findings.

5.3.1 Structure

Observations defined a clear physical and chemical structure to layers within the HTDF which persist over time. These layers have been identified in different reports as follows:

- ***Shallow layer (mixolimnion)***: composed of epilimnion and hypolimnion sub-layers during summer and winter stratification periods. These sub-layers completely mix during spring and fall turnover events to form a single layer.
- ***Chemocline (transition boundary)***: a boundary layer indicated by a rapid increase in electrical conductivity, TDS, and water density over a narrow depth range. Dissolved oxygen decreases to zero across the same boundary, marking this as an **oxycline**.
- ***Deep Layer (Monimolimnion)***: the bottom-most layer of the HTDF which is chemically isolated and receives tailings.

5.3.2 Deep Layer Convection

The tailings slurry has a warmer temperature than ambient water in the deep layer. Consequently, the liquid fraction of the tailings will rise through the deep layer until achieving a depth of neutral buoyancy near the bottom of the chemocline. At this depth, the slurry water cools and sinks. The result is a convection cell which vertically and horizontally mixes the deep layer. This mixed layer is easily identified in profiles that show a zone with no change in electrical conductivity with depth.

5.3.3 Increasing Deep Layer TDS

The injection of tailings has strongly increased sodium and chloride concentrations in the deep layer over time. Sulfate has also increased, but to a lesser degree. These three parameters are the major contributors to TDS.

5.3.4 Non-Mixing Status

Sodium and chloride do not react with other parameters in pit water to form mineral precipitants, nor do they adsorb onto mineral or organic surfaces. As such, these ions are excellent tracers for water from the deep layer. Prior to November 2017, low concentrations of sodium and chloride in the shallow water and in WTP influent provided definitive evidence that complete vertical circulation had not occurred.

5.3.5 Rising Chemocline

The boundary separating the deep layer from the shallow layer has steadily risen over time as a function of the volume displaced by both the liquid and solid fraction of the tailings.

This observation was the single most important finding, which guided the evolution from Conceptual Model 0 (Figure 3-2), to Conceptual Model 1, and ultimately, Conceptual Model 2 (discussed below).

There are three important considerations related to a rising chemocline:

- As the chemocline approaches the water surface, the upper most water in the chemocline can become entrained in the shallow layer during turnover events, causing changes in shallow layer chemistry.
- As the chemocline approaches the water surface, the chemocline is exposed to progressively more downward mixing energy during spring and fall mixing event. This increases the potential for whole-pit mixing.
- If the chemocline rises above 1510 to 1515 ft MSL, it will crest above the sill which separates the Main Basin from the Northeast Basin. This chemocline elevation could cause deep layer water to spill into the Northeast Basin. As of March 2018, both the WTP intake line plus the Mill Reclaim water intake line had been lowered below the chemocline which should slow, and potentially reverse, the rise of the chemocline.

5.3.6 Anoxic Conditions in the Deep Layer

The deep layer shows anoxic conditions indicated by dissolved oxygen concentrations near zero mg/L, elevated levels of ammonia-nitrogen, depleted levels of nitrate-nitrogen, and elevated levels of organic carbon. Most likely, this is driven by the presence of organic carbon in the tailings slurry in the form of residual xanthate. Xanthate is an organic compound used in the tailings-floatation process in the Mill. The injection of this organic carbon with tailings drives oxygen consumption and reduction in the deep layer.

5.3.7 Tailings Variability

The eight tailings samples collected show a wide variation in water chemistry. Mill operators state that tailings chemistry most likely changes on a daily basis depending on the region of the mine supplying ore to the mill. In the predictive model of HTDF geochemistry (see Section 6), the median water chemistry has been used to represent tailings water chemistry in the future. Furthermore, it is known that the addition of tailings from East Eagle will have higher levels of sodium and chloride than tailings from the current Eagle deposit. Variability in tailings chemistry is one of the largest sources of uncertainty in future predictions. For this reason, a sensitivity analysis was performed on tailings slurry chemistry as described in Section 8.

5.3.8 *Watershed Processes*

Changes in shallow water chemistry have been observed over time, yet the source of these changes has not been identified. Under a stratified scenario, the only processes affecting the chemistry of the shallow layer are:

- Groundwater inflow
- Direct rain water
- Evaporation of surface water
- Watershed inflow
- Upper-chemocline entrainment

Most of these processes (i.e. groundwater inflow, direct rain water, evaporation) have been quantified and have been assumed to be constant over time. However, watershed inflows, upper chemocline loading and in-layer processes are sources of uncertainty.

Changes in shallow layer chemistry have been observed on several occasions, most notably the gradual increase in TDS over time along with seasonal jumps in Fe, Mn, Ni and Cu concentrations coincident with fall and spring turnover events. To date, there has not been a systematic, basin-wide study of the chemistry of watershed inflows. It is assumed that pit wall runoff chemistry and rainwater/snow water chemistry have not changed over time. However, some operational activities may also contribute to the salt load in the surface layer, such as the storm water system which empties into the HTDF, and winter snow and ice management procedures. Another process that may influence the shallow layer is the entrainment of the top few feet of the upper chemocline during spring and fall turnover events.

5.3.9 *Ice Loss Events*

Each April, when ice melts from the water surface, a rapid change in chemistry is observed in WTP influent. In part, this is associated with mixing between the winter epilimnion and winter hypolimnion that develops under ice cover. The WTP currently extracts water from the winter hypolimnion exclusively. Following ice loss, the winter epilimnion and winter hypolimnion mix, and any mass loading which occurred during winter stratification reports to WTP influent.

One reason for this change may be the entrainment of the upper most layer of the chemocline during spring turnover, as described above. Another explanation may be that groundwater has a strong influence on shallow layer chemistry during ice covered conditions in the absence of runoff, storm water, and rainwater contributions. Yet another explanation may be that isolation from atmospheric oxygen during winter cause changes in redox chemistry.

It is presently thought that groundwater has higher concentrations of dissolved Fe, dissolved Mn and other dissolved metals than the shallow layer of the HTDF. Consequently, spring turnover causes these constituents to rapidly increase in WTP influent.

A similar effect most likely occurs during fall turnover, but is much less pronounced. This could be because fall turnover takes place gradually over several weeks to months, whereas spring turnover occurs nearly instantaneously after ice is lost.

5.4 Improvements to the Conceptual Model of the HTDF

Conceptual models for the HTDF have changed over time as more information has been gained about the system. As previously discussed, the original “fixed layer” conceptual model (C0) used for the original limnological model (L0) represented the HTDF as a two-layer system where the position of the chemocline was assumed to be fixed and no exchange of fluids occurred between layers (Figure 3-2). In the previous geochemistry model (G0b), the entire HTDF was assumed to mix annually above 1420 ft MSL.

Insight gained from direct observations led to improvements in the original conceptual model. Most importantly, the original limnology model (L0) assumed that all tailings were solid, and did not reflect changes in volume caused by the liquid portion of tailings over time. Moreover, the geochemistry model did not account for the presence of an isolated deep layer which received and stored liquid tailings.

Hatch’s first update to the conceptual model, called the “leaky layer” conceptual model (C1) focused on accurately accounting for the volume of liquid and solid tailings added to the HTDF over time (Figure 5-1). This update included the following assumption:

- a two-layer system composed of a shallow layer, a transitional boundary (chemocline), and a deep layer;
- the depth and volume of each layer was dictated by basin morphology alone, and therefore, were constant over time;
- the addition of tailings to the deep layer forced water to “leak” vertically from one layer into the overlying layer over time; and
- water added from the transition layer to the shallow layer circulated during spring and fall turnover events, and drove changes in shallow water chemistry.

Subsequent chemical analyses show that chloride and sodium concentration were not increasing overtime in the shallow layer as required by the “leaky” conceptual model. In addition, profiles of electrical conductivity showed that the position of the chemocline was not fixed, but instead, was rising in the water column over time. Revised limnological models also showed this process.

These observations led to the development of the “rising chemocline” conceptual model (C2) which is presently used in limnological and geochemical models (Figure 5-2). This model assumes the following:

- A two-layer system composed of a shallow layer, a transitional boundary (chemocline), and a deep layer;
- Tailings consolidation occurs as soon as tailings are injected to the floor of the HTDF based on tailings properties and laboratory consolidation tests. All pore water that can be added from tailings consolidation over time is instantaneously added to the deep layer upon injection. This water chemistry is equivalent to the dissolved fraction of the tailings slurry.
- The bottom of the deep layer rises over time to reflect the deposition of solid tailings;
- The top of the deep layer rises over time to reflect the addition of the liquid fraction of the tailings and vertical displacement caused by the deposition of the solid fraction of tailings;
- The thickness of the chemocline and the shallow layer decrease over time as the top of the deep layer rises;
- The top of the deep layer will continue to rise until one of three events occurs:
    - Complete mixing of the entire water body
    - The deep layer overtops the sill separating the Northeast Basin from the Main Basin, and directly enters the WTP intake
    - A balance is achieved between inputs to the deep layer (tailings slurry plus RO brine) with withdrawals from the deep layer (Mill Reclaim water and WTP influent).

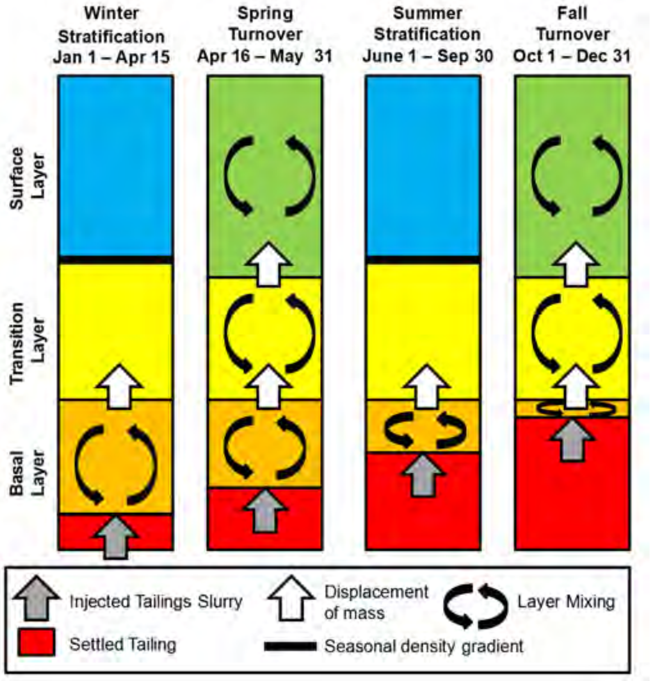

Figure 5-1: Conceptual Model C1, the "leaky layer" conceptual model, used in early 2016 models of HTDF chemistry

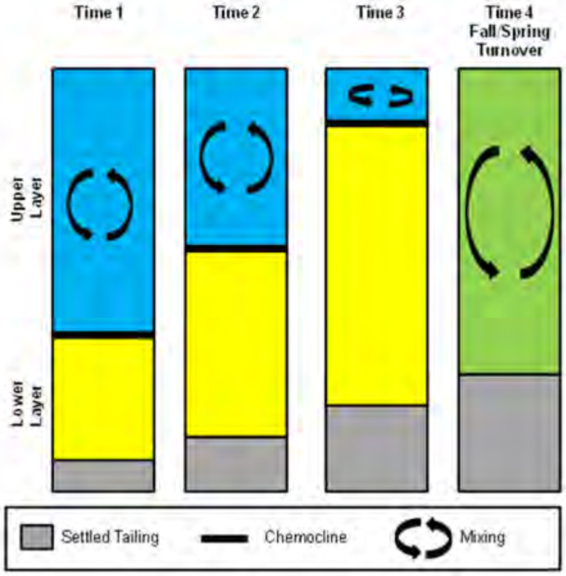

Figure 5-2: Conceptual model C2, the "rising chemocline" conceptual model, used in all limnology and geochemistry models of the HTDF since mid-2016

6. Predictive model of HTDF Limnology

6.1 Purpose and Overview

Based on current resource estimates from both Eagle and East Eagle, the top elevation of tailings would be less than 1515 ft MSL if the HTDF were to be filled to a uniform bottom depth. However, to provide flexibility in tailings deposition plans, Eagle wishes to investigate various deposition scenarios that would result in a non-uniform bottom depth. One scenario involves using tailings to construct a shallow bench at one end of this pit whereas the remaining tailings would be deposited deeper. This bench could potentially become the foundation of a littoral zone, where the water column is shallow enough to allow light to penetrate to the basin floor which facilitates the growth of vascular plants. Engineered littoral zones have been shown to add long term water quality and aquatic ecosystem benefits in other flooded pits.

To this end, this section investigates the physical response of the HTDF to the deposition of tailings to a maximum elevation of 1515 ft MSL in a small region of the pit (i.e. maximum top of tailings), while the remaining tailings are deposited at an elevation of 1442 ft MSL (i.e. average pit floor). Both exceed the current permitted tailings elevation of 1420 ft MSL.

To investigate the potential for complete mixing following the end of tailings injection, a 3.6-year limnological prediction of the HTDF was generated using the 2-D (length vs depth) hydrodynamic model CE-QUAL-W2 (Cole and Wells, 2011). The bathymetry accounted for the estimated total volume of tailings to be generated from both Eagle and Eagle East deposits. To investigate the sensitivity of stratification to extreme storm events, hourly wind speeds were set equal to the windiest year on record for the region.

6.2 Effect of Tailing Deposition on Lake Bathymetry

The first step in developing a limnological prediction was to quantify the volume of tailings that would be disposed in the HTDF prior to the end of operations. Using updated resource estimates for Eagle and Eagle East, combined with consolidation and specific gravity tests on tailings samples, it was estimated that a volume of 3.0 to 3.5 million m^3 would be required to dispose of all tailings from both deposits. For comparison, the Main Basin of the HTDF stored 7.2 million m^3 of water below 1530 ft MSL prior to the start of operations (Foth, 2007).

The next step was to estimate the final bathymetry, or shape of the pit floor, after tailings deposition concludes in late 2023. In one deposition plan under consideration by Eagle, tailings will be deposited unevenly in the HTDF to create a small shelf with an elevation of 1515 ft MSL and a main floor with an elevation of 1442 ft MSL. The resulting bathymetry is illustrated using the input bathymetry file to the CE-QUAL-W2 model. Figure 6-1 shows a map-view of the surface of the Main Basin of the HTDF discretized into 37 segments. The model domain focuses only on the Main Basin of the HTDF because tailing will not be added to the Northeast Basin under the proposed permit.

Each segment is approximately 90 ft long and 600 ft wide, and is numbered from South to North. Segments 37 and 36 at the North end of the domain are situated above the bedrock sill that separates the Main Basin from the Northeast Basin. Segment 37 represents the HTDF outlet. The shallow platform at 1515 ft MSL was deposited in Segments 35, 34, and 33. Tailings were deposited to a maximum elevation of 1442 ft MSL in all remaining segments.

Figures 6-2 and 6-3 provide a before and after comparison that illustrates the effect of tailings deposition on HTDF bathymetry. Figure 6-2 shows a cross-sectional view of all Segments and Layers in the Main Basin prior to the start of operations in 2014 developed using bathymetric data reported in Foth (2007). Each layer is approximately 3 ft thick. Figure 6-3 shows the same cross-sectional view at the end of operations in 2023 following the deposition of >3 million m^3 of tailings. The shallow shelf at 1515 ft MSL is shown at the top right of the diagram adjacent to the bedrock sill. The remaining tailings are deposited above the Ropes tailings to create a pit floor at 1442 ft MSL.

Again, we emphasis that this bathymetry is the result of just one tailings distribution pattern under consideration by Eagle. The purpose of this analysis is to investigate the flexibility Eagle has with its tailings deposition plan.

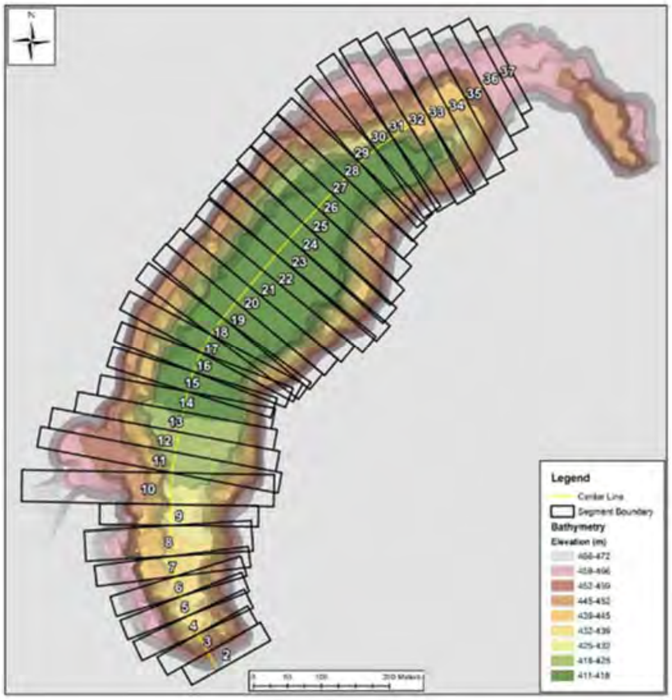

Figure 6-1: Map-view of the HTDF showing segments used in the hydrodynamic model

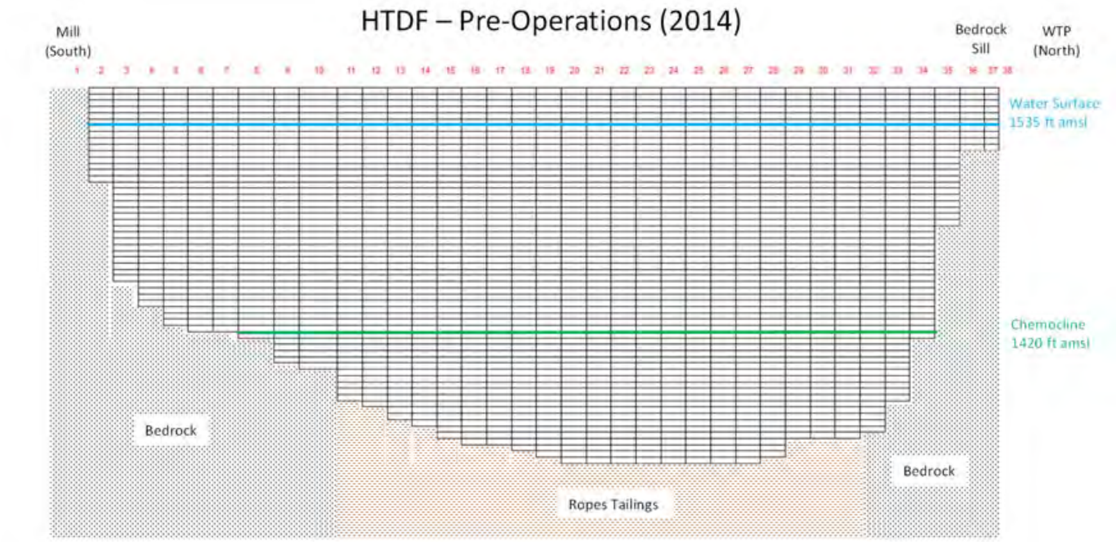

Figure 6-2: Cross-section view of the HTDF from South (left) to North (right) showing all Segments and Layers prior to deposition of Eagle tailings

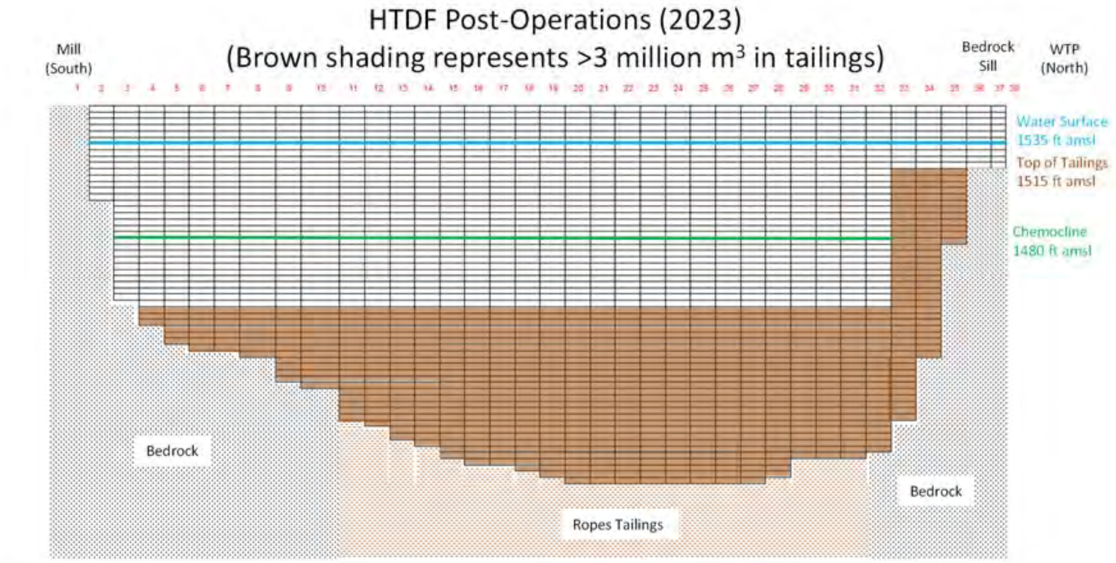

Figure 6-3: Cross-section view of the HTDF from South (left) to North (right) showing all Segments and Layers after deposition of >3 million m3 of tailings from Eagle and Eagle East (shaded brown)

6.3 Initial Conditions and Inflows

Based on Conceptual Model C2 (Figure 5-2), the model assumed that, at the end of operations, the HTDF would have a salinity-stratified water column composed of a fresh surface water layer overlying a brackish deep water layer separated by a chemocline. The initial elevation of the top of the chemocline in Limnology Prediction A was approximately 1480 ft MSL (Figure 6-3). The surface water layer was assigned a TDS of 500 mg/L. To create a conservative model, it was assumed that the deep water layer had a TDS of only 5000 mg/L. In reality, the TDS of the deep layer is likely to be above 5000 mg/L owing to the injection of RO brine (discussed in Section 7). The greater the TDS of the deep water layer, the more likely the HTDF is to remain stratified. Therefore, a low initial TDS was used to enhance the likelihood of complete mixing (i.e. to avoid artificially stratifying the lake in the model).

At the end of operations, inputs to the HTDF will be limited to groundwater, pit wall and watershed runoff, and direct rainfall, whereas outflows will be limited to wetland discharge and evaporation. Tailings injection will not occur after operations conclude, therefore the volume and discharge velocity of injection are not considered. The volumetric flow rates, temperature and TDS of groundwater, pit wall runoff, and rainwater were specified in CE-QUAL-W2 based on the HTDF water balance and measured water chemistries. The model calculated the volume leaving the HTDF by evaporation and spilling over a fixed discharge point at elevation at 1536 ft MSL into the adjacent wetland.

6.4 Timing and Meteorological Inputs

The model begins in June 2024 and runs for 3.6 years through February 2028. Meteorological data were obtained from the National Weather Service (NWS) station at the former Marquette County Airport in Negaunee, Michigan. This station is roughly 17 miles East of the HTDF at an elevation of 431 ft MSL. Hourly meteorological data are available online for a 53-year discontinuous period, spanning 1948-1955 and 1973-2017. Model inputs include air temperature, dew point temperature, wind speed, wind direction, cloud cover, and solar radiation.

An initial, post-operations, limnological prediction used meteorological data from the year 2015 and repeated daily data from 2015 for all corresponding dates in the model. Year 2015 had a maximum wind speed of 10.3 m/sec and an average daily wind speed of 3.8 m/sec.

To determine the windiest year on record, average annual winds for the 53-year data set were ranked, and recurrence intervals were calculated (Figure 6-4). Year 1978 had the highest average annual windspeed in the 53-year record of 5.3 m/sec, and a corresponding maximum wind speed of 29.8 m/sec. Years with average wind speeds of this magnitude have a recurrence interval of greater than 50 years based on this analysis.

To investigate the impact of extreme wind events on HTDF circulation, hourly wind speeds from 1978 replaced wind speeds in the 2015 meteorological file.

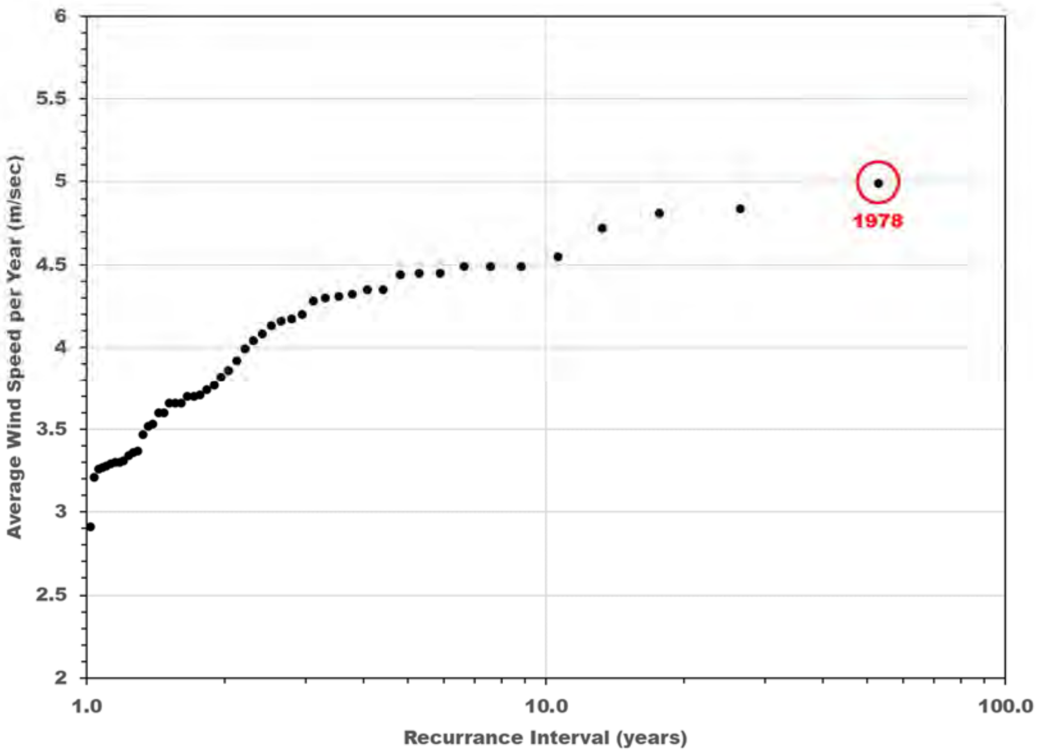

Figure 6-4: Wind speed frequency curve for average annual wind speeds recorded at the NWS station in Negaunee, Michigan from 1948-2017

6.5 Model limitations

The hydrodynamic model CE-QUAL-W2 has been widely used to model circulation in lakes and reservoirs as well as within the mining industry to model the circulation of flooded pits. The application history along with a full description of model can be found at the following web site: http://www.cee.pdx.edu/w2/

As with any model, there are specific limitation inherent to the model program itself. For the present study, CE-QUAL-W2 has the following limitations:

- The 2-dimensional model assumes well-mixed conditions in the lateral direction (y-direction, or the short axis of the pit). Variability is allowed in the longitudinal direction (x-direction, or the long-axis of the pit) and the vertical direction (z-direction).

- The hydrostatic assumption is used for the vertical momentum equation, whereby vertical velocities are much, much less than horizontal velocities. The Coriolis Effect is assumed to be negligible.
- Geochemical inputs are limited to TDS in the hydrodynamic model. A separate geochemical model in GoldSim was used to evaluate geochemistry over time (see Section 7).
- Wave propagation is modeled as a function of wind stress added to the lake surface. Once added to the system, momentum is conserved within the model using an energy balance and is only reduced by water viscosity and friction at the pit walls and floor.
- The present model assumes that winds measured at the National Weather Service (NWS) station in Negaunee, Michigan, are equivalent to winds at the HTDF. As mentioned, this station is 17 miles East of the HTDF and 118 feet lower in elevation than the water surface.
- Winds over the water surface have been reduced by 25% from the NWS values to account for the sheltering effect of the pit walls.
- Earthquakes are not reflected in the model as the region is considered seismically inactive. This means that momentum is not added to the pit by seismic energy.

6.6 Results and Discussion

At the start of the prediction on June 19, 2024, the HTDF had a salinity-stratified water column (Figure 6-5). The top of the chemocline boundary occurred at approximately 1480 ft MSL or 451 m MSL.

By the end of the prediction, on February 28, 2028, the HTDF still had a salinity-stratified water column (Figure 6-6). Complete mixing did not occur during seven potential turnover events in Fall 2024, Spring 2025, Fall 2025, Spring 2026, Fall 2026, Spring 2027, or Fall 2027. The gradual increase in TDS with depth, along with the absence of a sharp increase in TDS at surface by the end of the model, show that the HTDF did not mix from top to bottom.

The following changes are observed in the water column over time:

- The top of the chemocline rose by approximately 23 feet (7 m) over the course of the simulation.
- The maximum concentration of TDS below the chemocline decreased by approximately 1500 mg/L.

- The overall thickness of the chemocline boundary layer increased from approximately 12 ft (3.5 m) (Figure 6-5), to approximately 43 ft (13 m) (Figure 6-6).

The upward dispersion of mass is the result of hydrodynamic processes called seiching and eddy diffusion, and not the result of a deep, fresh-water input.

During the fall and spring, when the surface water layer has a uniform temperature and density, wind energy causes the surface water to rock, or seiche, back and forth above the deep water layer. Turbulence along the boundary between these layers causes a small volume of saline water to transfer upwards into the shallow layer each year, and a small volume of fresh water to transfer downward below the chemocline each year.

This process is called eddy diffusion. The stronger the density gradient between the surface water layer and the deep water layer, the less mass transfer occurs across the boundary.

Because the prediction used wind speeds from the windiest year on record (1978) for the entire 3.6-year input file, we can conclude:

- the HTDF will remain stratified under lesser wind speeds; and
- upward mass transfer by eddy diffusion will occur, but at a slower rate.

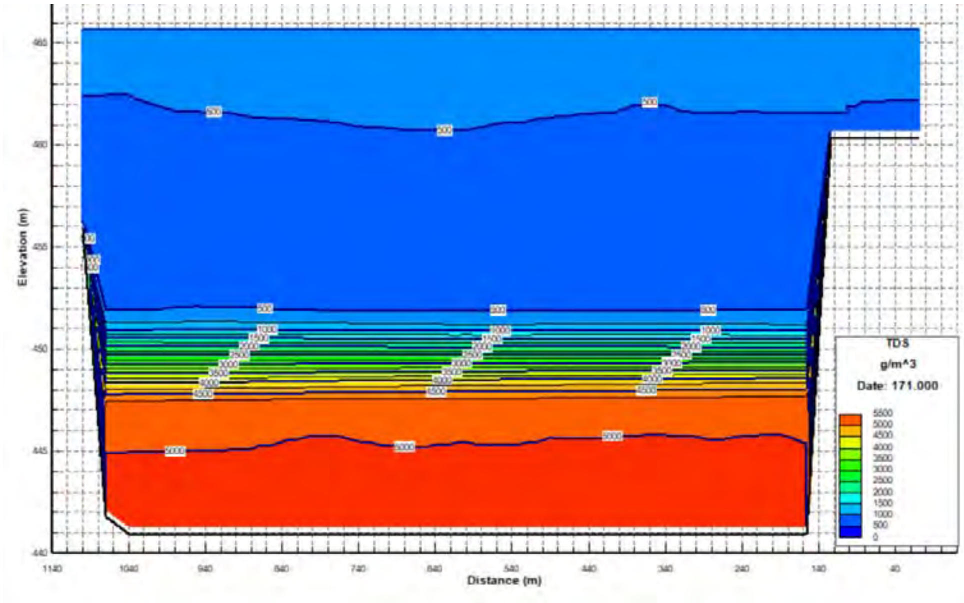

Figure 6-5: Cross-section view of the HTDF from South (left) to North (right) showing initial concentrations of TDS at the start of the Limnology Prediction A on 6/19/2024. The top of the chemocline was initially set at 1480 ft (451 m) above MSL

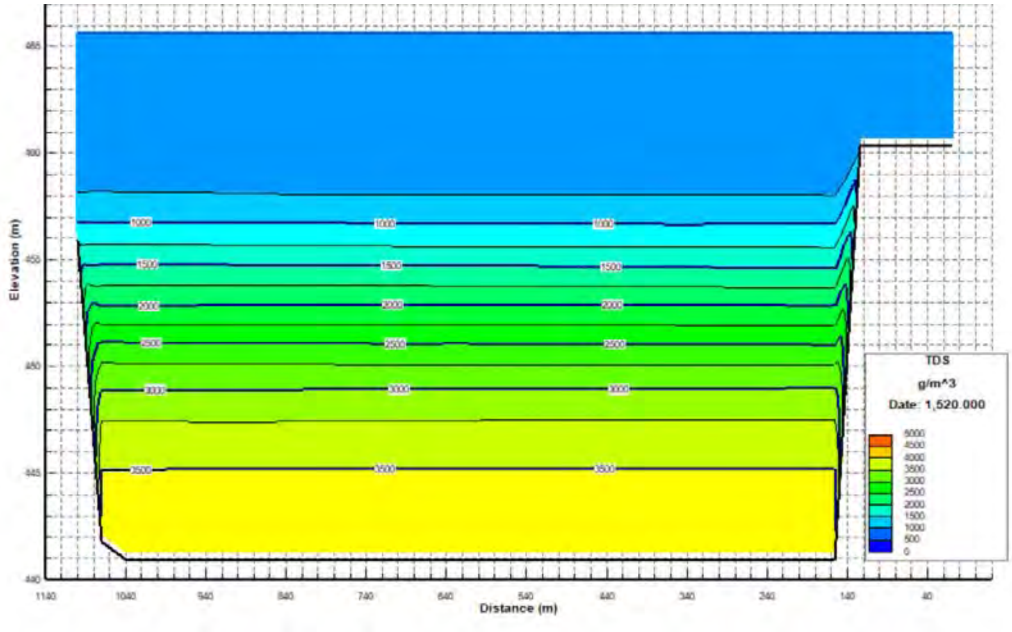

Figure 6-6: Cross-section view of the HTDF from South (left) to North (right) showing final concentrations of TDS at the end of the Limnology Prediction A on 2/28/2028

6.7 Sensitivity Analysis on Initial Chemocline Elevation

In Limnology Prediction A, the elevation of the top of the chemocline at the end of operations was specified as being 1480 ft (451 m) MSL (Figure 6-5). To evaluate the sensitivity of the model to changes this initial condition, the model was re-run using the following initial elevations for the top of the chemocline:

B. 1496 ft MSL

A. 1506 ft MSL

B. 1516 ft MSL

Figures 6-7 to 6-12 show the initial and final TDS profiles produced by each model after 3.6 years. The following general statements can be derived from this analysis:

- Meromictic conditions occur over the duration of the 3.6 year prediction regardless of the initial elevation of the top of the chemocline.
- Spring and fall turnover events mix the water column to a consistent depth of 32 feet below the final water surface, or 1504 ft (458 m) MSL, regardless of the initial elevation of the top of the chemocline.
- Vertical transport of mass occurs in each prediction as a product of seiching and eddy diffusion.
- The final TDS concentration above the chemocline, and by extension, the time required to treat the HTDF after closure, are strongly influenced by the initial position of the top of the chemocline. The initial volume below the chemocline is larger if the top of the chemocline is higher in the water column, and there is a greater mass stored below the chemocline as the volume below the chemocline increases. As a result, increasing the initial elevation of the chemocline raises the final TDS concentrations predicted throughout the water column.
- From a water management perspective, this sensitivity analysis demonstrates that selectively removing WTP influent from below the chemocline *during* operations could: i) lower the chemocline over time, ii) improve post-mining surface water quality, and iii) reduce the time needed for treatment *after* operations.

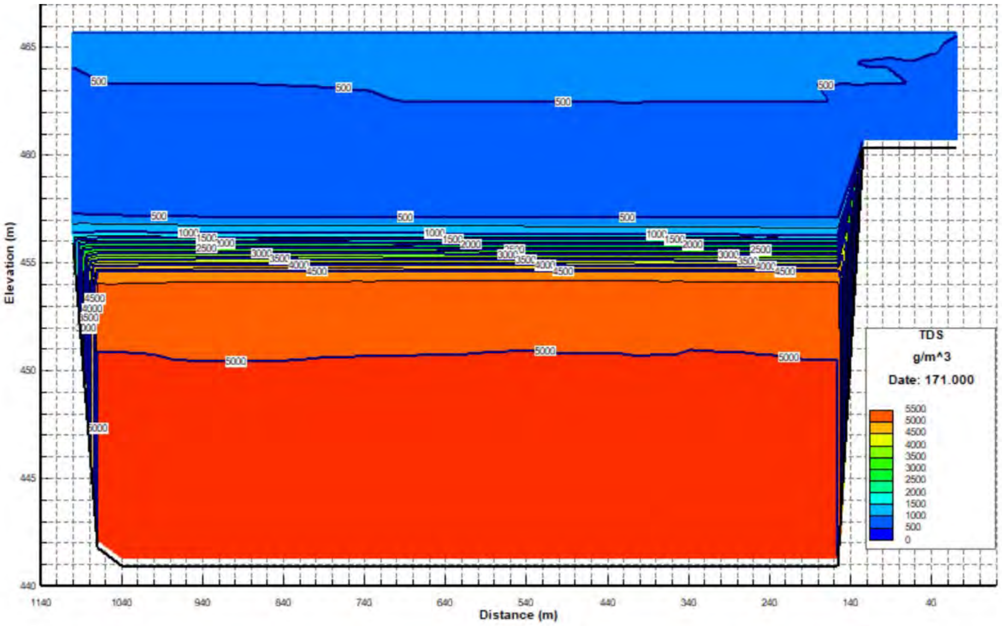

Figure 6-7: Cross-section view of the HTDF from South (left) to North (right) showing initial concentrations of TDS at the start of the Limnology Prediction B on 6/19/2024. The top of the chemocline was initially set at 1496 ft (456 m) above MSL

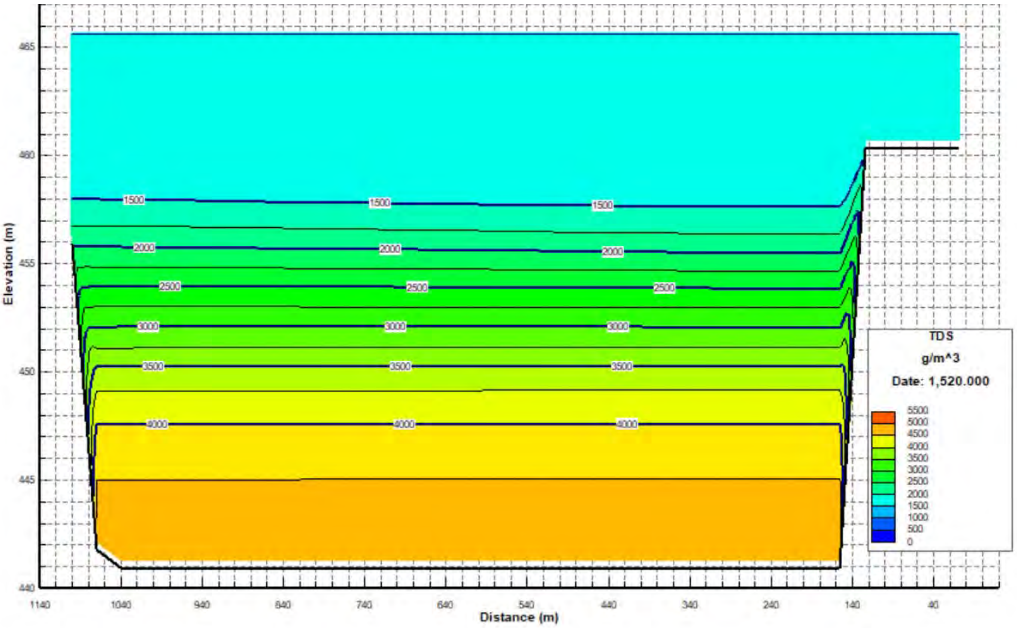

Figure 6-8: Cross-section view of the HTDF from South (left) to North (right) showing final concentrations of TDS at the end of the Limnology Prediction B on 2/28/2028

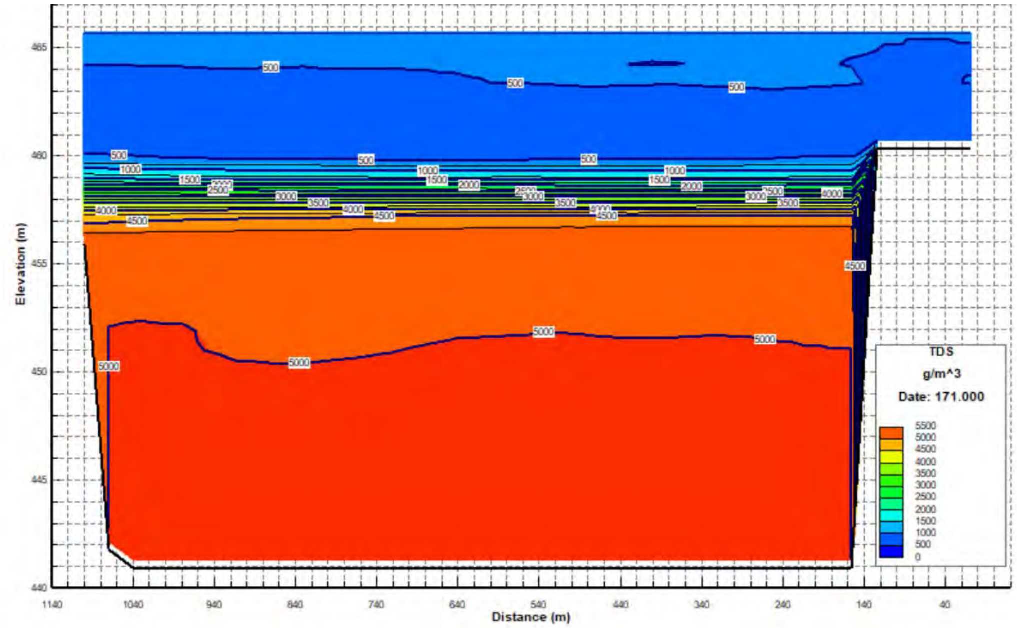

Figure 6-9: Cross-section view of the HTDF from South (left) to North (right) showing initial concentrations of TDS at the start of the Limnology Prediction C on 6/19/2024. The top of the chemocline was initially set at 1506 ft (459 m) above MSL

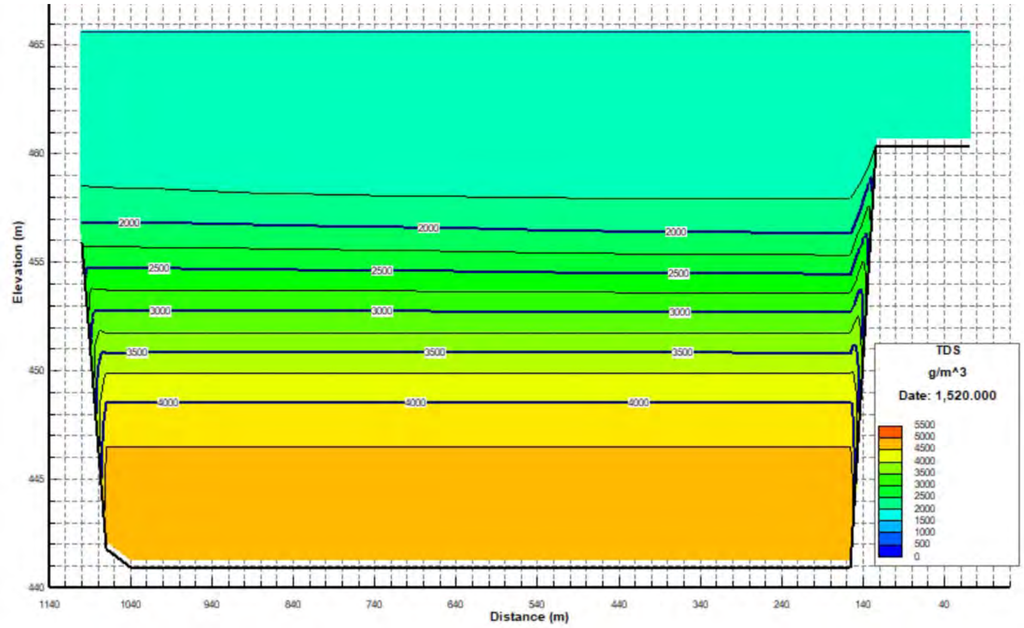

Figure 6-10: Cross-section view of the HTDF from South (left) to North (right) showing final concentrations of TDS at the end of the Limnology Prediction C on 2/28/2028

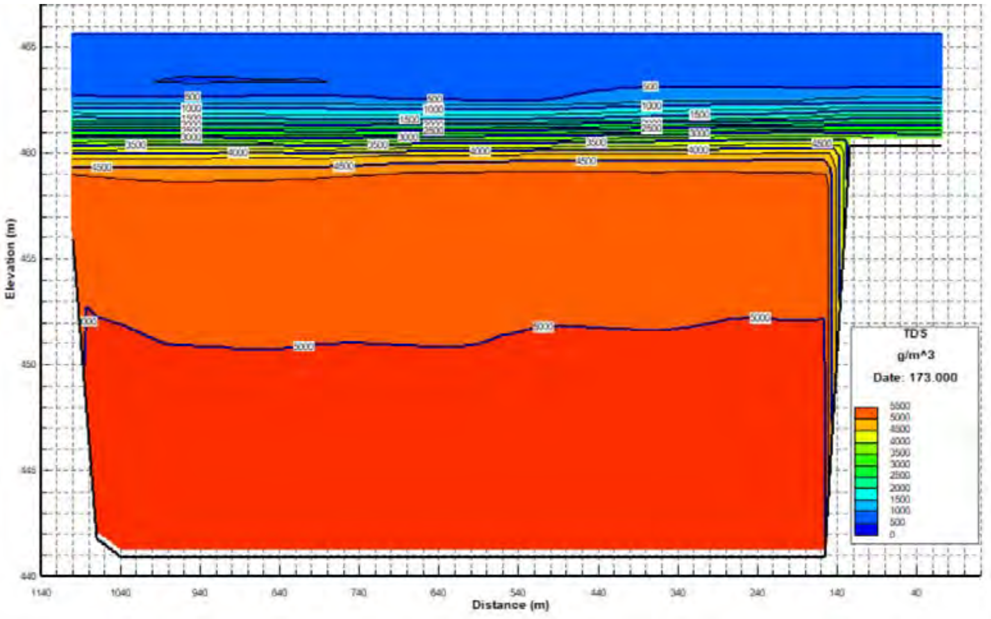

Figure 6-11: Cross-section view of the HTDF from South (left) to North (right) showing initial concentrations of TDS at the start of the Limnology Prediction D on 6/22/2024. The top of the chemocline was initially set at 1516 ft (462 m) above MSL

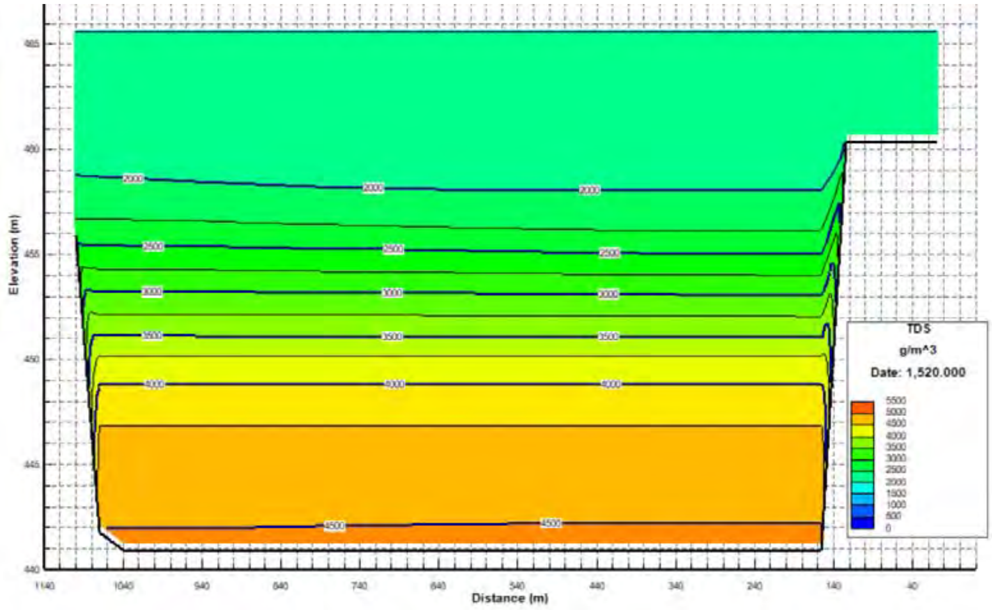

Figure 6-12: Cross-section view of the HTDF from South (left) to North (right) showing final concentrations of TDS at the end of the Limnology Prediction D on 2/28/2028

7. Predictive model of HTDF Water Chemistry

7.1 Purpose and Overview

This section investigates the chemical response of the HTDF to the deposition of tailings to a maximum elevation of 1515 ft MSL. The goal is to determine whether or not the water quality will stabilize at an acceptable discharge water quality that requires no further treatment, and how many years active treatment will be required after the end of operations.

To investigate water quality during and after operations, we generated a 25-year water quality prediction in the dynamic simulation model GoldSim (GoldSim Technology Group, 2014). The purpose of the geochemical model was to generate a worst-case, water quality prediction that:

- Investigated changes in TDS, Total Cu, Total Ni, and Total Se concentrations in WTP influent during operations and closure;
- Forecasted the time required for the HTDF to reach stable concentrations of TDS, Total Cu, Total Ni, and Total Se following the end of operations in 2023.

The treatment option considered in the model is only one of many treatment options available to Eagle that achieves discharge objectives. Eagle is currently considering additional treatment options, therefore, the final treatment option employed by Eagle may differ from the option assumed in this study.

7.2 Fundamental Assumptions

1. The model used daily time steps for a 35-year model that began in June 2015 and continued through December 2050.
2. The model included mass balance mixing reactions only, and did not include sedimentation, mineral precipitation, surface adsorption or oxidation reactions. The model assumed the complete dissolution of soluble minerals in the tailings slurry (see Section 7.3, Number 5). Thus, the current version provides a worst-case concentrations of trace elements by adding mass to the model but neglecting mass removal by geochemical and biogeochemical reactions, such as the removal of trace metals by surface adsorption onto suspended organic matter.
3. For the treatment of trace elements, the model assumed that existing clarification and ultra-filtration technologies in the WTP would be sufficient to reduce the concentrations of all constituents in WTP influent to below limits specified by MDEQ (2015). The WTP remained in operation after the end of mill operations, from 2023 onwards, until trace element concentrations dropped below MDEQ (2015) discharge limits.

4. For the treatment of TDS, the model assumed that an RO system would be employed to lower the TDS concentrations in WTP effluent. Beginning in 2016, a 400 gpm, portable RO system was installed adjacent to the WTP. A 600 gpm, permanent RO system is scheduled to go online in May 2018. The model treated all WTP influent with RO beginning in 2016, and returned all RO brine to the HTDF until 2024. This increased the salt concentration in the HTDF during this period.
5. Beginning in 2024, the model assumed that a ZLD plant went online. At that time, RO brine was no longer injected to the floor of the pit. The ZLD plant removed most of the dissolved mass from the RO brine. The resulting salt was exported from the HTDF basin by rail or truck, and disposed in a sanitary landfill. The RO and ZLD systems remained in operation from 2024 onward until TDS concentrations stabilized in the HTDF.
6. Contrary to the limnological model results described in Section 6, the model assumed the HTDF would completely mix on an annual basis beginning in April 2018. This change was implemented to demonstrate that Eagle is prepared to treat the worst-case water chemistry that would result from complete water column mixing. If mixing does not occur, influent to the WTP will have considerably lower concentrations of all constituents, and less time and expense will be required to treat the HTDF surface layer than projected herein.

7.3 Model Strategy Overview

GoldSim is a dynamic simulation model which manages volumes and mass added to a water body (GoldSim Technology Group, 2014). A 1-year model of existing conditions in the HTDF was generated from June 18, 2015 until August 31, 2016. The results of this prediction were compared to observed water chemistry in July 2016 which allowed the model to be assessed. Continuing from this point, a 34-year prediction of the future chemistry of the HTDF was generated from September 2016 until January 1st, 2050.

The predictions involved the following steps:

1. The volumes and representative concentrations of the shallow layer and deep layer were defined. These definitions are called the “initial conditions” and were based on observed water quality on June 18, 2015 (Table 5-1). This was the first complete profile measured in the HTDF since October 14, 2010 (Table 3-1). Hatch used the electrical conductivity profiles to define the boundaries and volumes of the shallow and deep layers in the model. Hatch specified the concentration of 35 parameters in each layer based on the median chemistry of samples collected within each layer (Table 7-1). The model multiplied the volume of each layer by the dissolved concentrations of these 35 constituents to calculate the mass stored in each layer. The concentration of TDS was calculated by the summation of these concentrations. Comparisons between calculated TDS and measured TDS (i.e. Residue, Dissolved at 180 °C) show strong agreement for HTDF samples.

2. A water balance was generated showing the daily volume of water added and removed from each layer beginning on June 18, 2015.
3. Each inflow was assigned a concentration for each of the 35 constituents listed in Table 7-1. This concentration was multiplied by the daily inflow volume to determine the mass added to each layer.
4. Outflows were taken directly from each layer. With the exception of evaporation, which had no dissolved solids, dissolved mass was removed from each layer as a function of the layer concentration and the volume removed.
5. Using column leachate test data (Section 4), mass loading associated with tailings dissolution was added directly to deep HTDF water beginning in July 2015.
6. Complete mixing between the deep and shallow water layers was assumed to begin in April 2018.
7. Beginning in 2020, the concentrations of Na and Cl in the tailings slurry water were doubled to reflect the expected composition of Eagle East tailings.

Table 7-1: List of Dissolved Constituents Modeled in GoldSim

Constituent	Constituent	Constituent	Constituent	Constituent
Al	Cr	Mn	Tl	NH_3
Sb	Co	Hg	V	SO_4
As	Cu	Mo	Zn	Ca
Ba	CN	Ni	HCO_3	Mg
Be	Fe	Se	Cl	K
B	Pb	Ag	F	Na
Cd	Li	Sr	NO_3	

7.4 HTDF Inputs

The spatial positions of inputs to the HTDF are conceptually represented in Figure 2-1. The volume and chemistry of each input is described below.

7.4.1 Groundwater Inflow

7.4.1.1 Volume

Groundwater input volumes were calculated in GoldSim based on the HTDF water balance provided by Eagle. This calculation involved using the observed water level, the pit stage storage curve, measured outputs and inputs, and solving for daily groundwater inflow. Groundwater was assumed to only report to the shallow layer of the HTDF model owing to density difference between inflowing groundwater and the deep layer.

7.4.1.2 Chemistry

Studies of groundwater hydrology indicate that the shallow Quaternary Aquifer up-gradient of the HTDF has a hydraulic conductivity 3 to 5 orders of magnitude higher than the deep groundwater system. This suggests that most groundwater added to the HTDF comes from the Quaternary Aquifer and not the bedrock system.

To determine a representative water quality entering the HTDF from groundwater, we compared major cation (Ca, Mg, Na, K) and major anion (Cl, HCO_3, SO_4) concentrations from all monitoring wells at the south end of the HTDF which were screened in the Quaternary Aquifer. These wells are upgradient of the HTDF and lie directly along the groundwater flow path to the water body. Thirty seven water samples collected from the following wells plot in a distinct cluster on a Piper Diagram (i.e. a trilinear diagram reflecting the relative proportions of major cation and major anion concentrations) which indicates a similar water chemistry:

- Well-3 (one sample from 1984)
- HW-3 (four samples from 2008)
- MW 706QAL (17 samples from 2014-2017)
- MW 9R (15 samples from 2014-2017)

The input water groundwater chemistry used in the model equal to the median concentration of these 37 samples. Input groundwater had a TDS of 503 mg/L based on this analysis (calculated from summation of ions, not from direct measurement). However, this TDS concentration could be a conservative, over-estimation as well MW 706QAL has a notably higher TDS than other wells and may be skewing results.

7.4.2 Tailings Inflow

7.4.2.1 Volume

The total volume of tailings slurry is measured daily by Eagle. Future slurry rates have been calculated from a projected tailings schedule provided by Eagle which includes the addition of Eagle East tailings beginning in 2020. This rate ranges from approximately 1500 to 1600 tonnes/day. All tailings are added to the deep layer of the HTDF in the model.

The liquid fraction of tailings was calculated from the percent solids in tailings provided by Eagle. Tailings injection ends on January 1, 2024, the approximate end date for mining operations.

7.4.2.2 Chemistry

Eagle has measured the chemistry of the tailings slurry on eight occasions since the start of operations between November 10, 2015 and July 20, 2017. The slurry is sampled from the tailings-thickener underflow pipe at the Mill. The sample slurry is allowed several minutes to settle before supernatant water is sampled. The median values of dissolved concentrations are used in the model.

Tailings from the Eagle East deposit are expected to have a higher TDS than tailings from the Eagle deposit. Preliminary tests on exploration samples indicated that Na and Cl concentrations in the tailings slurry may double when Eagle East comes online in 2020. To account for this change, the model doubles the concentration of Na and Cl in the tailings slurry beginning on January 1, 2020 and continuing until the end of operations in 2023.

7.4.3 Rain and Snowmelt

7.4.3.1 Volume

The National Weather Service (NWS) has measured daily precipitation in Clarksburg, Michigan, since 2003. Data from the year 2012 were closest to the average values for the 14-year period from 2003 to 2016. Therefore, daily data from 2012 were used to represent all future years in the model. Annual precipitation in 2012 was 29.7 inches.

7.4.3.2 Chemistry

Eagle collected a rain water sample on October 17, 2017. This rain water chemistry was used for all rain input in the geochemical model.

It is worth noting that Hg concentrations in natural rain water landing on site was 4.2 ng/L. This is 3 to 4 times higher than the discharge limit of 1.3 ng/L required by MDEQ (2015). It will be a significant effort for Eagle to clean the HTDF to a better water quality than site rain water, and the merits of this effort would be lost upon site discharge. Additional rain water sampling will help confirm background concentrations.

7.4.4 Watershed Runoff

7.4.4.1 Volume

The Australian Water Balance Model (AWBM) was implemented in GoldSim to calculate daily watershed runoff. Daily inputs are based on historic rainfall data measured at the Clarksburg NWS station.

7.4.4.2 *Chemistry*

Other than water samples collected from the HTDF itself, only two water samples had been collected from within the HTDF watershed at the time of writing. These samples were collected in February and April 2008 from a wetland near the south end of the HTDF identified as HMP-005 (Figure 1-1). The median chemistry of this water has been used to represent all watershed runoff and snowmelt.

Most likely, this water represents shallow groundwater seepage and not watershed runoff. Eagle has planned a new runoff sampling campaign involving pit "wall washing" (GARD Guide, 2012: http://www.gardguide.com/index.php?title=Chapter_5b#5.4.13_Field_Methods) to gather more representative data on runoff chemistry.

7.4.5 *Ultra-Filtration Backwash*

The ultra-filtration system in the WTP is flushed daily by backwashing. Backwash is injected into the deep layer via a return pipe located 110 ft below the water surface (Figure 2-1). Eagle measures the volume of daily backwash generated. The chemistry of backwash is assumed to be equal to the chemistry of WTP influent on the same day.

7.4.6 *RO Brine*

In 2016, Eagle has rented a portable RO unit. A permanent RO unit is scheduled to go online in 2018. Roughly 25% of the water that enters the RO unit becomes brine. This brine contains roughly 98% of the constituent mass that enters the unit. When in operation, the RO Brine is injected into the deep layer of the HTDF using the ultra-filtration backwash return pipe described above.

7.5 HTDF Outputs

The spatial positions of outputs from the HTDF are conceptually represented in Figure 2-1. The volume and chemistry of each input is described below.

7.5.1 *Water Treatment Plant Influent*

Influent to the WTP is currently extracted from a pipe in the Northeast Basin, roughly 30 ft below the water surface. The volume of water extracted changes daily to maintain a constant water level between 1530 and 1532 ft MSL. Eagle monitors this volume on a daily basis.

7.5.2 *Mill Reclaim Water*

Water for the Mill is provided by a pipe at the south end of the Main Basin. This pipe is located 10 ft below the water surface and extracts water from the shallow layer. In August 2017, a second intake pipe was placed below the chemocline. Eagle monitors the reclaim water volume on a daily basis.

7.5.3 *Evaporation*

Evaporative loss was based on average monthly pan evaporation rates reported by the Natural Resources Conservation Service of Marquette, Michigan.

7.6 Model Results

7.6.1 TDS

The model predicts that TDS concentrations in WTP influent will increase to approximately 5000 mg/L by 2024 as a function of tailings injection, the increase in TDS associated with Eagle East tailings beginning in 2020, the dissolution of soluble salts within the tailings, and the injection of RO brine (Figure 7-1). A large step increase occurs in April 2018 as a result of the first complete mixing event. After mixing, surface water is slightly diluted by rainwater, groundwater and surface runoff. Subsequent mixing in November causes concentrations to increase again. Cycles of concentration and dilution continue until early 2024, when the ZLD system goes online. The ZLD system permanently removes salt from the HTDF which causes concentrations to decrease over time. Concentrations drop below 500 mg/L by 2041, approximately 18 years after the end of operations. Concentrations are close to stabilizing by 2050.

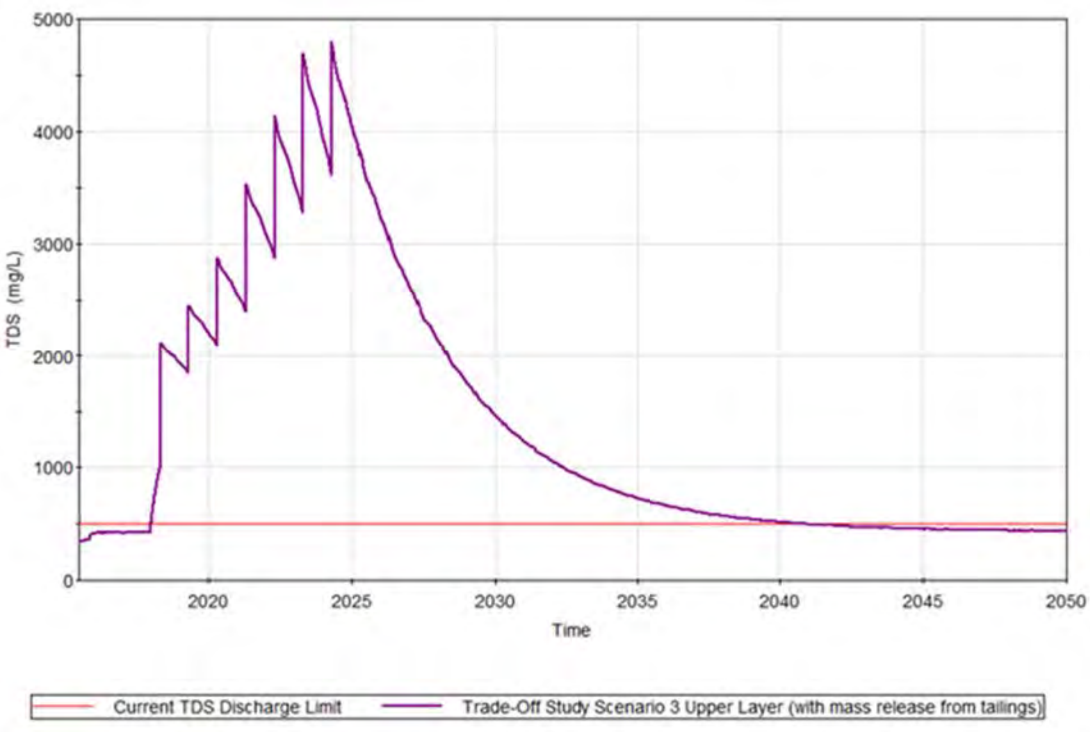

Figure 7-1: Predicted concentration of TDS from in WTP influent over time

7.6.2 *Total Copper*

Predicted concentrations of Total Copper show a similar sawtooth pattern as TDS, but never exceed the MDEQ (2015) guideline (Figure 7-2). An initial increase in late 2015 was most likely caused by a one-off loading event from the watershed associated with rail car cleaning. Concentrations decrease over time once tailings addition ends in 2024 and ZLD operation begins. Concentrations stabilize by 2045.

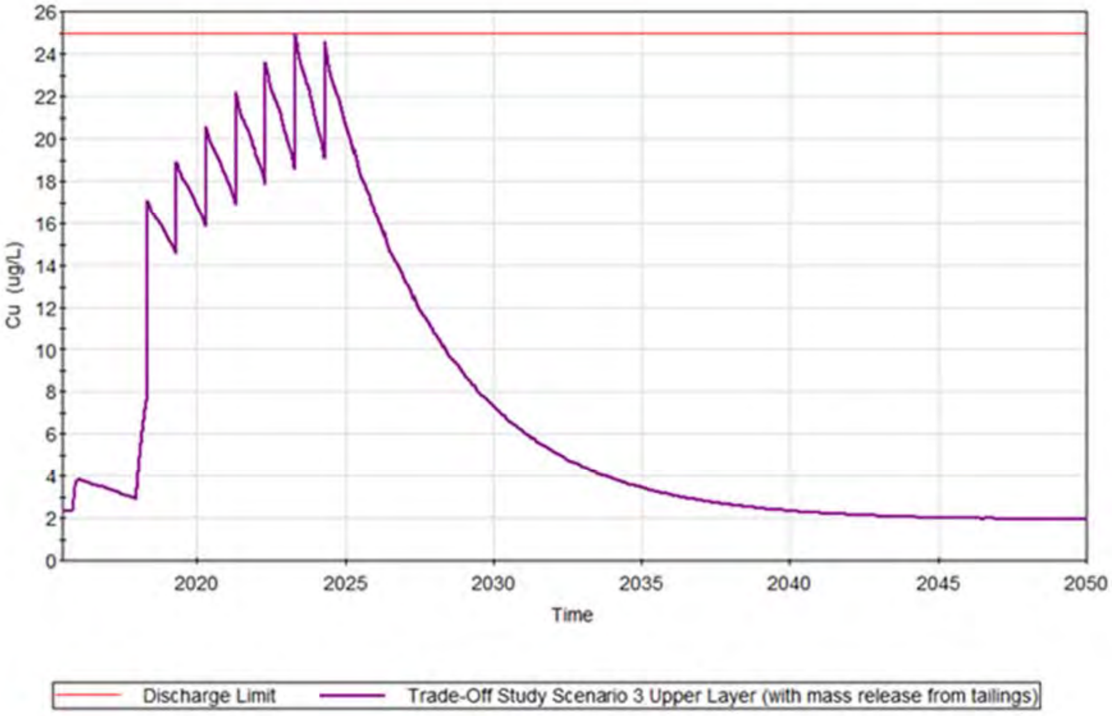

Figure 7-2: Predicted concentrations of Total Copper in WTP influent over time

7.6.3 Total Nickel

Predicted concentrations of Total Nickel show a similar sawtooth pattern as Total Copper (Figure 7-3). An initial increase in 2016 was most likely caused by a one-off loading event from the watershed associated with rail car cleaning. Concentrations in WTP influent rise above the MDEQ (2015) limit in 2018 following the first mixing event, and drop below the limit in late 2035, 12 years after closure. Concentrations stabilize after 2045.

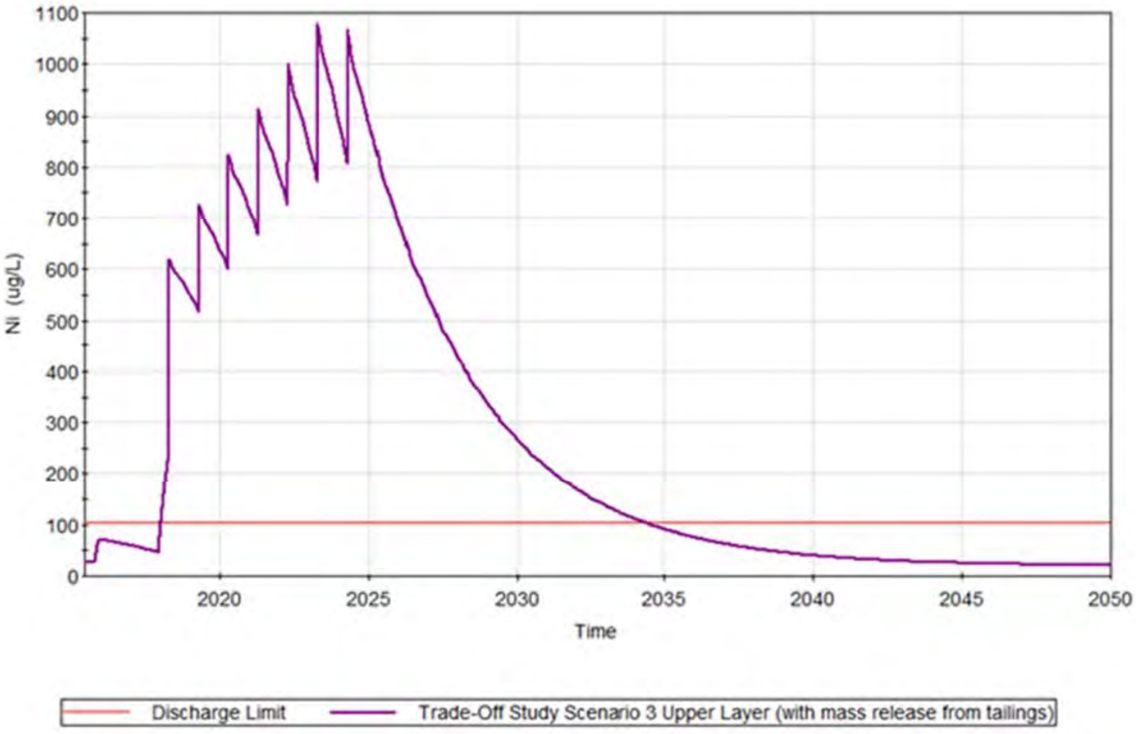

Figure 7-3: Predicted concentrations of Total Nickel in WTP influent over time

7.6.4 Total Selenium

Predicted concentrations of Total Selenium show a similar sawtooth pattern as TDS (Figure 7-4). Concentrations in WTP influent rise above the MDEQ (2015) guideline in 2018 with the first full mixing event, and then drop below in 2029, six years after the end of operations. Concentrations decrease over time and stabilize after 2040.

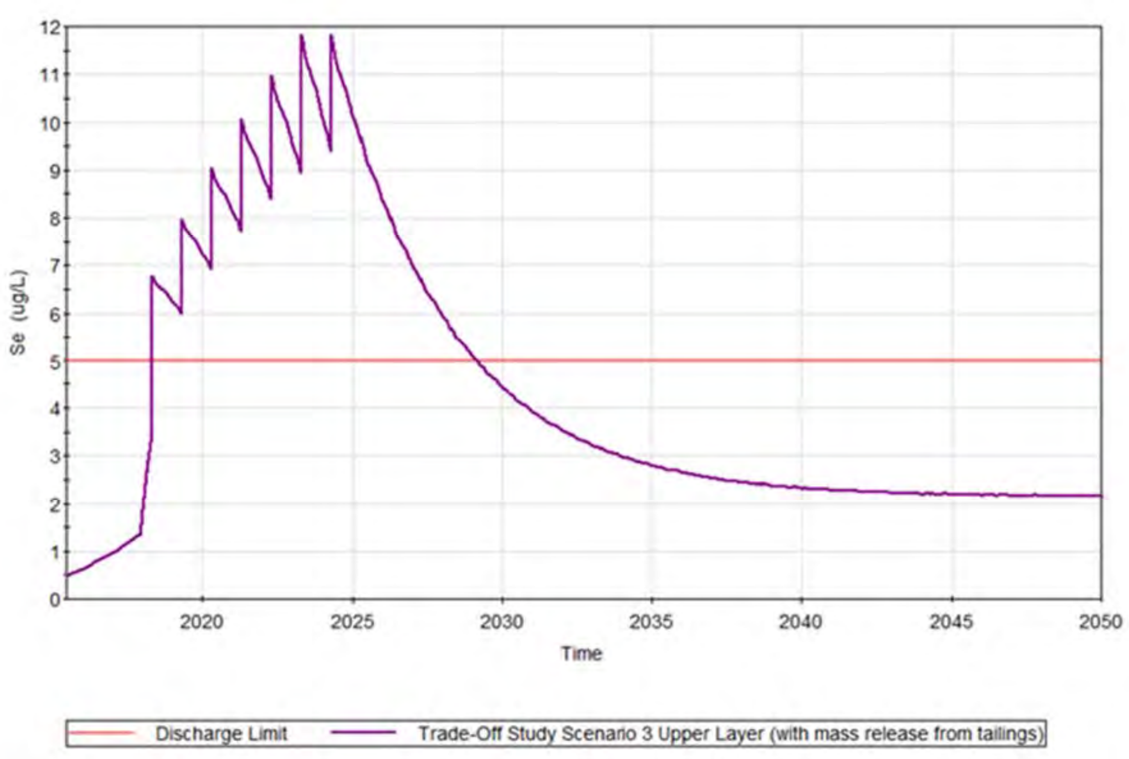

Figure 7-4: Predicted concentrations of Total Selenium in WTP influent over time

7.7 Water Treatment Duration

Modeling in GoldSim indicates that trace element concentrations in WTP influent drop below MDEQ (2015) limits 11 years after the end of operations. Potentially, the clarification and ultra filtration systems could be discontinued at that time if they are not required to prevent the fouling of RO membranes. Modeling also indicates that TDS concentrations in WTP influent drop below MDEQ (2015) limits after 18 years. The RO and ZLD systems could be discontinued at that time.

Several conservative assumptions have been used in this predicting which have resulted in a worst-case water quality prediction requiring additional time for cleanup, including:

- complete leaching of mass from all tailings added to the HTDF,
- high groundwater TDS concentrations,
- complete mixing of the water column beginning in 2018;
- a doubling of Na and Cl in tailings slurry with the addition of Eagle East tailings; and
- exclusion of geochemical and biogeochemical reactions which remove mass from the water column.

Use of less-conservative, more realistic, assumptions will improve water quality over a shorter period of time and decrease the predicted duration of treatment.

8. Model Sensitivity

A detailed sensitivity analysis was performed on the HTDF geochemistry model with respect to the following inputs:

- Input tailings geochemistry;
- Input groundwater chemistry; and
- Annual rainfall.

8.1 Methods

8.1.1 *GoldSim Set Up*

GoldSim began on June 18, 2015 and used observed concentrations measured from the HTDF water column on June 18, 2015 as initial conditions. The mass balance model, generated in GoldSim, used observed daily water balance inputs provided by Eagle, and daily values for 2015 from the NWS station in Clarksburg. Tailings slurry was injected from the start of the model through the end of operations on January 1, 2024. The first complete turnover event in the former model occurred in November 2017.

8.1.2 *Tailings Water Chemistry*

The GoldSim model was run using the using minimum, median, and maximum input concentrations in five samples collected from the tailings thickener underflow between November 10, 2015 and October 6, 2016. Dissolved concentrations from filtered samples were used in the analysis.

8.1.3 *Groundwater Chemistry*

The GoldSim model was run using the minimum, median, and maximum input concentrations from twelve water samples collected from monitoring well KMW-5R between May 30, 2014 and August 26, 2016.

8.1.4 *Rain Water Input*

The mean annual rainfall depth over the 13 year period from 2003 to 2015 was 29.3 inches. Over this record, 2013 was the wettest year, exhibiting 18% more rainfall than the mean, and 2006 was the driest year, exhibiting 13% less rainfall than the mean. By comparison, 2015 was a notably dry year with 13% less precipitation than the mean. Total annual precipitation in 2012 was 29.7 inches, therefore making 2012 the most representative year with respect to total annual precipitation.

The sensitivity analysis considered two conditions:

- 25% more daily rainfall than the mean annual rainfall year (i.e. 125% mean); and
- 25% less daily rainfall than the mean annual rainfall year (i.e. 75% mean).

The rainfall sensitivity analysis used rainfall from 2012 as a base case scenario. We increased the daily precipitation in 2015 by 25% of 2012 rainfall. Likewise, the rainfall sensitivity analysis decreased daily precipitation in 2015 by 25% of 2012 rainfall. As a result, the sensitivity analysis provides slightly more and slightly less rainfall variation than observed under natural conditions.

8.2 Results

Variations in tailings slurry composition generated significant differences in the modeled results, whereas variations in groundwater composition and annual rainfall generated only minor difference in modeled results. Importantly, selection of maximum versus minimum concentrations for the tailings slurry caused the predicted WTP influent to exceed or fall below MDEQ limits for some constituents.

Several points must be kept in mind when interpreting the effect of tailings slurry on the WTP influent chemistry:

- Available tailings slurry samples show high chemical variability from sample to sample.
- At the time of modeling, there was a considerably small sample size ($n = 5$) of tailings slurry data compared to the two other datasets ($n \geq 12$). This low sample size increased the standard deviation and reduced confidence in the statistical data.
- Consequently, we have low confidence in the model's ability to accurately represent the tailings slurry composition over time. As noted in previous studies, tailings slurry composition remains one of the largest sources of uncertainty in our predictions. This finding justifies the use of conservative modeling assumptions in geochemical models.
- The tailings slurry composition is expected to change in the near future with the addition of tailings from Eagle East. In the prediction described in Section 7, this change was accommodated by assuming a doubling of Na and Cl concentrations in the tailings slurry.

By comparison, variability in groundwater composition and annual rainfall have considerably less influence. The concentration of TDS in groundwater causes moderate variability in model results of up to 200 mg/L, which could reduce or extend the time required to achieve the post-closure MDEQ limit of 500 mg/L. Because trace element concentrations in groundwater from monitoring well KMW-5R were mostly below detection limits, this study showed no variability in metal parameters over time. In current modeling efforts, KMW-5R is no longer deemed representative of groundwater inputs (see Section 7).

Rainwater caused minor changes in predicted concentrations owing to dilution. However, this analysis could change if additional chemical analyses are performed on site rainwater, snow, and pit wall runoff. In the present study, rain is viewed as driving dilution only. New chemistry data could suggest that rain at the potential source of specific elements to the HTDF, most notably total Hg, and possibly Se.

9. Conclusions

This report summarizes geochemical reports conducted on the HTDF by Hatch and other consultancies up through March 2018.

Several key points have been identified:

- General considerations:
    - The HTDF is an anthropogenic, flooded mine pit.
    - The location of the HTDF has a long history of mine-related activities dating back 150 years, starting in the 1870's. These include prior use as a tailings disposal facility for the Ropes Mine.
    - Most likely, less environmental impact would be generated by maximizing the existing storage capacity within the HTDF for additional tailings storage than by creating a new tailings disposal facility.
    - Observations from existing tailings disposal facilities in North America show that a water cover of 10 ft is sufficient to limit sulfide oxidation and the entrainment of tailings due to wind mixing.
    - If the permit application is approved, the final, steady-state water level in the HTDF will be between 1535 to 1540 ft MSL. This will provide a 20 to 25 ft water cover above tailings deposited as shallow as 1515 ft MSL. These shallow tailings would be deposited near the shoreline in order to provide the foundation for a littoral zone in the future. However, most tailings will be deposited much deeper in the interior of the HTDF.
    - Perennial stratification of the HTDF was initially generated in 1985 by salinity associated with the Ropes tailings. Stratification continues through present day.
- Previous limnological and geochemical predictions generated before operations showed the following:
    - If stratification is lost at some time in the future, therefore allowing the entire water body to circulate annually and resulting in high concentrations of dissolved oxygen being transported to the tailings-water interface, only the top 7.5 mm of tailings would potentially oxidize. This would have a minimal impact on water quality.
    - Previous limnology and geochemical models did not fully investigate the contribution of TDS concentrations in tailings slurry water to: (a) TDS concentrations in HTDF water, (b) stratification, or (c) treatment options.

- Experiments and monitoring:
  - 97-week, saturated column leachate tests provide the best understanding of potential interactions between HTDF water and tailings under oxidizing conditions. The calculated mass loading from tailings has been included in the geochemical prediction provided herein.
  - Monitoring shows the HTDF is a two-layer system, separated by a strong chemocline.
  - The injection of tailings has strengthened the density gradient across the chemocline and caused the elevation of the chemocline to rise in the water column over time. This has led to the generation of a new conceptual model of the HTDF system (C2).
- Limnological modeling:
  - A 3.6-year limnological prediction was generated of the Main Basin of the HTDF beginning in mid-2024, just after the end of operations.
  - The bathymetry file accounted for the deposition of >3 million m^3 of tailings from Eagle and East Eagle.
  - Tailings were filled to 1515 ft MSL in a small region at the northern end of the Main Basin which extended roughly 300 ft to the south into the basin. The remaining tailings were deposited on the floor of the pit, above the Ropes tailings.
  - For water bodies with complex bathymetry, such as the elongate HTDF with its variable bottom depth, it is better to use a 2-D or 3-D hydrodynamic model such as CE-QUAL-W2 or GEMS, respectively. 1-D hydrodynamic models, such as DYRESM, have less capacity to accurately represent complex bathymetry.
  - The model predicted the HTDF will not undergo complete mixing.
  - The model predicted gradual upward transport of mass to the surface layer owing to seiching, turbulence at layer boundaries, and eddy diffusion. The processes will gradually remove mass from the deep layer over time.
- Geochemical modeling:
  - The most recent model of HTDF water quality is based on four conservative assumptions which produced a worst-case water quality:
    - The HTDF will completely mix each April and November, beginning in April 2018.
    - All tailings added to the pit from 2015 onwards will completely react with lake water, and soluble minerals will instantly dissolve.

    - Eagle East tailings will have twice the concentration of Na and Cl as Eagle tailings.
    - No geochemical or biogeochemical reactions were included which would lower the concentrations of trace elements and major ions.
  - The model made several assumptions about water treatment which are still being reviewed by Eagle:
    - The model assumed that a clarification and ultrafiltration system would be used at the WTP to remove trace elements from WTP influent until influent concentrations dropped below MDEQ (2015) limits.
    - From 2016 to 2023, the model assumed Eagle would implement an RO system that would return RO brine to the HTDF.
    - From 2023 until TDS stabilized, the model assumed Eagle would implement a ZLD system to treat the RO brine and export salt from the basin.
  - The model predicted that the water quality of the HTDF would stabilize and require no future treatment within 18 years of closure. A shorter treatment time would apply with less conservative assumptions. Specifically:
    - The model predicted that trace elements in WTP influent (Total Cu, Total Ni, and Total Se) would drop below MDEQ (2015) limits within 10 years of the end of operations. At this point, the clarification and ultrafiltration systems would no longer be required.
    - The model predicted that TDS would drop below MDEQ (2015) limits with 18 years of the end of operations. At this point, the RO and ZLD systems would no longer be required.
- Sensitivity Analysis
  - The single greatest source of uncertainty in the model is the chemistry of tailings slurry water. Ongoing monitoring of tailings thickener underflow water by Eagle will continue to reduce uncertainty in future predictions.
  - The model is relatively insensitive to changes in groundwater chemistry and annual rainfall.

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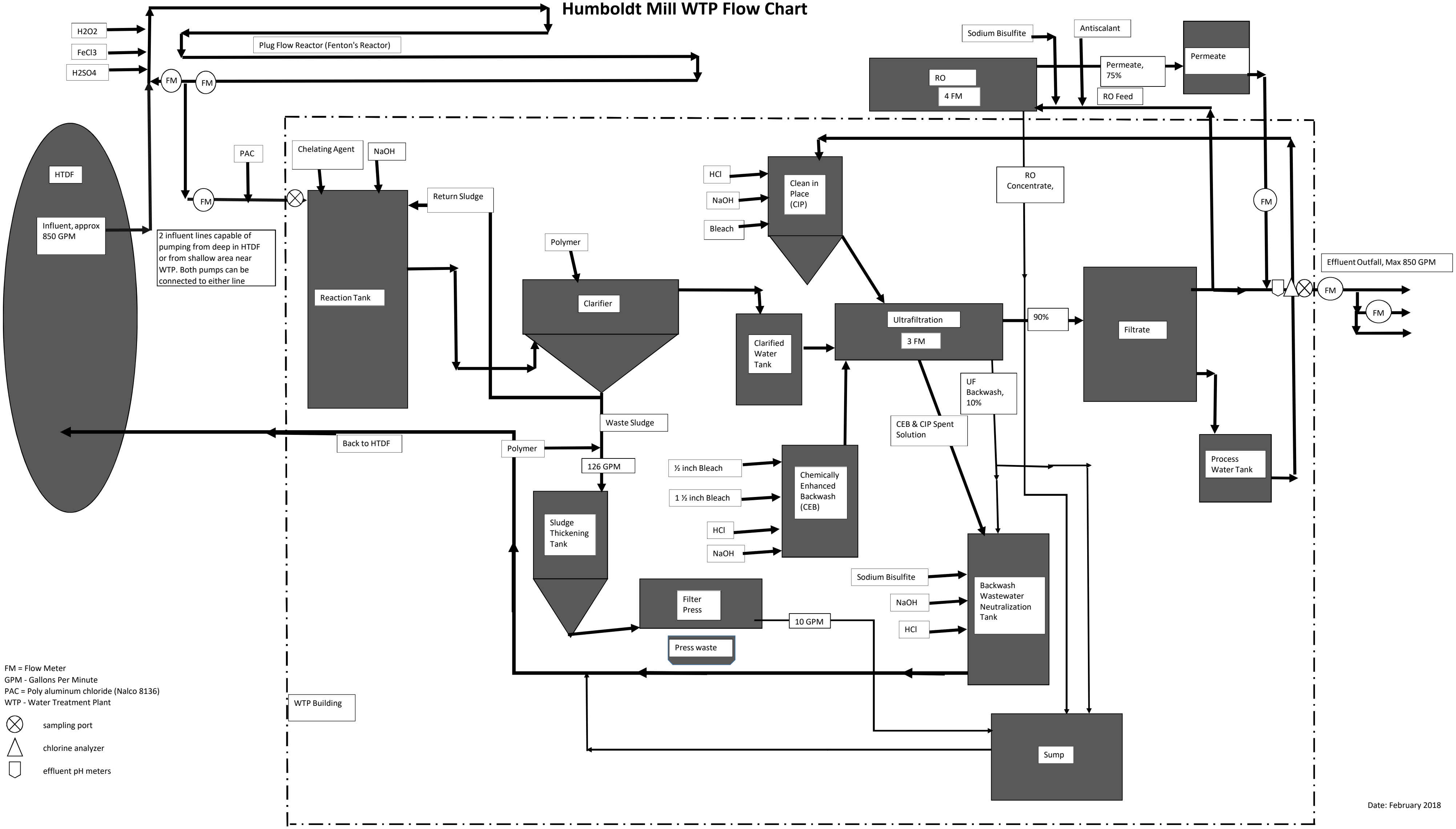
APPENDIX B

WTP FLOW CHART

WTP NARRATIVE DESCRIPTION

Humboldt Mill WTP Flow Chart



FM = Flow Meter
GPM - Gallons Per Minute
PAC = Poly aluminum chloride (Nalco 8136)
WTP - Water Treatment Plant

⊗ sampling port
△ chlorine analyzer
⬠ effluent pH meters

Date: February 2018

HUMBOLDT MILL WATER TREATMENT PLANT

PROCESS DESCRIPTION

The objective of the Eagle Mine - Humboldt Mill Water Treatment Plant is to treat the water from the existing Humboldt Tailings Disposal Basin for environmental discharge. The treated water will be discharged through a pipeline to a receiving wetland. The discharge water quality is set by permit No. MI0058649 issued by the Michigan Department of Environmental Quality (MDEQ) authorization to discharge under NPDES.

The treatment system includes the following major unit processes: Oxidation, Neutralization/Coagulation/Reaction tank with pH adjustment, clarification and Ultrafiltration (UF). Solids generated in the process are concentrated with a sludge thickener and filter press. An optional Reverse Osmosis (RO) trailer is installed at the facility to be used as needed to remove dissolved solids from the water. Concentrate from the RO trailer is currently rejected back to the Humboldt Tailings Disposal Facility (HTDF).

Oxidation

The current process begins with an oxidation step utilizing Fenton's reaction to destruct thiosalts and lower the chemical oxygen demand. Water is pumped through a plug flow reactor where hydrogen peroxide, ferric chloride, an iron catalyst in the reaction, are added. To dissolve the iron catalyst, the pH of the stream must be lowered. This is accomplished by addition of sulfuric acid upon startup or recirculating up to 50% of the reactor effluent prior to chemical addition. Recycling reactor effluent eliminates the addition of sulfuric acid and reduces caustic demand for neutralization.

Neutralization/Coagulation/ Reaction Tank System

Following oxidation, the water passes to neutralization and metals precipitation in the coagulation reaction tank. Caustic is used to neutralize the water, and the primary function of the coagulation system is to form $Fe(OH)_3$ (ferric hydroxide) precipitated solid which will adsorb and co-precipitate with trace metals such as selenium, lead, zinc and mercury. The optimum chemical dose and pH conditions will be determined by jar testing or pilot testing. Ferric chloride (Hydrex™ 3250) is the coagulant to be used, the assumed dose is 40 mg/L and will be injected to the supply line to the coagulation/ reaction tank 650-TK-201. Hydrex 6909, or similar, will be used for low level metals removal/polishing. It is expected that the trace metal adsorption and/or co precipitation will be improved with a higher ferric hydroxide precipitates concentration, therefore solids will be recycled from the clarifier in this process.

Coagulation/Reaction Tank

The coagulation/ reaction tank system consists of an FRP tank with mixer and a coagulant chemical feed system. The coagulation/ reaction tank shall provide approximately 50 minutes reaction time. The target pH in the reaction tank is 8.5. Caustic addition will be required to maintain the target pH.

All chemical dosing systems including the ferric chloride system, Hydrex 6909 (or similar) system, and caustic system shall be supplied from tote tanks and two 100% feed pumps (one operating; one stand-by).

Clarifier

The primary function of the inclined plate clarifier is to separate the solids through gravity sedimentation. A polymer feed system with two 100% feed pumps will be provided to improve clarification performance. An emulsion type polymer will be supplied from a tote tank. A portion of the underflow solids will be recycled to the coagulation/ reaction tank to maintain a high solids concentration in the system. Excess solids will be discharged to a sludge thickener and further concentrated for dewatering by a filter press. The solids from the filter press will be hauled offsite for disposal. The clarified supernatant water will contain suspended solids (TSS), which will be removed by the downstream UF system.

Clarified Water Tank

The primary function of the Clarified Water tank is to provide flow buffering between the inclined plate clarifier and the UF system. The break tank is sized to provide a minimum 10 minutes residence time at the design flow.

UF System

The primary function of the UF system is to remove suspended solids and the associated contaminants from clarified water. The UF system consists of ferric chloride feed pumps, UF feed pumps, UF feed strainers, UF membrane skids, UF filtrate/backwash water storage tank, UF backwash pumps with chemical enhanced backwash (CEB) system, UF backwash waste neutralization tank and pumps, compressed air system and clean in place (CIP) system.

Ferric Chloride Feed Pumps

Ferric chloride (Hydrex 3250) is injected in the UF Feed to coagulate residual polymer from the carry over floc particles. Two 100% chemical feed pumps will be included (one operating; one stand-by). The ferric chloride pump is paced on the flow.

UF Feed Pumps

The UF feed pumps deliver water to the UF membrane skids. The pumps are driven by VFDs and controlled by the flow meters. Three UF feed pumps each dedicated to a UF membrane skid are provided. The UF feed pumps are selected based on flow and pressure requirements of UF membrane skids.

UF Feed Strainers

The function of the UF feed strainers is to remove large particulates to protect the downstream UF membrane system. The UF feed strainer was selected for micron retention size and flow rate per the UF membrane manufacturer's recommendations (130 µm). The backwash cycle of the self-cleaning strainer occurs automatically, triggered by operating pressure differential switch or time set at the local control panel.

UF Membrane Skids

There are three UF membrane skids; each skid includes eighteen UF modules and provides 50% operating capacity. The design flux is 29.1 gfd based on the UF membrane supplier. The UF filtrate is under pressure as it flows to the UF Filtrate/Backwash tank. The UF backwash waste flows to the UF backwash waste neutralization tank.

UF Filtrate/Backwash Water Storage Tank

The UF Filtrate/ Backwash storage tank provides a hydraulic buffer to store sufficient water for UF backwashing and final pH adjustment if required before the water is discharged. The tank is sized to provide the minimum storage capacity of 8,550 gallons as projected by the membrane supplier. The pH of the UF filtrate will be measured for reporting requirements to verify the required range of 6-9. The filtrate flow will be measured for reporting requirements.

UF Backwash Pumps

The function of the UF backwash pumps is to supply water to remove the solids accumulated on the membrane surface during the normal filtration period. Two 100% backwash pumps are provided based on the flow and pressure requirements provided by the membrane supplier. During a normal backwash, the backwash pumps are turned on to reverse the flow through membranes to dislodge the accumulated solids.

Sodium hypochlorite will be added to the backwash flow for biological control since the feed water from the pond is initially treated through reducing chemistry.

Chemical enhanced backwashes (CEBs) are required to remove some organics and mineral scales on the membrane. Sodium hypochlorite and sodium hydroxide are used in a high pH CEB to remove organics, and hydrochloric acid is injected into the backwash water in a low pH CEB to remove mineral scales.

UF Backwash Waste Neutralization Tank and Pumps

The function of the UF backwash waste neutralization tank is to store the backwash waste water surge flow, neutralize pH and free chlorine as may be required before recycling the waste water to the coagulation/ reaction tank. Two 100% capacity neutralized waste transfer pumps each at 50 gpm will return the neutralized waste water to the coagulation reaction tank. This recycle flow is less than 10% of the total feed flow. A pH Indicator/ controller will provide the wastewater pH for operator information.

Treated Water Discharge/ Off Spec Return Pumps

The UF filtrate (Treated Water) will be discharged to the receiving outfall. Off spec/ return water will be returned to the existing HTDF. A level control in the tank will stop the pumps (or automatic valve in case pumps are not required) based on a preset tank level.

Reverse Osmosis

The RO system is housed inside a 53-foot long insulated trailer. Feed water enters the inlet of the trailer at up to 666.6 gpm at 40 to 90 psig through two (2) 6", flanged piping connections, and passes into the prefilter of the RO system. Feed water is treated with an antiscalant feed to protect the membranes and a sodium bisulfite feed is available if chlorine is measured in the feed water. The four (4) RO skids in the trailer are arranged in a 3:2:1 – 5 M array. Product water produced is delivered to a permeate tank inside the WTP. The system can produce from 125 to 500 gpm of RO product water when the units are operated in single-pass mode. The system is designed to operate at 75% recovery. Water quality is monitored by a conductivity analyzer located on each RO unit. Water quantity is measured and totalized by flow meters on each RO unit. Permeate is blended with UF Filtrate prior to discharge to the facility’s outfalls.

Solids Handling

Sludge Thickening Tank

A cone bottom tank will provide gravity separation of the clarifier sludge to further concentrate the suspended solids. Air Operated Diaphragm pumps will draw thickened solids from the bottom of the thickening tank to feed the sludge dewatering filter press. Thickener supernatant will flow by gravity to the building sump.

Plate & Frame Filter Press

A 25 cubic foot capacity filter press will be used to dewater the thickened sludge. The filter press includes a four step incremental increase in feed pump pressure, and semi-automatic plate shifter to assist the operator with cleaning.

A polymer feed system with two 100% feed pumps will be provided to add a filter aid and improve dewatering performance. An emulsion type polymer will be supplied from a tote tank.

Dewatered solids will be deposited into a roll-off box and hauled away for disposal at a landfill.

APPENDIX C

TAILINGS DEPOSITIONAL STUDY

Report

HTDF Tailings Deposition Plan

H349392-00000-22A-066-0003

					C Biederman	
2018-03-12	1	Approved for Use	D. Li	R. Dávila	C. Biederman	Lundin
DATE	**REV.**	**STATUS**	**PREPARED BY**	**CHECKED BY**	**APPROVED BY**	**APPROVED BY**
				Discipline Lead	**Functional Manager**	**Client**

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1. Executive Summary

The Humboldt Tailings Disposal Facility (HTDF) located in the Upper Peninsula of Michigan, is an iron-mine pit lake which was used for the disposal of Au-ore tailings from 1985 to 1989. Since August 2014, the Eagle mine (Eagle) has injected pyrrhotite-rich, Ni-Cu-ore tailings onto the floor of the HTDF. By the end of mine life, approximately 5 million tonnes of tailings mass, equivalent to 3.1 million m^3 will need to be disposed subqueously in the existing flooded pit. The current deposition plan creates tailings cones that rise above the floor of the HTDF to a Stage 1 elevation of 1425 ft above mean sea level (amsl). These cones have an average slope of 15% and an initial settled dry density of approximately 1.6 metric dry tonnes per cubic meter (t/m^3).

The geochemistry of the tailings, pit lake limnology and water treatment aspects associated with the overall tailings management are presented in other reports and are excluded from the scope presented herein.

In June 2016, Lundin's Eagle operation retained Hatch to develop a new tailings deposition plan with the goal of maximizing the storage capacity of the HTDF. The Hatch plan ultimately involves the construction of two (2) tailings distribution pipes above the water surface which will extend north along the west and east shorelines of the HTDF, originating from the tailings pump house at the south end of the pit lake. Each distribution pipe will have small spigot lines spaced at 100-ft intervals that run perpendicular to the pit slope from 1531 ft amsl (the surface) to 1425 ft (Stage 1) and 1475 ft (or higher elevation as necessary for Stage 2). This side-wall injection system will operate for 7 months each year, between May and November, when the lake is ice free, and will result in the growth of deposition cones which grow from the pit walls towards the lake interior. During the 5 months when the lake is ice covered between December and April, the old deposition plan will be utilized to create cones in the interior of the lake. Side wall injection would begin in October 2016, following a one-month construction period during September.

Based on current projected tailings production schedule for the life-of-mine (2014-2023) and a conservative, initial, settled, density of 1.6 t/m^3, the deposition plan presented herein allows storage of all tailings produced from the Eagle and East Eagle mines below 1475 ft amsl with an average storage efficiency of 74%. This means that there will be additional storage capacity remaining in the interior of the pit lake in 2024. The plan avoids the need for a floating barge to facilitate tailings deposition, which will save injection infrastructure costs and reduce project complexity. Upon mine closure and the termination of tailings injection in 2024, Eagle will have several options to utilize the remaining storage capacity: (a) leave it unfilled; (b) sell it to a local iron mine and fill it with non-reactive tailings or waste rock; (c) partially fill it with a thin organic layer (e.g. settled phytoplankton) to further isolate tailings from the surface environment.

Hatch recommends regularly updating this model as new bathymetric data become available. Consolidation of tailings at the bottom of each cone over time will lead to a higher settled dry density of 2.3 t/m^3 which will gradually occur within the first 50 years of closure. Future bathymetric observations will lead to an understanding of the rate at which consolidation occurs which will allow for a more accurate, less conservative prediction of tailings deposition. To this end, it is proposed that an ongoing dialog happensbetween Hatch and TriMedia to plan for future bathymetry surveys. We also recommend annual or biannual updates to this model bases on actual deposition rates and locations, updated bathymetry, and experience to be gained by Eagle during side-wall deposition. Finally, the HTDF Operation Manual should be updated, and the Operations team familiarized with the new procedures described herein.

2. Introduction

The Humboldt Mill in Champion, Michigan currently processes Ni-Cu ore from the Eagle Mine which is owned by Lundin Mining Corporation. In the near future, ore from the new East Eagle mine will also be processed at this facility. Both mines are projected to conclude production in 2023. The tailings slurry that results from ore processing is subaqueously deposited in a 180-foot-deep pit lake adjacent to the Mill referred to as the HTDF.

Tailings deposition results in the growth of subaqueous cones which rise from the floor of the pit lake.

This report provides a new tailings deposition plan for subaqueous tailings disposal in the HTDF to cover the life-of-mine tailings production of approximately 5.0 million tonnes of tailings (equivalent to 3.1 million m^3) produced from the Eagle (active) and East Eagle (proposed) mines from 2014 until mine closure in 2023. The plan specifies spigot discharge locations, volumes added, storage capacity, and the resulting top of tailings over time.

2.1 Scope of Work

On June 16, 2016, Eagle retained Hatch to develop a new tailings deposition plan for the HTDF under *Amendment Number Five to Statement of Work 4500004836*. Hatch's proposal included a scope of work, schedule, budget and deliverables for the tailings deposition to complete the following task:

- Prepare of a geotechnical laboratory testing program to evaluate the geotechnical characteristics of the tailings slurry. The factual data would then be interpreted for input to, and validation of, the deposition model.
- Evaluate the existing deposition performance using bathymetric surveys and tailings production records.
- Develop a detailed deposition plan for the HTDF to contain life-of-mine tailings production of approximately 5 million metric tonnes of tailings from Eagle and East Eagle. The deposition plan includes operational guidance in the form of recommended slurry discharge locations and predicted deposit quantities at each location.

- Make recommendations for ongoing monitoring, surveying, and calibration of the deposition plan, to be refined as operating experience is gained with the plan.

The scope defined two deliverables: (a) Design Criteria, submitted to Eagle on August 3 (Hatch, 2016d); and (b) Tailings Deposition Plan with sketches of staged deposition, presented herein. This scope covered only the deposition of slurried tailings in the HTDF. Other aspects of tailings chemistry and the HTDF in general have been addressed elsewhere (see Section 3.2).

3. Previous Work

3.1 Design Criteria

Hatch submitted a Design Criteria for tailings deposition on August 3rd (Hatch, 2016d). This report:

- Described the methodology used to characterize tailings density and cone-slope angles from bathymetric surveys;
- Defined stage-storage relationships in the HTDF;
- Defined the volume of tailings that will be added to the HTDF over the mine life (2014-2023) using estimates of ore production from Eagle and East Eagle mines;
- Presented the deposition philosophy, the foundation for the deposition plan; and
- Provided a list of specific questions related to tailings placement and site capacity for Eagle to address.

The subaqueous tailings deposition method at the HTDF as adopted by Eagle offers a solution of storage and managing of the tailings geochemical characteristics. The geochemistry of the tailings, pit lake limnology, and water treatment aspects associated with the overall tailings management are presented in other reports and are excluded from the scope presented herein.

Hatch held a group discussion on August 12, 2016 with Eagle. This meeting answered all outstanding questions and led to the deposition plan presented here.

4. Tailings Characterization

4.1 Geotechnical Testing Program

As a component of the present study, Eagle collected two, 5-gallon buckets of tailings slurry from the thickener underflow in June 2016, and shipped the sample to a geotechnical laboratory to determine its geotechnical characteristics for input to the deposition model. Tests were carried out under the direction of Hatch by *SNC-Lavalin* at their soil laboratory facility in Saskatoon, Saskatchewan, Canada.

The test program entailed:

- Specific Gravity
- Particle Size Distribution
- Column Settling Tests
- Slurry Consolidation Test

The results of the geotechnical tests are provided in Appendix A. Detailed description of each of these tests and interpretation of the results are provided in the following sections.

4.1.1 Specific Gravity

The specific gravity of the tailings was determined using pycnometer in accordance with ASTM D854 standard procedure. The specific gravity (G_s) was determined to be 3.68. Although this value is high if compared to tailings from other ore types, it is consistent with the expected range of G_s values for tailings reported by Eagle of 3.5 to 4.0 (Travis Hansen, personal communication, 2015), and with G_s values of tailings reported for other Cu-ore tailings at the Kidd Creek Cu-Zn mine (3.1) and the Brunswick Pu-Zn-Cu mine (3.8 to 4.4) (Table 4-2). Generally, as the sulfide content of the ore increases, the specific gravity of the tailings also increases.

4.1.2 Particle Size Distribution

The particle size distribution of the tailings was determined using conventional sieve and hydrometer methods in accordance with ASTM D422 standard procedure. The sieving method was used to determine the coarse fraction (i.e., gravel and sand particle sizes larger than 74 μm), while the hydrometer method was used to determine the fines fraction (i.e., silt and clay particle sizes finer than 74 μm). The results of each method were combined to produce a complete particle size distribution curve that is representative of the whole sample tested.

The particle size distribution of the tailings is shown on Figure 4-1. The gradation indicates that the material consists of 50%wt sand, 49.4%wt silt and 0.6%wt clay size particles finer than 2 μm based on the ASTM D2487 soil classification (referred to as the Unified Soil Classification System, or USCS). Thus, the tailings sample can be interpreted as being relatively coarse with a uniform, well-sorted, poorly-graded grain-size distribution.

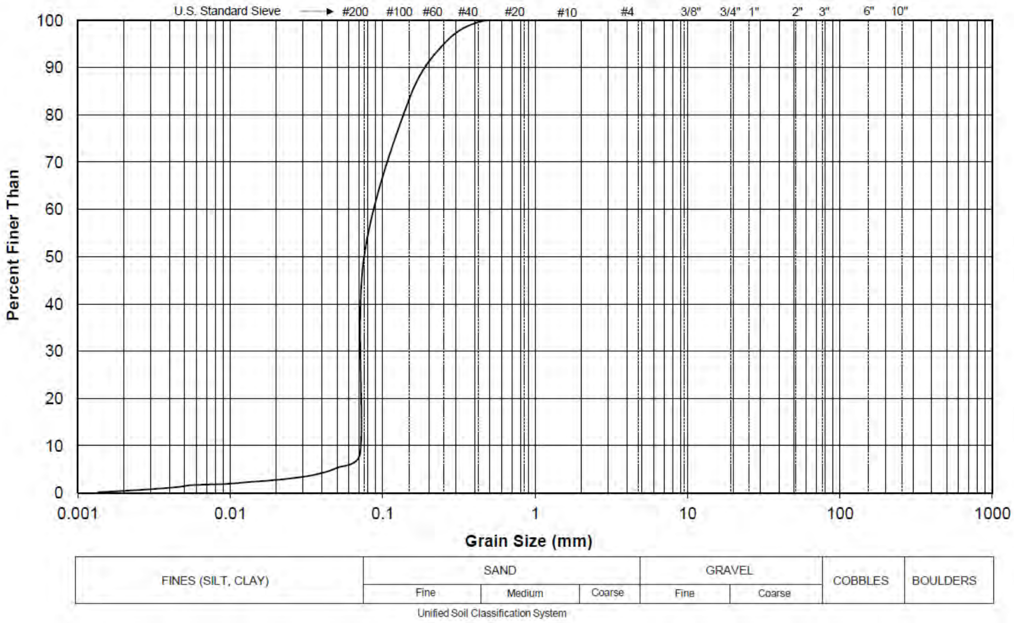


Figure 4-1: Grain Size Distribution of Tailings

4.1.3 *Column Settling Tests*

The aim of the one-dimensional, self-weight column settling tests was to estimate the following:

- Rate of density increase over time; and
- Estimate of final density after self-weight settling is complete.

This test does not have an ASTM procedure but instead follows an industry accepted one. In settling tests, the level of the settled solids is monitored over time, and the test is generally terminated when no further increase in settled density is occurring. This settled density is representative of a self-weight loading of the tailings.

The tailings sample was prepared to a slurry with a solids content (C_w) of 30% that corresponds to the current tailings discharge operation (Travis Hansen, personal communication, 2016). The self-weight settling tests were undertaken with the following conditions:

- Undrained Test – Bottom of the cylinder is sealed and the water remains constant while the solids settle by self-weight to the bottom of the cylinder. Thus, the settling environmental simulates a settling behavior in a subaqueous condition (deposit under water) much like the deposition in the HTDF.
- Drained Test – Bottom of the cylinder is allowed to freely drain (valve left open immediately after the sample is placed in the cylinder). Thus, this settling environment simulates a settling behavior in a subaerial condition (deposit above water) much like the

conventional tailings beach deposit above water in a surface impoundment. Although this scenario is not representative of the current deposit at the HTDF, it provides an upper range of settled density that can be achieved under self-weight with downward hydraulic flows.

The results of the settling tests are presented on Figure 4-2 and Figure 4-3 for undrained and drained column settling tests, respectively. The results indicate that the tailings material achieved settled dry density of 1.67 metric tonnes per cubic meter (t/m^3) for undrained condition (Figure 4-2) within about 22 minutes and 1.92 t/m^3 for drained condition within about 16 minutes (Figure 4=3).

For the undrained test, a void ratio (volume voids / volume solids) close to 1.21 was achieved at the above settled density.

These results suggest the coarseness of the tailings particles exhibit a rapid self-weight settling behavior.

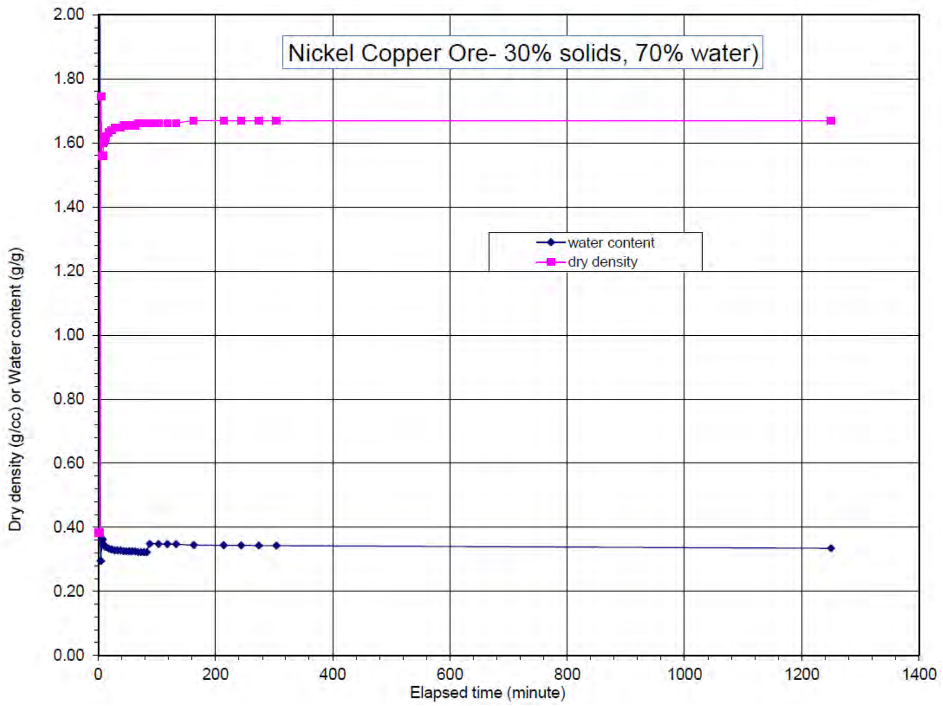


Figure 4-2: Dry density Histogram for Undrained Column Settling Test

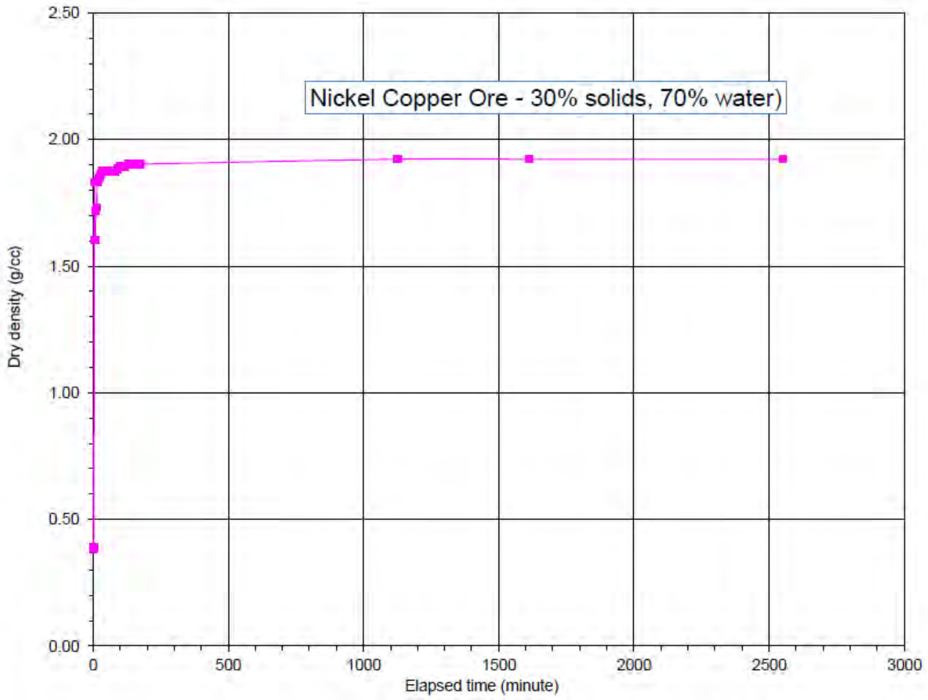


Figure 4-3: Density Histogram for Drained Column Settling Test

4.1.4 *Slurry Consolidation Test*

Consolidation refers to the increase in effective stress (through reduction in pore water pressure and/or increase in total stress) and density that occurs as the tailings are loaded. For tailings, this loading generally results from the self-weight of the placed tailings, as well as the placement of additional material on top of previously placed tailings. Consolidation behavior is therefore important in assessing the future, expected densities likely to be achieved within the HTDF.

This test adopts a specialized procedure using a custom, slurry consolidometer apparatus that measures the consolidation properties of a slurry sample. The consolidometer is a column with an inside diameter of 150 mm, equipped with a filter and drainage media at its base. Material is poured into the apparatus at the expected depositional solids concentration and typically allowed to settle overnight. Additional filter and drainage media are subsequently placed on the surface of the settled material. A mechanical counter-balanced loading system allows a precise, direct vertical stress to be applied to the sample. During this loading process, excess pore pressure drains from the top boundary of the sample. The vertical displacement and pore pressure at the base of the samples are monitored throughout the test. Constant back pressure can be maintained for the duration of the test, allowing direct measurement of hydraulic conductivity at end of each consolidated stage/state, without interfering with the equilibrium stress state that has developed in the consolidated sample.

Hence, a constant head permeability test is undertaken at the end of selected load stages to obtain estimates of hydraulic conductivity and its variation with representative depth.

The tailings sample was prepared to an initial solids content (C_w) of approximately 60% in the consolidation cell. Note, this is greater than the operation's solids content of the actual slurry because: (a) the 30% solids content would not settle-out enough solids to fill the consolidation cell and (b) 60% is closer to state where there is sufficient mass and consistency of sample in the cell to allow placement of a top filter plate and operate the consolidation cell.

The results of the slurry consolidation test are presented on Figure 4-4 (left graph) and in Appendix A. The void ratio (volume voids/volume solids; y-axis) decreases as the effective stress (x-axis) increases as a function of the loss in void volume. During unloading, the effective stress dropped from a maximum of 500 kPa to 0.5 kPa. This change in pressure had no impact on the void ratio, suggesting the rebound effect of the tailings is insignificant.

On Figure 4-4 (right graph) it is also shown the hydraulic conductivity of the tailings as a function of void ratio. Although the data is somewhat scattered, the general trend shows that higher void ratios correlate with higher hydraulic conductivities. This is a typical distribution, as tailings with a higher void ratio (i.e. more void space per sample) have higher permeability and higher hydraulic conductivity. These values were measured independently using a falling head test method performed on the sample at the end of the column drained test. The measured hydraulic conductivity was 1.8 x 10^{-6} m/s at settled void ratio of 0.91. This finding is consistent with the trend of hydraulic conductivity measurement from the consolidation test.

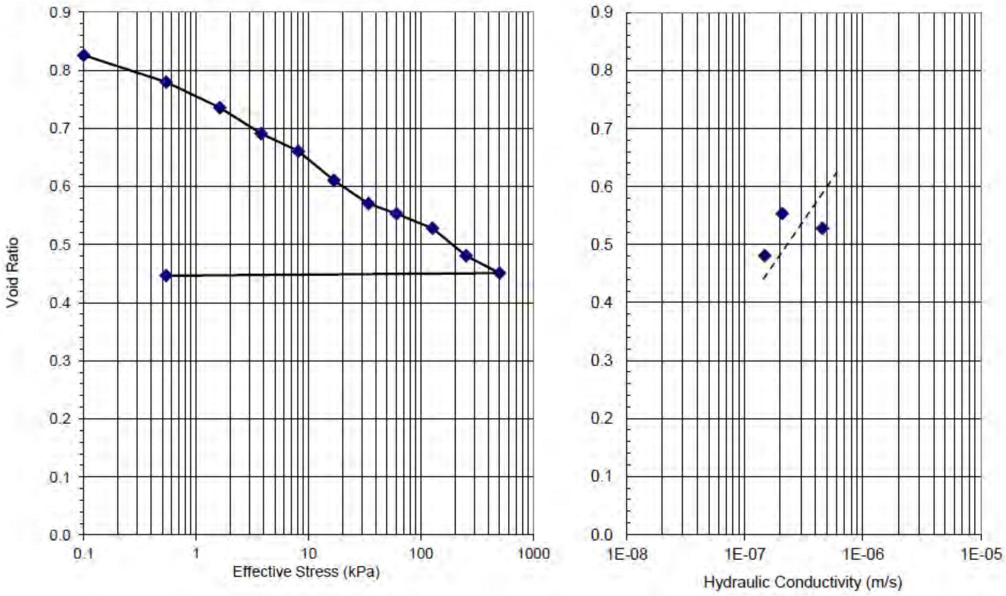


Figure 4-4: Slurry Consolidation Test Illustrating the Relationship of Effective Stress Load (left) and Hydraulic Conductivity versus Void Ratio (right)

4.2 Initial Deposit Density

For the purposes of the tailings deposition planning, the initial deposit density is assumed to be 1.6 t/m³. This value is consistent with a settled density of 1.67 t/m³ measured by the column settling test (Section 4.1.3) and with densities reported in other copper tailings (Table 4-2). Comparisons of bathymetric survey volume data and actual tailings tonnage deposited data provided by Eagle (see Figure 4-5, and Hatch, 2016b) show a slightly higher, average, observed density of 1.8 t/m³ (Table 4-1). To be conservative, Hatch elected to use the lowest calculated dry density because a smaller density number would produce a larger estimate of required tailings storage volume, according to the following equation:

$$\text{Volume Tailings } (m^3) = \text{Mass Tailings } (t) \div \text{Density } (t/m^3)$$

Table 4-1: Review of Bathymetric Survey Data and Tailings Discharge Tonnage (Hatch, 2016d)

Bathymetric Survey	Time Between Surveys	Cumulative Volume from Bathymetric Surveys	Cumulative Mass of Deposited Tailings	Estimated Dry Density of Deposited Tailings
Date	**Days**	**m³**	**Tonnes (metric)**	**Tonnes/m³**
Aug. 5, 2014	Baseline	0	0	0
Apr. 29, 2015	267	150,000	290,000	1.9
July 1, 2015	63	200,000	380,000	1.9
Sep. 28, 2015	89	320,000	510,000	1.6
Apr. 29, 2016	214	440,000	800,000	1.8
Total	633	440,000	800,000	Ave. = 1.8

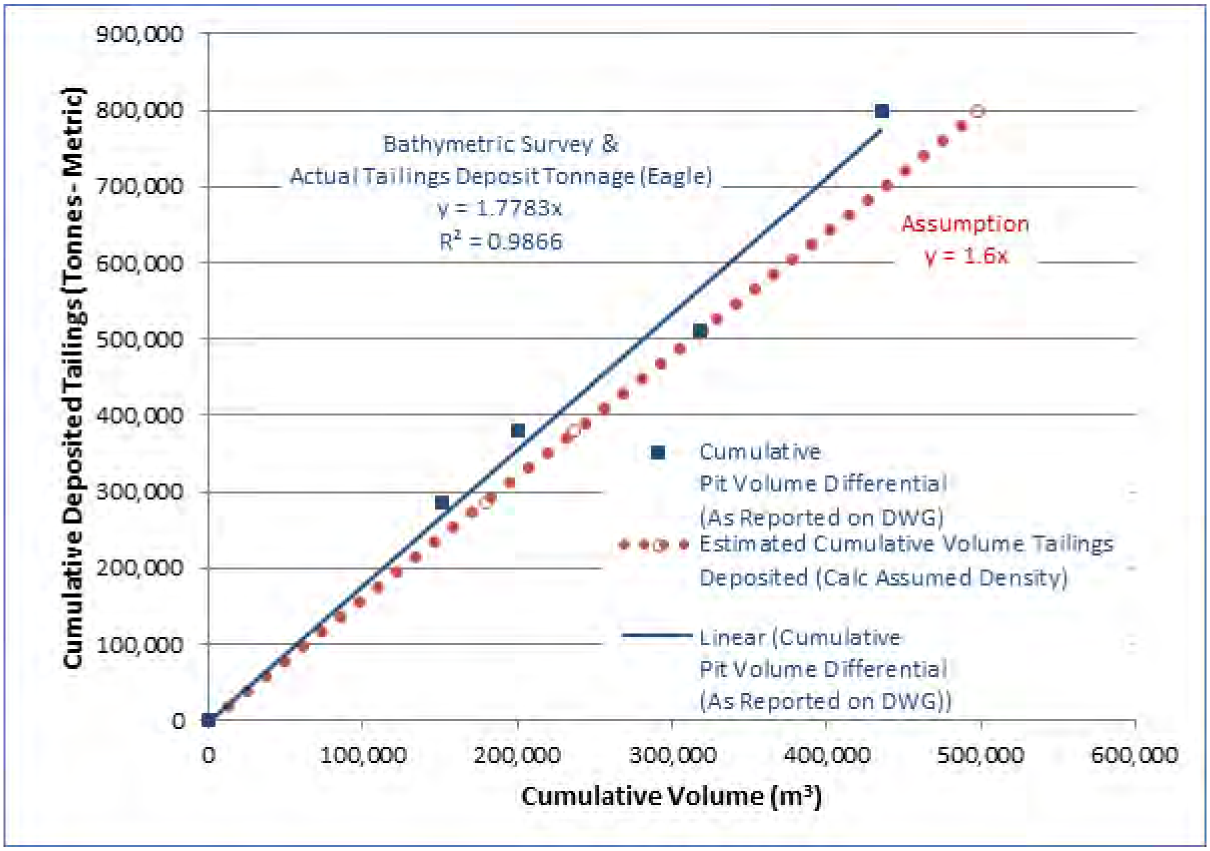


Figure 4-5: Estimate of Density of Deposited Tailings using Bathymetry and Actual Tailings Tonnge (Hatch, 2016d)

Table 4-2: Review of Published Densities of Copper Tailings (Hatch, 2016d)

Reference	Estimated Density of Tailings				Comments
Kidd Creek Copper-Zinc Mine (Timmins, Ontario)	1.7 t/m^3				Sub-aerial deposit Specific gravity 3.1
Vicks (1990): Planning, Design and Analysis of Tailings Dams	*Copper Tailings Fractions*	*Pcv*	*t/m^3*	*Average (t/m^3)*	Unknown deposition method Unknown tailings properties
	Sands fraction min.	93	1.49	1.63	
	Sands fraction max.	110	1.76		
	Slimes fraction min.	70	1.12	1.28	
	Slimes fraction max.	90	1.44		
Brunswick Lead-Zinc-Copper Mine (New Brunswick)	1.8 to 2.3 t/m^3 (avg. 2 t/m^3)				3.8 to 4.4 (avg. 4.1)

4.3 Ultimate Deposit Density

The results of the slurry consolidation test (Section 4.1.4) were used to estimate a weighted average density of the tailings deposit at the ultimate deposit elevation of 1475 m. This calculation assumed a long-term condition (roughly 50 years after the end of mine closure) where the deposited tailings had undergone full consolidation. The density of the tailings deposit at this ultimate consolidated state is estimated to be in the order of 2.3 t/m^3. Note that this ultimate density should not be applied for deposition modeling as it does not represent the state of tailings immediately following deposition from discharge spigots (i.e. short-term consolidation). The higher density in the ultimate consolidated state suggests that the tailings will settle and consolidate over time, and will gradually expel excess pore water into the bottom of the pit lake. As a result, the HTDF will become slightly deeper over time within the first 50 years of closure.

4.4 Estimate of Deposit Slope

The tailings deposition slope to be adopted for the study is 15%. The tailings deposit slope was estimated using the April 29, 2016 Bathymetric Survey (Figure 4-6). From northeast to southwest, there were three cone features evident in this bathymetric survey labeled Cone A, Cone B and Cone C, respectively. Each of the cones was reviewed to estimate a representative tailings deposit slope.

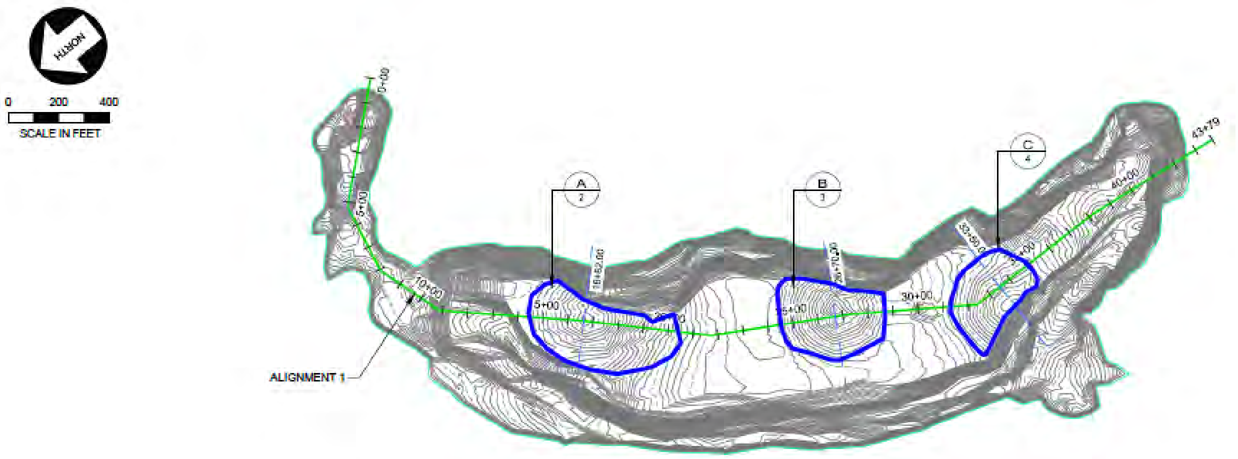


Figure 4-6: Bathymetry of the HTDF on April 29, 2016 Showing Locations of Three Deposit Cones

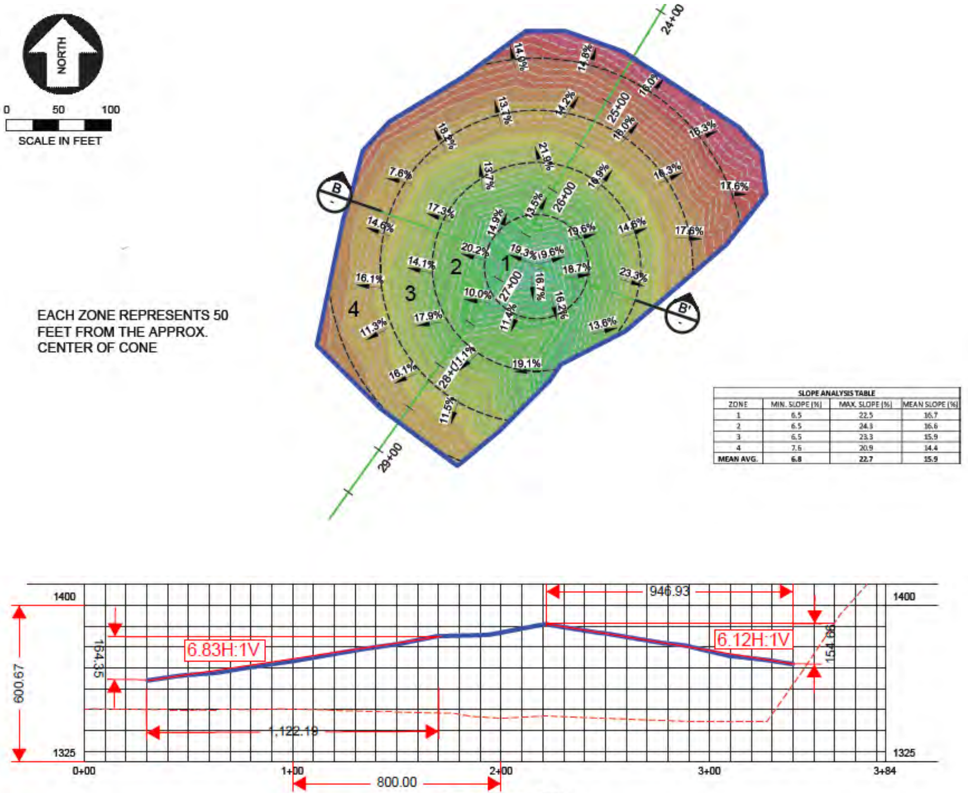
Hatch's analysis produced the following comments regarding the deposit slope evaluation. Data used in the slope analysis are provided in Table 4-3 and Figure 4-7:

- Cone A was influenced by the confines of the narrow pit area and its slope was not representative. Therefore, it was not considered in the evaluation.
- Cone B, and to a lesser extent, Cone C, were not confined by pit walls and thus were more representative for slope evaluation.

- In general, the observed slopes did not exhibit a concave geometry as occurs at above-water sub-aerial tailings sites where slurry flows experience particle size segregation.
- Actual deposit slopes of 12 to15% appear to be steeper than the typical underwater deposit slope of nickel-copper tailings. This may be due to the current slurry discharge practices being adopted and the coarseness of the tailings particles (50%wt sand content; Figure 4-7). It is understood that the slurry pipe is extended to depth (near the base of the pit, below ~180 feet of water) and slurry is allowed to end-discharge from the pipe opening until the tailings cone backs up and submerges the pipe outlet thereby creating a 'volcano' effect of tailings discharge. This may reduce the energy of discharge and thereby creating a cone with steeper slopes than normal. The discharge method should be reviewed and the beach slope should also be monitored by continued bathymetric surveys to confirm any changes to the deposit slope assumption.

Table 4-3: Estimation of Deposit Slopes (Hatch, 2016d)

	Cone Location B		Cone Location C	
	Slope	Grade (%)	Slope	Grade (%)
Section 1	6.83H:1V	14.6	7.96H:1V	12.6
Section 2	6.12H:1V	16.3	-	-
Average		15.5		12.6



SLOPE ANALYSIS TABLE			
ZONE	MIN. SLOPE (%)	MAX. SLOPE (%)	MEAN SLOPE (%)
1	6.5	22.5	16.7
2	6.5	24.3	16.6
3	6.5	23.3	15.9
4	7.6	20.9	14.4
MEAN AVG.	6.8	22.7	15.9

Figure 4-7: Example of Slope Estimation for Cone B

4.5 Tailings Storage Requirement

4.5.1 Mine Plan

The baseline reference date is April 29, 2016. All deposition modeling and planning is referenced to this date.

The mine tailings production plan for both Eagle and East Eagle mines was obtained from Eagle on July 7, 2016 (Table 4-4). Based on this plan, the total life-of-mine storage requirement is approximately 5 million tonnes which is equivalent to 3,130,000 m^3 at assumed deposited dry density of 1.6 t/m^3.

As of April 29, 2016, a total of 798,000 tonnes (~500,000 m^3 at 1.6 t/m^3 dry density) had already been deposited in the pit. Thus, the remaining life-of-mine storage requirement is 4,200,000 tonnes, or 2,630,000 m^3 at 1.6 t/m^3 density.

Table 4-4: Mine Tailings Production Plan

Time (Calendar Year)	Operating Time (days)	Annual Tailings Production (tonnes)*	Average Daily Production Rate (tonnes/day)	Annual Volume (m^3) Produced at assumed density of 1.6 t/m^3	Cumulative Volume Produced (m^3)
2014	152	135,866	894	85,000	85,000
2015	365	494,170	1354	310,000	400,000
2016	366	510,388	1395	320,000	720,000
2017	365	530,533	1454	330,000	1,000,000
2018	365	570,848	1564	360,000	1,400,000
2019	365	605,239	1658	380,000	1,800,000
2020	366	572,287	1564	360,000	2,100,000
2021	365	552,842	1515	350,000	2,500,000
2022	365	525,733	1440	330,000	2,800,000
2023	365	467,826	1282	290,000	3,100,000
Total = 9.5 years		5.0 million tonnes			3.1 million m^3

* Data provided in "LOM Budget with East Eagle (Travis Hansen, personal communication, July 7, 2016).

4.5.2 Storage Capacity

A stage storage relationship of the pit was developed based on April 29, 2016 Bathymetric Survey (Table 4-5 and Figure 4-8). This relationship provides the remaining volume available for tailings storage below any particular elevation within the pit assuming that tailings are deposited in uniform, horizontal layers. Depositing the remaining 2.6 million m^3 of tailings would raise the pit lake bottom to approximately 1455 ft amsl assuming 100% storage efficiency (Table 4-5). At 90% storage efficiency, 2.89 million m^3 would be required to store all remaining tailings, and the pit lake bottom would be approximately 1465 ft amsl. At 80% storage efficiency, 3.25 million m^3 would be required to store all remaining tailings, and the pit lake bottom would be approximately 1470 ft amsl. The Hatch deposition plan (presented below) recommends adding tailings below 1475 ft amsl and assumes a 74% storage efficiency (Table 4-5; Figure 4-7). Greater storage efficiency could be achieved by using a barge system to fill the trough created by tailings in the interior of the pit. However, this system is not require to achieve storage goals.

Table 4-5: Stage Storage Relationship Based on April 29, 2016 Bathymetric Survey

Elevation (Feet)	Cumulative Volume added after April 29, 2016 (m^3)	Elevation (Feet)	Cumulative Volume added after April 29, 2016 (m^3)
1,351	-	1,445	2,149,048
1,355	2,856	1,450	2,352,831
1,360	25,707	1,455	2,566,146
1,365	64,113	1,460	2,787,519
1,370	117,709	1,465	3,016,094
1,375	183,866	1,470	3,252,094
1,380	261,111	1,475	3,496,916
1,385	348,240	1,480	3,753,785
1,390	445,505	1,485	4,021,784
1,395	553,149	1,490	4,301,320
1,400	672,798	1,495	4,591,592
1,405	803,686	1,500	4,892,365
1,410	944,299	1,505	5,203,545
1,415	1,094,454	1,510	5,527,275
1,420	1,252,959	1,515	5,868,408
1,425	1,418,696	1,520	6,223,500
1,430	1,590,842	1,525	6,592,499
1,435	1,769,488	1,530	6,975,649
1,440	1,955,188	1,531	7,067,235

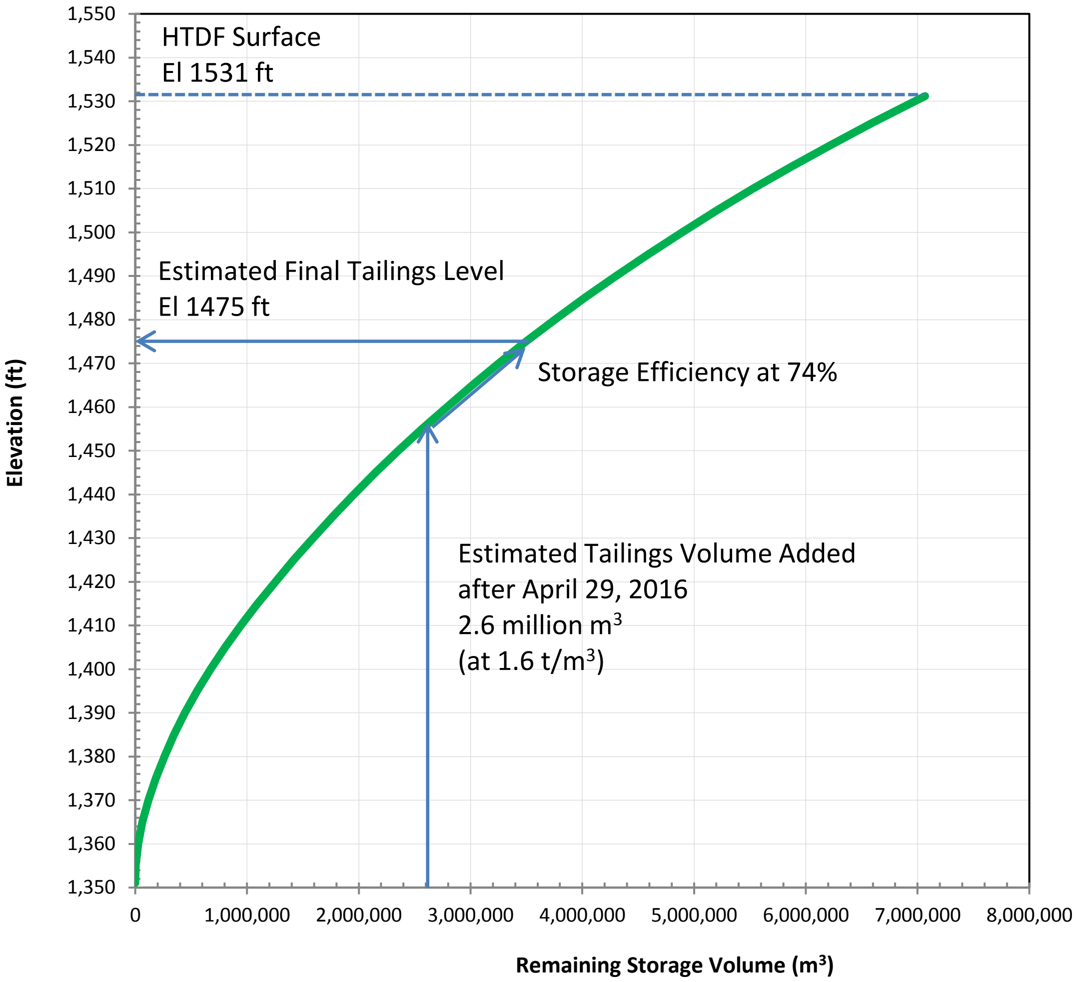


Figure 4-8: Stage Storage Relationship Based on April 29, 2016 Bathymetry

5. Tailings Deposition Plan

5.1 Basis

The basis /criteria for the development of a tailing deposition plan was presented in the document entitled, “Tailings Deposition Plan Design Criteria” (Hatch, 2016d). Table 5-1 summarizes the key tailings properties assumed in this plan.

Table 5-1: Summary of Characteristic Properties for Deposited Tailings

Property	Value	Source
Specific Gravity (G_s)	3.68	Measured Lab Test (Appendix A)
Discharge Slurry Solids Content (C_w)	30%	Eagle
Slurry Density in Pipe	1.3 t/m^3	Calculated
Settled Density of Deposit (ρ_d)	1.6 t/m^3	Hatch Interpretation Based on Assessment of Lab Tests and Bathymetric Survey Data (Section 4.2)
Average deposit slope for sub-aqueous depositional mode of the tailings slurry (S)	15%	Hatch Interpretation Based on Assessment of Bathymetric Survey Data (Section 4.3)
Stage 1 Deposit Elevation	1425 ft	Eagle
Surface Elevation of HTDF	1531 ft	Eagle

5.2 Deposition Philosophy

The philosophy for tailings deposition is as follows:

- The first deposition phase (Stage 1) will be defined by elevation of 1425 ft amsl. This is done to allow time for a permit amendment to be filed and approved by MDEQ (2015). For the purposes of the deposition modeling, this approval was assumed to occur in 2017.
- The second deposition phase (Stage 2) will place tailings above elevation 1425 ft amsl in order to store the remainder of the tailings to end of operation.
- Considering the geometric shape of the pit and the estimated deposit slope, primary discharge will be conducted from the pit perimeter. In discussion with Eagle, it is understood that the proposed discharge system will comprise the following:
    - Two (2) distribution pipelines installed along the western and eastern perimeter of the pit. Considering the ease of accessibility along the western perimeter of the pit, the western pipe will be constructed first. The distribution pipe will be suspended by cables from anchor blocks (jersey barriers) positioned along the shoreline. A similar distribution pipe will be installed on the eastern perimeter after the experience is gained from installing and operating the western pipe route. This distribution pipe will be suspended 10 ft above the pit lake surface (1531 ft amsl) to be above the pit lake high water mark and to avoid potential damage to spigot valves if submerged and/or frozen.

- Drop tailings spigot pipes downward from 1425 ft amsl instead of the current system of building “cones” from the floor of the pit upwards to 1425 ft amsl. This strategy could potentially:
    - Reduce the pressure in the injection line;
    - Avoid pipes becoming blocked or pinched by accumulated sediment;
    - Flatten the angle of the cones leading to greater storage; and
    - Change the orientation of fluid discharging at the end of the pipe from upward to downward, which might reduce upward mixing in the water column.
    - This would be achieved by fixing feeder pipes to the pit wall, as described above. Once pit fills to 1425 ft, new pipes would be installed.
- Spigot pipes with control valves will be positioned at approximately 100 ft intervals along the distribution pipe. Spigot pipe will be installed into the pit lake to a specified depth (first 1425 ft, later 1475 ft). Spigot pipes will be operated from boat access if required, and will be disconnected from the distribution pipe when not required (to prevent pulling forces on the distribution pipeline).
- Spacing between discharge locations will be optimized in order to maximize storage. Hatch has considered both a 100-foot spacing between cones and a 200-foot spacing between cones (Table 5-2). The tighter the spacing, the more material that can be stored below a given depth. However, tighter cone spacing also means that discharge pipes will need to be changed more frequently (Table 5-2).

Table 5-2: Sensitivity of Cone Spacing on Cone Duration and Storage Efficiency

	100 Ft Spacing (7.5 ft drop between cones) – Efficiency is about 5 ft loss in stage curve			200 Ft Spacing (15 ft drop between cones) - efficiency is 10 ft loss in stage curve		
Hypothetical Discharge Point	Volume of Cone (Cubic Yards)	Volume of Cone (m^3)	Duration of Cone Placement (days)	Volume of Cone (Cubic Yards)	Volume of Cone (m^3)	Duration of Cone Placement (days)
DP-03	332,486	254,204	276	332,486	254,204	276
DP-05	80,674	61,680	67	156,628	119,751	130
DP-06	34,405	26,305	29	63,972	48,910	53

5.3 Deposition Model

Depositional modeling was conducted utilizing the July 2016 bathymetric survey as the base surface as well as the design criteria and mine schedule as presented by Hatch (2016d), discussions between Hatch and Eagle on August 12, 2016, as well as tailings deposition best management practices.

Three-dimensional deposition models were developed utilizing the AutoDesk Civil 3D software package (2014 version).

Based on the deposition philosophy described in Section 5.2, the deposition sequence plan is presented in Table 5-3. This table provides the figure number in Appedix B, the season over which deposition occurs, a unique cone ID number, the Northing and Easting of the cone's location using the mine grid system, the final elevation of the cone at the end of the season, the final volume, the duration of injection, the incremental volume added, and the cumulative volume added.

Table 5-3: Staged Deposition Plan Schedule

Figure	Season	Cone ID	Northing* (ft)	Easting* (ft)	Elevation (ft)	Cone Volume (m^3)	Seasonal Tailings Volume (m^3)	Tailings Volume Deposited (cumulative m^3)
Initial Condition October 1, 2016								**570,000**
Figure 1	Cover Sheet							
Figure 2	Fall 2016	S-01 Partial	23866	19073	1409	53,000	53,000	623,000
Figure 3	Winter 2017	W-01	24183	19670	1413	136,000	136,000	759,000
Figure 4	May-July 2017	S-01	23866	19073	1425	72,000	73,000	832,000
Figure 5	July-December 2017	S-02 PARTIAL	23906	19023	1449	123,000	123,000	950,000
Figure 6	Winter 2018	W-02	23896	19561	1428	146,000	146,000	1,100,000
Figure 7	Summer 2018	S-02	23906	19023	1472	210,000	210,000	1,310,000
Figure 8	Winter 2019	W-03	23656	19336	1456	155,000	155,000	1,470,000
	Summer 2019	S-03	23825	18965	1475	42,000	224,000	1,690,000
		S-04	23739	18914	1475	37,000		
		S-05	23652	18864	1475	34,000		
		S-06	23560	18827	1475	35,000		
		S-07	23466	18793	1475	33,000		
		S-08	23367	18777	1475	32,000		
		S-09	23272	18746	1472	12,000		

Figure	Season	Cone ID	Northing* (ft)	Easting* (ft)	Elevation (ft)	Cone Volume (m^3)	Seasonal Tailings Volume (m^3)	Tailings Volume Deposited (cumulative m^3)
Figure 9	Winter 2020	W-04	23389	19180	1473	156,000	156,000	1,840,000
	Summer 2020	S-10	24688	19957	1474	211,000	211,000	2,060,000
Figure 10	Winter 2021	W-05	24050	19765	1454	142,000	142,000	2,200,000
	Summer 2021	S-11	24635	19872	1475	48,000	198,000	2,400,000
		S-12	24644	19773	1475	20,000		
		S-13	24588	19690	1475	36,000		
		S-14	24554	19596	1475	25,000		
		S-15	24511	19509	1475	20,000		
		S-16	24437	19441	1475	26,000		
		S-17	24360	19378	1475	23,000		
Figure 11	Winter 2022	W-06	23758	19648	1475	140,000	140,000	2,540,000
	Summer 2022	S-18	24281	19317	1475	17,000	189,000	2,730,000
		S-19	24208	19249	1475	11,000		
		S-20	24133	19183	1475	8,000		
		S-21	24049	19128	1475	6,000		
		S-22	23966	19073	1475	3,000		
		S-23	23174	18726	1475	17,000		
		S-24	23106	18800	1475	40,000		
		S-25	24428	20356	1475	59,000		
		S-26	24355	20289	1475	11,000		
		S-27	24304	20203	1475	15,000		

Figure	Season	Cone ID	Northing* (ft)	Easting* (ft)	Elevation (ft)	Cone Volume (m^3)	Seasonal Tailings Volume (m^3)	Tailings Volume Deposited (cumulative m^3)
Figure 12	Winter 2023	W-07	22859	19122	1475	124,000	124,000	2,850,000
	Summer 2023	S-28	24247	20120	1475	16,000	177,000	3,030,000
		S-29	24174	20052	1475	12,000		
		S-30	24102	19983	1475	13,000		
		S-31	24003	19969	1475	6,000		
		S-32	23903	19962	1475	5,000		
		S-33	23808	19932	1475	3,000		
		S-34	23643	19775	1475	4,000		
		S-35	23587	19692	1475	9,000		
		S-36	23516	19621	1475	10,000		
		S-37	23450	19547	1475	7,000		
		S-38	23402	19459	1475	10,000		
		S-39	23322	19399	1475	12,000		
		S-40	23222	19397	1475	10,000		
		S-41	23023	19379	1475	9,000		
		S-42	22935	19332	1475	3,000		
		S-43	22784	19220	1475	8,000		
		S-44	22688	19228	1475	14,000		
		S-45	23007	18790	1475	3,000		
		S-46	22910	18816	1475	5,000		
		S-47	22765	18819	1475	11,000		
		S-48	22667	18800	1475	8,000		

* Coordinates system defined by HTDF mine grid.

The first side-wall injection cone (S-01) begins in October 2016, after the completion of infrastructure, during the summer (S) season (Appendix B, Figure 2). This cone is placed on the western wall of the HTDF north of the pump house. Injection occurs for two months prior to the onset of pit lake ice during the winter (W) season.

During the winter season (December-April), a different cone (W-01) is deposited in the interior of the HTDF using the old deposition strategy (2014-present) (Appendix B, Figure 3).

In May 2017 (S), side-wall injection recommences at the first cone until it achieves a top elevation of 1425 ft by July (Appendix B, Figure 4). At that time, the injection point is shifted and a second side-wall cone (S-02) is deposited through November (Appendix B, Figure 5). We assume that by the time injection begins on cone S-02, Eagle has received an amended permit..

The second winter deposition cone (W-02) begins in December 2017 and concludes in April 2018 (Appendix B, Figure 6). This cone is deposited in the interior of the pit lake using the old deposition strategy.

Because the second side cone occupies the most volume, deposition from May through November 2018 occurs at the same location (S-02) as November 2017 (Appendix B, Figure 7). By this time, Eagle staff will be well acquainted with side-wall deposition methods, and will have verified the predictions used in this model.

The third winter deposition cone (W-03) begins in December 2018 and concludes in April 2019 (Appendix B, Figure 8). This cone is deposited in the interior of the pit lake using the old deposition strategy.

By April 2019, enough tailings have accumulated at the second cone location (S-02) that it rapidly achieves its Stage 2 elevation of 1475 ft. Thereafter, cones are filling along the western side of the pit lake moving south in rapid succession, as these cones have smaller volume and take less time to achieve their maximum elevation (Figure 8).

Figures 9 through 12 in Appendix B show the continued deposition during summer and winter seasons through the conclusion of the mine life in 2023. In general, the summer season is used to build cones from the side walls towards the interior, whereas the winter is used to fill the trough that develops in the interior of the pit lake. The position of cones will need to be reassessed annually as a result of new data and actual tailings production rates. On account of decreasing volume, the duration of some side cones generally becomes shorter as time progresses with a minimum duration of 3 days achieved in 2023. This means the operations or tailings line crew will be increasingly busy (turning on and off spigot lines) as the mine life comes to an end.

6. Ultimate Storage Capacity of the HTDF

In addition to the current projected tailing volume requiring disposal (3.1 million m^3 over the life of mine), Eagle requested the maximum volume of tailings which could be stored in the HTDF. Two final tailings elevations were considered in this analysis, 1528 ft amsl and 1515 ft amsl, which correspond to depths of 3 and 16 feet below the current water surface of 1531 ft. Using the stage-storage relationship from the April 29, 2016, we determined the remaining volume in the pit below each elevation, and added the volume of tailings stored in the pit as of that date, in order to calculate the total storage capacity of the pit below these elevations. The resulting volume is associated with a 100% storage efficiency. We calculated the tailings volume to be added associated with storage efficiencies of 90%, 80%, and 75%. Results are shown in Table 6-1. Under the poorest storage efficiency considered (75%) the HTDF has the capacity to store 5.5 million m^3 of tailings below a 3 foot water cap. This is 2.4 million m^3 more tailings than currently will be added to the pit lake, or an additional 3.8 million tonnes of ore with a settled density of 1.6 t/m^3. However, Hatch does not recommend adding tailings above 1515 ft amsl in order to avoid overtopping the sill which separates the main basin from the northeast basin where water is removed for the water treatment plant. This approach will allow the northeast basin to be used as a settling basin before water treatment.

Table 6-1: Ultimate Storage Capacity of the HTDF

		Potential Tailings Volume that can be added to the HTDF based on Storage Efficiency (%)			
Final top of tailings	**Depth below water surface (1531 ft amsl)**	**100% Efficiency**	**90% Efficiency**	**80% Efficiency**	**75% Efficiency**
ft amsl	ft	million m^3	million m^3	million m^3	million m^3
1528	3	7.3	6.6	5.8	5.5
1515	16	6.4	5.8	5.1	4.8

7. Recommendations

- In advance of the next bathymetric survey, a dialog should occur between Hatch and TriMedia, the contractor conducting bathymetric survey. The agenda should address field techniques that can be employed to minimize noise in the survey data and to focus measurements around active deposition locations. Other topics should include:
  - The steep pit wall may cause reflections/interferences that affect on the depth measurement and thereby reduce the level of accuracy at the pit walls. This may lead to errors in the HTDF storage calculation.
  - If possible, future bathymetric surveys should carry out a calibration by a physical measurement using string and weight to validate readings from the depth sounding instrument.
- Eagle should obtain their own depth sounding equipment, such as a sonar or depth finder used in scuba diving, which will allow more frequent measurements of cone development and consolidation in between TriMedia bathymetric surveys.

- The conservative settled tailings dry density used in this study (1.6 t/m^3) means that the actual depth of deposited tailings will be slightly deeper the depths presented herein, and the duration of spigot locations will be slightly longer than predicted. Eagle should monitor tailings depths over time in order to maximize spigot times and more accurately estimate long-term consolidation rates.
- Hatch should regularly update the projected deposition model based on actual tailings production rates, actual cone locations and depths, and experience gained by Eagle during side-wall deposition.
- The HTDF Operations Manual should be updated based on this plan, and the Operations staff should be appraised of this plan.

8. References

Hatch, 2016a. Design Criteria: Tailings Deposition Plan Design Criteria. Hatch Document No. H349392-00000-22A-210-0001. Submitted to Eagle on August 3, 2016 by Hatch, Lakewood, Colorado.

MDEQ, 2015. Authorization to discharge under the National Pollutant Discharge Elimination System. Permit No. MI0058649. State of Michigan, Department of Environmental Quality. Issued April 7, 2016.

Appendix A
Laboratory Test Results

ASTM D854

SNC·LAVALIN

SPECIFIC GRAVITY TEST (FINE MATERIAL)

Client: Lundin Mining
Project: Slurry Consolidation Testing
Project #: 639834
Technician: MC
Date: 2016/07/19

Sample: Nickel Copper Ore

PYCNOMETER DATA:

Pycnometer #: P3
Mass of pycnometer empty & dry (g): 199.03
Mass of pycnometer with water (g): 697.39
Temperature (^{o}C): 22

PRE-TEST SAMPLE INFORMATION:

Water Content (wet sample):

Tare #: ZAP-5
Tare Mass (g): 31.15
Wet sample + tare (g): 107.75
Dry sample + tare (g): 107.49
Dry sample (g): 76.34
Water Content (%): 0.34

Wet weight (g): 50.070
Calc. Dry Weight (g): 49.900

POST-TEST INFORMATION:

Mass of pycnometer, water, & sample (g): 733.41
Temperature (^{o}C): 24.8
Mass of dry sample (g): 49.90

CERTIFIED BY CCIL

Specific gravity: 3.681

Comments:

Version 14 - April 13 2016

PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis

Sieve	Diameter (mm)	% Finer
3"	76.2	100
2"	50.8	100
1"	25.4	100
3/4"	19.1	100
3/8"	9.5	100
# 4	4.75	100
# 10	2.00	100
# 20	0.850	100
# 40	0.425	100
# 60	0.250	95
# 100	0.150	84
# 200	0.075	50

Hydrometer Analysis

Dispersing agent:
Sodium Hexametaphosphate

Dosage of dispersing agent:
40 g/L

Diameter (mm)	% Finer
0.0710	8.5
0.0507	5.4
0.0361	3.9
0.0256	3.2
0.0181	2.7
0.0133	2.3
0.0094	1.9
0.0056	1.7
0.0047	1.3
0.0033	0.9
0.0024	0.6
0.0014	0.2

SNC·LAVALIN

Client:	Lundin Mining
Project:	Slurry Consolidation Testing
Project #:	639834
Sample:	Nickle Copper Ore - Sample 1
Date:	26-Jul-16

Particle Size Distribution Summary

% GRAVEL	
% SAND	50
% SILT SIZE (<75μm>5μm)	48.5
% CLAY SIZE (<5μm)	1.5

Comments:

Ver 4 Jan 20 2016

CERTIFIED BY CCiL

FINES (SILT, CLAY)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Unified Soil Classification System

The testing services reported here have been performed in accordance with accepted local industry standards.

The results presented are for the sole use of the designated client only.

This report constitutes a testing service only. It does not represent any interpretation or opinion regarding specification compliance or material suitability.

Engineering interpretation will be provided by SNC-Lavalin upon request.

SNC • LAVALIN

UNDRAINED SETTLING TEST

Client: Lundin Mining
Project:
Job No: 639834
Tech: MC/JA Date: 27-Jul-16

Sample: Nickel Copper Ore

INITIAL PARAMETERS

a.	Cylinder (Tare) Weight =	221.10	g	d. Moisture Content (from drying test) =	**0.1**	%
b.	Initial Slurry Volume =	1000	ml	e. Initial Slurry Bulk Density =	1.28	g/cm³
c.	Tare + Initial Slurry Weight =	1499.97	g	f. Weight of water added =	895.21	g
	Minutes until first reading	1		g. Weight of Solids with 0.13% wc=	384.38	g

On-going Readings

			A.	B.	C.	D.	E.	F.	G.	H.
	Date of Reading	Time of Reading	Total Cylinder Weight (g)	Total Cylinder Volume (ml)	Settled Slurry Volume (ml)	Water Recovery (%)	Volume Reduction of Solids (%)	Slurry Bulk Density (g/cm³)	Slurry Dry Density (g/cm³)	Moisture Content (%)
1	26-Jul-16	11:15	1499.97	1000	1000.0	0.00	0.00	1.28	0.38	233%
2	26-Jul-16	11:16	1499.96	1000	1000.0	0.00	0.00	1.28	0.38	233%
3	26-Jul-16	11:17	1498.95	1000	999.0	0.00	0.00	1.28	0.38	232%
4	26-Jul-16	11:18	1498.92	1000	220.0	0.87	0.78	2.26	1.74	30%
5	26-Jul-16	11:19	1498.90	1000	220.0	0.87	0.78	2.26	1.74	30%
6	26-Jul-16	11:20	1498.89	1000	246.0	0.84	0.75	2.13	1.56	36%
7	26-Jul-16	11:21	1498.85	1000	246.0	0.84	0.75	2.13	1.56	36%
8	26-Jul-16	11:22	1498.83	1000	246.0	0.84	0.75	2.13	1.56	36%
9	26-Jul-16	11:23	1498.82	1000	240.0	0.85	0.76	2.16	1.60	35%
10	26-Jul-16	11:24	1498.80	1000	239.0	0.85	0.76	2.16	1.61	34%
11	26-Jul-16	11:25	1498.79	1000	238.0	0.85	0.76	2.17	1.61	34%
12	26-Jul-16	11:26	1498.78	1000	237.0	0.85	0.76	2.17	1.62	34%
13	26-Jul-16	11:27	1498.76	1000	237.0	0.85	0.76	2.17	1.62	34%
14	26-Jul-16	11:32	1498.71	1000	235.0	0.85	0.77	2.18	1.63	33%
15	26-Jul-16	11:37	1498.66	1000	234.0	0.86	0.77	2.19	1.64	33%
16	26-Jul-16	11:42	1498.62	1000	233.0	0.86	0.77	2.19	1.65	33%
17	26-Jul-16	11:47	1498.59	1000	233.0	0.86	0.77	2.19	1.65	33%
18	26-Jul-16	11:52	1498.56	1000	233.0	0.86	0.77	2.19	1.65	33%
19	26-Jul-16	11:57	1498.53	1000	232.0	0.86	0.77	2.20	1.65	33%
20	26-Jul-16	12:02	1498.50	1000	232.0	0.86	0.77	2.20	1.65	33%
21	26-Jul-16	12:07	1498.48	1000	232.0	0.86	0.77	2.20	1.65	33%
22	26-Jul-16	12:12	1498.46	1000	232.0	0.86	0.77	2.20	1.65	33%
23	26-Jul-16	12:17	1498.43	1000	232.0	0.86	0.77	2.20	1.65	33%
24	26-Jul-16	12:22	1498.42	1000	231.0	0.86	0.77	2.20	1.66	32%
25	26-Jul-16	12:27	1498.40	1000	231.0	0.86	0.77	2.20	1.66	32%
26	26-Jul-16	12:32	1498.37	1000	231.0	0.86	0.77	2.20	1.66	32%
27	26-Jul-16	12:37	1498.35	1000	231.0	0.86	0.77	2.20	1.66	32%
28	26-Jul-16	12:42	1498.31	990	231.0	0.85	0.77	2.24	1.66	35%
29	26-Jul-16	12:57	1498.20	990	231.0	0.85	0.77	2.24	1.66	35%
30	26-Jul-16	13:12	1498.16	990	231.0	0.85	0.77	2.24	1.66	35%
31	26-Jul-16	13:27	1498.10	990	231.0	0.85	0.77	2.24	1.66	35%

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UNDRAINED SETTLING TEST

Client: Lundin Mining
Project:
Job No: 639834
Tech: MC/JA Date: 27-Jul-16

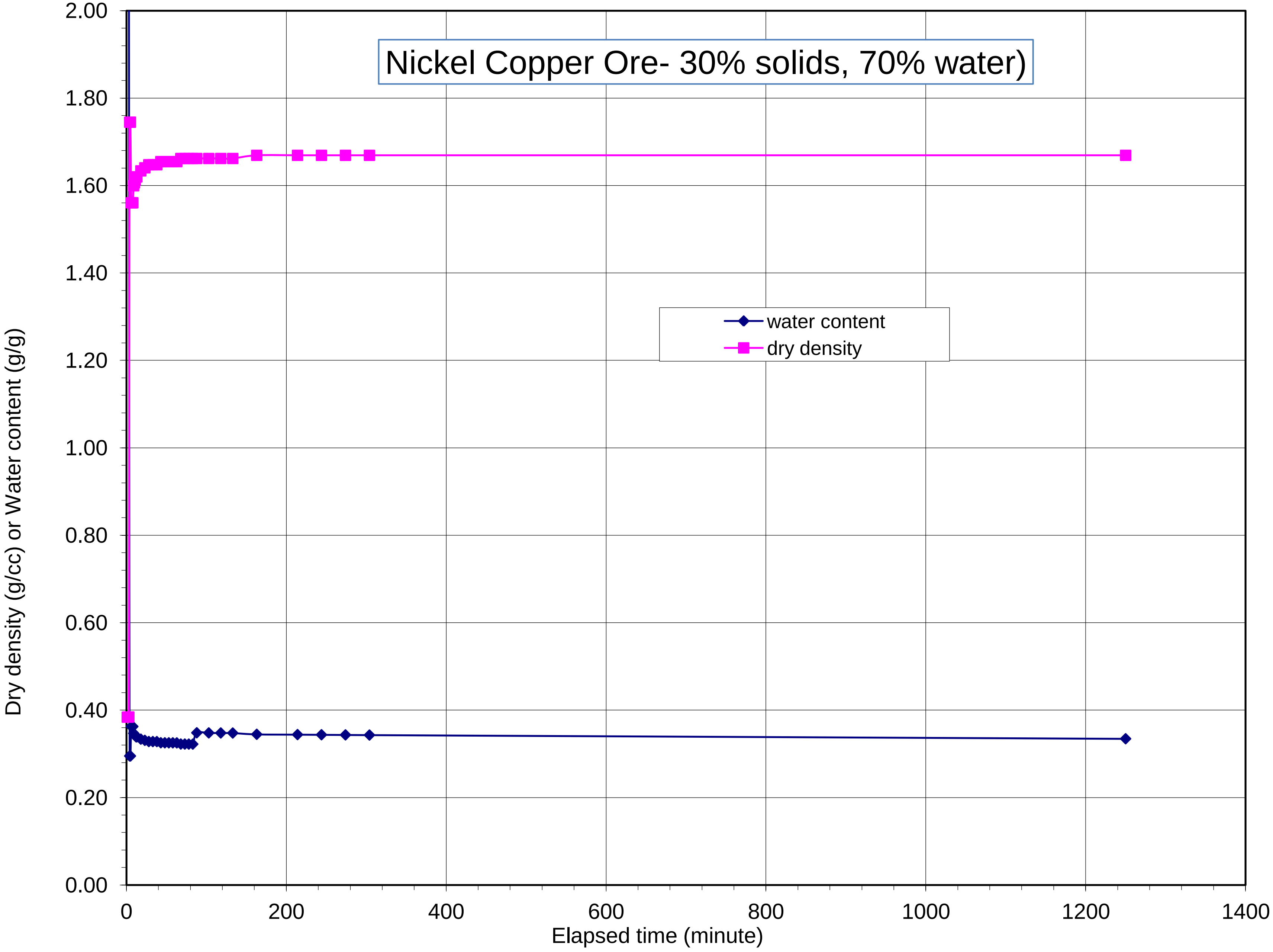
Sample: Nickel Copper Ore

INITIAL PARAMETERS

a. Cylinder (Tare) Weight =	221.10	g	d. Moisture Content (from drying test) =	**0.1**	%
b. Initial Slurry Volume =	1000	ml	e. Initial Slurry Bulk Density =	1.28	g/cm³
c. Tare + Initial Slurry Weight =	1499.97	g	f. Weight of water added =	895.21	g
Minutes until first reading	1		g. Weight of Solids with 0.13% wc=	384.38	g

On-going Readings

			A.	B.	C.	D.	E.	F.	G.	H.
	Date of Reading	Time of Reading	Total Cylinder Weight (g)	Total Cylinder Volume (ml)	Settled Slurry Volume (ml)	Water Recovery (%)	Volume Reduction of Solids (%)	Slurry Bulk Density (g/cm³)	Slurry Dry Density (g/cm³)	Moisture Content (%)
32	26-Jul-16	13:57	1497.96	990	230.0	0.85	0.77	2.25	1.67	34%
33	26-Jul-16	14:48	1497.73	990	230.0	0.85	0.77	2.25	1.67	34%
34	26-Jul-16	15:18	1497.59	990	230.0	0.85	0.77	2.25	1.67	34%
35	26-Jul-16	15:48	1497.46	990	230.0	0.85	0.77	2.25	1.67	34%
36	26-Jul-16	16:18	1497.33	990	230.0	0.85	0.77	2.24	1.67	34%
37	27-Jul-16	8:04	1494.06	990	230.0	0.85	0.77	2.23	1.67	33%


Nickel Copper Ore- 30% solids, 70% water)
water content
dry density
Dry density (g/cc) or Water content (g/g)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
200
400
600
800
1000
1200
1400
Elapsed time (minute)

SNC·LAVALIN

DRAINED SETTLING TEST

Client: Lundin Mining
Project:
Job No: 639734
Tech: MC/JA Date: 26-Jul-16

Sample: Nickel Copper Ore (30%-Solid, 70%-Water)

INITIAL PARAMETERS 2

a. Cylinder (Tare) Weight =	227.02	g	d. Moisture Content (from drying test) =	**0.1**	%
b. Initial Slurry Volume =	1000.00	ml	e. Initial Slurry Bulk Density =	1.28	g/cm^3
c. Tare + Initial Slurry Weight =	1504.28	g	f. Weight of water added	895.21	g
Minutes until first reading	1		g. Weight of Solids with 0.13% wc=	384.38	g

On-going Readings

	Date of Reading	Time of Reading	Elapsed time t (minutes)	Total Cylinder Weight (before decant) (g)	Total Cylinder Volume (ml)	Settled Slurry Volume (ml)	Cumulative Drainage Volume Collected (ml)	Decanted Water Volume (ml)	Slurry Bulk Density (g/cm^3)	Slurry Dry Density (g/cm^3)
1	26-Jul-16	13:17	1	1484.00	1000	1000	60	0	1.26	0.38
2	26-Jul-16	13:19	3	1472.50	990	990	71	0	1.26	0.39
3	26-Jul-16	13:21	5	1466.33	965	210	76	0	2.31	1.83
4	26-Jul-16	13:23	7	1469.83	960	240	81	0	2.18	1.60
5	26-Jul-16	13:26	10	1454.72	950	224	89	0	2.24	1.72
6	26-Jul-16	13:29	13	1448.56	948	222	96	0	2.23	1.73
7	26-Jul-16	13:32	16	1447.78	940	210	102	0	2.34	1.83
8	26-Jul-16	13:37	21	1433.20	930	208	112	0	2.33	1.85
9	26-Jul-16	13:42	26	1424.07	920	207	121	0	2.34	1.86
10	26-Jul-16	13:47	31	1415.43	910	206	130	0	2.35	1.87
11	26-Jul-16	13:52	36	1406.95	905	205	139	0	2.34	1.88
12	26-Jul-16	13:57	41	1399.56	900	205	147	0	2.33	1.88
13	26-Jul-16	14:02	46	1392.01	890	205	156	0	2.34	1.88
14	26-Jul-16	14:07	51	1383.88	880	205	165	0	2.35	1.88
15	26-Jul-16	14:12	56	1377.73	875	205	172	0	2.34	1.88
16	26-Jul-16	14:17	61	1371.08	870	205	179	0	2.34	1.88
17	26-Jul-16	14:27	71	1355.67	852	205	195	0	2.35	1.88
18	26-Jul-16	14:37	81	1340.65	840	205	210	0	2.33	1.88
19	26-Jul-16	14:47	91	1326.26	824	204	224	0	2.35	1.88
20	26-Jul-16	14:57	101	1312.20	818	203	238	0	2.32	1.89
21	26-Jul-16	15:12	116	1291.51	790	203	259	0	2.35	1.89
22	26-Jul-16	15:27	131	1271.72	775	202	279	0	2.34	1.90
23	26-Jul-16	15:42	146	1250.75	750	202	300	0	2.36	1.90
24	26-Jul-16	15:57	161	1232.54	730	202	318	0	2.36	1.90
25	26-Jul-16	16:12	176	1214.72	710	202	336	0	2.37	1.90
26	27-Jul-16	8:02	1126	703.87	200	200	896	0	2.38	1.92
27	27-Jul-16	16:09	1613	702.46	200	200	897	0	2.38	1.92
28	28-Jul-16	7:48	2552	702.32	200	200	897	0	2.38	1.92
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										

SNC·LAVALIN

DRAINED SETTLING TEST

Client: Lundin Mining
Project:
Job No: 639734
Tech: MC/JA Date: 26-Jul-16

Sample: Nickel Copper Ore (30%-Solid, 70%-Water)

INITIAL PARAMETERS 2

a. Cylinder (Tare) Weight =	227.02	g	d. Moisture Content (from drying test) =	**0.1**	%
b. Initial Slurry Volume =	1000.00	ml	e. Initial Slurry Bulk Density =	1.28	g/cm³
c. Tare + Initial Slurry Weight =	1504.28	g	f. Weight of water added	895.21	g
Minutes until first reading	1		g. Weight of Solids with 0.13% wc=	384.38	g

On-going Readings

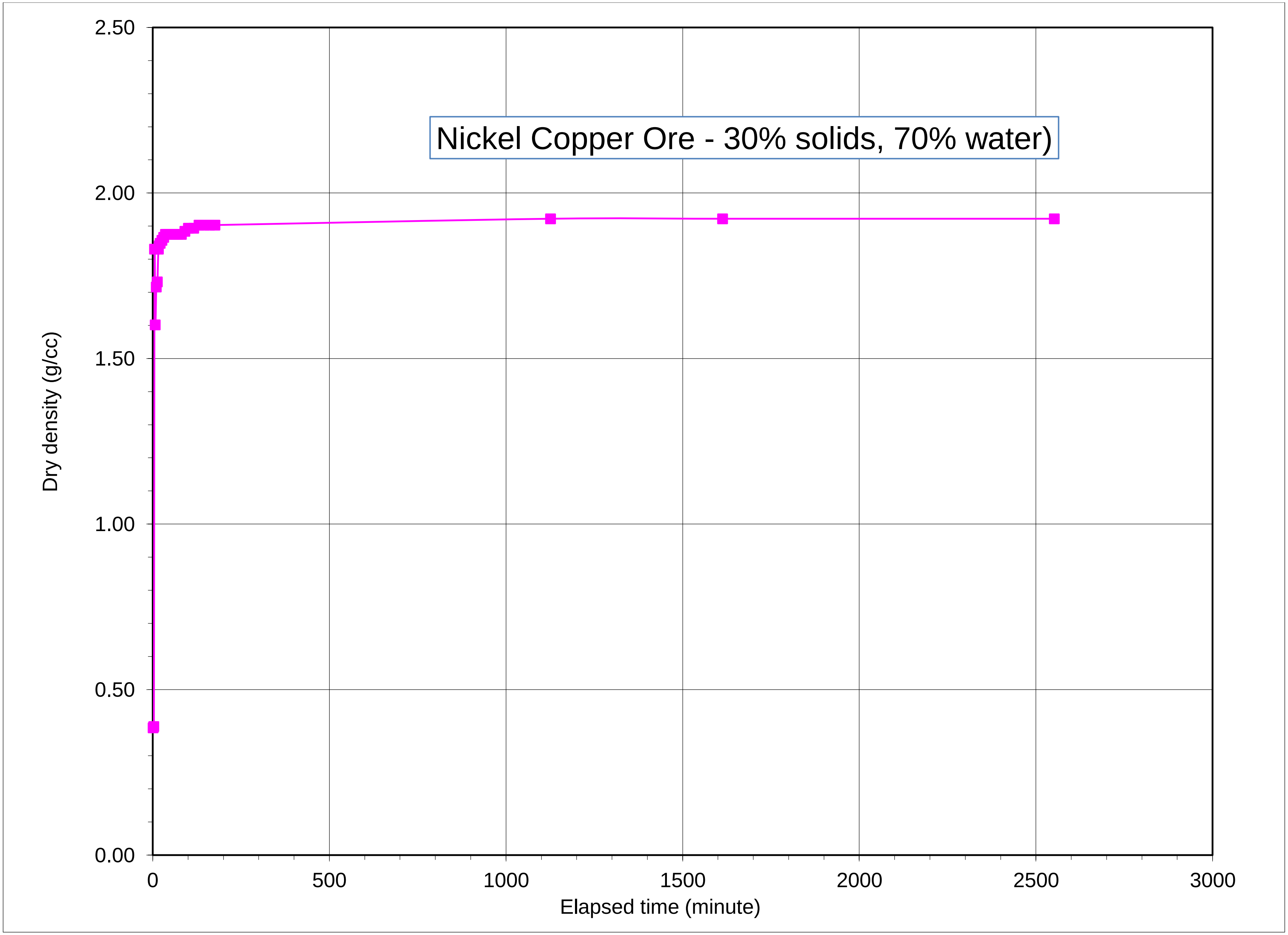
	Date of Reading	Time of Reading	Elapsed time t (minutes)	Total Cylinder Weight (before decant) (g)	Total Cylinder Volume (ml)	Settled Slurry Volume (ml)	Cumulative Drainage Volume Collected (ml)	Decanted Water Volume (ml)	Slurry Bulk Density (g/cm³)	Slurry Dry Density (g/cm³)

Falling Head Test

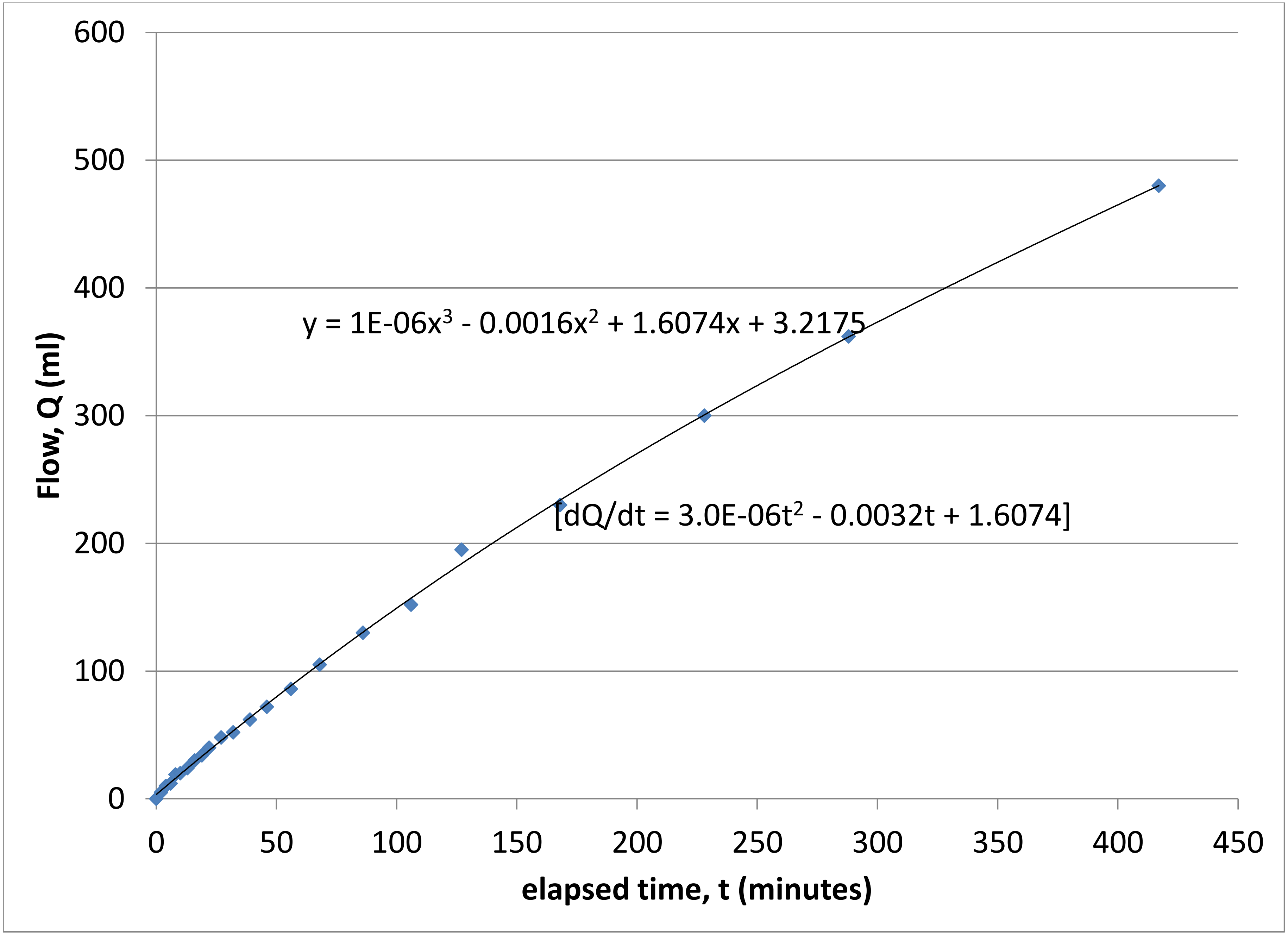
diameter of cylinder, mm = 60.0

cross-sectional area of buret (a) & sample (A), a = A, (cm2 28.3

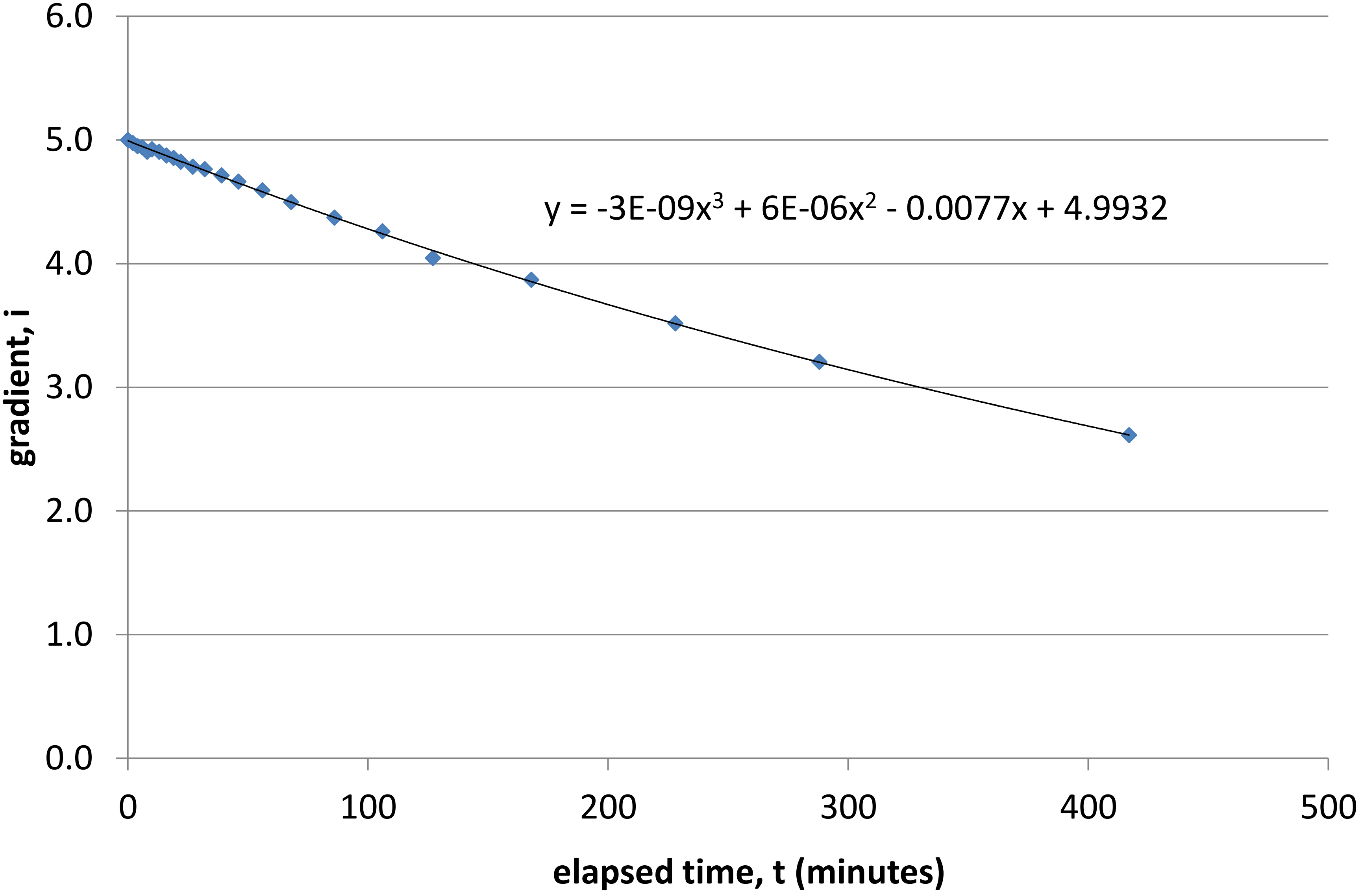
	Date of Reading	Time of Reading	Time elapsed t (minutes)	Total Cylinder Volume reading (ml)	Height of water surface, h (mm)	Settled Slurry Volume (ml)	Height of slurry, l (mm)	flow volume (ml)	flow gradient i = h/l	calculated K (see notes below) m/s
1	28-Jul-16	08:15 AM	0	1000	356	200	71	0	5.00	1.90E-06
2	28-Jul-16	08:17 AM	2	995	354	200	71	5	4.98	1.90E-06
3	28-Jul-16	08:19 AM	4	990	352	200	71	10	4.95	1.89E-06
4	28-Jul-16	08:21 AM	6	988	351	200	71	12	4.94	1.89E-06
5	28-Jul-16	08:23 AM	8	981	349	200	71	19	4.91	1.89E-06
6	28-Jul-16	08:25 AM	10	980	348	199	71	20	4.92	1.89E-06
7	28-Jul-16	08:28 AM	13	976	347	199	71	24	4.90	1.89E-06
8	28-Jul-16	08:31 AM	16	970	345	199	71	30	4.87	1.88E-06
9	28-Jul-16	08:34 AM	19	966	343	199	71	34	4.85	1.88E-06
10	28-Jul-16	08:37 AM	22	960	341	199	71	40	4.82	1.88E-06
11	28-Jul-16	08:42 AM	27	952	338	199	71	48	4.78	1.87E-06
12	28-Jul-16	08:47 AM	32	948	337	199	71	52	4.76	1.87E-06
13	28-Jul-16	08:54 AM	39	938	334	199	71	62	4.71	1.86E-06
14	28-Jul-16	09:01 AM	46	928	330	199	71	72	4.66	1.86E-06
15	28-Jul-16	09:11 AM	56	914	325	199	71	86	4.59	1.85E-06
16	28-Jul-16	09:23 AM	68	895	318	199	71	105	4.50	1.84E-06
17	28-Jul-16	09:41 AM	86	870	309	199	71	130	4.37	1.83E-06
18	28-Jul-16	10:01 AM	106	848	302	199	71	152	4.26	1.81E-06
19	28-Jul-16	10:22 AM	127	805	286	199	71	195	4.05	1.79E-06
20	28-Jul-16	11:03 AM	168	770	274	199	71	230	3.87	1.77E-06
21	28-Jul-16	12:03 PM	228	700	249	199	71	300	3.52	1.73E-06
22	28-Jul-16	01:03 PM	288	638	227	199	71	362	3.21	1.72E-06
23	28-Jul-16	03:12 PM	417	520	185	199	71	480	2.61	1.80E-06
24	28-Jul-16	04:12 PM	477	470	167	199	71	530	2.36	1.91E-06
25	29-Jul-16	07:50 AM	1415	199	71	199	71	801	1.00	Desaturated
26	29-Jul-16	01:50 PM	1775	199	71	199	71	801	1.00	Desaturated
27										
28										
29										
30										
31										
32										
33										
34										
35										
16										
16	Notes:	$i = -3E\text{-}07t^3 + 6E\text{-}06t^2 - 0.0077t + 4.9932$			(see gradient vs time plot)					
16		$q = dQ/dt = 3.0E\text{-}06t^2 - 0.0032t + 1.6074$			(see Flow vs time plot)					
16										



Nickel Copper Ore - 30% solids, 70% water)
Dry density (g/cc)
2.50
2.00
1.50
1.00
0.50
0.00
0
500
1000
1500
2000
2500
3000
Elapsed time (minute)



600
500
400
300
200
100
0
Flow, Q (ml)
y = 1E-06x³ - 0.0016x² + 1.6074x + 3.2175
[dQ/dt = 3.0E-06t² - 0.0032t + 1.6074]
0
50
100
150
200
250
300
350
400
450
elapsed time, t (minutes)


6.0
5.0
4.0
3.0
2.0
1.0
0.0
gradient, i
0
100
200
300
400
500
elapsed time, t (minutes)
y = -3E-09x3 + 6E-06x2 - 0.0077x + 4.9932

LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC•LAVALIN Environment

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	4-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper Ore	**Checked by:**	JG
Test Procedure:	Tailings (60% Solids)		
Method of testing:	------	**Condition of test:**	Inundated

Input:

Diameter of ring:	152	mm
Settled Height of sample:	70.27	mm
Specific gravity:	3.680	
Initial wet sample mass:	4096.8	g
Initial water content:	59.4	%
Initial LVDT reading:	38.89	mm
Final dry mass of sample:	2570.1	g
Mechanical Advantage:	1.00	

Calculations:

Cross-sectional area:	181.46	cm^2	1.8E-02 m^2	37.211
Volume of solids:	698.41	cc	7.0E-04 m^3	
Total volume:	1275.11	cc (prior to loading)		
Volume of voids:	576.70	cc (prior to loading)		
Initial void ratio:	0.83	(prior to loading)		
Dry mass of solids:	2570.14	g		
Initial wet density:	3213	kg/m^3 (prior to loading)		
Initial dry density:	2016	kg/m^3 (prior to loading)		
Initial LVDT reading:	38.89	mm		

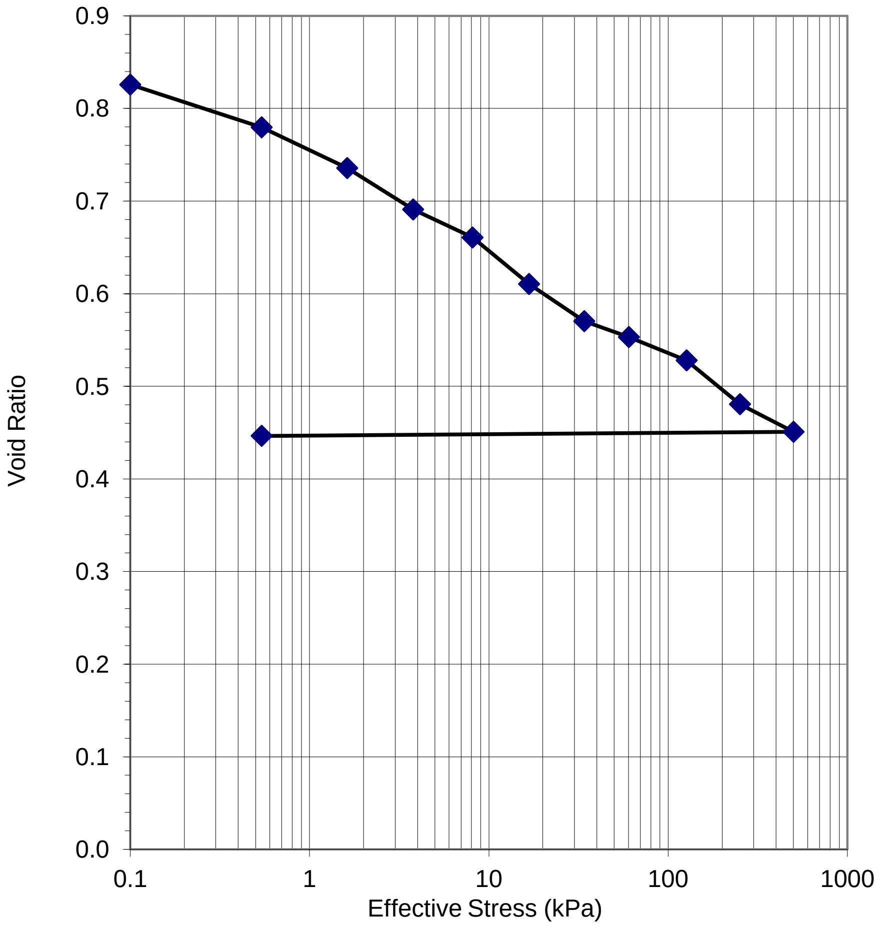
		At End of Primary Consolidation									
Loading Increment	Pressure (kPa)	R_{100} (mm)	Uncorrected Sample Height (mm)	Equipment Compressibility (mm)	Corrected Sample Height (mm)	Volume of Sample (cc)	Volume of Voids (cc)	Void Ratio			Hydraulic conductivity, m/s
	0	38.89						0.83			
1	0.5	37.05	68.43	0.06	68.50	1242.92	544.51	0.78			
2	1.6	35.33	66.71	0.09	66.80	1212.17	513.76	0.74			
3	3.8	33.61	64.99	0.09	65.08	1180.96	482.55	0.69			
4	8.1	32.42	63.80	0.11	63.92	1159.83	461.42	0.66			
5	16.8	30.45	61.83	0.15	61.99	1124.77	426.36	0.61			
6	34.1	28.88	60.26	0.18	60.44	1096.74	398.33	0.57			
7	60.4	28.22	59.60	0.18	59.78	1084.77	386.36	0.55			2.09E-07
8	126.8	27.20	58.58	0.23	58.81	1067.18	368.77	0.53			4.57E-07
9	251.6	25.33	56.71	0.28	56.99	1034.15	335.74	0.48			1.48E-07
10	500.5	24.13	55.51	0.33	55.84	1013.31	314.91	0.45			
11	0.5	24.23	55.61	0.06	55.68	1010.27	311.86	0.45			

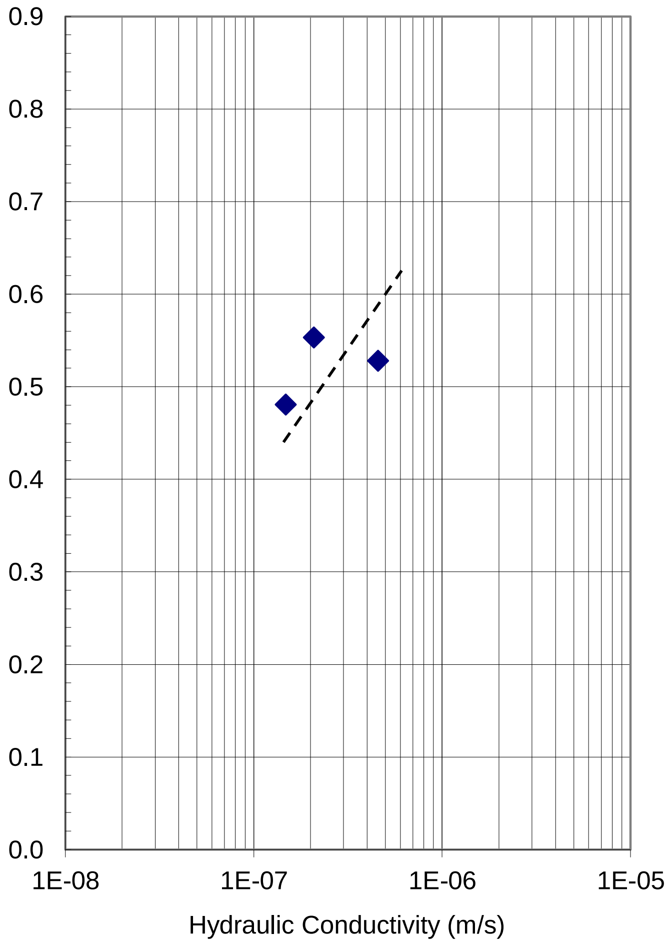
LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC•LAVALIN
Environment

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Project Name**	Lundin Mining
Date:	4-Aug-16	**Operated by:**	CP
Sample No:	Nickel Copper Ore	**Checked by:**	NE
Test Procedure:	Tailings (60% Solids)		
Method of testing:	------	**Condition of test:**	Inundated





LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC·LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	4-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper Ore	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

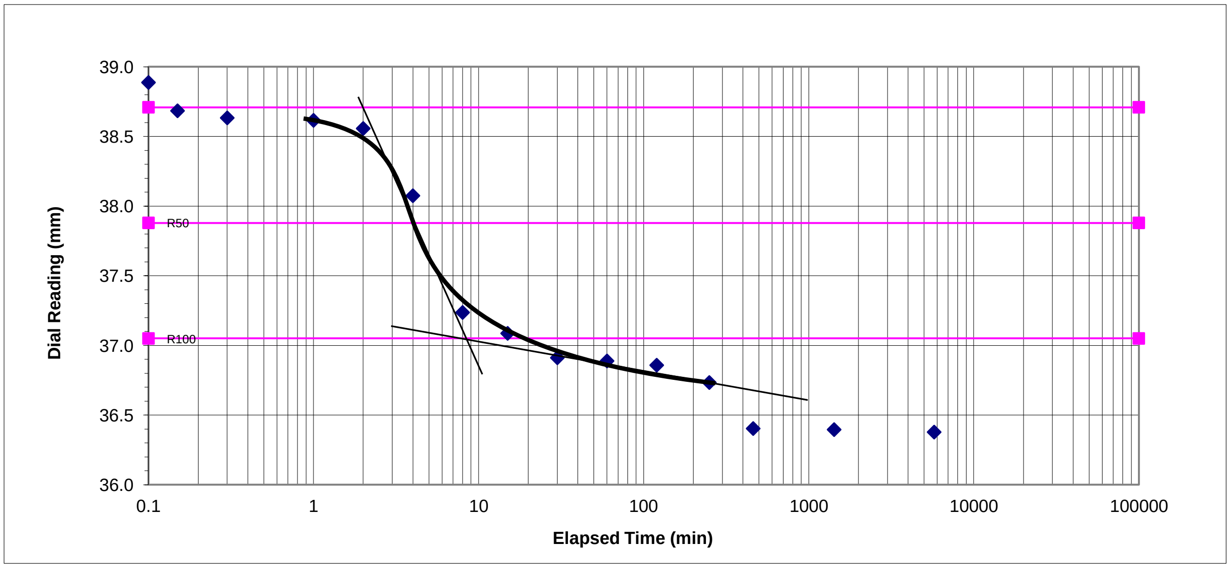
Loading Data:

Previous total load (on arm):	0 g		Total load (on arm):	1000	g
Load added (on arm):	1000 g		Pressure:	0.541	kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
4-Aug	8	24	0	38.887
4-Aug	8	24.06	0.1	38.760
4-Aug	8	24.15	0.1	38.684
4-Aug	8	24.3	0.3	38.633
4-Aug	8	25	1	38.616
4-Aug	8	26	2	38.557
4-Aug	8	28	4	38.075
4-Aug	8	32	8	37.236
4-Aug	8	39	15	37.087
4-Aug	8	54	30	36.911
4-Aug	9	24	60	36.888
4-Aug	10	24	120	36.858
4-Aug	12	34	250	36.733
4-Aug	16	5	461	36.403
5-Aug	8	10	1426	36.396
8-Aug	8	20	5756	36.378

R_1:	38.63	mm	R_0:	38.71	mm
R_2:	38.56	mm mm (reading at 4 times time at R_1)	R_{50}:	37.88	mm
R_{100}:	37.05	mm	t_{50}:	240	sec
t_{50}:	4	min (based on R_{50})			



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC·LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	8-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

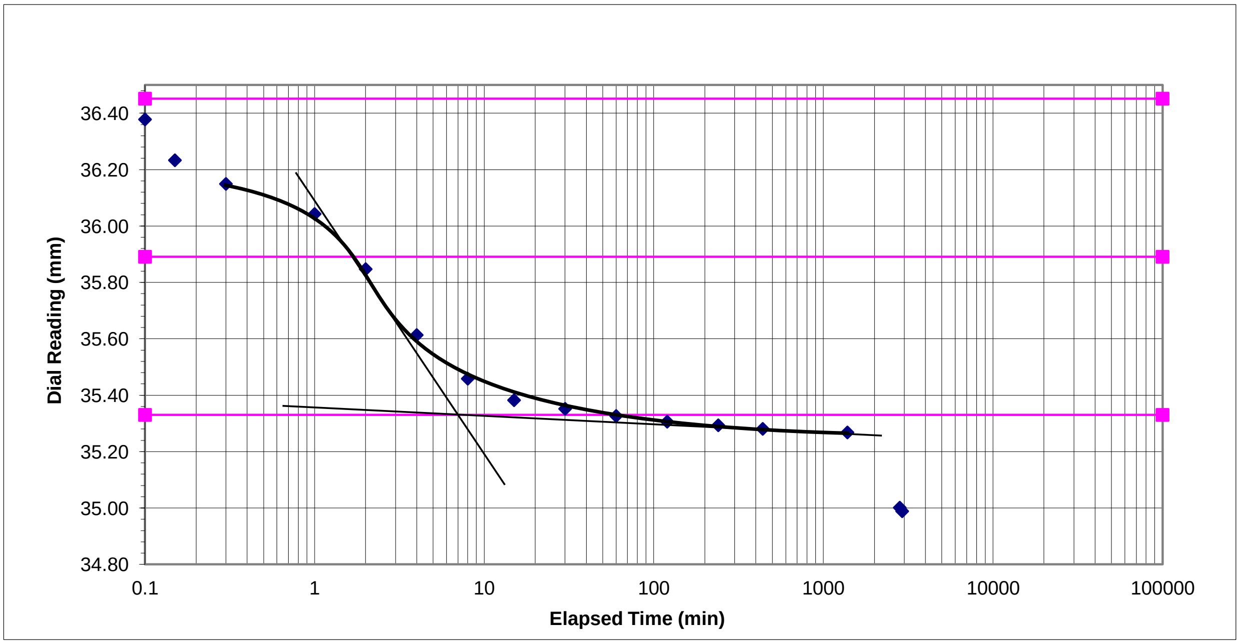
Loading Data:

Load added (on arm):	2000	g	Total load (on arm):	3000	g
			Pressure:	1.6	kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
8-Aug	8	46	0	36.378
8-Aug	8	46.06	0.06	36.309
8-Aug	8	46.15	0.15	36.233
8-Aug	8	46.3	0.3	36.149
8-Aug	8	47	1	36.043
8-Aug	8	48	2	35.847
8-Aug	8	50	4	35.613
8-Aug	8	54	8	35.458
8-Aug	9	1	15	35.382
8-Aug	9	16	30	35.352
8-Aug	9	46	60	35.326
8-Aug	10	46	120	35.306
8-Aug	12	46	240	35.293
8-Aug	16	5	439	35.281
9-Aug	7	52	1386	35.268
10-Aug	7	47	2821	35.001
10-Aug	9	22	2916	34.989

R_1:	36.149	mm	R_0:	36.452	mm
R_2:	35.847	mm (reading at 4 times time at R_1)	R_{50}:	35.891	mm
R_{100}:	35.330	mm	t_{50}:	120	sec
t_{50}:	2	min (based on R_{50})			



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC • LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	10-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:		Tailings	
Method of testing:		------	

Loading Data:

Load added (on arm): 4000 g

Total load (on arm): 7000 g

Pressure: 3.8 kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
10-Aug	9	28	0	34.989
10-Aug	9	28.06	0.06	34.925
10-Aug	9	28.15	0.15	34.722
10-Aug	9	28.3	0.3	34.569
10-Aug	9	29	1	34.303
10-Aug	9	30	2	34.011
10-Aug	9	32	4	33.807
10-Aug	9	36	8	33.706
10-Aug	9	43	15	33.668
10-Aug	9	58	30	33.630
10-Aug	10	28	60	33.604
10-Aug	13	28	240	33.566
10-Aug	16	2	394	33.553
11-Aug	8	11	1363	33.538
12-Aug	8	5	2797	33.528
15-Aug	7	53	7105	33.515

R_1: 34.569 mm

R_2: 34.011 mm (reading at 4 times time at R_1)

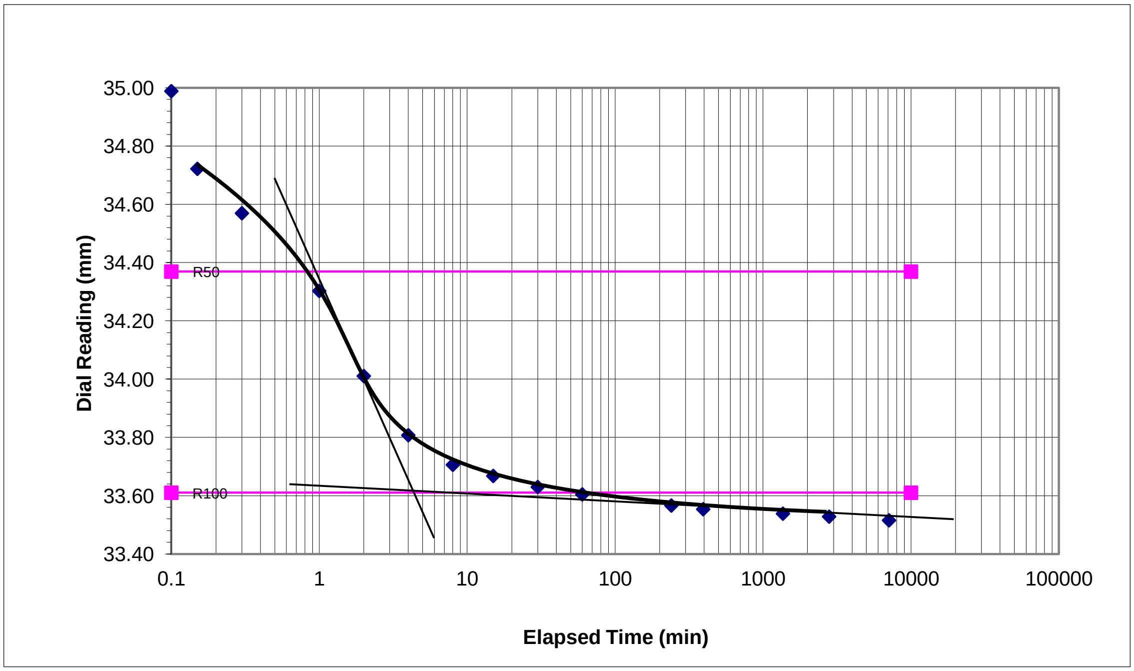
R_{100}: 33.610 mm

t_{50}: 0.8 min (based on R_{50})

R_0: 35.128 mm

R_{50}: 34.369 mm

t_{50}: 48 sec



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

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SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	15-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

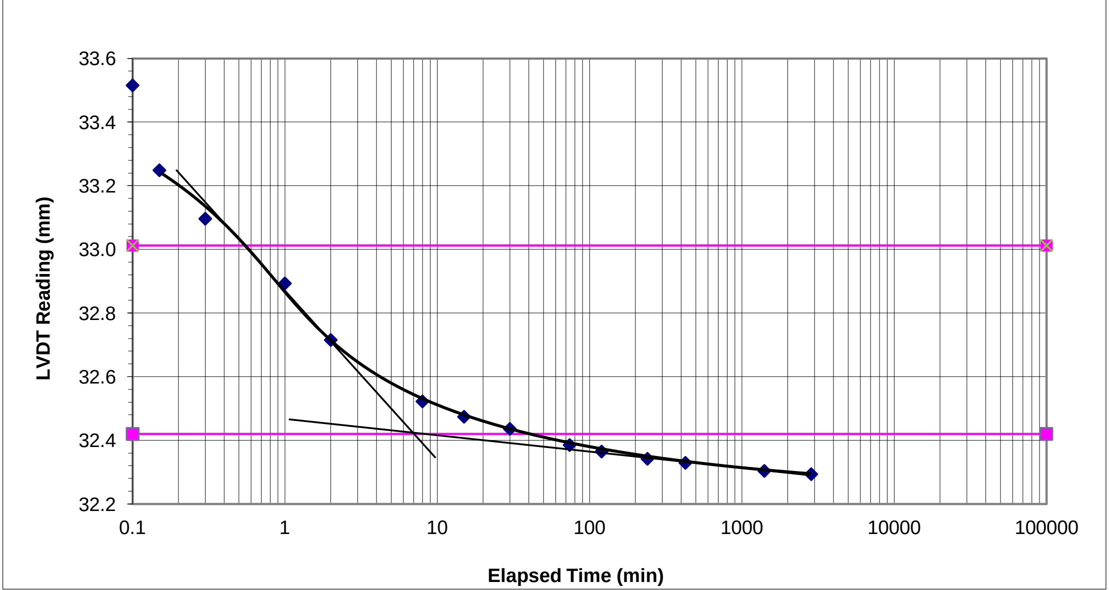
Loading Data:

Load added (on arm):	8000	g	Total load (on arm):	15000	g
			Pressure:	8.1	kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
15-Aug	8	45	0	33.515
15-Aug	8	45.06	0.1	33.350
15-Aug	8	45.15	0.15	33.249
15-Aug	8	45.3	0.3	33.096
15-Aug	8	46	1	32.893
15-Aug	8	47	2	32.715
15-Aug	8	49	4	31.267
15-Aug	8	53	8	32.522
15-Aug	9	0	15	32.474
15-Aug	9	15	30	32.436
15-Aug	9	59	74	32.385
15-Aug	10	45	120	32.365
15-Aug	12	45	240	32.342
15-Aug	15	51	426	32.329
16-Aug	8	10	1405	32.304
17-Aug	8	19	2854	32.294

R_1:	33.350	mm	R_0:	33.604	mm
R_2:	33.096	mm (reading at 4 times time at R_1)	R_{50}:	33.012	mm
R_{100}:	32.420	mm	t_{50}:	36	sec
t_{50}:	0.6	min (based on R_{50})			



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC·LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	17-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG

Test Procedure: Tailings
Method of testing: ------

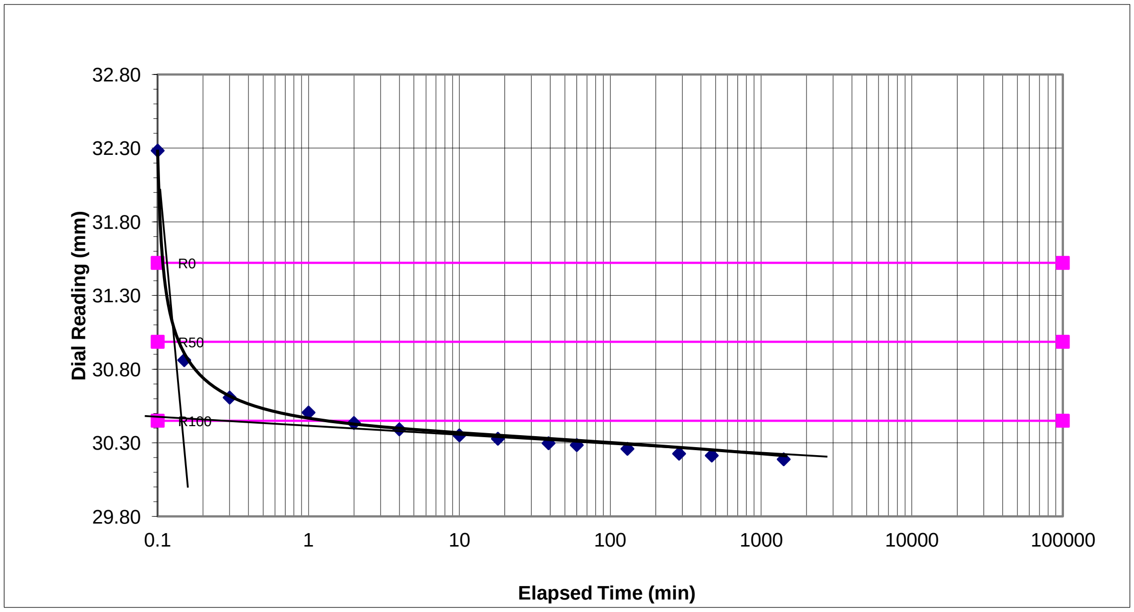
Loading Data:

Load added (on arm):	16000	g	Total load (on arm):	31000	g
			Pressure:	16.8	kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading mm
17-Aug	8	27	0	32.283
17-Aug	8	27.06	0.1	31.064
17-Aug	8	27.15	0.15	30.861
17-Aug	8	27.3	0.3	30.607
17-Aug	8	28	1	30.505
17-Aug	8	29	2	30.434
17-Aug	8	31	4	30.391
17-Aug	8	37	10	30.350
17-Aug	8	45	18	30.328
17-Aug	9	6	39	30.297
17-Aug	9	27	60	30.284
17-Aug	10	37	130	30.259
17-Aug	13	13	286	30.226
17-Aug	16	18	471	30.213
18-Aug	7	59	1412	30.188

R_1:	31.064	mm	R_0:	31.521	mm
R_2:	30.607	mm (reading at 4 times time at R_1)	R_{50}:	30.986	mm
R_{100}:	30.450	mm	t_{50}:	9	sec
t_{50}:	0.15	min (based on R_{50})			



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC • LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	18-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

Loading Data:

Load added (on arm): 32000 g

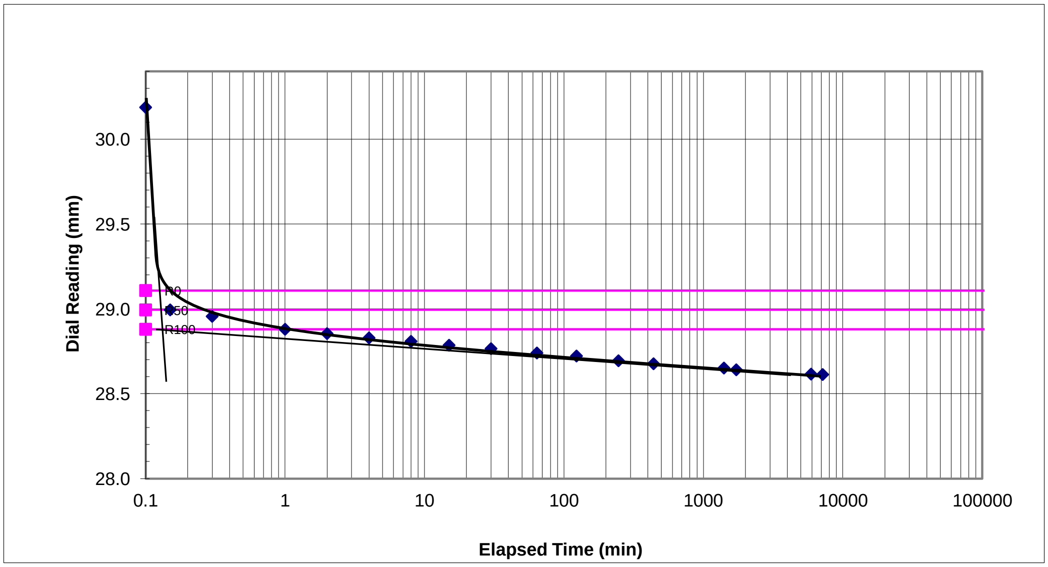
Total load (on arm): 63000 g

Pressure: 34.1 kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
18-Aug	8	46	0	30.188
18-Aug	8	46.06	0.1	29.058
18-Aug	8	46.15	0.1	28.994
18-Aug	8	46.3	0.3	28.956
18-Aug	8	47	1	28.880
18-Aug	8	48	2	28.854
18-Aug	8	50	4	28.829
18-Aug	8	54	8	28.809
18-Aug	9	1	15	28.786
18-Aug	9	16	30	28.766
18-Aug	9	50	64	28.740
18-Aug	10	49	123	28.722
18-Aug	12	52	246	28.694
18-Aug	16	5	439	28.677
19-Aug	8	10	1404	28.651
19-Aug	13	27	1721	28.641
22-Aug	11	23	5917	28.616
23-Aug	8	13	7167	28.613

R_1:	28.99	mm	R_0:	29.11	mm
R_2:	28.88	mm (reading at 4 times time at R_1)	R_{50}:	28.99	mm
R_{100}:	28.88	mm	t_{50}:	18	sec
t_{50}:	0.30	min (based on R_{50})			



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC • LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	23-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

Loading Data:

Load added (on arm): 48748 g

Total load (on arm): 111748 g

Pressure: 60.4 kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
23-Aug	8	52	0	28.613
23-Aug	8	52.06	0.06	28.499
23-Aug	8	52.15	0.15	28.473
23-Aug	8	52.3	0.3	28.270
23-Aug	8	53	1	28.207
23-Aug	8	54	2	28.158
23-Aug	8	56	4	28.123
23-Aug	9	0	8	28.092
23-Aug	9	7	15	28.067
23-Aug	9	12	20	28.054
23-Aug	10	9	77	28.011
23-Aug	10	54	122	27.991
23-Aug	12	52	240	27.958
23-Aug	16	30	458	27.930
24-Aug	8	24	1412	27.894
25-Aug	8	15	2843	27.871
26-Aug	8	19	4287	27.859
29-Aug	8	0	8588	27.843

R_1: 28.27 mm

R_2: 28.16 mm (reading at 4 times time at R_1)

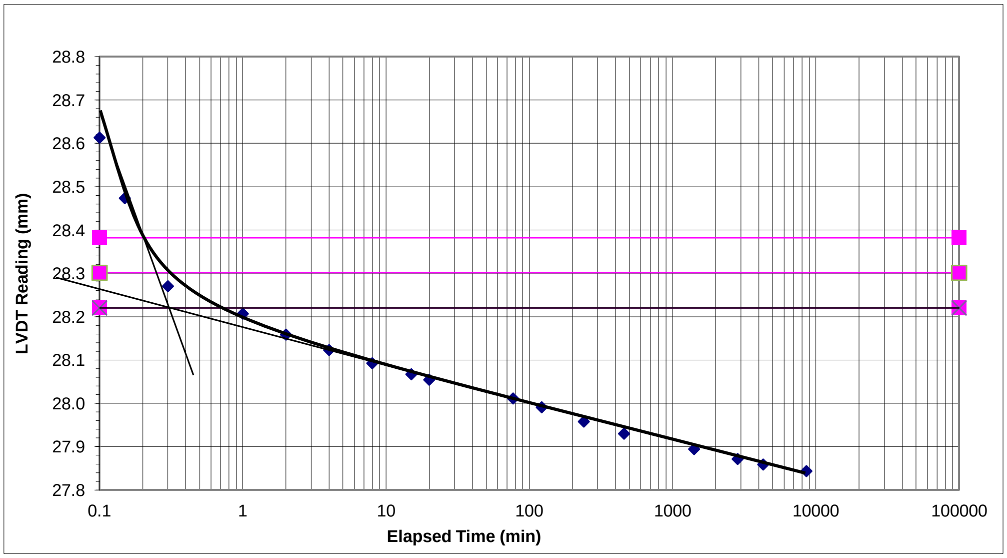
R_{100}: 28.22 mm

t_{50}: 0 min (based on R_{50})

R_0: 28.38 mm

R_{50}: 28.30 mm

t_{50}: 15 sec



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC • LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	29-Aug-16	**Operated by:**	JA
Sample No:	Nickel Copper Ore	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

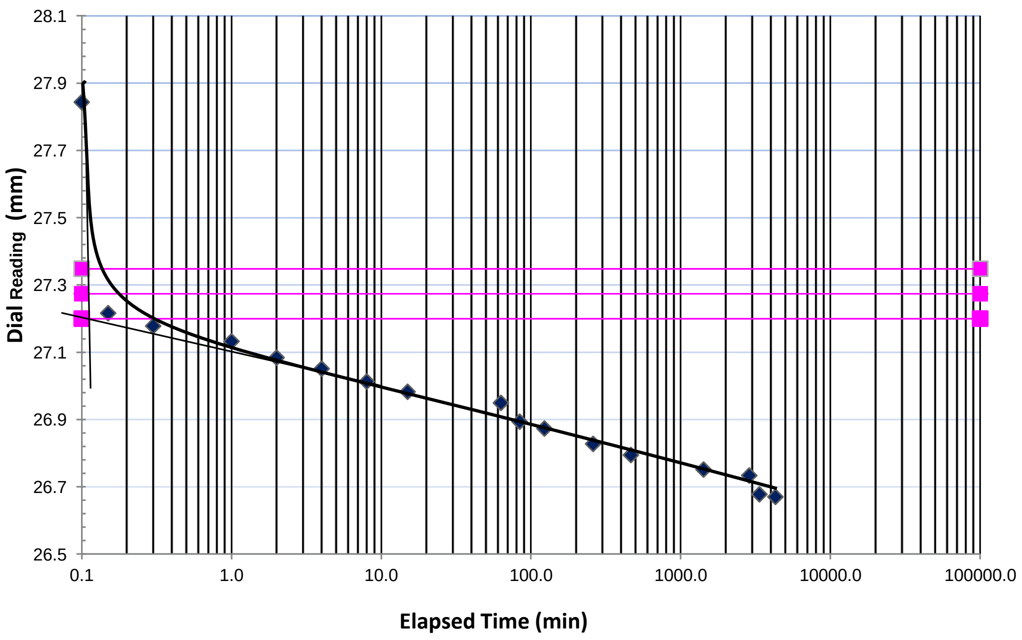
Loading Data:

Load added (on arm):	122805	g	Total load (on arm):	234553	g
			Pressure:	126.8	kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
29-Aug	8	25	0.10	27.843
29-Aug	8	25.06	0.06	27.305
29-Aug	8	25.15	0.15	27.216
29-Aug	8	25.3	0.30	27.178
29-Aug	8	26	1.00	27.132
29-Aug	8	27	2.00	27.084
29-Aug	8	29	4.00	27.051
29-Aug	8	33	8.00	27.013
29-Aug	8	40	15.00	26.982
29-Aug	8	88	63.00	26.949
29-Aug	9	49	84.00	26.894
29-Aug	10	28	123.00	26.873
29-Aug	12	45	260.00	26.827
29-Aug	16	10	465.00	26.794
30-Aug	8	6	1421.00	26.751
31-Aug	8	12	2867.00	26.734
31-Aug	16	20	3355.00	26.678
1-Sep	7	55	4290.00	26.670

R_1:	27.22	mm	R_0:	27.35	mm
R_2:	27.08	mm (reading at 4 times time at R_1)	R_{50}:	27.27	mm
R_{100}:	27.20	mm	t_{50}:	12	sec
t_{50}:	0.2	min (based on R_{50})			



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC·LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	1-Sep-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

Loading Data:

Load added (on arm): 230836 g

Total load (on arm): 465389 g

Pressure: 251.6 kPa

Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
1-Sep	9	1	0	26.667
1-Sep	9	1.06	0.06	26.314
1-Sep	9	1.15	0.15	26.086
1-Sep	9	1.3	0.3	26.035
1-Sep	9	2	1	25.921
1-Sep	9	3	2	25.862
1-Sep	9	5	4	25.819
1-Sep	9	9	8	25.773
1-Sep	9	16	15	25.743
1-Sep	9	35	34	25.697
1-Sep	10	1	60	25.667
1-Sep	11	4	123	25.608
1-Sep	13	1	240	25.583
1-Sep	16	13	432	25.535
2-Sep	7	58	1377	25.382
2-Sep	15	24	1823	25.367
6-Sep	8	26	7165	25.337
7-Sep	8	26	8605	25.329

R_1: 25.92 mm

R_2: 25.82 mm (reading at 4 times time at R_1)

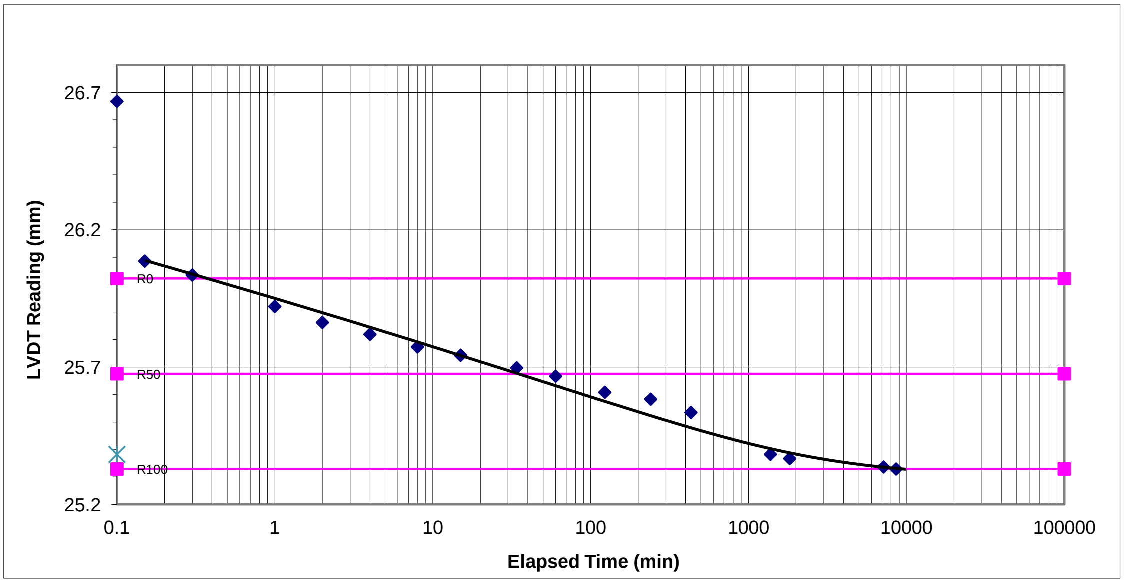
R_{100}: 25.33 mm

t_{50}: 25 min (based on R_{50})

R_0: 26.02 mm

R_{50}: 25.68 mm

t_{50}: 1500 sec



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC·LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	7-Sep-16	**Operated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

Loading Data:

Load added (on arm): 460392.7 g

Total load (on arm): 925782 g

Pressure: 500.5 kPa

Deflection Data:

465389.2

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
7-Sep	9	15	0	25.329
7-Sep	9	15.06	0.06	25.090
7-Sep	9	15.15	0.15	25.019
7-Sep	9	15.3	0.30	24.928
7-Sep	9	16	1	24.691
7-Sep	9	17	2	24.620
7-Sep	9	19	4	24.562
7-Sep	9	23	8	24.508
7-Sep	9	30	15	24.460
7-Sep	9	45	30	24.417
7-Sep	10	26	71	24.371
7-Sep	11	33	138	24.326
7-Sep	13	49	274	24.277
7-Sep	16	19	424	24.249
8-Sep	8	21	1386	24.199
9-Sep	9	24	2889.00	24.160
12-Sep	8	17	7142.00	24.130

R_1: 25.02 mm

R_2: 24.69 mm (reading at 4 times time at R_1)

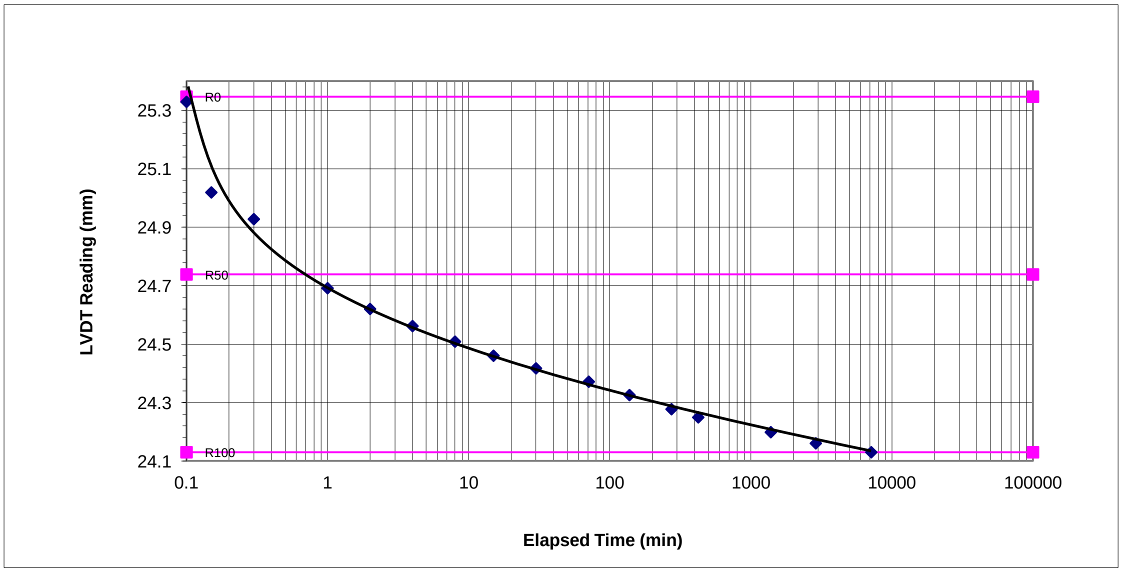
R_{100}: 24.13 mm

t_{50}: 8 min (based on R_{50})

R_0: 25.35 mm

R_{50}: 24.74 mm

t_{50}: 480 sec



LABORATORY REPORT: SLURRY CONSOLIDATION WITH CONSTANT-HEAD HYDRAULIC CONDUCTIVITY TEST

SNC·LAVALIN

SLURRY CONSOLIDATION AND k-TEST

Project No:	639834	**Client:**	Lundin Mining
Date:	12-Sep-16	**Opeated by:**	JA
Sample No:	Nickel Copper	**Checked by:**	JG
Test Procedure:	Tailings		
Method of testing:	------		

Loading Data:

Load added (on arm): -924782 g

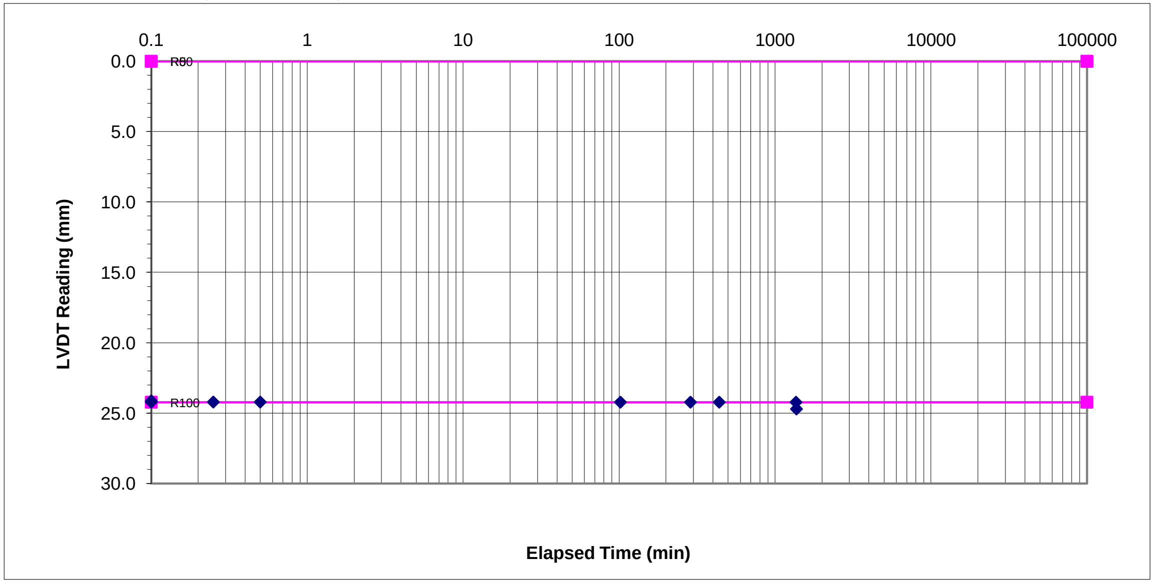
Total load (on arm): 1000 g

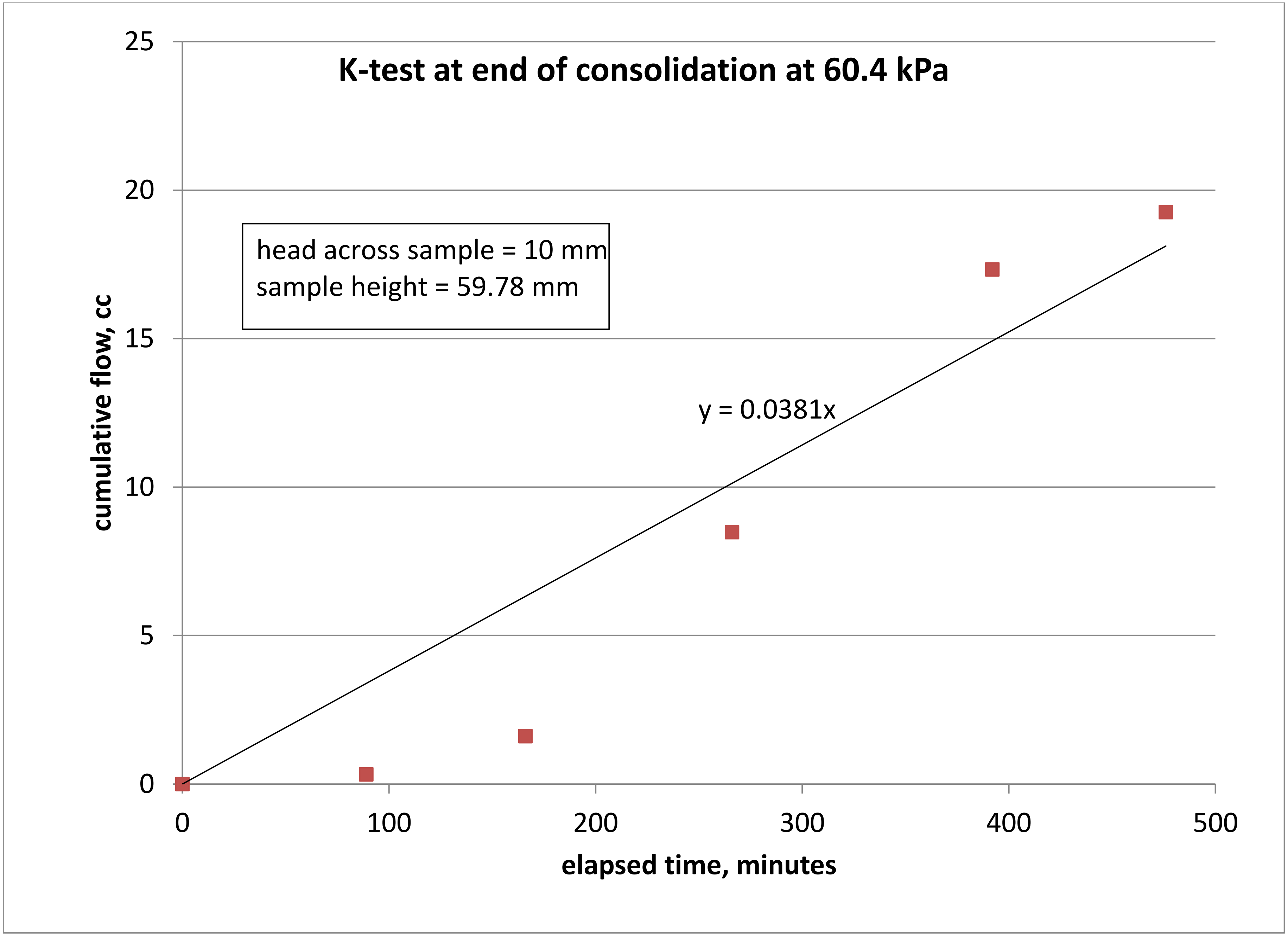
Pressure: 0.5 kPa

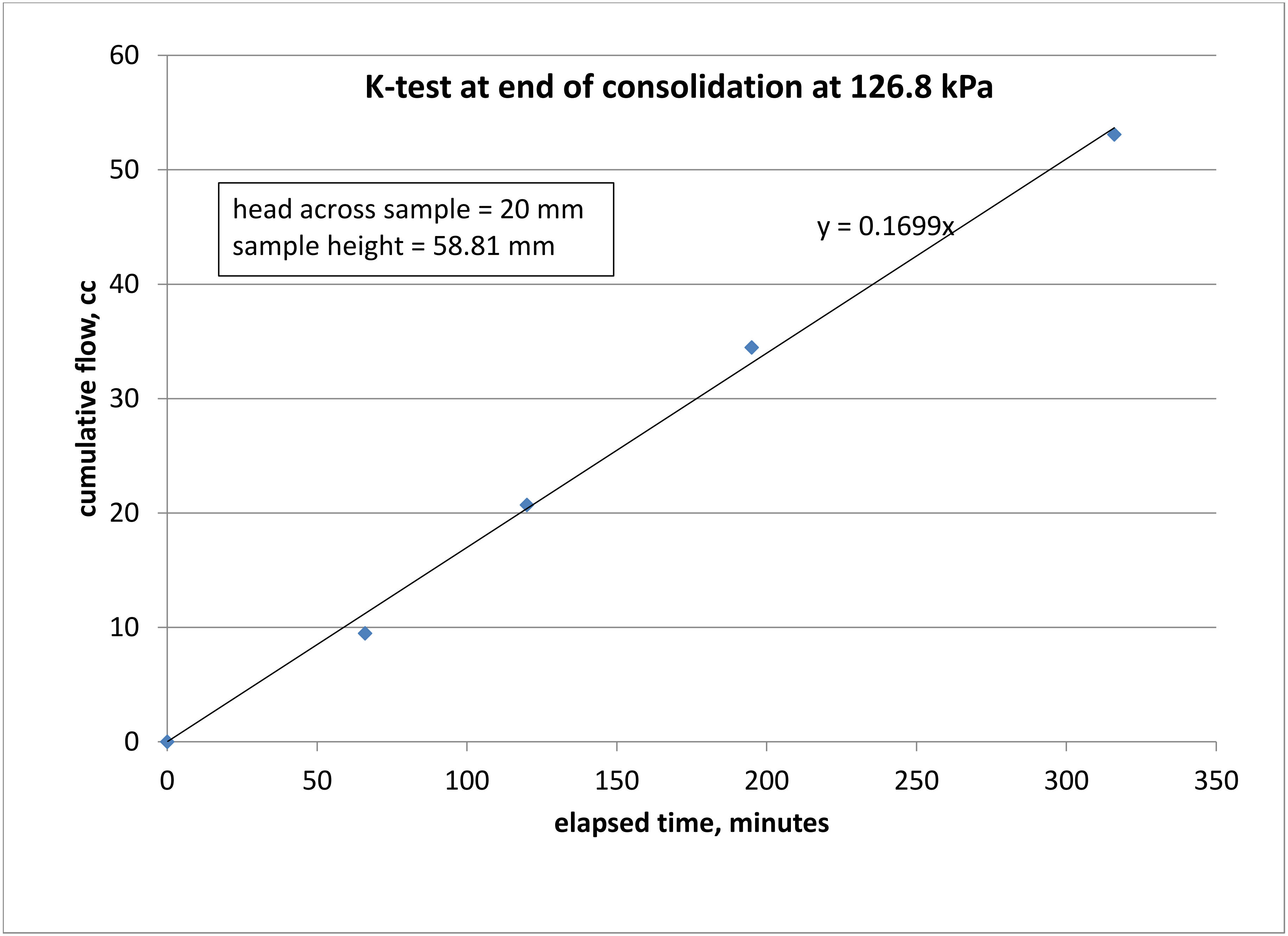
Deflection Data:

Date	Hour	Minute	Elapsed Time (minutes)	Dial Reading (mm)
12-Sep	8	51	0	24.130
12-Sep	8	51.1	0.1	24.219
12-Sep	8	51.25	0.25	24.219
12-Sep	8	51.5	0.5	24.219
12-Sep	10	33	102	24.229
12-Sep	13	38	287	24.229
12-Sep	16	10	439	24.229
13-Sep	7	34	1363	24.229
13-Sep	7	44	1373	24.712

R_1:	-	mm	R_0:	-	mm
R_2:	-	mm (reading at 4 times time at R_1)	R_{50}:	-	mm
R_{100}:	24.23	mm	t_{50}:	-	sec
t_{50}:	-	min (based on R_{50})			




K-test at end of consolidation at 60.4 kPa
head across sample = 10 mm
sample height = 59.78 mm
y = 0.0381x
cumulative flow, cc
elapsed time, minutes
0
5
10
15
20
25
0
100
200
300
400
500


K-test at end of consolidation at 126.8 kPa
head across sample = 20 mm
sample height = 58.81 mm
y = 0.1699x
cumulative flow, cc
elapsed time, minutes
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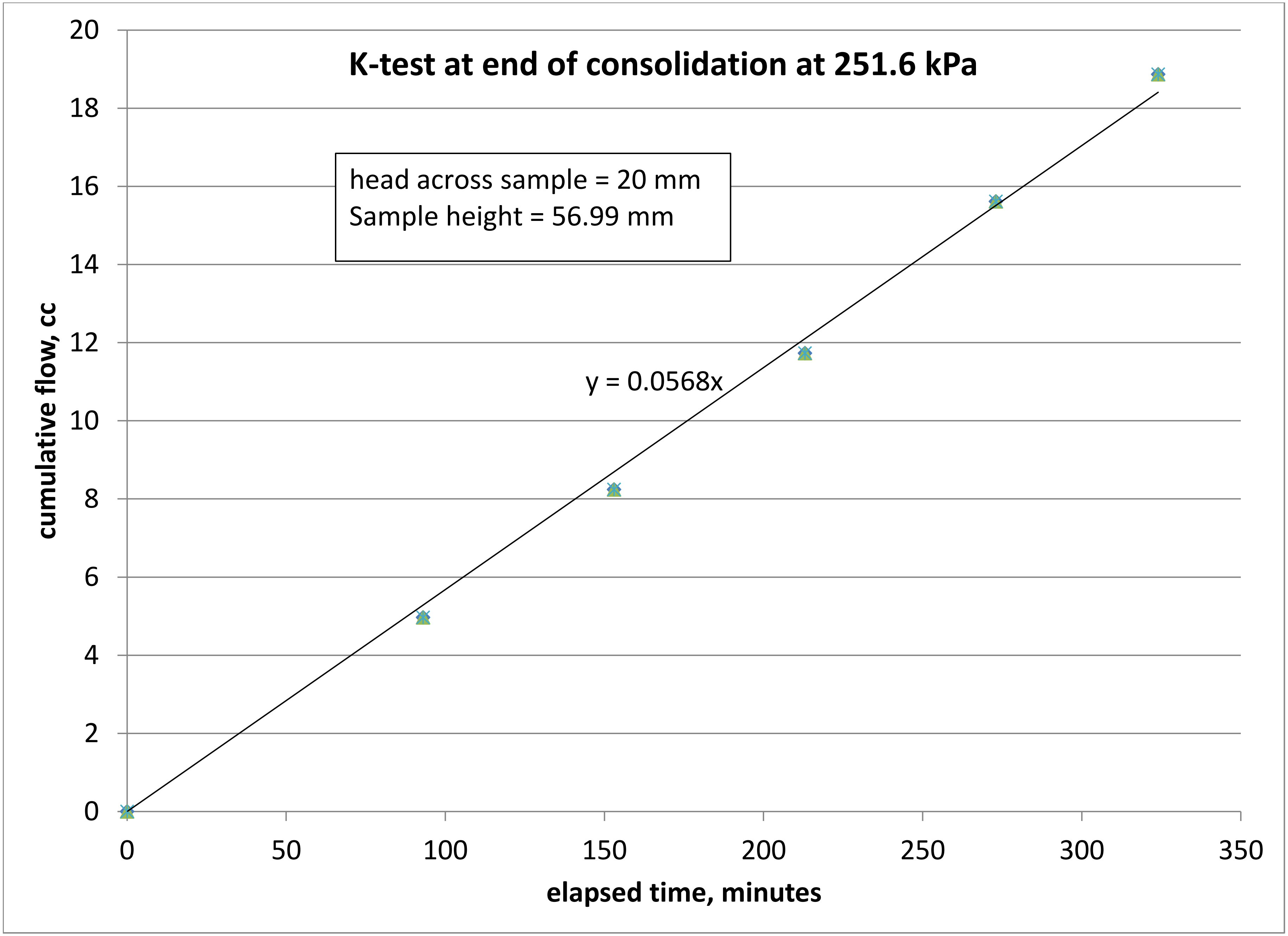
20
30
40
50
60
0
50
100
150
200
250
300
350


K-test at end of consolidation at 251.6 kPa
head across sample = 20 mm
Sample height = 56.99 mm
y = 0.0568x
cumulative flow, cc
elapsed time, minutes
0
2
4
6
8
10
12
14
16
18
20
0
50
100
150
200
250
300
350

Appendix B
Deposition Plan Figures

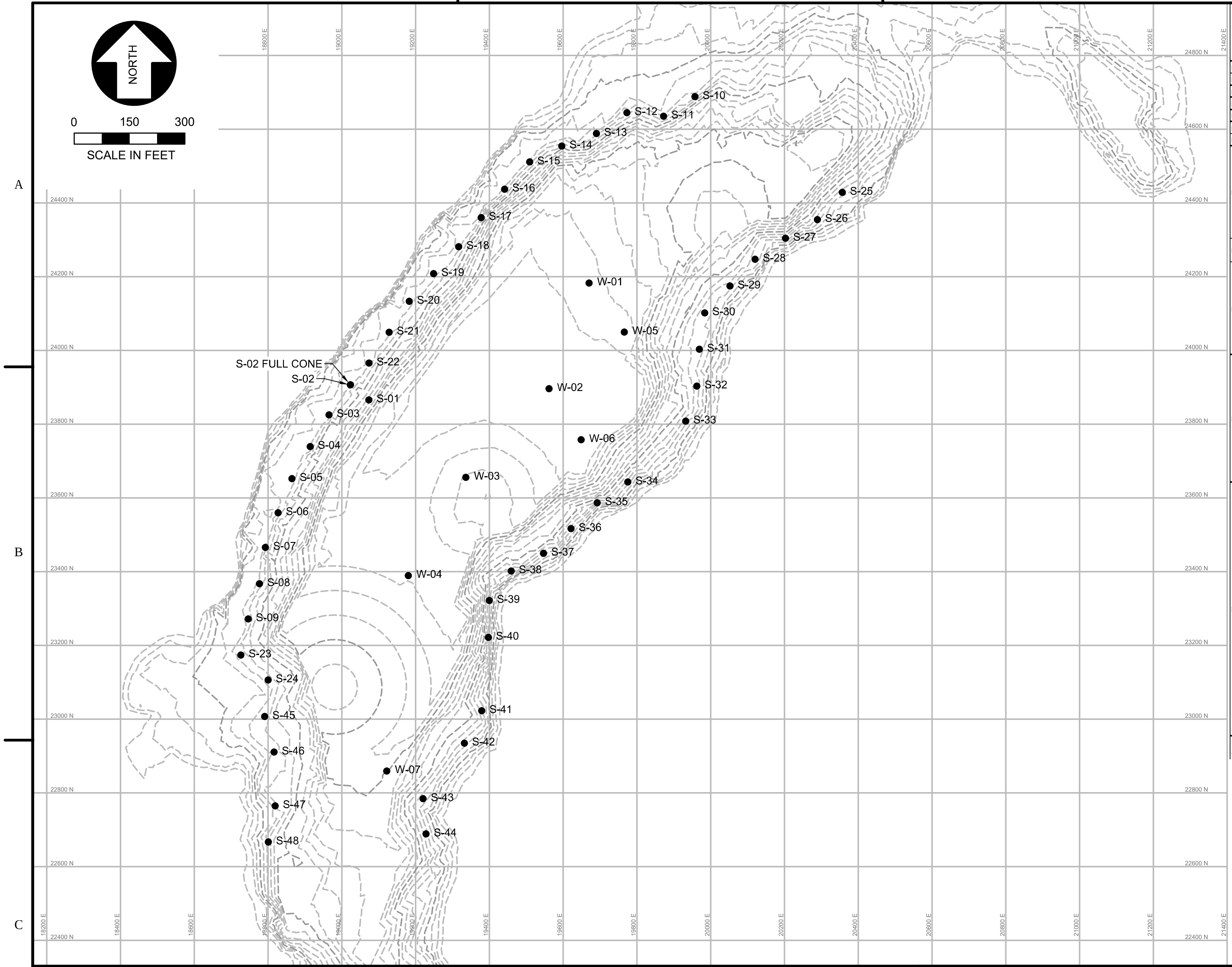


Figure	Season	Cone ID	Northing	Easting	Elevation (ft)	Cone Volume (yd^3)	Seasonal Tailings Volume (yd^3)	Tailings Volume Deposited (cumulative yd^3)
Figure 1	Cover Sheet							
Figure 2	Fall 2016	S-01 Partial	23866	19073	1409	69,779	70,000	70,000
Figure 3	Winter 2017	W-01	24183	19670	1413	178,141	178,000	248,000
Figure 4	May-July 2017	S-01	23866	19073	1425	94,878	95,000	343,000
Figure 5	July-December 2017	S-02 PARTIAL	23906	19023	1449	161,450	161,000	504,000
Figure 6	Winter 2018	W-02	23896	19561	1428	191,488	191,000	695,000
Figure 7	Summer 2018	S-02	23906	19023	1472	275,059	275,000	970,000
Figure 8	Winter 2019	W-03	23656	19336	1456	203,108	203,000	1,173,000
	Summer 2019	S-03	23825	18965	1475	54,561	293,000	1,466,000
		S-04	23739	18914	1475	48,310		
		S-05	23652	18864	1475	44,769		
		S-06	23560	18827	1475	45,242		
		S-07	23466	18793	1475	43,471		
		S-08	23367	18777	1475	41,319		
		S-09	23272	18746	1472	15,148		
Figure 9	Winter 2020	W-04	23389	19180	1473	204,087	204,000	1,670,000
	Summer 2020	S-10	24688	19957	1474	276,959	277,000	1,947,000
Figure 10	Winter 2021	W-05	24050	19765	1454	185,603	186,000	2,133,000
	Summer 2021*	S-11	24635	19872	1475	63,303	260,000	2,393,000
		S-12	24644	19773	1475	25,751		
		S-13	24588	19690	1475	47,297		
		S-14	24554	19596	1475	32,583		
		S-15	24511	19509	1475	26,644		
		S-16	24437	19441	1475	33,637		
		S-17	24360	19378	1475	30,404		
Figure 11	Winter 2022*	W-06	23758	19648	1475	183,375	183,000	2,576,000
	Summer 2022*	S-18	24281	19317	1475	22,083	248,000	2,824,000
		S-19	24208	19249	1475	14,539		
		S-20	24133	19183	1475	10,358		
		S-21	24049	19128	1475	8,325		
		S-22	23966	19073	1475	4,546		
		S-23	23174	18726	1475	22,922		
		S-24	23106	18800	1475	52,616		
		S-25	24428	20356	1475	77,634		
		S-26	24355	20289	1475	14,718		
		S-27	24304	20203	1475	20,093		
Figure 12	Winter 2023*	W-07	22859	19122	1475	161,898	162,000	2,986,000
	Summer 2023*	S-28	24247	20120	1475	20,871	232,000	3,218,000
		S-29	24174	20052	1475	16,018		
		S-30	24102	19983	1475	16,435		
		S-31	24003	19969	1475	8,431		
		S-32	23903	19962	1475	6,424		
		S-33	23808	19932	1475	4,394		
		S-34	23643	19775	1475	5,040		
		S-35	23587	19692	1475	11,181		
		S-36	23516	19621	1475	12,910		
		S-37	23450	19547	1475	9,599		
		S-38	23402	19459	1475	12,689		
		S-39	23322	19399	1475	16,022		
		S-40	23222	19397	1475	12,991		
		S-41	23023	19379	1475	11,146		
		S-42	22935	19332	1475	3,426		
		S-43	22784	19220	1475	10,906		
		S-44	22688	19228	1475	18,615		
		S-45	23007	18790	1475	3,985		
		S-46	22910	18816	1475	6,672		
		S-47	22765	18819	1475	14,070		
		S-48	22667	18800	1475	9,946		

*Modeling is balanced between summer and winter volumes based on available summer cone volumes. Ie if the summer season is short some volume it is made up in the following winter season

FOR CLIENT REVIEW

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DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

lundin mining

EAGLE MINE
FIGURE 1
COVER SHEET

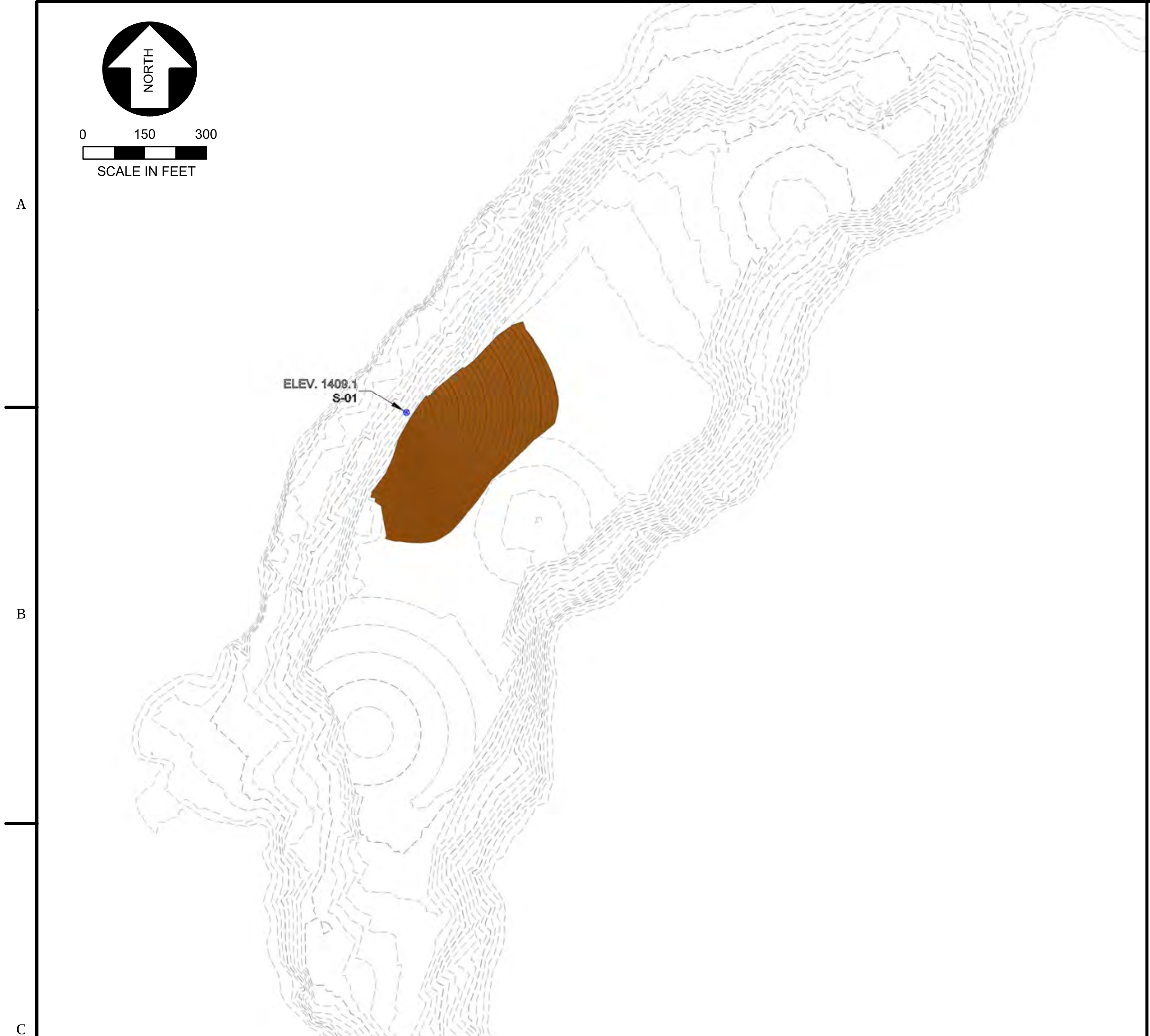
SCALE
1"=300'
OR AS NOTED

DWG. No.
H349392

REV
A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:19pm
FILE: P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 1- CONE COORDINATES.dwg LAYOUT NAME: COVER SHEET



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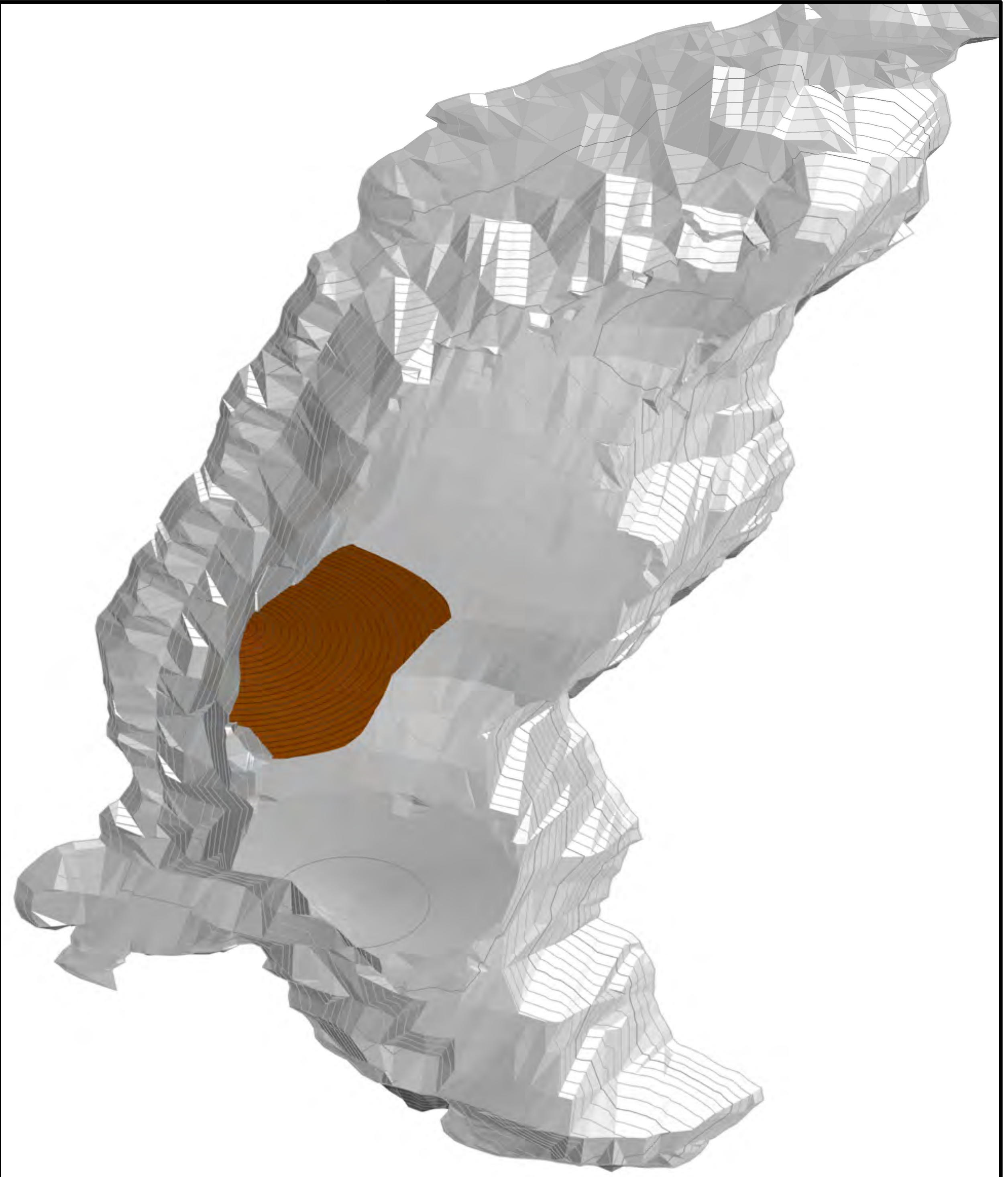

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FOR CLIENT REVIEW

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REVISIONS

ROLE	NAME	SIGNATURE	DATE
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DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

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EAGLE MINE
FIGURE 2
DECEMBER, 2016 - ORE STACKING

SCALE 1"=300' OR AS NOTED

DWG. No. H349392

REV A

SHEET SIZE: B

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DATE : 08/25/16 TIME : 3:19pm
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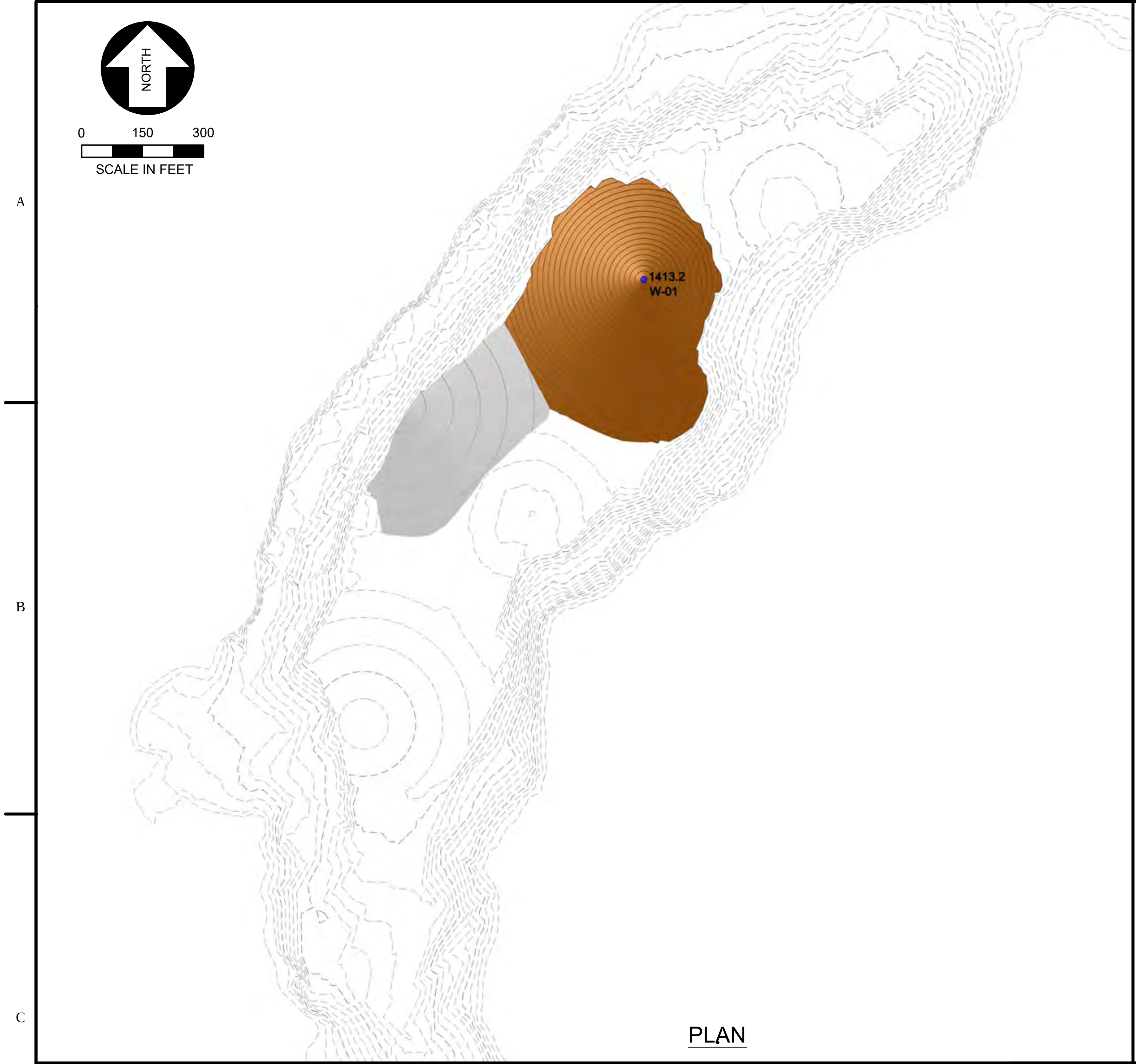

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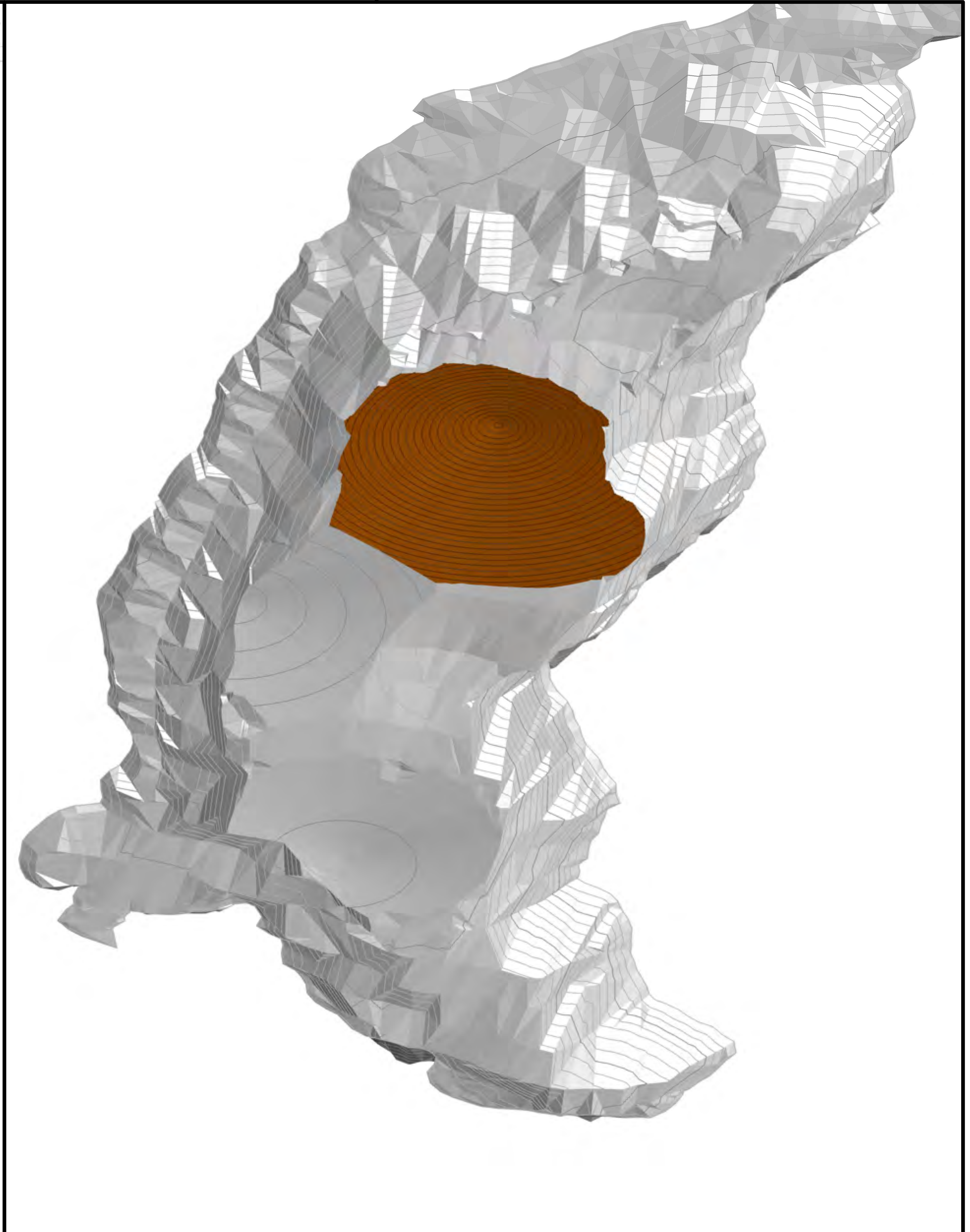

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DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

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HATCH
lundin mining

EAGLE MINE
FIGURE 3
MAY 2017 - ORE STACKING

SCALE 1"=300' OR AS NOTED

DWG. No. H349392

REV A

SHEET SIZE: B

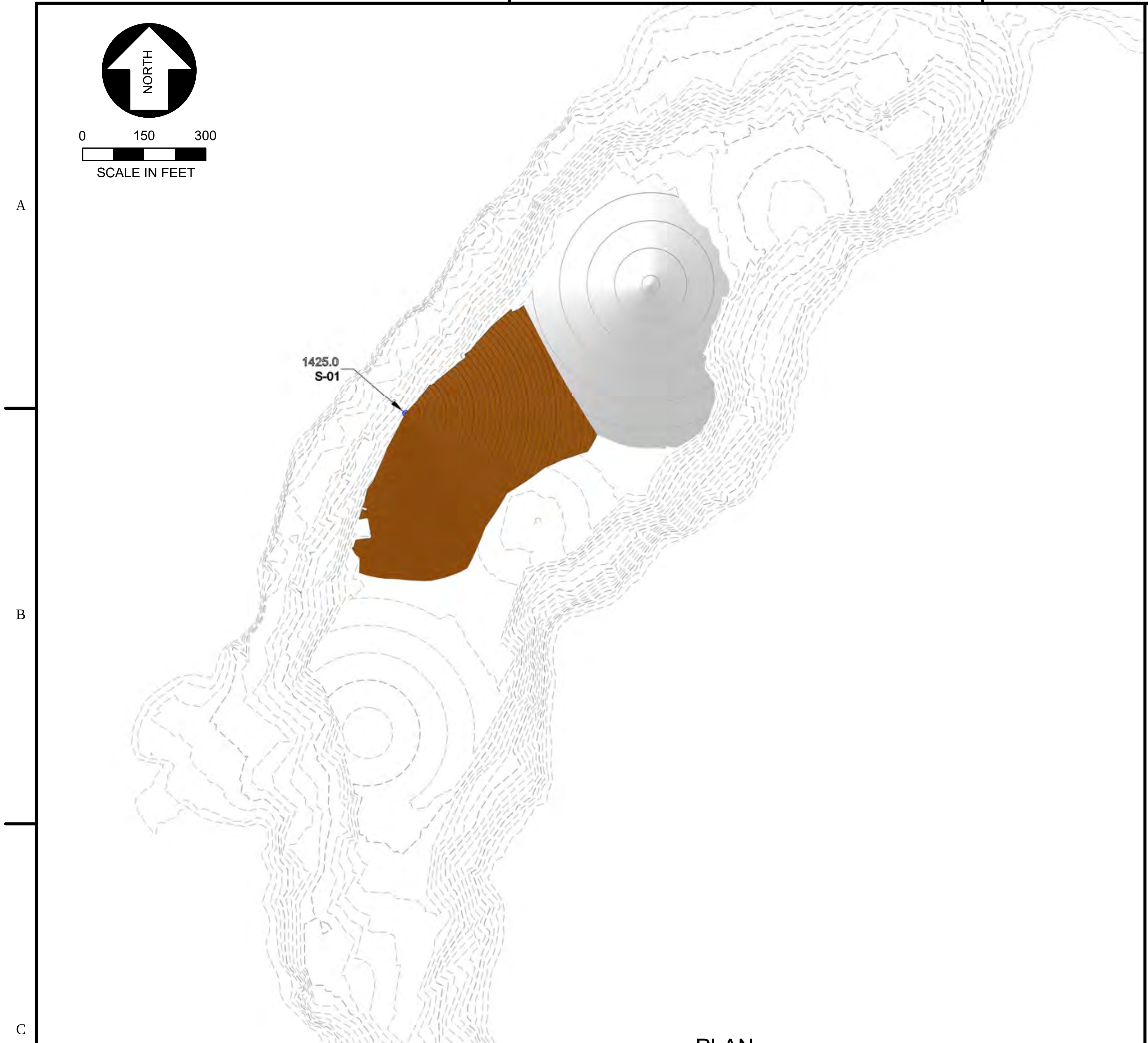
USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:20pm
FILE : P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 3- MAY 2017 ORE STACKING.dwg LAYOUT NAME: 11X17L

1 2 3 4

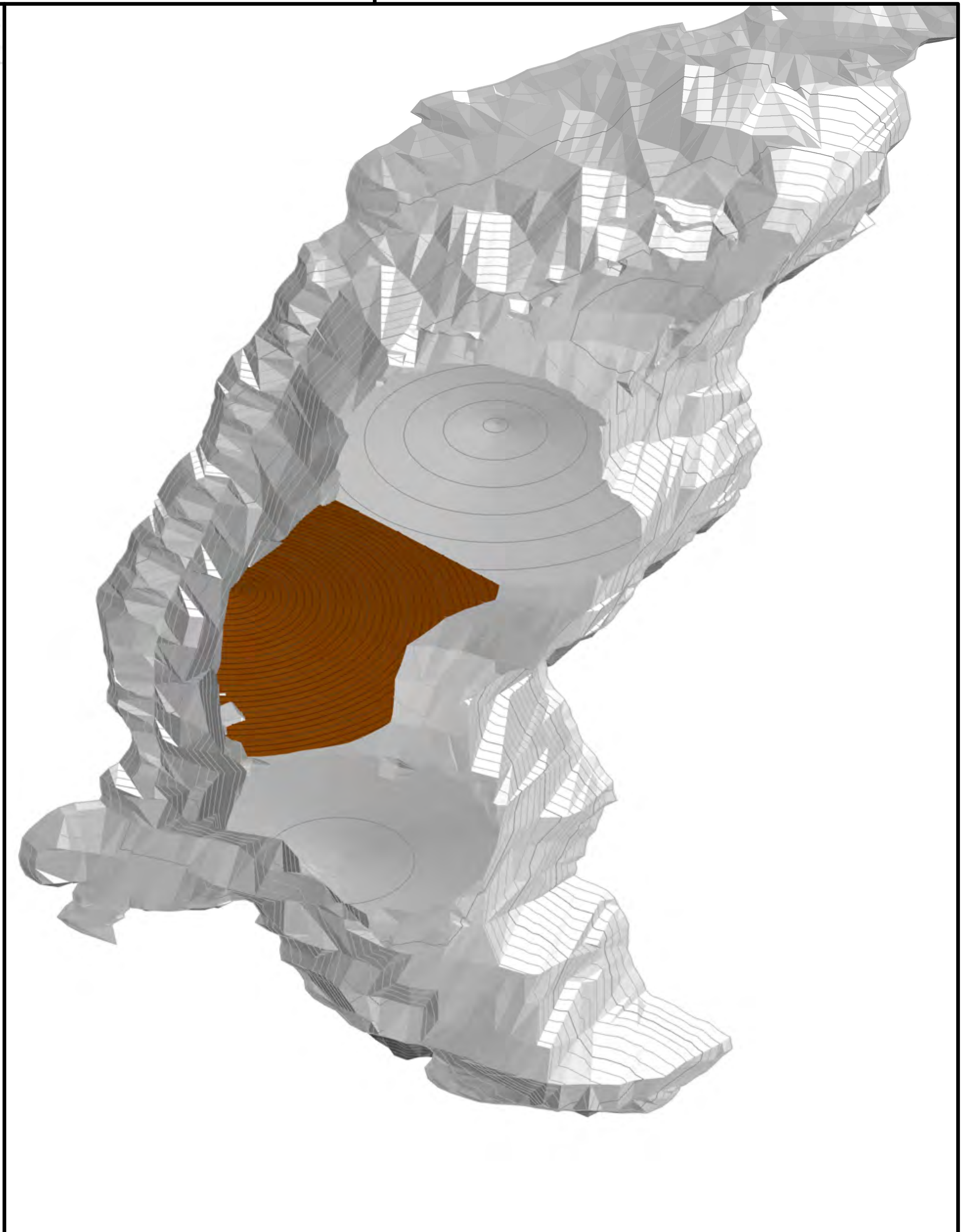
A

B

C



PLAN



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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

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DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

lundin mining

EAGLE MINE
FIGURE 4
JULY 2017 - ORE STACKING

SCALE
1"=300'
OR AS NOTED

DWG. No.
H349392

REV
A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:21pm
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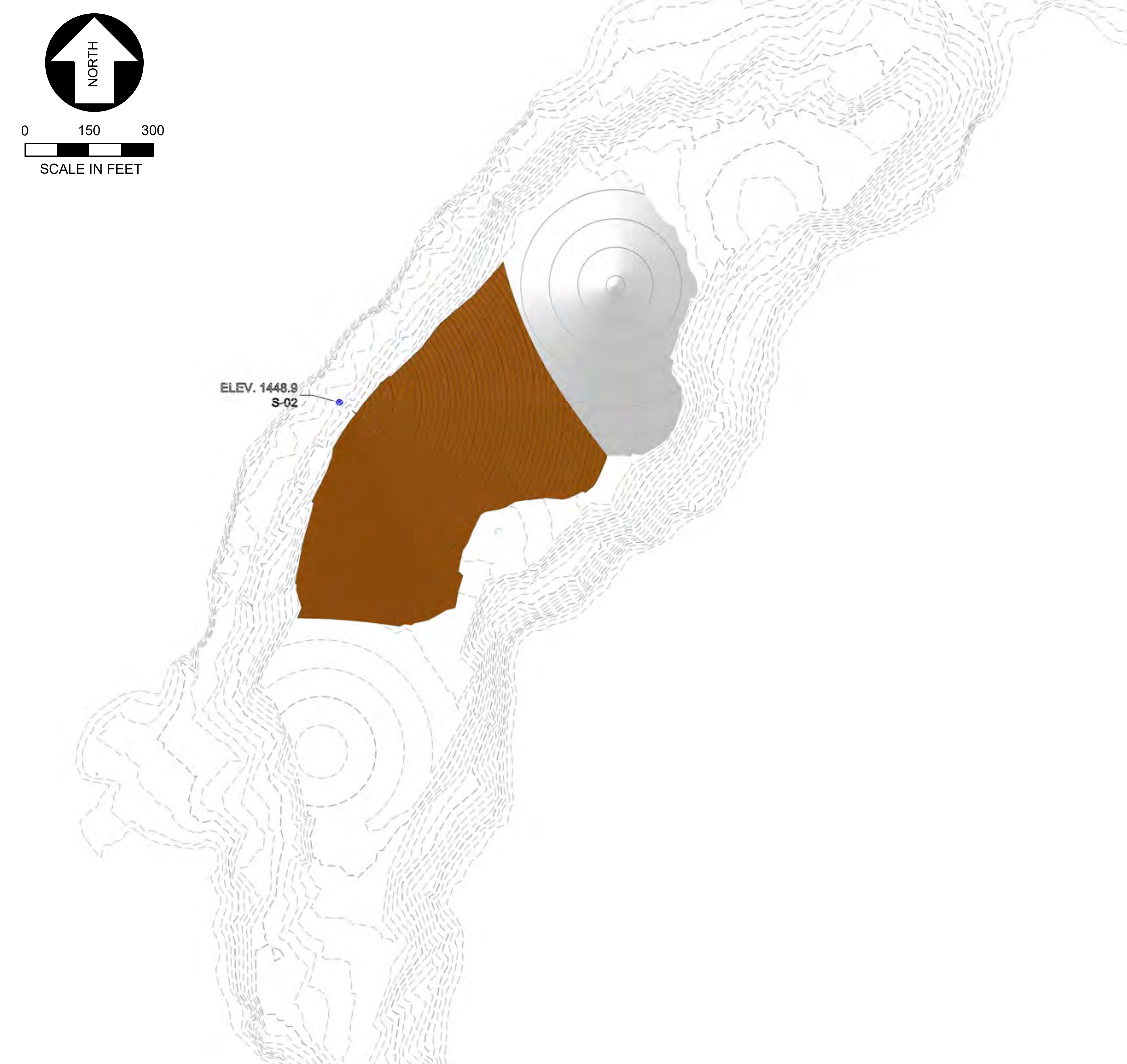

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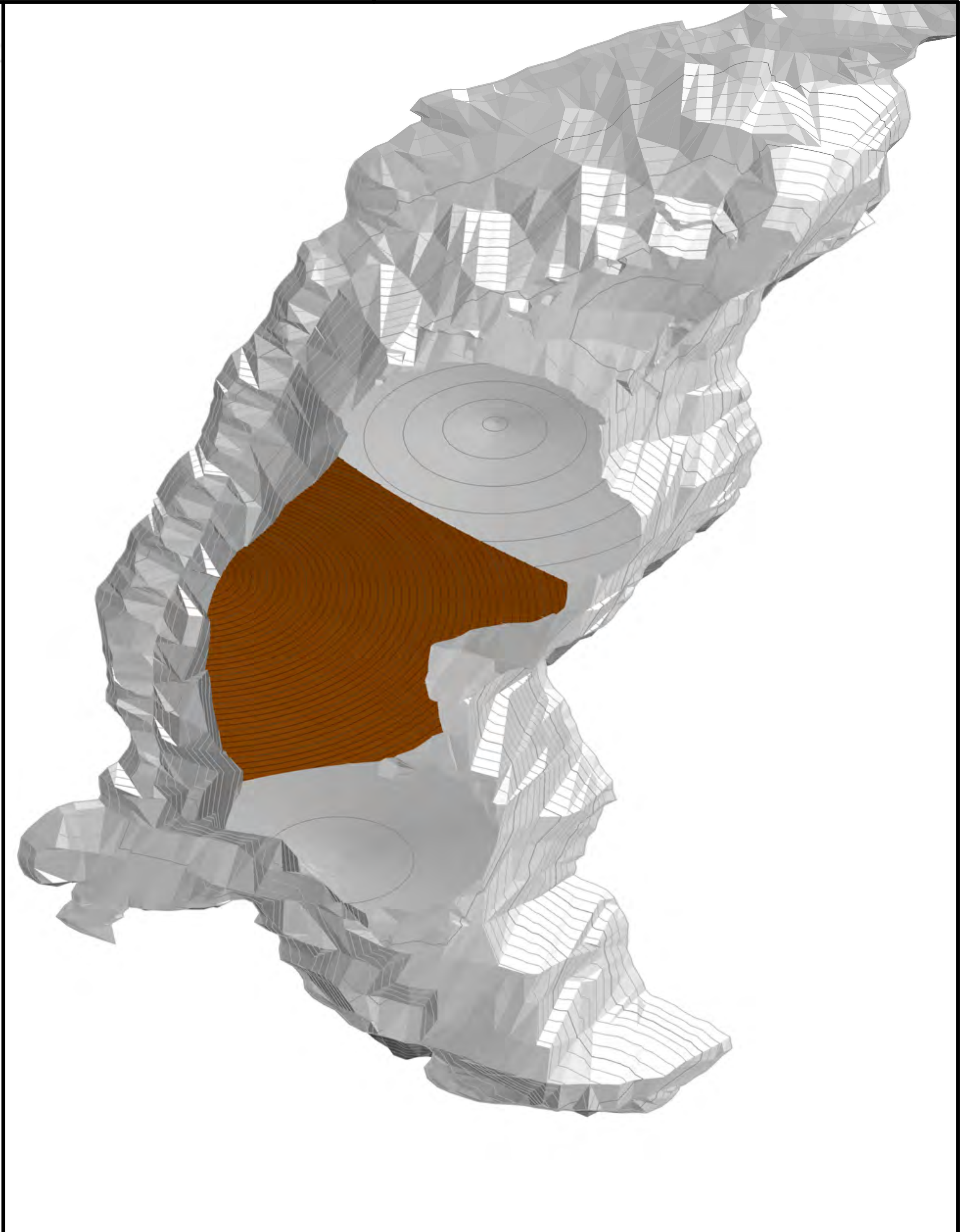

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH
lundin mining

EAGLE MINE
FIGURE 5
DEC 2017 - ORE STACKING

SCALE
1"=300'
OR AS NOTED

DWG. No. H349392

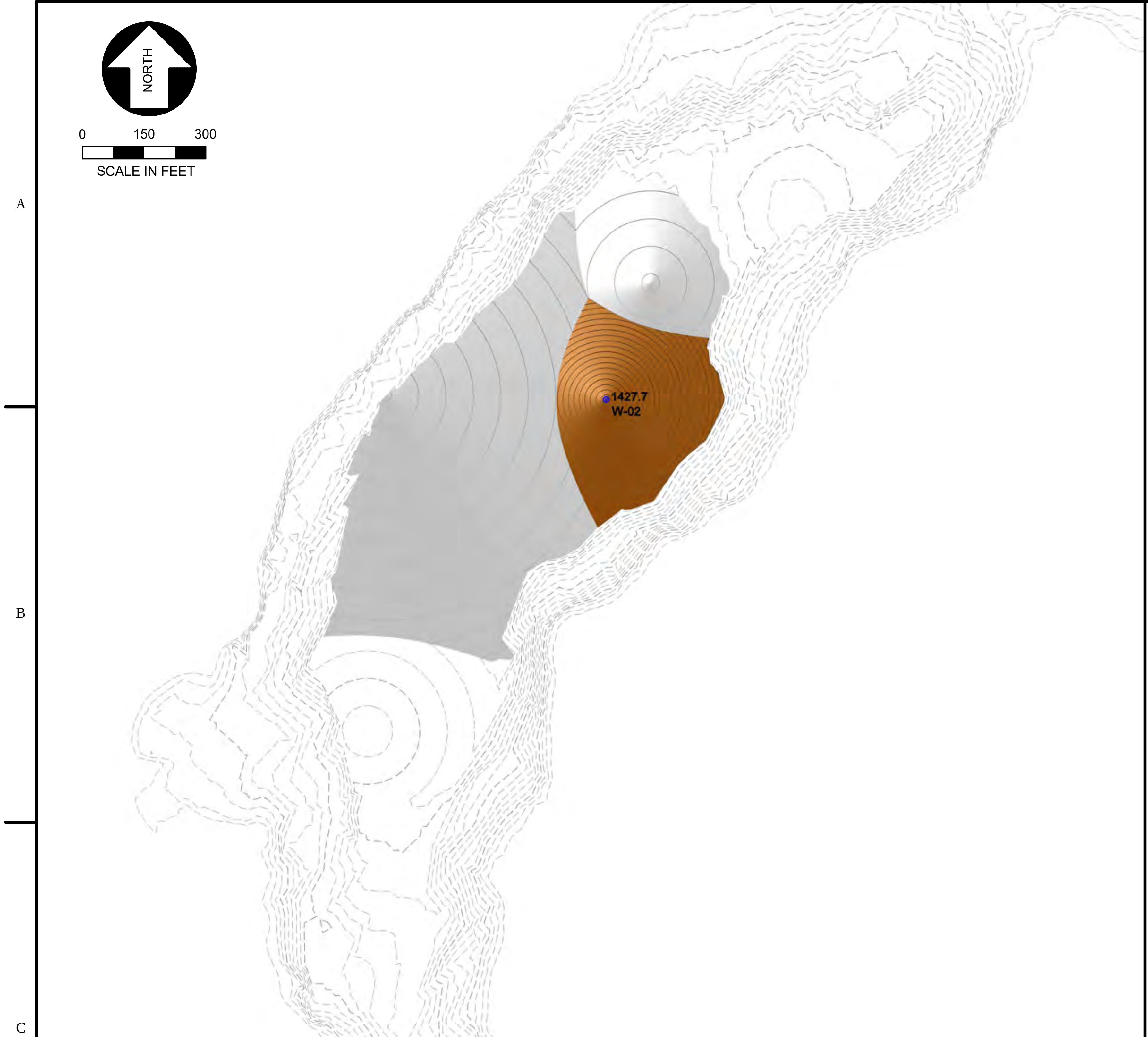
REV A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:22pm
FILE : P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 5- DEC 2017 ORE STACKING.dwg LAYOUT NAME: DEC 2017 ORE STACKING

1 2 3 4

A B C



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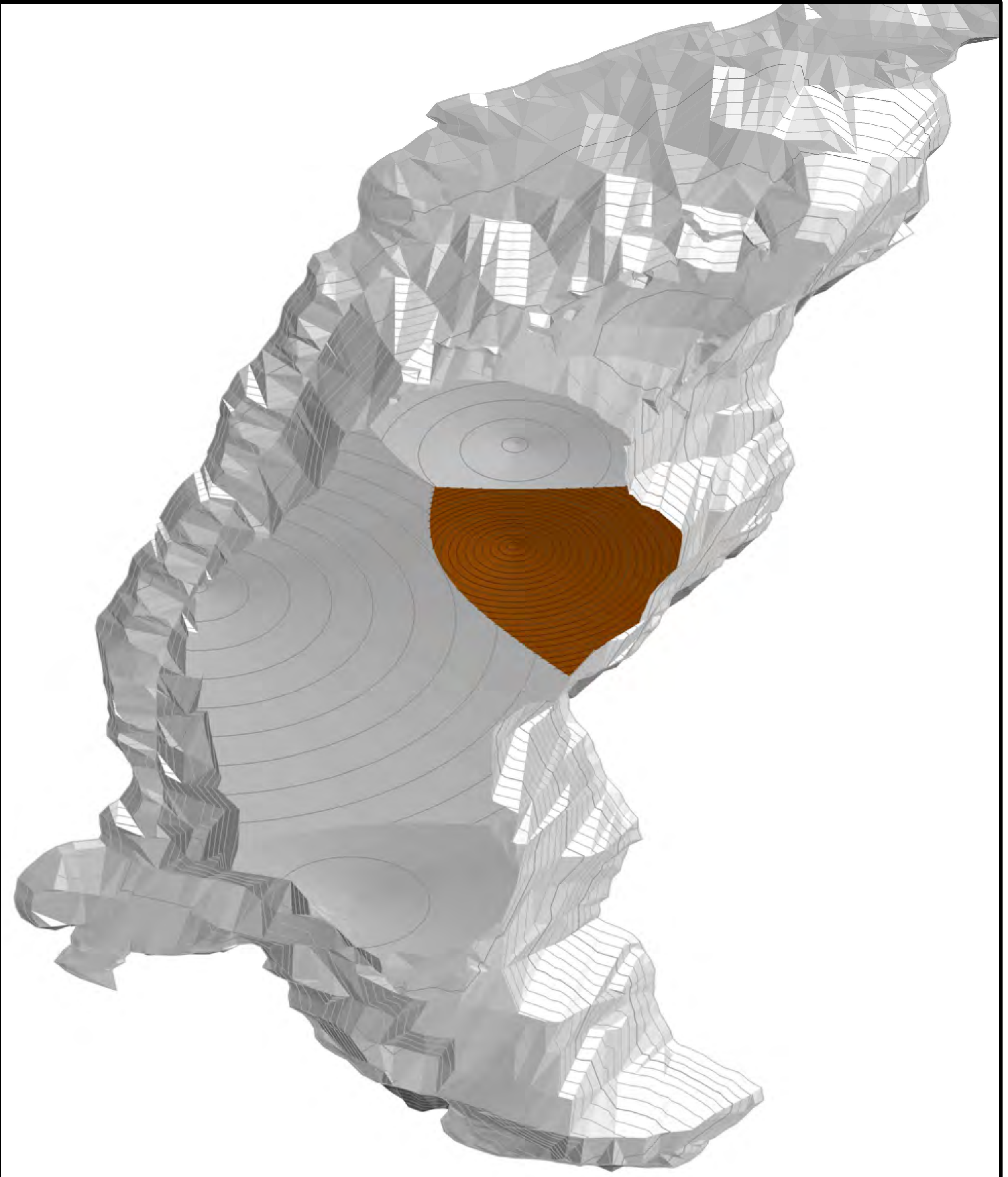

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH
lundin mining

EAGLE MINE
FIGURE 6
MAY 2018 - ORE STACKING

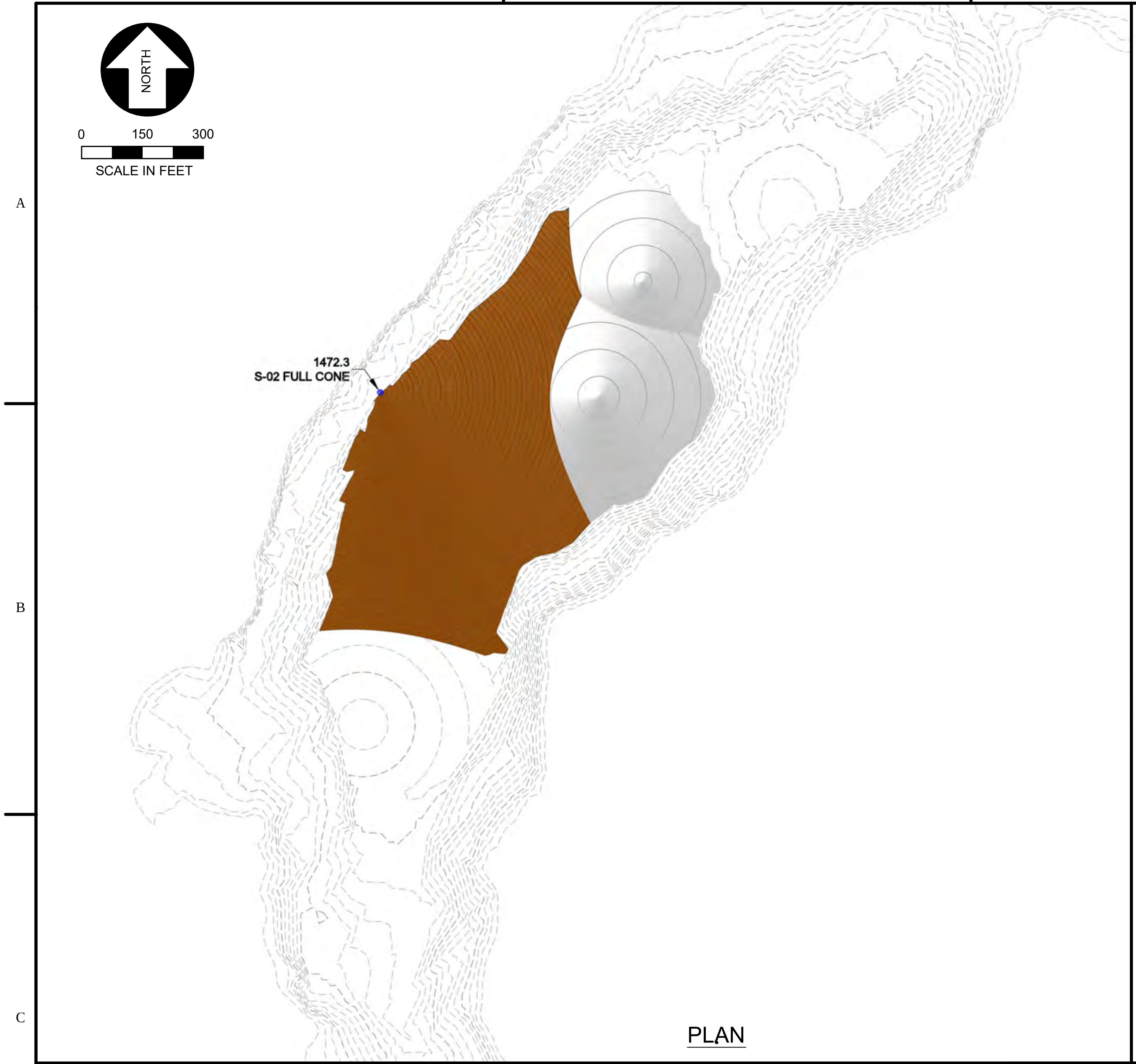
SCALE
1"=300'
OR AS NOTED

DWG. No.
H349392

REV
A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:23pm
FILE : P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 6- MAY 2018 ORE STACKING.dwg LAYOUT NAME: MAY 2018 ORE STACKING



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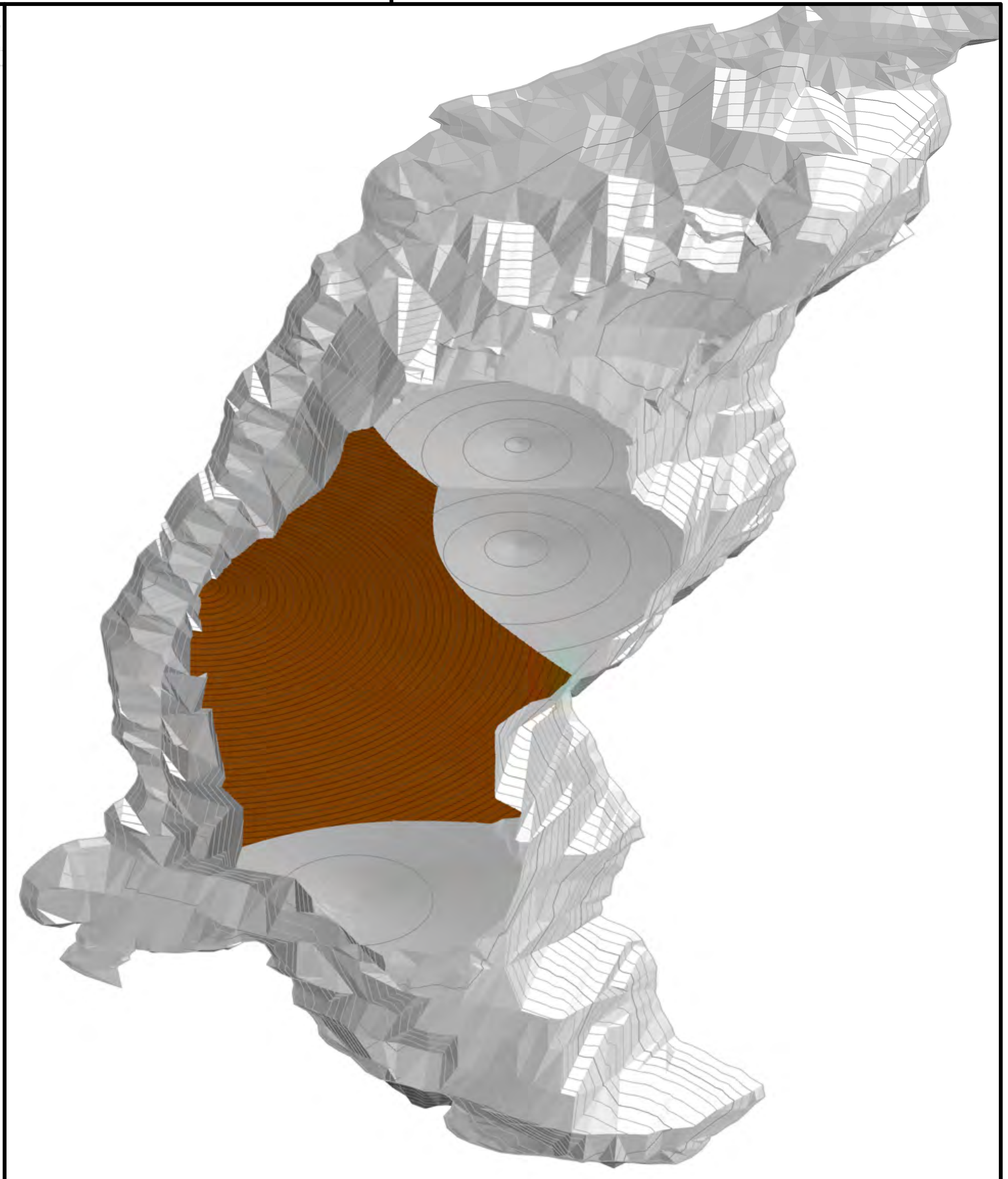

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

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EAGLE MINE
FIGURE 7
DEC 2018 - ORE STACKING

SCALE 1"=300' OR AS NOTED

DWG. No. H349392

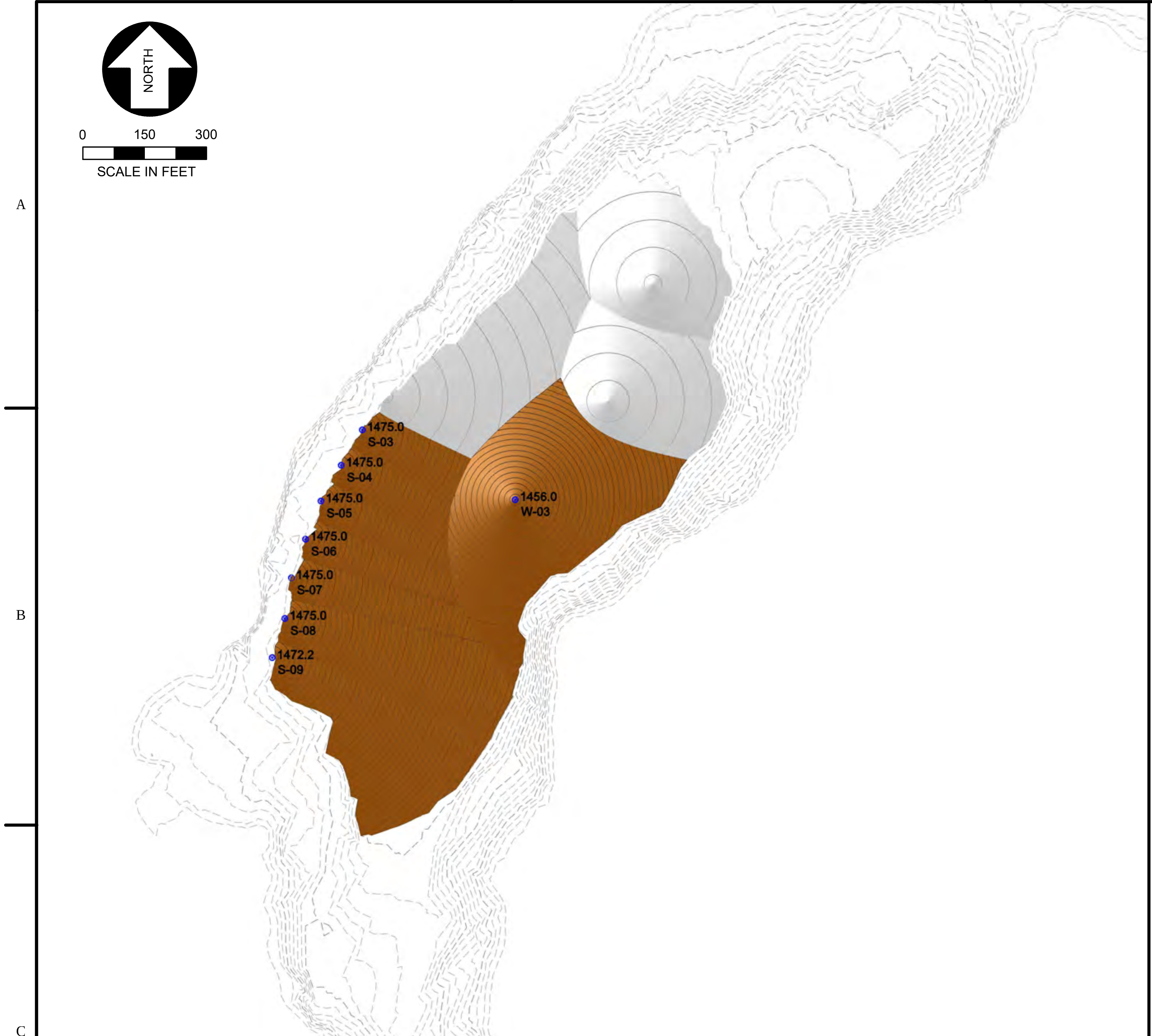
REV A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:24pm
FILE: P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 7- DEC 2018 ORE STACKING.dwg LAYOUT NAME: DEC 2018 ORE STACKING

1 2 3 4

A B C



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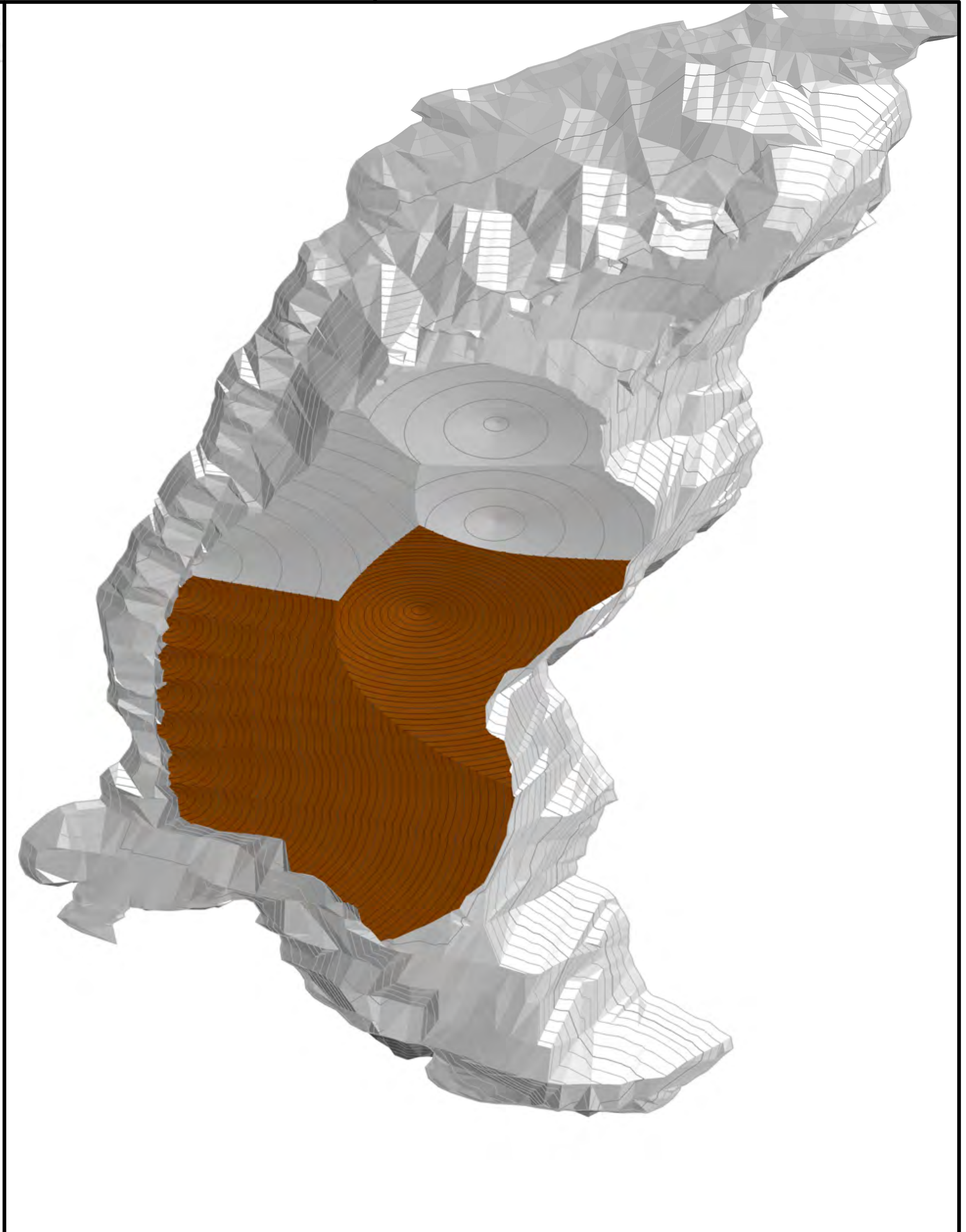

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH
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EAGLE MINE
FIGURE 8
YEAR 2019 - ORE STACKING

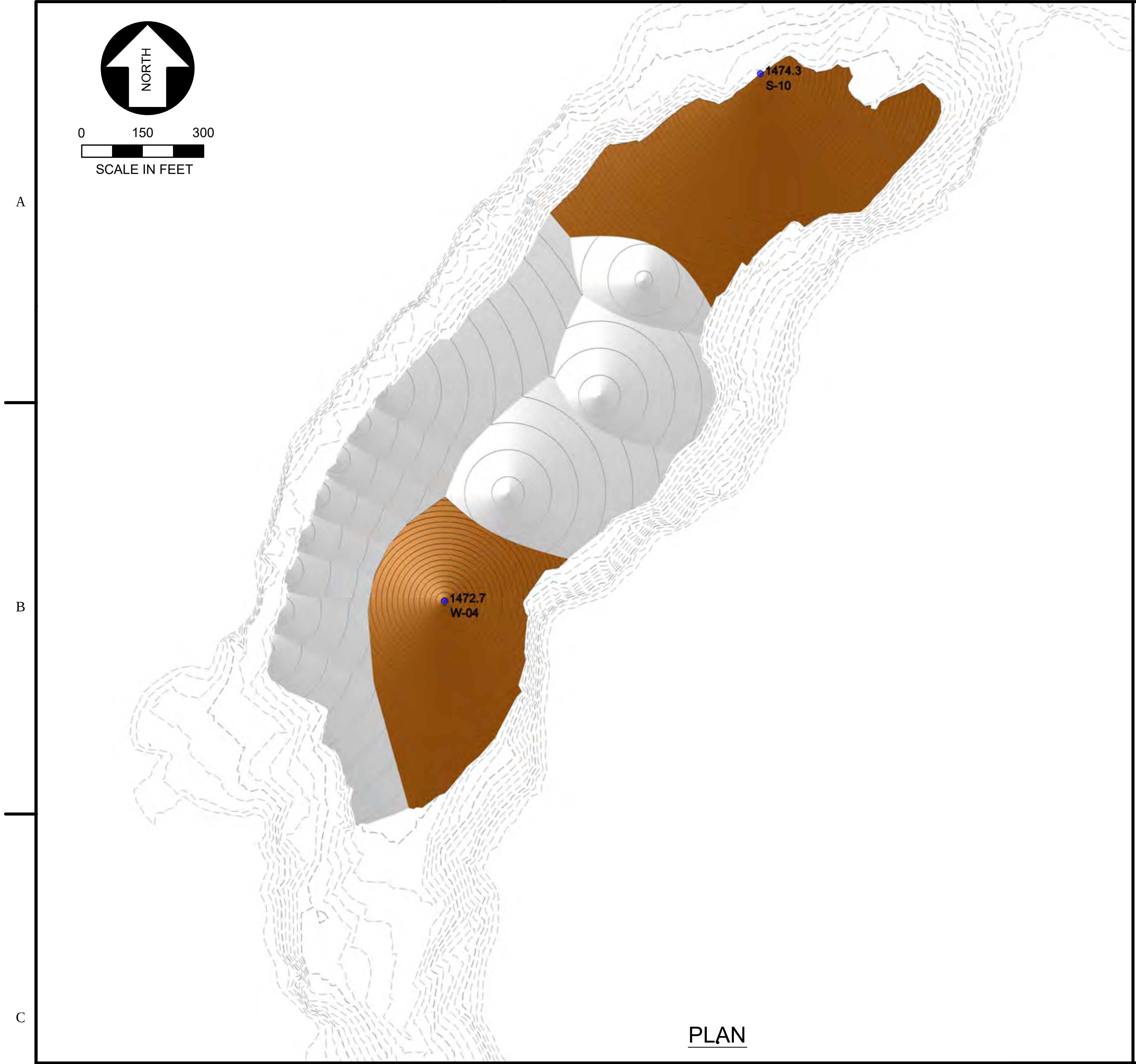
SCALE 1"=300' OR AS NOTED

DWG. No. H349392

REV A

SHEET SIZE: B

USERNAME : MORI7413
DATE : 08/25/16 TIME : 3:24pm
FILE : P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 8- YEAR 2019 ORE STACKING.dwg LAYOUT NAME: YEAR 2019 ORE STACKING



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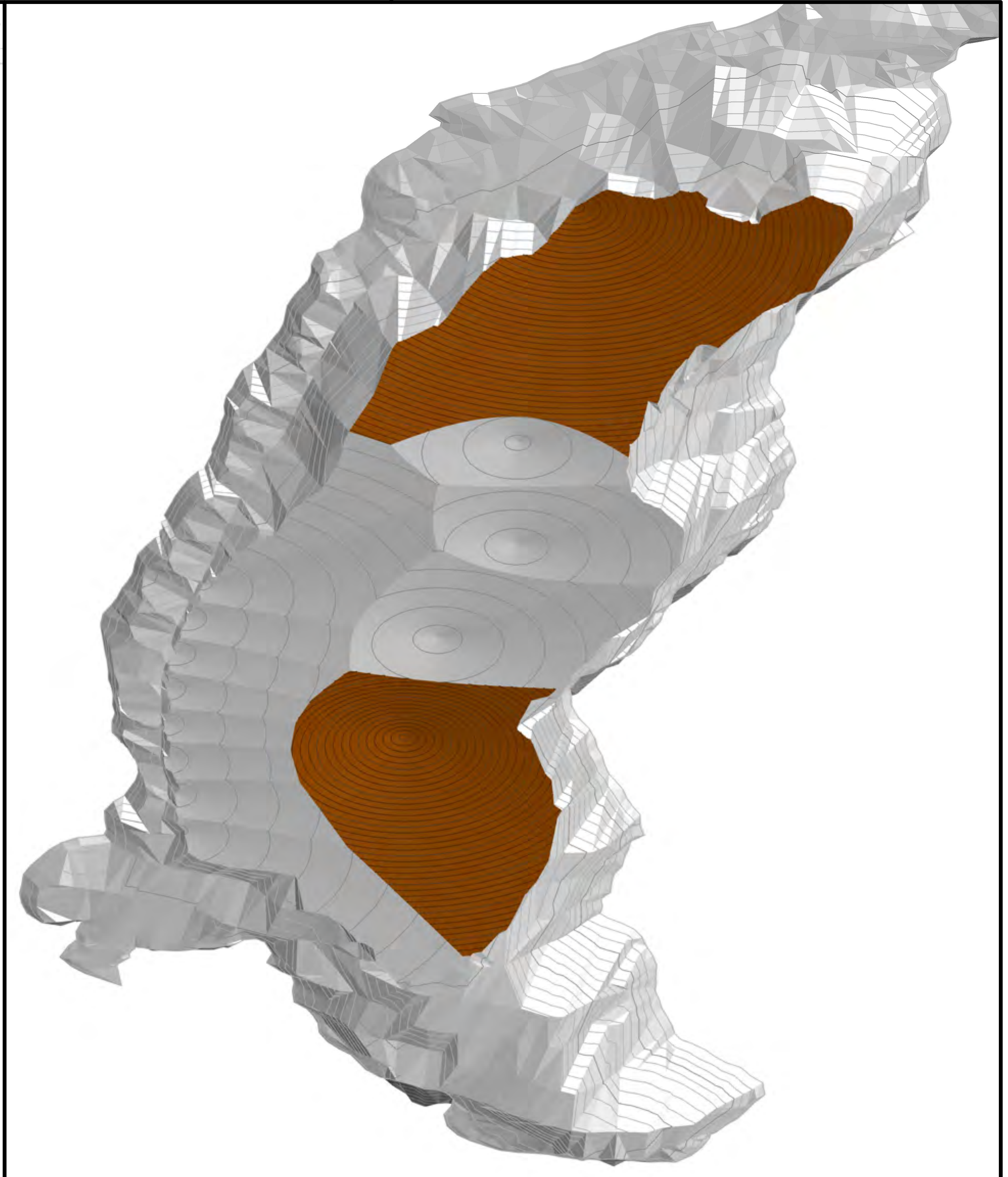

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

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EAGLE MINE
FIGURE 9
YEAR 2020 - ORE STACKING

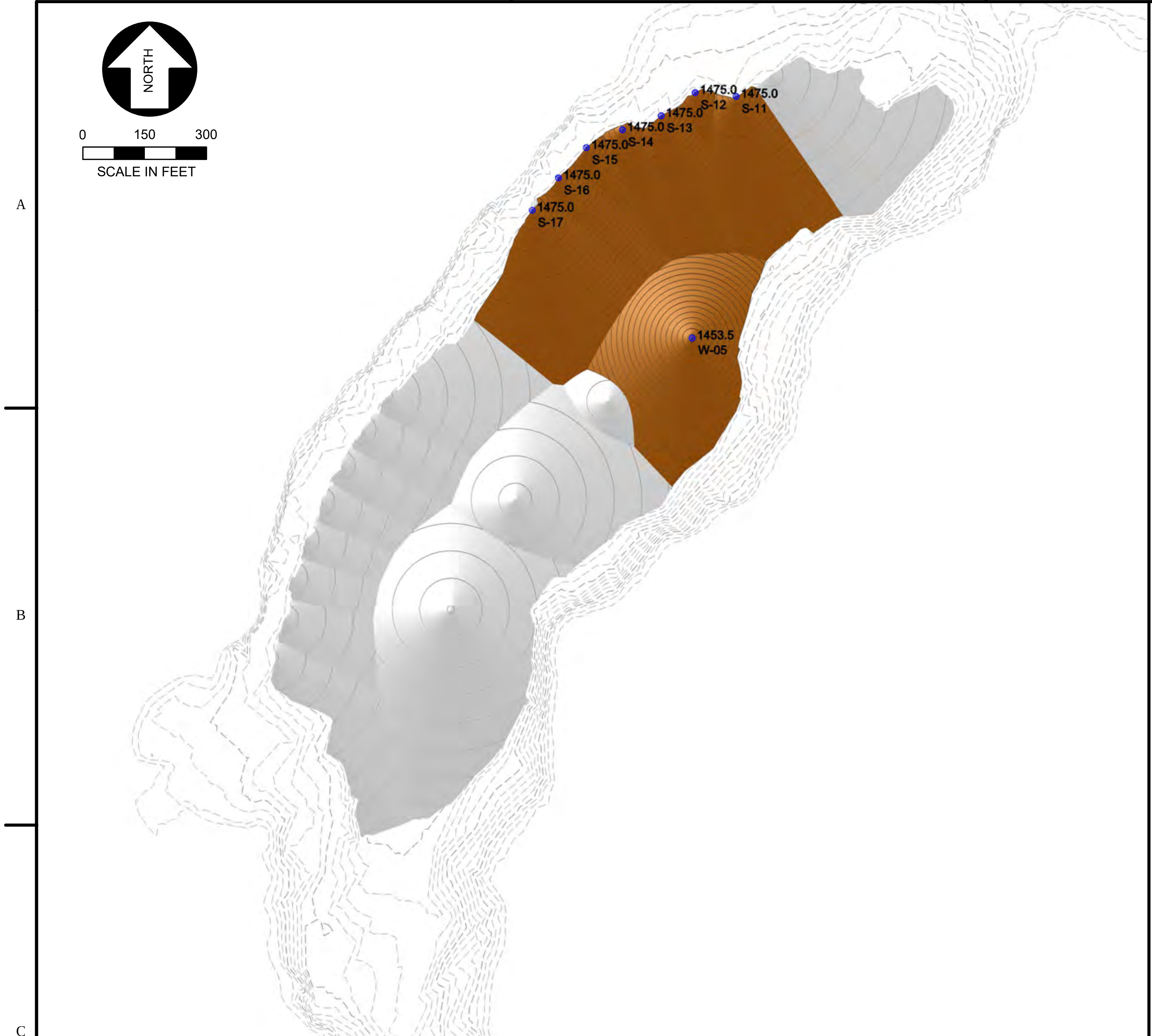
SCALE
1"=300'
OR AS NOTED

DWG. No.
H349392

REV
A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:25pm
FILE: P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 9- YEAR 2020 ORE STACKING.dwg LAYOUT NAME: YEAR 2020 ORE STACKING



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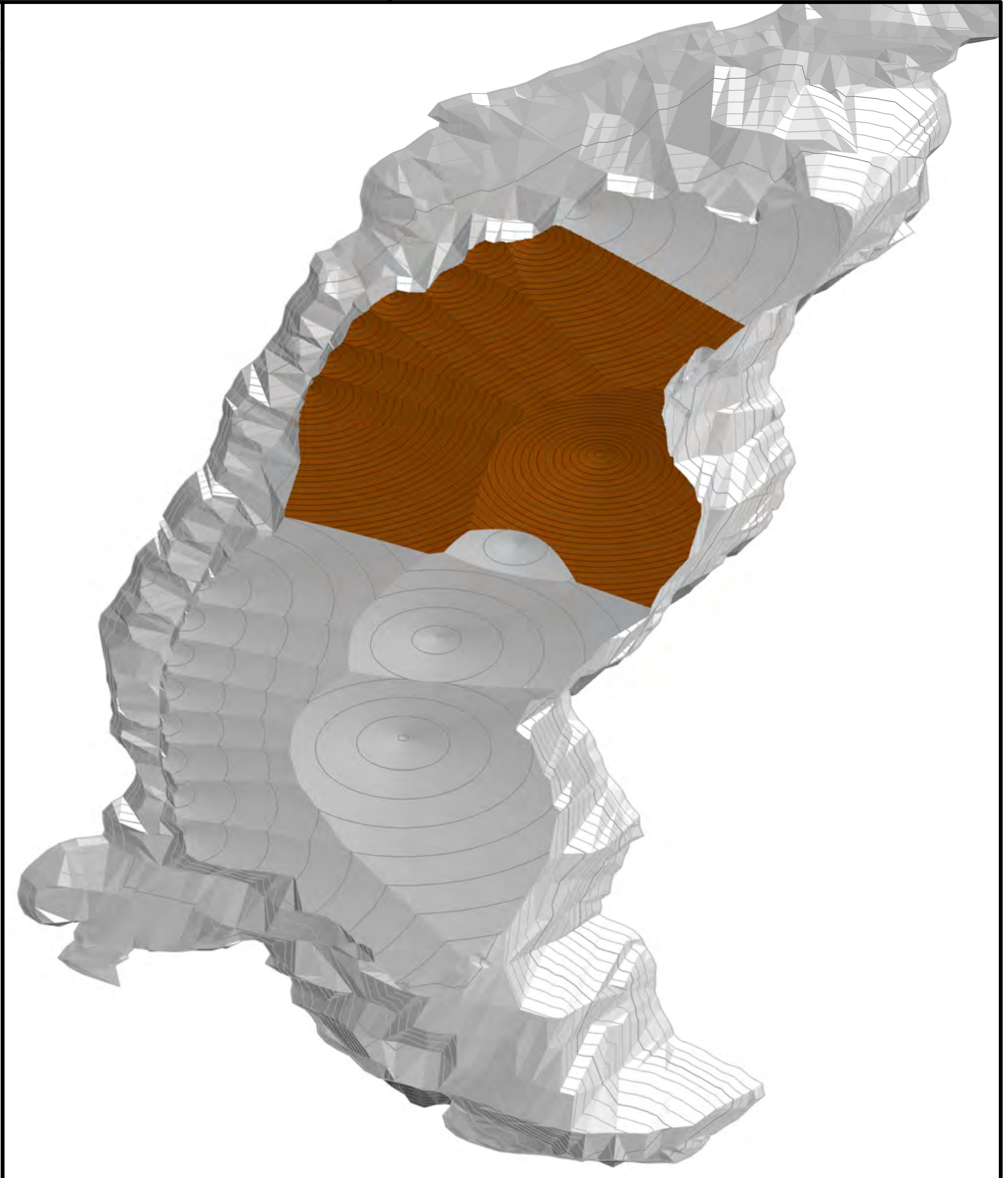

ISOMETRIC

FOR CLIENT REVIEW

No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

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EAGLE MINE
FIGURE 10
YEAR 2021 - ORE STACKING

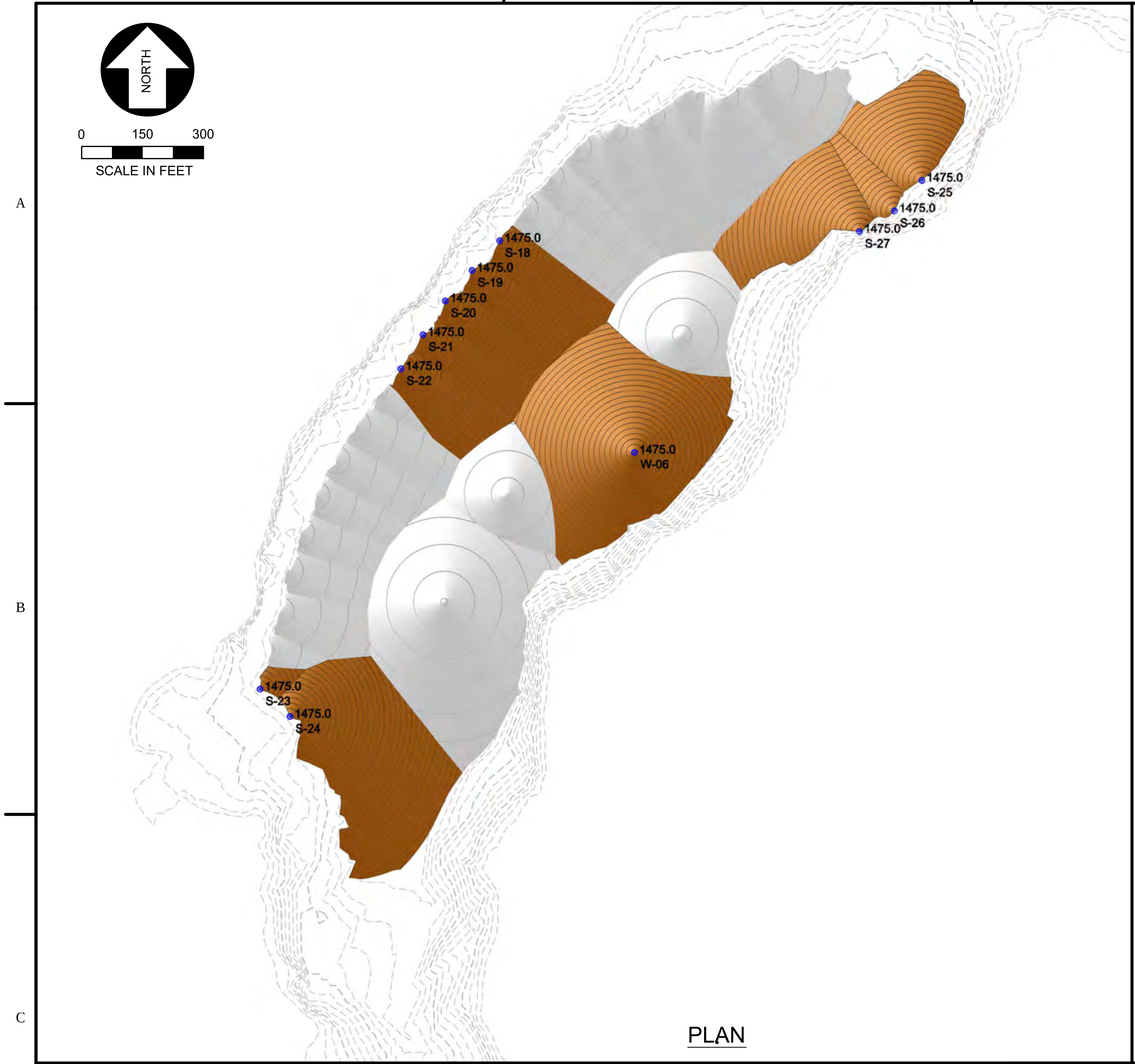
SCALE
1"=300'
OR AS NOTED

DWG. No.
H349392

REV
A

SHEET SIZE: B

USERNAME : MORI77413
DATE : 08/25/16 TIME : 3:26pm
FILE: P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 10- YEAR 2021 ORE STACKING.dwg LAYOUT NAME: YEAR 2021 ORE STACKING



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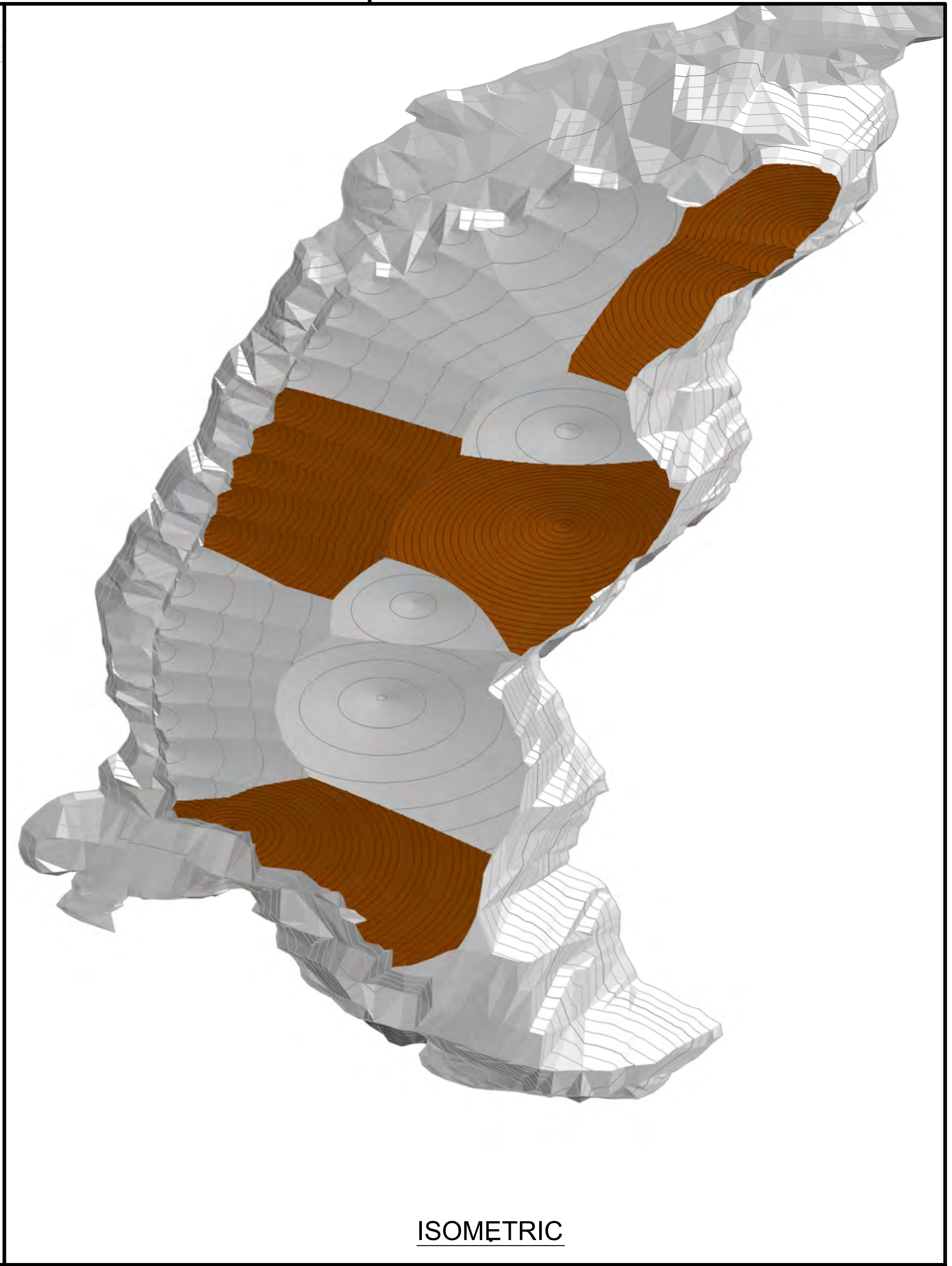

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

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EAGLE MINE
FIGURE 11
YEAR 2022 - ORE STACKING

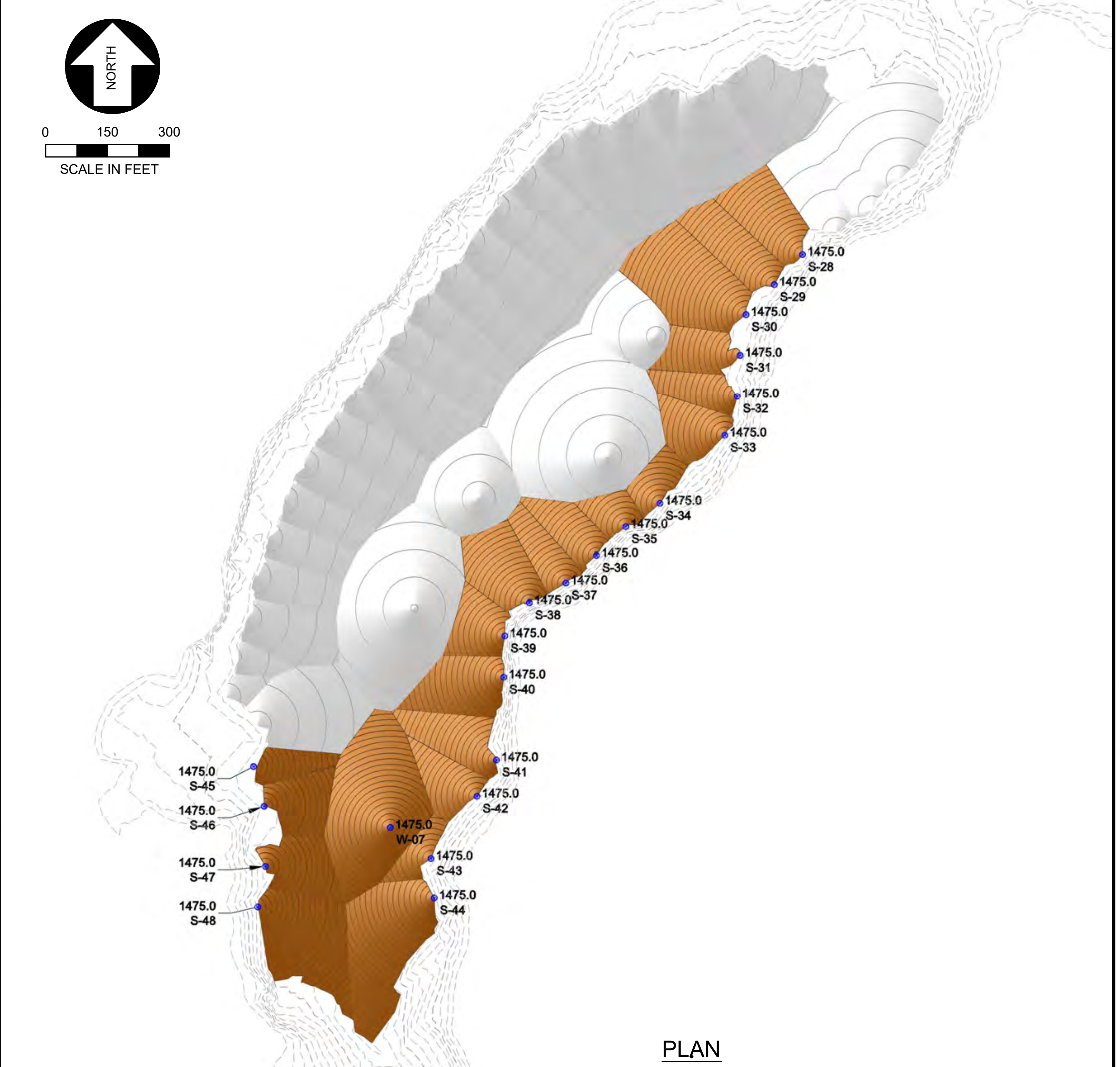
SCALE
1"=300'
OR AS NOTED

DWG. No.
H349392

REV
A

SHEET SIZE: B

USERNAME : MORI77413
DATE: 08/25/16 TIME: 3:27pm
FILE: P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 11- YEAR 2022 ORE STACKING.dwg LAYOUT NAME: YEAR 2022 ORE STACKING



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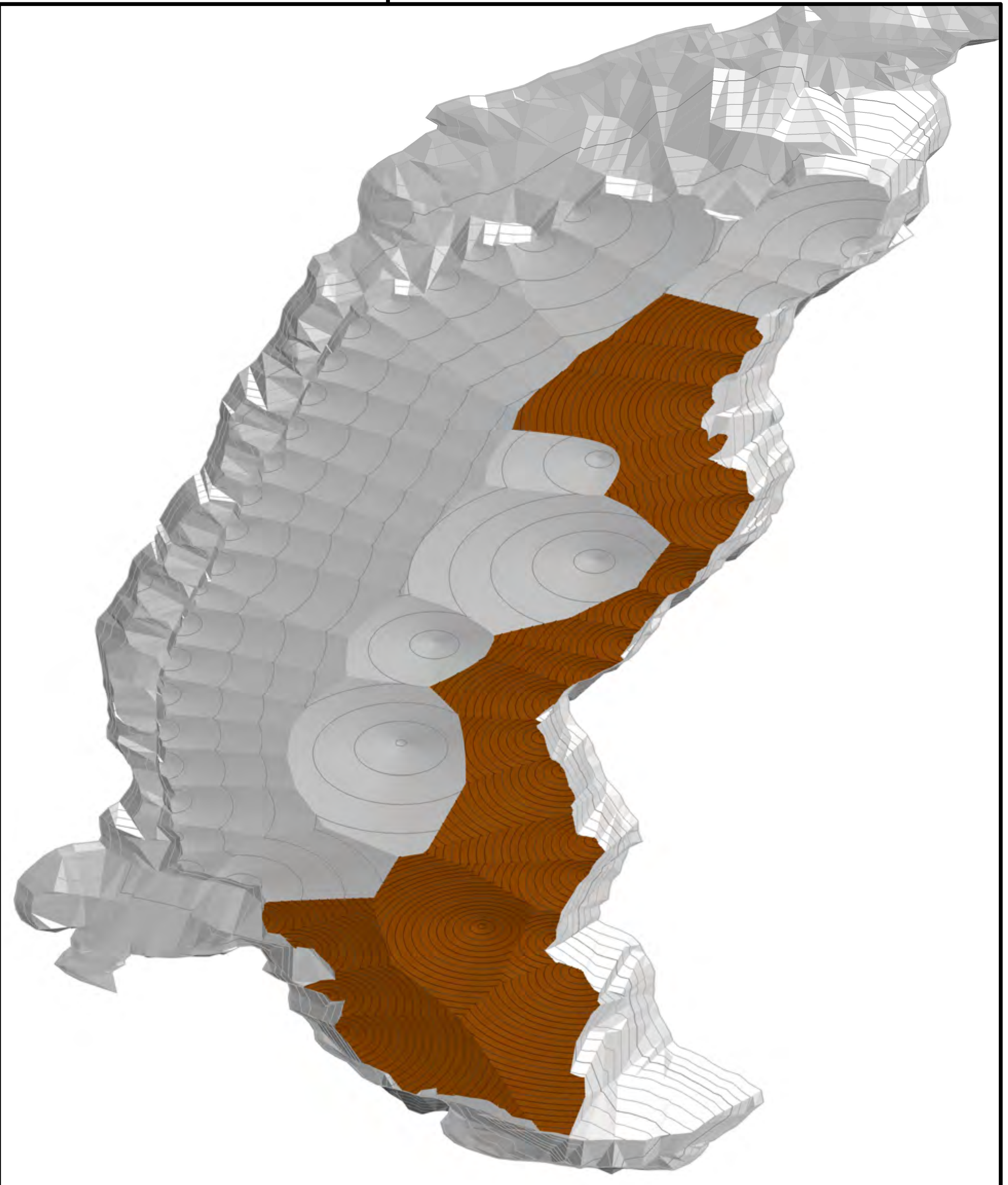

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No.	DESCRIPTION	BY	CHK'D	DATE

REVISIONS

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	MMORISON	NR	08-24-2016
DESIGNER	MMORISON	NR	08-24-2016
CHECKER	KLOCK	NR	08-24-2016
DESIGN COORD.			
RESP. ENG.	DLI	NR	08-24-2016
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER	DCASTENDYK	NR	08-24-2016

DRAWING APPROVAL STATUS: FOR CLIENT REVIEW

HATCH

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EAGLE MINE
FIGURE 12
YEAR 2023 - ORE STACKING

SCALE 1"=300' OR AS NOTED

DWG. No. H349392

REV A

SHEET SIZE: B

USERNAME : MORI77413
DATE: 08/25/16 TIME: 3:28pm
FILE: P:\EAGLEMINE\349392\CAD\FINAL ORE STACKING FIGURES\FIGURE 12- DEC 2023 ORE STACKING.dwg LAYOUT NAME: DEC 2023 ORE STACKING

APPENDIX D

SPECIAL PERMIT CONDITION F3 (a, b, e, and f)

Table 2 (1st Quarter 2010)
Humboldt Pit Profile at HPL002 on 2-23-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	0.3	523	9.5	
1	2.1	512	9.4	
2	3.3	513	9.7	
3	3.4	515	9.9	
4	3.5	516	9.9	
5	3.5	515	10	
6	3.5	515	9.9	
7	3.6	515	9.9	
8	3.6	515	9.8	
9	3.6	515	9.8	
10	3.6	515	9.7	
11	3.6	515	9.6	
12	3.6	515	9.6	
13	3.6	515	9.6	
14				
15	3.6	515	9.5	
16				
17	3.6	516	9.5	
18				
19	3.6	517	9.5	
20	3.6	517	9.4	
21				
22	3.6	518	9.4	
23				
24	3.6	519	9.3	
25	3.6	520	9.2	
26	3.7	526	8.3	Est. for DO.
27	3.9	558	3.3	
28	3.9	565	1.9	
29	3.9	575	0.5	
30	4.0	588	<0.1	
31				
32	4.0	609	<0.1	
33				
34	4.1	631	<0.1	
35				
36	4.2	643	<0.1	
37	4.2	644	<0.1	
38				
39	4.3	658	<0.1	
40				
41				
42	4.3	676	<0.1	
43				
44				
45	4.4	694	<0.1	
46				
47	4.5	705	<0.1	
48				
49	4.6	711	<0.1	
50				
51				
52	4.6	715	<0.1	

Table 2 (1st Quarter 2010)
Humboldt Pit Profile at HPL002 on 3-16-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	0.2	223	11	
1	3.8	503	10	
2	3.6	512	10	
3	3.6	512	9.9	
4				
5	3.6	513	9.9	
6				
7	3.6	512	9.9	
8				
9	3.6	512	9.8	
10	3.6	513	9.8	
11				
12	3.6	513	9.7	
13				
14	3.6	513	9.6	
15				
16	3.6	513	9.6	
17				
18	3.6	514	9.5	
19				
20	3.6	515	9.4	
21				
22	3.6	516	9.3	
23				
24	3.6	517	9.2	
25	3.7	520	8.7	
26	3.9	543	4.5	
27	3.9	557	2.4	
28	3.9	566	1.1	
29	4.0	575	<0.1	
30	4.0	589	<0.1	
31				
32	4.1	612	<0.1	
33				
34	4.1	627	<0.1	
35				
36	4.2	639	<0.1	
37	4.2	643	<0.1	
38				
39	4.3	655	<0.1	
40				
41	4.3	670	<0.1	
42				
43	4.4	682	<0.1	
44				
45	4.5	693	<0.1	
46				
47	4.5	703	<0.1	
48				
49	4.6	708	<0.1	
50				
51				
52	4.6	711	<0.1	

Table 2 (1st Quarter 2010)
Humboldt Pit Profile at HPL003 on 2-23-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25oC	DO (ppm)	Note
surface	0.3	529	9.4	
1	2.2	516	9.5	
2	3.3	516	9.6	
3	3.4	516	9.8	
4				
5				
6	3.5	516	9.8	
7				
8				
9				
10	3.6	515	9.6	
11				
12				
13				
14				
15	3.6	517	9.5	
16				
17				
18				
19				
20	3.7	518	9.3	
21				
22				
23				
24				
25	3.8	524	8.4	
26	3.9	537	5.7	
27	3.9	556	3.5	
28	3.9	567	1.6	
29	3.9	575	0.4	
30	4.0	582	<0.1	
31				
32				
33				
34				
35				
36				
37	4.2	647	<0.1	
38				
39				
40				
41				
42	4.4	679	<0.1	
43				
44				
45				
46				
47	4.5	707	<0.1	
48				
49				
50				
51				
52				
53				
54	4.6	717	<0.1	

Table 2 (1st Quarter 2010)
Humboldt Pit Profile at HPL003 on 3-16-10

Depth (m)	Temp (°C)	**Sp Cond (μmhos/ cm @ 25^{o}C**	**DO (ppm)**	**Note**
surface	0.5	291	11	
1	3.6	509	9.9	
2				
3	3.6	513	9.8	
4				
5				
6	3.5	514	9.8	
7				
8				
9				
10	3.6	514	9.7	
11				
12				
13				
14				
15	3.6	514	9.5	
16				
17				
18				
19				
20	3.6	515	9.3	
21				
22				
23				
24				
25	3.7	521	8.6	
26	3.8	544	5.0	
27	3.9	557	2.7	
28	3.9	565	1.4	
29	4.0	576	0.1	
30	4.0	588	<0.1	
31				
32				
33				
34				
35				
36				
37	4.2	645	<0.1	
38				
39				
40				
41				
42	4.4	674	<0.1	
43				
44				
45				
46				
47	4.5	703	<0.1	
48				
49				
50				
51				
52				
53				
54	4.6	709	<0.1	

Table 2 (1st Quarter 2010)
Humboldt Pit Profile at HPL004 on 2-23-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25oC	DO (ppm)	Note
surface	0.1	527	9.7	
1	2.0	518	9.8	
2	3.3	516	9.7	
3	3.5	516	9.8	
4				
5				
6	3.5	516	9.8	
7				
8				
9				
10	3.6	515	9.5	
11				
12				
13				
14				
15	3.6	516	9.4	
16				
17				
18				
19				
20	3.6	518	9.3	
21				
22				
23				
24				
25	3.7	522	8.6	
26	3.9	546	4.5	
27	3.9	559	2.9	
28	3.9	565	1.8	
29	4.0	576	0.2	
30	4.0	589	<0.1	
31				
32				
33				
34				
35				
36				
37	4.2	648	<0.1	
38				
39				
40				
41				
42	4.4	678	<0.1	
43				
44				
45				
46				
47	4.5	707	<0.1	
48				
49				
50				
51				
52				
53				
54				
55				
56	4.7	720	<0.1	

Table 2 (1st Quarter 2010)
Humboldt Pit Profile at HPL004 on 3-16-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25°C	DO (ppm)	Note
surface	0.4	190	11	
1	3.6	508	10	
2				
3	3.6	513	9.8	
4				
5				
6	3.6	514	9.7	
7				
8				
9				
10	3.5	514	9.8	
11				
12				
13				
14				
15	3.6	513	9.6	
16				
17				
18				
19				
20	3.6	516	9.4	
21				
22				
23				
24				
25	3.7	521	8.5	
26	3.8	539	6.0	
27	3.9	559	2.5	
28	3.9	568	0.8	
29	4.0	574	<0.1	
30	4.0	582	<0.1	
31				
32				
33				
34				
35				
36				
37	4.2	645	<0.1	
38				
39				
40				
41				
42	4.4	675	<0.1	
43				
44				
45				
46				
47	4.5	703	<0.1	
48				
49				
50				
51				
52				
53				
54				
55				
56	4.7	715	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 4-27-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25°C	DO (ppm)	Note
surface	7.8	507	11	
1	7.8	507	11	
2	7.8	507	11	
3	7.7	507	11	
4	7.7	507	11	
5	7.5	507	11	
6	7.5	507	11	
7	7.5	507	11	
8	7.5	506	11	
9	7.3	507	11	
10	6.9	507	11	
11	6.3	507	11	
12	5.7	509	10	
13	5.2	511	10	
14	5.0	512	9.9	
15	4.7	513	9.6	
16	4.6	515	9.4	
17	4.5	516	9.4	
18	4.4	518	9.2	
19	4.3	521	8.9	
20	4.2	522	8.4	
21	4.2	525	8.2	
22	4.1	528	7.8	
23	4.1	530	7.5	
24	4.1	534	7.2	
25	4.1	539	6.4	
26	4.0	547	5.6	
27	4.0	550	5.1	
28	4.0	556	4.6	
29	4.0	563	3.8	
30	4.0	569	3.1	
31	4.1	583	2.3	
32	4.1	613	0.8	
33	4.1	625	0.3	
34	4.2	627	0.3	
35	4.2	640	<0.1	
36	4.2	650	<0.1	
37	4.3	655	<0.1	
38	4.3	660	<0.1	
39	4.3	662	<0.1	
40	4.3	665	<0.1	
41	4.3	670	<0.1	
42	4.3	672	<0.1	
43	4.4	679	<0.1	
44	4.4	680	<0.1	
45	4.4	682	<0.1	
46	4.4	685	<0.1	
47	4.5	694	<0.1	
48	4.5	700	<0.1	
49	4.5	702	<0.1	
50	4.5	705	<0.1	
51	4.5	707	<0.1	
52	4.6	709	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 5-17-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25°C	DO (ppm)	Note
surface	11	511	10	
1	11	511	10	
2	11	511	10	
3	11	511	10	
4	10	511	10	
5	10	511	10	
6	9.7	511	10	
7	9.5	511	10	
8	9.2	511	10	
9	8.8	511	10	
10	8.2	511	10	
11	6.8	513	10	
12	6.6	513	10	
13	6.2	514	10	
14	5.6	515	9.7	
15	5.0	520	9.4	
16	4.8	520	9.2	
17	4.8	521	9.1	
18	4.6	522	9.0	
19	4.5	523	8.9	
20	4.5	525	8.7	
21	4.4	526	8.5	
22	4.4	527	8.4	
23	4.3	530	8.2	
24	4.3	531	8.0	
25	4.2	542	6.9	
26	4.1	553	5.7	
27	4.1	561	4.8	
28	4.1	570	3.9	
29	4.1	579	3.6	
30	4.1	588	2.4	
31	4.1	602	1.8	
32	4.1	604	1.6	
33	4.1	617	1.0	
34	4.2	632	0.4	
35	4.2	642	0.2	
36	4.2	650	<0.1	
37	4.2	652	<0.1	
38	4.3	660	<0.1	
39	4.3	666	<0.1	
40	4.3	669	<0.1	
41	4.3	677	<0.1	
42	4.4	687	<0.1	
43	4.4	698	<0.1	
44	4.5	702	<0.1	
45	4.5	704	<0.1	
46	4.5	709	<0.1	
47	4.5	711	<0.1	
48	4.5	712	<0.1	
49	4.5	712	<0.1	
50	4.5	713	<0.1	
51	4.5	713	<0.1	
52	4.6	715	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 6-14-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25°C	DO (ppm)	Note
surface	17.2	540	9.3	
1	17.1	539	9.3	
2	16.97	539	9.3	
3	16.81	539	9.3	
4	16.30	539	9.6	
5	11.97	539	11.2	
6	10.58	538	11.3	
7	9.83	539	11.2	
8	9.33	539	11.0	
9	8.87	539	10.9	
10	8.22	538	10.6	
11	7.42	540	10.7	
12	6.82	541	10.6	
13	6.24	542	10.4	
14	5.66	544	10.2	
15	5.28	546	9.9	
16	5.00	548	9.7	
17	4.75	550	9.4	
18	4.57	551	9.3	
19	4.5	554	9.1	
20	4.4	556	8.72	
21	4.35	559	8.46	
22	4.3	563	8.1	
23	4.2	567	7.7	
24	4.2	571	7.2	
25	4.1	578	5.9	
26	4.2	586	5.53	
27	4.1	594	4.4	
28	4.1	599	3.9	
29	4.1	610	2.9	
30	4.1	624	1.6	
31	4.1	643	0.7	
32	4.2	655	0.4	
33	4.2	662	0.3	
34	4.2	672	<0.1	
35	4.2	677	<0.1	
36	4.2	681	<0.1	
37	4.3	689	<0.1	
38	4.3	694	<0.1	
39	4.3	698	<0.1	
40	4.3	707	<0.1	
41	4.3	712	<0.1	
42	4.4	719	<0.1	
43	4.4	726	<0.1	
44	4.4	733	<0.1	
45	4.5	737	<0.1	
46	4.5	744	<0.1	
47	4.5	746	<0.1	
48	4.5	747	<0.1	
49	4.5	748	<0.1	
50	4.5	748	<0.1	
51	4.5	749	<0.1	
52	4.5	749	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 4-27-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	7.8	506	11	
1	7.8	507	11	
2	7.7	507	11	
3	7.7	507	11	
4	7.7	507	11	
5	7.6	507	11	
6	7.5	507	11	
7	7.5	507	11	
8	7.3	507	11	
9	7.1	507	11	
10	6.9	507	11	
11	6.4	507	11	
12	6.1	508	11	
13	5.8	509	10	
14	5.5	510	10	
15	4.9	513	9.8	
16	4.6	516	9.4	
17	4.5	516	9.3	
18	4.4	517	9.2	
19	4.3	518	9.1	
20	4.3	520	8.8	
21	4.3	522	8.7	
22	4.2	525	8.3	
23	4.1	528	8.0	
24	4.1	533	7.2	
25	4.1	537	6.6	
26	4.1	543	6.2	
27	4.1	545	5.7	
28	4.0	563	3.9	
29	4.1	579	2.9	
30	4.1	589	2.2	
31	4.1	592	2.0	
32	4.1	609	1.2	
33	4.1	616	0.7	
34	4.1	627	0.2	
35	4.2	638	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 5-17-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	12	512	10	
1	11	511	10	
2	11	511	10	
3	11	511	10	
4	10	511	10	
5	9.7	511	10	
6	9.6	511	10	
7	9.3	511	10	
8	9.1	511	10	
9	8.9	511	10	
10	8.3	511	10	
11	7.6	512	10	
12	6.7	513	10	
13	6.1	514	9.9	
14	5.5	516	9.6	
15	5.3	517	9.6	
16	5.0	519	9.3	
17	4.8	521	8.9	
18	4.6	523	8.7	
19	4.4	524	8.7	
20	4.4	527	8.4	
21	4.3	529	8.3	
22	4.3	531	8.0	
23	4.2	533	7.7	
24	4.2	536	7.5	
25	4.2	539	7.0	
26	4.2	545	6.5	
27	4.1	565	4.4	
28	4.1	579	3.1	
29	4.1	587	2.8	
30	4.1	597	2.1	
31	4.1	604	1.7	
32	4.1	613	1.4	
33	4.1	620	0.9	
34	4.1	634	0.4	
35	4.2	648	0.1	
36	4.2	650	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 6-14-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	17.0	539	9.4	
1	16.9	539	9.4	
2	16.9	539	9.4	
3	16.9	539	9.4	
4	16.8	539	9.4	
5	11.7	538	11.2	
6	10.7	538	11.3	
7	9.9	539	11.1	
8	9.4	539	11.1	
9	8.8	539	10.9	
10	8.1	539	10.9	
11	7.6	540	10.8	
12	6.9	541	10.7	
13	6.2	542	10.4	
14	5.6	543	10.2	
15	5.2	546	9.8	
16	4.9	548	9.6	
17	4.8	550	9.4	
18	4.6	551	9.3	
19	4.5	553	9.3	
20	4.5	555	8.9	
21	4.4	558	8.6	
22	4.3	561	8.3	
23	4.2	564	7.8	
24	4.2	570	7.1	
25	4.1	576	6.5	
26	4.1	584	5.3	
27	4.1	592	5.2	
28	4.1	598	4.1	
29	4.1	608	3.2	
30	4.1	624	1.6	
31	4.1	642	0.9	
32	4.2	652	0.4	
33	4.2	660	0.2	
34	4.2	668	<0.1	
35	4.2	675	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL003 on 4-27-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	7.5	507	11	
1	7.4	507	11	
2				
3	7.4	507	11	
4				
5				
6	7.4	507	11	
7				
8				
9				
10	639	507	11	
11				
12				
13				
14				
15	4.8	513	9.9	
16				
17				
18				
19				
20	4.3	519	9.1	
21				
22				
23				
24				
25	4.1	535	7.1	
26				
27	4.0	551	5.1	
28				
29	4.0	575	2.9	
30	4.1	586	2.1	
31	4.1	600	1.5	
32	4.1	618	0.3	
33	4.1	629	<0.1	
34				
35	4.2	641	<0.1	
36				
37	4.2	654	<0.1	
38				
39				
40				
41				
42	4.4	676	<0.1	
43				
44				
45				
46				
47	4.5	703	<0.1	
48				
49				
50				
51				
52				
53	4.6	711	<0.1	
54	4.6	712	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL003 on 5-17-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	12	512	11	
1	11	512	11	
2				
3	11	512	11	
4				
5				
6	9.8	511	10	
7				
8				
9				
10	8.0	512	10	
11				
12				
13				
14				
15	4.8	517	9.9	
16				
17				
18				
19				
20	4.3	528	9.1	
21				
22				
23				
24				
25	4.1	548	7.1	
26				
27	4.0	562	5.1	
28				
29	4.0	585	2.9	
30	4.1	607	2.1	
31	4.1	614	1.0	
32	4.1	622	0.6	
33	4.1	626	0.6	
34				
35	4.2	641	<0.1	
36		648	<0.1	
37	4.2	652	<0.1	
38				
39				
40				
41				
42	4.4	678	<0.1	
43				
44				
45				
46				
47	4.5	701	<0.1	
48				
49				
50				
51				
52				
53	4.6	714	<0.1	
54	4.6	715	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL003 on 6-14-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	16.9	538	9.3	
1	16.9	539	9.3	
2				
3	16.8	539	9.3	
4				
5				
6	10.7	538	11.1	
7				
8				
9				
10	8.1	539	10.9	
11				
12				
13				
14				
15	5.3	545	10.0	
16				
17				
18				
19				
20	4.4	554	9.3	
21				
22				
23				
24				
25	4.1	576	6.3	
26				
27	4.1	591	4.8	
28				
29	4.1	607	2.9	
30	4.1	622	1.8	
31	4.1	640	1.4	
32	4.2	653	0.3	
33	4.2	663	<0.1	
34	4.2	671	<0.1	
35	4.2	678	<0.1	
36				
37	4.2	688	<0.1	
38				
39				
40				
41				
42	4.4	716	<0.1	
43				
44				
45				
46				
47	4.5	740	<0.1	
48				
49				
50				
51				
52				
53	4.5	749	<0.1	
54	4.5	749	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL004 on 4-27-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	7.4	507	11	
1	7.4	507	11	
2				
3	7.4	507	11	
4				
5				
6	7.2	507	11	
7				
8				
9				
10	7.0	507	11	
11				
12				
13				
14				
15	4.7	514	9.5	
16				
17				
18				
19				
20	4.3	519	8.9	
21				
22				
23				
24				
25	4.1	532	7.5	
26				
27	4.1	543	5.9	
28				
29	4.0	566	3.7	
30	4.0	583	2.3	
31	4.1	599	1.3	
32	4.1	616	0.5	
33	4.1	631	<0.1	
34				
35	4.2	639	<0.1	
36				
37	4.2	651	<0.1	
38				
39				
40				
41				
42	4.4	680	<0.1	
43				
44				
45				
46				
47	4.5	704	<0.1	
48				
49				
50				
51				
52				
53				
54	4.6	711	<0.1	
55	4.6	712	<0.1	
56	4.6	713	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL004 on 5-17-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	11	512	10	
1	11	512	10	
2				
3	10	512	10	
4				
5				
6	9.7	512	10	
7				
8				
9				
10	8.2	514	10	
11				
12				
13				
14				
15	5.1	519	9.6	
16				
17				
18				
19				
20	4.3	528	8.4	
21				
22				
23				
24				
25	4.1	547	6.6	
26	4.1	552	5.5	
27				
28				
29	4.1	580	3.0	
30	4.1	591	2.3	
31	4.1	608	1.4	
32	4.1	621	0.6	
33	4.2	627	0.4	
34	4.2	630	0.3	
35	4.2	640	<0.1	
36				
37	4.2	652	<0.1	
38				
39				
40				
41				
42	4.4	682	<0.1	
43				
44				
45				
46				
47	4.5	702	<0.1	
48				
49				
50				
51				
52				
53				
54	4.5	713	<0.1	
55	4.5	714	<0.1	
56	4.5	714	<0.1	

Table 2 (2nd Quarter 2010)
Humboldt Pit Profile at HPL004 on 6-14-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	Note
surface	16.82	539	9.28	
1	16.82	539	9.29	
2				
3	16.69	539	9.29	
4				
5				
6	10.63	538	11.20	
7				
8				
9				
10	8.39	539	10.85	
11				
12				
13				
14				
15	5.28	546	9.98	
16				
17				
18				
19				
20	4.39	555	8.89	
21				
22				
23				
24				
25	4.13	578	6.09	
26				
27	4.10	593	4.19	
28				
29	4.10	607	3.08	
30	4.10	620	1.90	
31	4.13	636	0.81	
32	4.14	648	0.35	
33	4.15	658	<0.1	
34	4.17	669	<0.1	
35	4.20	677	<0.1	
36				
37	4.22	688	<0.1	
38				
39				
40				
41				
42	4.36	718	<0.1	
43				
44				
45				
46				
47	4.47	742	<0.1	
48				
49				
50				
51				
52				
53	4.53	749	<0.1	
54				
55				
56	4.54	751	<0.1	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 7-19-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25°C	DO (ppm)	ORP (mV)	Note
surface	22.46	507	8.17	174.8	
1	22.47	507	8.18	171.1	
2	22.47	506	8.18	169.2	
3	22.46	506	8.18	167.7	
4	21.02	507	8.03	172.1	
5	15.86	512	10.49	176.8	
6	11.98	518	11.18	180.0	
7	10.35	515	11.29	181.7	
8	9.71	515	11.49	182.3	
9	9.04	515	10.42	186.2	
10	8.41	514	10.28	187.4	
11	7.72	515	10.32	187.9	
12	6.91	516	10.34	188.8	
13	6.20	519	9.98	190.4	
14	5.83	520	9.84	190.7	
15	5.37	522	9.50	191.4	
16	5.12	524	9.34	191.6	
17	4.92	525	9.14	191.7	
18	4.69	527	8.93	191.7	
19	4.57	528	8.79	191.7	
20	4.50	531	8.60	191.8	
21	4.43	534	8.20	192.2	
22	4.38	537	7.89	192.1	
23	4.32	541	7.45	192.4	
24	4.25	547	6.49	192.3	
25	4.19	555	5.69	192.4	
26	4.16	561	4.52	192.6	
27	4.15	566	3.74	192.5	
28	4.13	574	2.89	192.4	
29	4.12	584	1.84	192.3	
30	4.13	604	0.45	192.2	
31	4.14	615	0.16	191.8	
32	4.17	627	0.09	190.8	
33	4.19	633	<0.1	189.9	
34	4.20	638	<0.1	189.5	
35	4.21	644	<0.1	189.0	
36	4.22	648	<0.1	188.7	
37	4.25	652	<0.1	188.2	
38	4.26	657	<0.1	187.8	
39	4.27	662	<0.1	187.4	
40	4.29	667	<0.1	187.0	
41	4.31	673	<0.1	186.6	
42	4.34	679	<0.1	186.0	
43	4.35	682	<0.1	185.7	
44	4.37	686	<0.1	185.2	
45	4.41	694	<0.1	184.7	
46	4.44	702	<0.1	183.8	
47	4.46	706	<0.1	182.8	
48	4.49	709	<0.1	181.9	
49	4.50	711	<0.1	181.4	
50	4.51	712	<0.1	180.9	
51	4.52	713	<0.1	180.2	
52	4.52	713	<0.1	179.6	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 8-23-10

Depth (m)	Temp (°C)	Sp Cond (μmhos/ cm @ 25^{o}C	DO (ppm)	ORP (mV)	Note
surface	20.99	510	8.47	293.8	
1	20.99	510	8.44	294.3	
2	20.98	510	8.43	295.8	
3	20.94	509	8.37	298.0	
4	20.54	510	8.40	299.5	
5	20.32	510	8.36	301.5	
6	14.60	520	10.82	309.8	
7	11.90	521	11.00	315.0	
8	10.60	521	11.22	316.0	
9	9.63	523	10.71	320.6	
10	8.48	522	10.13	323.9	
11	7.66	522	9.96	325.9	
12	7.00	523	10.00	327.0	
13	6.52	525	9.87	328.3	
14	5.96	527	9.62	329.3	
15	5.53	528	9.37	330.1	
16	5.15	531	9.32	330.2	
17	4.92	532	9.07	330.8	
18	4.73	535	8.76	331.2	
19	4.63	536	8.60	331.3	
20	4.52	539	8.40	331.6	
21	4.49	541	8.32	331.7	
22	4.47	545	7.88	332.2	
23	4.29	547	7.17	331.7	
24	4.23	553	6.63	332.0	
25	4.18	561	5.08	332.4	
26	4.19	570	4.29	332.6	
27	4.19	576	3.55	332.6	
28	4.15	581	2.87	332.4	
29	4.14	595	1.34	332.3	
30	4.16	609	0.59	332.0	
31	4.18	662	0.35	331.6	
32	4.17	629	0.20	330.8	
33	4.20	639	0.15	330.1	
34	4.22	646	0.13	329.7	
35	4.22	653	0.13	329.2	
36	4.24	658	0.10	328.6	
37	4.25	663	<0.1	328.2	
38	4.27	668	<0.1	327.6	
39	4.28	672	<0.1	327.3	
40	4.30	677	<0.1	327.0	
41	4.33	683	<0.1	326.5	
42	4.35	689	<0.1	326.1	
43	4.39	697	<0.1	325.4	
44	4.41	703	<0.1	324.9	
45	4.44	709	<0.1	324.5	
46	4.45	711	<0.1	323.9	
47	4.48	715	<0.1	323.2	
48	4.49	718	<0.1	322.7	
49	4.50	719	<0.1	322.2	
50	4.51	720	<0.1	321.9	
51	4.53	722	<0.1	321.7	
52	4.53	722	<0.1	321.4	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 9-20-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25°C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	14.54	510	9.60	94.4	136.6	8.10	
1	14.53	510	9.60	94.4	133.0	8.11	
2	14.53	510	9.59	94.3	132.2	8.12	
3	14.54	510	9.59	94.3	131.2	8.13	
4	14.53	509	9.58	94.2	130.8	8.13	
5	14.53	510	9.57	94.1	130.7	8.13	
6	14.53	509	9.57	94.0	130.4	8.14	
7	14.53	510	9.56	93.9	130.5	8.15	
8	11.92	523	10.74	100.1	138.0	7.94	
9	9.79	524	10.24	90.3	145.5	7.69	
10	8.83	523	10.36	89.1	144.4	7.68	
11	8.05	524	10.29	87.0	144.9	7.65	
12	7.25	525	10.24	84.8	146.1	7.62	
13	6.66	526	9.86	80.6	148.2	7.55	
14	6.06	528	9.76	78.5	149.0	7.52	
15	5.62	531	9.58	76.1	149.9	7.49	
16	5.21	532	9.34	73.5	150.7	7.45	
17	4.97	535	9.00	70.3	151.6	7.42	
18	4.74	536	8.78	68.3	151.8	7.40	
19	4.58	539	8.65	66.1	152.2	7.38	
20	4.56	542	8.21	63.5	153.1	7.36	
21	4.55	546	7.91	61.1	154.1	7.32	
22	4.50	549	7.63	58.9	154.9	7.29	
23	4.37	552	7.12	54.9	154.4	7.28	
24	4.31	557	6.24	47.8	154.9	7.25	
25	4.27	563	5.38	41.4	155.4	7.22	
26	4.20	571	4.09	31.4	156.0	7.19	
27	4.21	578	3.32	25.5	156.5	7.17	
28	4.17	584	3.01	23.1	156.5	7.16	
29	4.16	591	1.84	14.0	156.9	7.14	
30	4.15	606	0.49	3.6	157.3	7.12	
31	4.18	622	0.35	2.7	156.7	7.12	
32	4.20	634	0.20	1.5	156.1	7.13	
33	4.21	643	0.15	1.1	155.8	7.14	
34	4.22	650	0.13	1.0	155.6	7.15	
35	4.24	657	0.11	0.9	155.4	7.17	
36	4.24	650	0.12	0.9	154.9	7.19	
37	4.26	665	0.09	0.7	154.6	7.20	
38	4.27	669	<0.1	0.6	154.5	7.21	
39	4.29	674	<0.1	0.6	154.3	7.22	
40	4.30	679	<0.1	0.6	153.9	7.23	
41	4.32	684	<0.1	0.7	153.7	7.24	
42	4.35	689	<0.1	0.6	153.6	7.25	
43	4.38	697	<0.1	0.5	153.0	7.26	
44	4.40	704	<0.1	0.5	152.0	7.28	
45	4.43	710	<0.1	0.4	151.1	7.30	
46	4.46	715	<0.1	0.4	150.2	7.32	
47	4.49	719	<0.1	0.6	148.7	7.35	
48	4.50	721	<0.1	0.5	148.0	7.36	
49	4.51	723	<0.1	0.4	147.4	7.37	
50	4.52	723	<0.1	0.4	146.8	7.38	
51	4.53	724	<0.1	0.4	146.4	7.39	
52	4.54	724	<0.1	0.4	146.2	7.39	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 7-19-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25°C	DO (ppm)	ORP (mV)	Note
surface	22.73	505	8.18	171.7	
1	22.40	505	8.21	168.0	
2	22.35	505	8.21	166.0	
3	22.22	505	8.21	164.7	
4	21.34	506	8.01	167.6	
5	16.19	510	10.48	172.2	
6	12.76	513	11.29	173.1	
7	10.62	514	11.30	175.3	
8	9.90	514	10.93	176.4	
9	9.03	514	10.46	180.0	
10	8.13	513	10.12	182.4	
11	7.46	516	10.31	182.7	
12	6.89	516	10.27	183.8	
13	6.26	517	10.05	185.2	
14	5.77	519	9.90	186.1	
15	5.43	520	9.72	186.9	
16	5.07	523	9.50	187.8	
17	4.85	524	9.21	188.3	
18	4.66	526	9.02	188.8	
19	4.54	528	8.83	189.2	
20	4.42	530	8.69	189.8	
21	4.33	534	8.22	190.6	
22	4.27	537	7.73	191.2	
23	4.23	540	7.31	191.6	
24	4.19	546	7.06	192.2	
25	4.19	550	5.83	192.9	
26	4.19	559	4.74	193.4	
27	4.14	568	3.75	194.1	
28	4.13	572	3.07	194.4	
29	4.12	581	2.40	194.7	
30	4.12	596	1.01	195.1	
31	4.15	610	0.25	194.9	
32	4.17	620	0.20	194.4	
33	4.19	629	0.11	193.7	
34	4.22	638	<0.1	193.1	
35	4.23	644	<0.1	192.3	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 8-23-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	ORP (mV)	Note
surface	21.33	510	8.47	329.0	
1	20.91	509	8.47	329.3	
2	20.80	510	8.48	329.9	
3	20.72	509	8.47	329.9	
4	20.59	509	8.45	330.4	
5	19.12	513	9.15	336.6	
6	14.74	521	10.87	340.8	
7	12.31	520	11.04	344.3	
8	10.59	521	11.25	345.3	
9	9.53	521	10.61	349.7	
10	8.54	520	10.44	351.0	
11	7.80	521	10.12	353.5	
12	7.09	522	9.92	355.4	
13	6.44	524	9.84	355.8	
14	5.87	526	9.68	356.0	
15	5.44	528	9.47	356.3	
16	5.11	531	9.18	356.6	
17	4.84	533	8.94	356.9	
18	4.70	535	8.76	356.9	
19	4.55	537	8.52	357.3	
20	4.55	540	8.22	357.6	
21	4.47	542	7.96	357.5	
22	4.30	545	7.65	357.3	
23	4.26	549	7.18	358.0	
24	4.22	554	6.32	357.6	
25	4.19	560	5.46	357.7	
26	4.19	568	4.55	358.1	
27	4.18	574	3.86	358.1	
28	4.17	580	2.97	358.1	
29	4.14	591	1.68	358.1	
30	4.16	609	0.51	357.7	
31	4.16	624	0.21	357.3	
32	4.17	632	0.11	356.0	
33	4.18	638	<0.1	354.9	
34	4.20	646	<0.1	354.6	
35	4.22	654	<0.1	353.7	
36	4.23	659	<0.1	353.4	
37	4.26	664	<0.1	353.0	
38	4.27	667	<0.1	352.6	
39	4.28	673	<0.1	352.3	
40	4.30	677	<0.1	351.9	
41	4.32	682	<0.1	351.4	
42	4.34	687	<0.1	351.0	
43	4.36	690	<0.1	350.7	
44	4.39	697	<0.1	349.9	
45	4.41	703	<0.1	349.3	
46	4.43	707	<0.1	348.7	
47	4.46	712	<0.1	347.8	
48	4.48	715	<0.1	347.1	
49	4.49	718	<0.1	346.2	
50	4.51	720	<0.1	345.4	
51	4.51	720	<0.1	345.0	
52	4.52	721	<0.1	344.3	
53	4.52	721	<0.1	343.7	
54	4.53	722	<0.1	343.2	
55	4.55	717	<0.1	202.8	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 9-20-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	14.52	509	9.53	93.6	178.2	8.23	
1	14.49	509	9.52	93.5	172.4	8.26	
2	14.47	509	9.53	93.6	170.0	8.25	
3	14.44	509	9.53	93.5	168.4	8.25	
4	14.43	509	9.53	93.5	167.5	8.25	
5	14.42	509	9.52	93.4	166.3	8.26	
6	14.41	509	9.53	93.5	166.1	8.25	
7	14.38	509	9.54	93.5	165.2	8.26	
8	12.32	522	10.90	102.5	172.8	7.91	
9	9.94	523	10.67	94.5	176.0	7.82	
10	8.91	523	10.17	87.8	179.2	7.71	
11	8.14	523	10.16	85.9	179.7	7.70	
12	7.18	525	10.14	84.0	180.5	7.67	
13	6.61	526	9.81	80.1	182.2	7.61	
14	5.95	528	9.65	77.5	183.0	7.58	
15	5.57	530	9.48	75.3	183.5	7.55	
16	5.24	532	9.22	72.8	184.0	7.52	
17	4.98	535	8.87	69.5	184.4	7.48	
18	4.75	536	8.71	67.8	185.5	7.45	
19	4.61	538	8.46	65.7	185.7	7.43	
20	4.51	541	8.32	64.3	186.1	7.41	
21	4.43	544	7.92	61.1	186.5	7.37	
22	4.36	547	7.56	58.2	186.9	7.34	
23	4.37	551	7.10	54.6	187.8	7.31	
24	4.24	556	6.33	48.3	188.2	7.28	
25	4.21	564	5.09	38.8	189.7	7.22	
26	4.18	571	4.04	30.9	189.9	7.20	
27	4.17	580	3.04	23.1	190.9	7.17	
28	4.15	591	1.82	14.0	191.1	7.14	
29	4.15	604	0.49	3.7	192.0	7.10	
30	4.15	615	0.16	1.3	190.9	7.11	
31	4.18	626	0.14	1.1	190.7	7.11	
32	4.19	634	0.11	0.9	190.4	7.12	
33	4.19	642	<0.1	0.7	190.0	7.13	
34	4.21	648	<0.1	0.6	189.8	7.14	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL003 on 7-19-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	ORP (mV)	Note
surface	22.35	506	8.22	157.4	
1	22.28	506	8.21	153.0	
2					
3	22.19	506	8.20	150.9	
4					
5	16.21	512	10.25	157.0	
6					
7					
8					
9					
10	8.26	514	10.40	163.7	
11					
12					
13					
14					
15	5.36	522	9.83	167.8	
16					
17					
18					
19					
20	4.45	531	8.94	170.1	
21					
22					
23					
24					
25	4.18	550	5.98	172.4	
26					
27	4.14	569	3.61	173.0	
28					
29	4.12	587	2.12	173.3	
30	4.14	603	0.81	173.2	
31	4.15	616	0.15	171.7	
32	4.16	624	0.11	171.0	
33	4.18	631	<0.1	170.5	
34	4.20	640	<0.1	170.0	
35	4.21	646	<0.1	169.4	
36	4.23	650	<0.1	169.0	
37	4.24	656	<0.1	168.3	
38					
39					
40					
41					
42	4.34	679	<0.1	166.9	
43					
44					
45					
46					
47	4.47	706	<0.1	163.8	
48					
49					
50					
51					
52	4.53	714	<0.1	161.6	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL003 on 8-23-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	ORP (mV)	Note
surface	20.62	509	8.44	313.0	
1	20.65	509	8.44	312.3	
2	20.65	509	8.43	312.0	
3	20.66	509	8.42	311.8	
4	20.65	509	8.40	311.8	
5	19.83	510	8.34	315.6	
6	14.67	521	10.55	321.9	
7	12.02	520	11.25	323.9	
8	10.59	520	11.23	325.1	
9	9.64	521	10.81	328.1	
10	8.50	520	10.35	331.6	
11	7.73	521	10.17	334.1	
12	7.02	523	10.10	335.6	
13	6.39	525	9.95	336.9	
14	5.97	526	9.80	337.9	
15	5.50	529	9.51	339.0	
16	5.12	531	9.28	339.9	
17	4.86	533	8.98	340.7	
18	4.68	535	8.78	341.6	
19	4.56	537	8.55	342.2	
20	4.45	540	8.23	343.1	
21	4.41	543	7.95	343.7	
22	4.34	546	7.60	344.2	
23	4.26	549	7.42	344.8	
24	4.22	554	6.33	345.2	
25	4.19	560	5.48	346.0	
26	4.17	568	5.10	346.9	
27	4.15	575	3.44	347.1	
28	4.14	582	2.81	347.6	
29	4.14	592	1.64	347.6	
30	4.15	607	0.74	348.0	
31	4.15	617	0.30	347.5	
32	4.17	629	0.19	347.3	
33	4.19	635	0.14	346.5	
34	4.20	644	0.13	346.2	
35	4.22	653	0.10	345.9	
36	4.23	658	<0.1	345.4	
37	4.25	663	<0.1	345.1	
38	4.26	669	<0.1	344.9	
39	4.28	674	<0.1	344.4	
40	4.31	680	<0.1	343.9	
41	4.33	686	<0.1	343.4	
42	4.35	691	<0.1	343.1	
43	4.38	696	<0.1	342.6	
44	4.40	701	<0.1	342.0	
45	4.43	707	<0.1	341.5	
46	4.45	711	<0.1	341.1	
47	4.46	714	<0.1	340.2	
48	4.48	716	<0.1	340.0	
49	4.49	719	<0.1	339.1	
50	4.51	721	<0.1	338.5	
51	4.52	721	<0.1	337.9	
52	4.52	722	<0.1	337.6	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL003 on 9-20-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25°C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	14.38	509	9.65	94.6	127.7	8.22	
1							
2	14.40	509	9.63	94.4	125.1	8.25	
3	14.38	509	9.61	94.2	125.2	8.25	
4							
5	14.38	509	9.60	94.1	126.9	8.24	
6							
7							
8							
9							
10	9.38	522	9.38	89.6	137.3	7.94	
11							
12							
13							
14							
15	5.52	531	9.65	76.4	144.5	7.67	
16							
17							
18							
19							
20	4.52	543	8.72	67.6	149.7	7.47	
21							
22							
23							
24							
25	4.20	565	5.12	39.3	153.3	7.30	
26							
27	4.18	577	3.55	26.9	153.8	7.23	
28							
29	4.15	593	1.53	11.8	155.0	7.17	
30	4.15	610	0.58	4.5	155.6	7.14	
31	4.16	622	0.24	1.9	155.1	7.14	
32	4.18	635	0.18	1.3	154.7	7.14	
33	4.19	644	0.14	1.1	154.5	7.16	
34	4.21	651	0.13	1.0	154.2	7.18	
35	4.22	655	0.11	0.8	154.2	7.18	
36	4.24	661	<0.1	0.7	154.3	7.19	
37	4.25	665	<0.1	0.6	154.0	7.21	
38							
39							
40							
41							
42	4.35	692	<0.1	0.5	153.7	7.24	
43							
44							
45							
46							
47	4.48	719	<0.1	0.5	149.9	7.33	
48							
49							
50							
51							
52	4.53	724	<0.1	0.4	148.4	7.36	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL004 on 7-19-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25°C	DO (ppm)	ORP (mV)	Note
surface	22.46	505	8.12	142.7	
1	22.25	505	8.17	143.7	
2					
3	22.16	505	8.18	144.5	
4					
5	16.44	510	10.53	153.6	
6					
7					
8					
9					
10	8.48	518	10.13	163.0	
11					
12					
13					
14					
15	5.61	522	9.82	167.6	
16					
17					
18					
19					
20	4.47	529	8.87	170.8	
21					
22					
23					
24					
25	4.24	554	5.47	174.9	
26					
27	4.13	568	3.54	176.0	
28					
29	4.13	585	1.58	176.7	
30	4.14	607	0.52	177.0	
31	4.15	614	0.20	176.5	
32	4.16	623	0.12	176.0	
33	4.17	629	<0.1	175.8	
34	4.19	636	<0.1	175.5	
35	4.20	641	<0.1	175.1	
36					
37	4.23	651	<0.1	174.6	
38					
39					
40					
41					
42	4.34	679	<0.1	173.2	
43					
44					
45					
46					
47	4.45	703	<0.1	171.5	
48					
49					
50					
51					
52	4.52	712	<0.1	169.3	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL004 on 8-23-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	ORP (mV)	Note
surface	20.61	509	8.41	311.7	
1	20.60	509	8.40	312.1	
2	20.59	509	8.40	312.5	
3	20.58	509	8.39	312.7	
4	20.55	509	8.40	313.2	
5	19.76	510	8.45	317.7	
6	14.64	520	10.91	323.4	
7	12.05	521	11.27	324.8	
8	10.66	522	11.29	326.8	
9	9.71	522	10.80	329.6	
10	8.73	521	10.36	332.6	
11	7.77	522	10.14	335.6	
12	6.97	524	10.11	337.0	
13	6.37	525	9.95	338.3	
14	5.86	527	9.72	339.7	
15	5.47	529	9.51	341.1	
16	5.14	531	9.29	341.8	
17	4.76	534	8.88	343.0	
18	4.58	535	8.77	343.7	
19	4.49	537	8.55	344.4	
20	4.39	540	8.35	344.8	
21	4.35	542	7.99	345.6	
22	4.38	545	7.70	346.7	
23	4.29	548	7.27	347.1	
24	4.29	553	6.60	347.7	
25	4.23	558	5.64	348.6	
26	4.16	566	4.61	349.2	
27	4.15	574	3.53	350.4	
28	4.14	583	2.56	350.4	
29	4.14	590	1.73	350.9	
30	4.14	608	0.45	351.0	
31	4.16	625	0.15	350.5	
32	4.17	631	0.11	349.4	
33	4.18	640	0.10	349.0	
34	4.20	647	<0.1	349.0	
35	4.21	652	<0.1	348.8	
36	4.22	657	<0.1	348.6	
37	4.25	665	<0.1	348.3	
38	4.27	670	<0.1	347.9	
39	4.29	675	<0.1	346.9	
40	4.30	679	<0.1	346.8	
41	4.32	683	<0.1	346.5	
42	4.33	686	<0.1	346.5	
43	4.35	690	<0.1	346.2	
44	4.38	696	<0.1	345.9	
45	4.41	702	<0.1	345.6	
46	4.44	710	<0.1	344.9	
47	4.47	715	<0.1	344.3	
48	4.49	718	<0.1	343.9	
49	4.50	719	<0.1	343.4	
50	4.51	720	<0.1	343.0	
51	4.51	721	<0.1	342.3	
52	4.52	722	<0.1	341.8	

Table 2 (3rd Quarter 2010)
Humboldt Pit Profile at HPL004 on 9-20-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25°C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	14.39	509	9.54	93.4	172.3	8.27	
1	14.37	509	9.55	93.6	168.5	8.27	
2							
3	14.35	509	9.54	93.4	164.9	8.28	
4							
5	14.34	509	9.55	93.4	163.1	8.27	
6							
7							
8							
9							
10	9.44	527	10.29	90.1	171.3	8.01	
11							
12							
13							
14							
15	5.65	530	9.69	76.9	176.9	7.73	
16							
17							
18							
19							
20	4.50	540	8.43	65.2	179.5	7.50	
21							
22							
23							
24							
25	4.24	560	5.71	43.8	182.7	7.32	
26							
27	4.20	574	3.59	27.5	182.5	7.23	
28							
29	4.15	595	1.23	9.5	182.9	7.15	
30	4.15	615	0.21	1.7	182.8	7.13	
31	4.17	626	0.15	1.1	181.2	7.13	
32	4.18	635	0.12	0.9	181.1	7.13	
33	4.18	641	0.12	1.4	180.8	7.14	
34	4.20	648	0.10	0.7	180.5	7.15	
35	4.22	654	<0.1	0.7	180.5	7.16	
36	4.24	661	<0.1	0.6	180.3	7.17	
37	4.26	667	<0.1	0.5	180.2	7.18	
38							
39							
40							
41							
42	4.36	693	<0.1	0.5	178.8	7.23	
43							
44							
45							
46							
47	4.48	718	<0.1	0.4	176.1	7.29	
48							
49							
50							
51							
52	4.53	724	<0.1	0.4	172.9	7.35	

Table 2 (4th Quarter 2010)
Humboldt Pit Profile at HPL002 - Predawn on 10-13-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25°C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	12.60	501	9.99	94.1	365.4	8.18	
1	12.61	501	9.99	94.1	358.0	8.16	
2	12.61	501	9.98	94.1	355.7	8.16	
3	12.60	501	9.97	93.9	353.8	8.16	
4	12.59	501	9.96	93.8	353.7	8.15	
5	12.53	501	9.94	93.5	353.3	8.15	
6	12.49	501	9.91	93.2	353.0	8.13	
7	12.43	501	9.90	92.9	353.2	8.11	
8	12.17	502	9.80	91.4	354.0	8.07	
9	12.08	502	9.75	90.8	354.7	8.03	
10	10.82	509	9.74	88.1	359.4	7.86	
11	8.04	517	9.85	83.4	363.2	7.75	
12	7.10	520	9.74	80.4	364.6	7.66	
13	6.52	520	9.61	78.4	366.7	7.57	
14	6.21	522	9.35	75.7	368.1	7.51	
15	5.81	523	9.11	72.7	369.6	7.46	
16	5.33	526	8.82	69.7	370.4	7.44	
17	5.06	528	8.60	67.5	370.9	7.40	
18	4.82	531	8.36	65.1	371.4	7.38	
19	4.74	535	8.34	62.6	372.1	7.35	
20	4.60	537	7.80	60.5	372.6	7.31	
21	4.42	539	7.52	58.0	372.4	7.29	
22	4.35	544	6.86	52.8	372.6	7.26	
23	4.31	548	6.36	49.0	372.8	7.24	
24	4.26	552	5.60	42.9	373.0	7.22	
25	4.22	561	4.94	38.0	373.4	7.19	
26	4.20	569	3.12	24.0	373.8	7.15	
27	4.21	573	2.72	21.0	373.7	7.14	
28	4.19	578	2.06	15.8	373.7	7.12	
29	4.18	587	1.01	7.8	373.5	7.10	
30	4.18	598	0.36	2.8	373.4	7.09	
31	4.19	610	0.24	1.8	372.9	7.09	
32	4.20	621	0.17	1.3	372.3	7.09	
33	4.21	629	0.13	1.0	371.1	7.12	
34	4.22	639	0.11	0.8	370.3	7.12	
35	4.24	645	0.10	0.8	369.8	7.13	
36	4.25	649	<0.1	0.7	369.6	7.14	
37	4.26	653	0.1	0.8	368.3	7.17	
38	4.27	658	<0.1	0.7	368.1	7.17	
39	4.29	664	<0.1	0.6	367.9	7.17	
40	4.30	668	<0.1	0.6	367.6	7.19	
41	4.33	677	<0.1	0.7	367.3	7.20	
42	4.38	687	<0.1	0.5	365.7	7.23	
43	4.38	689	<0.1	0.5	365.0	7.24	
44	4.41	695	<0.1	0.5	364.0	7.26	
45	4.44	701	<0.1	0.5	363.2	7.28	
46	4.46	704	<0.1	0.6	362.4	7.29	
47	4.49	709	<0.1	0.5	361.5	7.31	
48	4.50	711	<0.1	0.5	361.0	7.32	
49	4.52	713	<0.1	0.4	360.1	7.33	
50	4.52	713	<0.1	0.4	359.5	7.35	
51	4.53	713	<0.1	0.4	358.8	7.35	
52	4.53	714	<0.1	0.5	358.2	7.36	

Table 2 (4th Quarter 2010)
Humboldt Pit Profile at HPL002 - Noon on 10-13-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	12.63	501	9.92	93.6	368.0	8.23	
1	12.61	501	9.91	93.4	366.7	8.22	
2	12.55	501	9.92	93.4	365.4	8.22	
3	12.53	501	9.92	93.2	364.3	8.22	
4	12.49	501	9.91	93.1	363.0	8.22	
5	12.49	501	9.90	93.0	362.6	8.21	
6	12.49	501	9.89	92.9	362.2	8.20	
7	12.38	501	9.85	92.3	361.8	8.18	
8	12.22	502	9.77	91.3	362.3	8.11	
9	12.10	502	9.72	90.6	362.4	8.09	
10	10.66	510	9.63	86.9	368.2	7.92	
11	8.90	517	9.64	83.5	372.4	7.80	
12	7.24	519	9.77	81.3	375.0	7.69	
13	6.41	521	9.60	77.9	376.9	7.65	
14	6.05	522	9.27	74.5	378.3	7.60	
15	5.67	524	9.16	73.1	378.2	7.58	
16	5.31	526	8.87	70.1	378.9	7.55	
17	4.94	529	8.65	67.6	379.7	7.52	
18	4.76	531	8.31	64.7	380.2	7.49	
19	4.69	533	8.16	63.3	381.2	7.45	
20	4.62	535	7.92	61.5	381.0	7.43	
21	4.51	539	7.66	59.2	381.8	7.40	
22	4.46	541	7.53	58.2	382.2	7.39	
23	4.44	545	6.81	52.5	383.4	7.33	
24	4.35	551	5.98	46.0	383.8	7.30	
25	4.25	562	4.40	33.9	384.3	7.25	
26	4.24	564	3.89	29.7	384.1	7.23	
27	4.21	571	3.29	25.3	384.4	7.21	
28	4.20	574	2.40	18.4	384.5	7.19	
29	4.18	583	1.46	11.2	384.0	7.17	
30	4.18	597	0.52	3.8	384.8	7.15	
31	4.20	624	0.17	1.2	383.6	7.15	
32	4.21	633	0.13	1.0	382.8	7.15	
33	4.21	638	0.12	0.9	381.9	7.17	
34	4.23	644	0.10	0.7	381.1	7.18	
35	4.24	647	<0.1	0.7	380.3	7.19	
36	4.25	650	<0.1	0.6	379.7	7.19	

Table 2 (4th Quarter 2010)
Humboldt Pit Profile at HPL003 on 10-13-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	12.54	501	9.89	93.2	265.3	8.21	
1	12.55	501	9.90	93.2	269.8	8.20	
2							
3	12.53	501	9.89	93.0	272.7	8.22	
4							
5	12.51	501	9.88	92.9	276.3	8.21	
6							
7							
8							
9							
10	10.31	514	9.74	86.9	290.7	7.94	
11							
12							
13							
14							
15	5.69	524	9.33	74.4	301.8	7.72	
16							
17							
18							
19							
20	4.52	537	7.82	60.6	309.4	7.51	
21							
22							
23							
24							
25	4.22	561	4.38	33.8	315.4	7.36	
26							
27	4.18	573	2.80	21.5	317.6	7.30	
28							
29	4.17	586	1.28	9.6	319.3	7.24	
30	4.16	598	0.33	2.5	319.6	7.21	
31	4.17	615	0.17	1.4	319.6	7.19	
32	4.18	623	0.13	1.0	319.7	7.19	
33	4.20	634	0.12	0.9	319.5	7.19	
34	4.21	641	0.11	0.8	319.1	7.20	
35	4.22	645	0.11	0.8	319.0	7.21	
36	4.24	654	0.09	0.7	318.9	7.22	
37	4.25	657	<0.1	0.7	318.9	7.22	
38							
39							
40							
41							
42	4.36	685	<0.1	0.6	317.7	7.25	
43							
44							
45							
46							
47	4.45	703	<0.1	0.6	316.1	7.29	
48							
49							
50							
51							
52	4.52	713	<0.1	0.5	314.4	7.34	

Table 2 (4th Quarter 2010)
Humboldt Pit Profile at HPL004 on 10-13-10

Depth (m)	Temp (°C)	Sp Cond (mmhos/ cm @ 25^{o}C	DO (ppm)	DO (%)	ORP (mV)	pH (SU)	Note
surface	12.62	501	9.86	93.0	343.2	8.19	
1	12.57	501	9.88	93.1	342.0	8.20	
2							
3	12.55	501	9.88	93.0	340.0	8.21	
4							
5	12.48	501	9.84	92.5	339.2	8.20	
6							
7							
8							
9							
10	10.84	509	9.74	88.0	346.1	8.02	
11							
12							
13							
14							
15	5.60	525	9.15	73.0	356.1	7.73	
16							
17							
18							
19							
20	4.50	535	7.89	61.1	359.6	7.57	
21							
22							
23							
24							
25	4.23	558	4.72	36.3	363.1	7.40	
26							
27	4.18	572	3.28	25.2	364.9	7.31	
28							
29	4.16	591	0.75	5.9	365.2	7.23	
30	4.16	598	0.23	1.9	364.6	7.20	
31	4.16	613	0.18	1.4	363.5	7.19	
32	4.17	621	0.14	1.0	362.9	7.18	
33	4.18	628	0.11	0.8	362.6	7.17	
34	4.19	635	0.10	0.8	361.8	7.18	
35	4.21	643	0.10	0.8	361.0	7.19	
36	4.23	647	0.08	0.6	360.6	7.20	
37	4.25	654	<0.1	0.6	360.2	7.20	
38							
39							
40							
41							
42	4.37	686	<0.1	0.5	358.5	7.22	
43							
44							
45							
46							
47	4.48	709	<0.1	0.6	355.4	7.29	
48							
49							
50							
51							
52	4.53	714	<0.1	0.5	353.2	7.34	

Table 1
Analytical Results HPL002 at 1 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**9.6**	--	**10**	
pH	SU	**7.6**	--	**7.5**	
SC	mmhos/ cm @ 25°C	**516**	--	**511**	
WT	°C	**2.5**	--	**4.3** e	
Metals					
Aluminum	µg/L	**1.20**	**0.45** B,s	**0.96** B	**0.14** B
Antimony	µg/L	**5.85**	**5.64**	**5.71**	**5.65**
Arsenic	µg/L	**0.977**	**0.566**	**0.720**	**0.423**
Barium	µg/L	**8.62**	**8.28**	**7.94**	**7.68**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**92.6**	**95.4**	**70.7**	**68.4**
Cadmium	µg/L	**0.023**	**0.021**	**0.022**	**0.024**
Chromium	µg/L	**0.203**	**0.022**	**0.070** s	**0.026**
Cobalt	µg/L	**2.78**	**2.62**	**2.87**	**2.64**
Copper	µg/L	**1.57**	**1.25**	**1.56**	**1.27**
Gold	µg/L	**0.694** e	**0.669** e	**0.612** e	**0.595** e
Iron	µg/L	**382**	**52.4**	**206**	**5.8**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.49**	**3.60**	**3.67**	**3.90**
Manganese	µg/L	**177**	**159**	**178**	**148**
Mercury	ng/L	**0.30** B	<0.15	<0.15	<0.15
Molybdenum	µg/L	**10.1**	**9.96**	**10.9**	**11.4**
Nickel	µg/L	**11.4**	**10.4**	**12.4**	**12.0**
Selenium	µg/L	**0.212**	**0.198**	**0.180**	**0.202**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**212**	**207**	**231**	**251**
Thallium	µg/L	<0.002	<0.002	**0.003** B	<0.002
Uranium	µg/L	**1.61**	**1.59**	**1.60**	**1.63**
Vanadium	µg/L	**0.059**	**0.023** B	**0.032** e	**0.020** B
Zinc	µg/L	**0.285**	**0.188** B	**0.250**	**0.194** B
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**13**	--	**14**	--
Fluoride	mg/L	**0.16**	--	**0.14**	--
Hydrogen Sulfide	mg/L	<0.0070	--	<0.0070	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.7**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	**0.0185**	--	**0.0131**	--
Sulfate	mg/L	**150**	--	**140**	--
Major Cations					
Calcium	mg/L	**52**	**52**	**53**	**52**
Magnesium	mg/L	**25**	**25**	**25**	**25**
Potassium	mg/L	**8.3**	**8.1**	**8.4**	**8.1**
Sodium	mg/L	**13**	**13**	**13**	**12**
General					
Hardness	mg/L	**233**	**233**	**235**	**233**
TDS	mg/L	**356**	--	**264**	
TSS	mg/L	NM	--	<3.3	

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 3 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**9.9**	--	**11**	--
pH	SU	**7.6**	--	**7.5**	--
SC	mmhos/ cm @ 25°C	**515**	--	**512**	--
WT	°C	**3.5**	--	**3.8** e	--
Metals					
Aluminum	µg/L	**0.77** B,s	**0.29** B,s	**0.55** B	**0.18** B
Antimony	µg/L	**5.98**	**5.80**	**5.75**	**5.69**
Arsenic	µg/L	**0.689**	**0.465**	**0.740**	**0.427**
Barium	µg/L	**8.31**	**8.02**	**7.93**	**7.68**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**99.4**	**99.2**	**69.3**	**70.1**
Cadmium	µg/L	**0.021**	**0.025**	**0.023**	**0.024**
Chromium	µg/L	**0.118** s	**0.021**	**0.037** s	**0.019** B
Cobalt	µg/L	**2.79**	**2.56**	**2.85**	**2.62**
Copper	µg/L	**1.49**	**1.16**	**1.50**	**1.24**
Gold	µg/L	**0.703** e	**0.714** e	**0.615** e	**0.585** e
Iron	µg/L	**260**	**50.1**	**220**	**4.6** B
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.61**	**3.55**	**3.98**	**3.86**
Manganese	µg/L	**159**	**125**	**184**	**147**
Mercury	ng/L	<0.15	<0.15	<0.15	<0.15
Molybdenum	µg/L	**10.4**	**10.2**	**11.2**	**11.3**
Nickel	µg/L	**11.5**	**10.3**	**12.2**	**12.0**
Selenium	µg/L	**0.203**	**0.189**	**0.189**	**0.184**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**210**	**207**	**249**	**248**
Thallium	µg/L	<0.002	<0.002	<0.002	<0.002
Uranium	µg/L	**1.54**	**1.53**	**1.66**	**1.64**
Vanadium	µg/L	**0.030** B	**0.015** B	**0.034**	**0.017** B
Zinc	µg/L	**0.311**	**0.175** B	**0.241**	**0.185** B
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**11**	--
Fluoride	mg/L	**0.14**	--	**0.20**	--
Hydrogen Sulfide	mg/L	<0.0060	--	<0.0070	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**140**	--	**140**	--
Major Cations					
Calcium	mg/L	**51**	**52**	**51**	**52**
Magnesium	mg/L	**25**	**25**	**25**	**25**
Potassium	mg/L	**8.3**	**8.2**	**8.2**	**8.1**
Sodium	mg/L	**13**	**13**	**12**	**13**
General					
Hardness	mg/L	**230**	**233**	**230**	**233**
TDS	mg/L	**334**	--	**338**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 5 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**9.9**	--	**9.9**	--
pH	SU	**7.6**	--	**7.5**	--
SC	mmhos/ cm @ 25°C	**516**	--	**514**	--
WT	°C	**3.5**	--	**3.6** e	--
Metals					
Aluminum	µg/L	**0.77** B,s	**0.38** B,s	**0.66** B	**0.16** B
Antimony	µg/L	**5.98**	**5.84**	**5.71**	**5.67**
Arsenic	µg/L	**0.648**	**0.449**	**0.726**	**0.438**
Barium	µg/L	**8.31**	**8.04**	**7.92**	**7.76**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**102**	**102**	**69.8**	**70.1**
Cadmium	µg/L	**0.021**	**0.023**	**0.023**	**0.021**
Chromium	µg/L	**0.082** s	**0.030**	**0.031** s	**0.018** B
Cobalt	µg/L	**2.79**	**2.54**	**2.94**	**2.68**
Copper	µg/L	**1.46**	**1.17**	**1.50**	**1.22**
Gold	µg/L	**0.696** e	**0.706** e	**0.604** e	**0.578** e
Iron	µg/L	**240**	**52.6**	**226**	**5.5**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.61**	**3.63**	**3.86**	**3.84**
Manganese	µg/L	**164**	**124**	**182**	**149**
Mercury	ng/L	<0.15	<0.15	<0.15	<0.15
Molybdenum	µg/L	**10.3**	**10.2**	**11.0**	**11.1**
Nickel	µg/L	**11.2**	**10.4**	**12.0**	**11.7**
Selenium	µg/L	**0.200**	**0.196**	**0.183**	**0.189**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**207**	**206**	**246**	**248**
Thallium	µg/L	<0.002	<0.002	**0.003** B	**0.003** B
Uranium	µg/L	**1.53**	**1.52**	**1.64**	**1.66**
Vanadium	µg/L	**0.037**	**0.014** B	**0.033** e	**0.016** B
Zinc	µg/L	**0.218** e	**0.195** B	**0.234**	**0.173** B
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**11**	--
Fluoride	mg/L	**0.18**	--	**0.18**	--
Hydrogen Sulfide	mg/L	<0.0060	--	<0.0070	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**140**	--
Major Cations					
Calcium	mg/L	**53**	**52**	**54**	**52**
Magnesium	mg/L	**25**	**25**	**26**	**25**
Potassium	mg/L	**8.6**	**8.0**	**8.5**	**8.2**
Sodium	mg/L	**13**	**13**	**13**	**13**
General					
Hardness	mg/L	**235**	**233**	**242**	**233**
TDS	mg/L	**356**	--	**312**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 10 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**9.6**	--	**9.9**	--
pH	SU	**5.7**	--	**7.5**	--
SC	mmhos/ cm @ 25°C	**516**	--	**514**	--
WT	°C	**3.6**	--	**3.6** e	--
Metals					
Aluminum	µg/L	**1.79**	**0.60** B,s	**0.61** B	**0.14** B
Antimony	µg/L	**5.90**	**5.84**	**5.82**	**5.64**
Arsenic	µg/L	**1.05**	**0.441**	**0.854**	**0.372**
Barium	µg/L	**9.44**	**8.93**	**8.40**	**7.98**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**101**	**101**	**68.3**	**71.1**
Cadmium	µg/L	**0.022**	**0.021**	**0.022**	**0.022**
Chromium	µg/L	**0.074** s	**0.042**	**0.037** s	**0.015** B
Cobalt	µg/L	**2.88**	**2.74**	**3.12**	**2.85**
Copper	µg/L	**1.41**	**1.09**	**1.51**	**1.18**
Gold	µg/L	**0.676** e	**0.665** e	**0.594** e	**0.566** e
Iron	µg/L	**535**	**60.3**	**419**	**19.0**
Lead	µg/L	**0.017** B	<0.015	<0.015	<0.015
Lithium	µg/L	**3.60**	**3.55**	**3.70**	**3.84**
Manganese	µg/L	**246**	**212**	**244**	**207**
Mercury	ng/L	**0.24** B,s	**0.18** B	<0.15	<0.15
Molybdenum	µg/L	**10.1**	**10.2**	**10.9**	**10.7**
Nickel	µg/L	**10.4**	**10.2**	**12.2**	**12.0**
Selenium	µg/L	**0.202**	**0.184**	**0.172**	**0.172**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**209**	**210**	**243**	**238**
Thallium	µg/L	<0.002	<0.002	<0.002	<0.002
Uranium	µg/L	**1.49**	**1.49**	**1.64**	**1.63**
Vanadium	µg/L	**0.048**	**0.028** B	**0.041** e	**0.013** B
Zinc	µg/L	**0.285**	**0.152** B	**0.247**	**0.181** B
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**11**	--
Fluoride	mg/L	**0.17**	--	**0.18**	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.0070	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.7**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**140**	--
Major Cations					
Calcium	mg/L	**52**	**52**	**53**	**53**
Magnesium	mg/L	**25**	**26**	**26**	**25**
Potassium	mg/L	**8.4**	**8.1**	**8.3**	**8.1**
Sodium	mg/L	**13**	**13**	**13**	**13**
General					
Hardness	mg/L	**233**	**237**	**239**	**235**
TDS	mg/L	**318**	--	**348**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 20 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**9.4**	--	**9.9**	--
pH	SU	**5.7**	--	**7.4**	--
SC	mmhos/ cm @ 25°C	**518**	--	**516**	--
WT	°C	**3.6**	--	**3.6** e	--
Metals					
Aluminum	µg/L	**1.06**	**0.19** B,s	**0.75** B	**0.14** B
Antimony	µg/L	**6.02**	**5.83**	**5.83**	**5.64**
Arsenic	µg/L	**0.819**	**0.340**	**1.04**	**0.339**
Barium	µg/L	**8.83**	**8.46**	**8.85**	**8.46**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**94.2**	**99.4**	**71.3**	**73.8**
Cadmium	µg/L	**0.020**	**0.018**	**0.022**	**0.023**
Chromium	µg/L	**0.041** s	**0.032**	**0.123** s	**0.021**
Cobalt	µg/L	**3.44**	**3.08**	**3.30**	**3.17**
Copper	µg/L	**1.44**	**1.11**	**1.54**	**1.13**
Gold	µg/L	**0.685** e	**0.701** e	**0.567** e	**0.568** e
Iron	µg/L	**589**	**76.7**	**611**	**10.4**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.61**	**3.78**	**4.04**	**3.80**
Manganese	µg/L	**284**	**247**	**287**	**270**
Mercury	ng/L	<0.15	<0.15	<0.15	<0.15
Molybdenum	µg/L	**10.2**	**9.97**	**10.6**	**10.6**
Nickel	µg/L	**12.1**	**11.7**	**12.6**	**12.3**
Selenium	µg/L	**0.200**	**0.197**	**0.198**	**0.175**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**213**	**209**	**231**	**237**
Thallium	µg/L	<0.002	<0.002	<0.002	<0.002
Uranium	µg/L	**1.55**	**1.54**	**1.61**	**1.61**
Vanadium	µg/L	**0.034**	**0.011** B	**0.050** e	**0.013** B
Zinc	µg/L	**0.340**	**0.204**	**0.294**	**0.199** B
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**12**	--
Fluoride	mg/L	**0.18**	--	**0.18**	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.0090	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**140**	--
Major Cations					
Calcium	mg/L	**55**	**53**	**53**	**53**
Magnesium	mg/L	**26**	**25**	**26**	**25**
Potassium	mg/L	**8.6**	**8.2**	**8.3**	**8.1**
Sodium	mg/L	**13**	**13**	**13**	**12**
General					
Hardness	mg/L	**244**	**235**	**239**	**235**
TDS	mg/L	**354**	--	**338**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 25 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**8.6**	--	**7.7**	--
pH	SU	**5.8**	--	**7.3**	--
SC	mmhos/ cm @ 25°C	**522**	--	**520**	--
WT	°C	**3.7**	--	**3.8** e	--
Metals					
Aluminum	µg/L	**0.84** B,s	**0.20** B,s	**0.89** B	<0.13
Antimony	µg/L	**6.45**	**6.33**	**7.83**	**7.85**
Arsenic	µg/L	**0.768**	**0.287**	**0.612**	**0.246**
Barium	µg/L	**8.60**	**8.32**	**8.12**	**7.93**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**104**	**104**	**77.0**	**78.0**
Cadmium	µg/L	**0.024**	**0.020**	**0.027**	**0.028**
Chromium	µg/L	**0.039** s	**0.023**	**0.059** s	**0.020** B
Cobalt	µg/L	**3.71**	**3.53**	**4.60**	**4.23**
Copper	µg/L	**1.53**	**1.17**	**1.89**	**1.51**
Gold	µg/L	**0.731** e	**0.729** e	**0.725** e	**0.734** e
Iron	µg/L	**596**	**77.7**	**314**	<1.4
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.68**	**3.63**	**3.86**	**3.75**
Manganese	µg/L	**298**	**282**	**347**	**318**
Mercury	ng/L	<0.15	<0.15	<0.15	<0.15
Molybdenum	µg/L	**10.7**	**10.5**	**13.4**	**13.3**
Nickel	µg/L	**14.9**	**14.6**	**24.9**	**25.0**
Selenium	µg/L	**0.188**	**0.175**	**0.196**	**0.189**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**211**	**211**	**245**	**237**
Thallium	µg/L	<0.002	<0.002	**0.003** B	**0.003** B
Uranium	µg/L	**1.60**	**1.59**	**2.05**	**2.07**
Vanadium	µg/L	**0.030** B	**0.011** B	**0.036** e	**0.014** B
Zinc	µg/L	**0.603**	**0.304**	**0.493**	**0.420**
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**13**	--
Fluoride	mg/L	**0.17**	--	**0.17**	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.010	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**2.0**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**140**	--
Major Cations					
Calcium	mg/L	**51**	**53**	**55**	**53**
Magnesium	mg/L	**25**	**25**	**27**	**26**
Potassium	mg/L	**8.4**	**8.3**	**9.6**	**9.1**
Sodium	mg/L	**13**	**13**	**15**	**14**
General					
Hardness	mg/L	**230**	**235**	**248**	**239**
TDS	mg/L	**354**	--	**336**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 27 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	3.0	--	1.9	--
pH	SU	6.0	--	7.1	--
SC	mmhos/ cm @ 25°C	554	--	559	--
WT	°C	3.9	--	3.9 e	--
Metals					
Aluminum	µg/L	0.63 B,s	0.24 B,s	0.66 B	<0.13
Antimony	µg/L	10.9	10.9	11.2	11.3
Arsenic	µg/L	0.376	0.207	0.434	0.203
Barium	µg/L	8.19	8.16	8.03	7.96
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	94.3	121	90.5	95.9
Cadmium	µg/L	0.036	0.039	0.038	0.036
Chromium	µg/L	0.068 s	0.021	0.033 s	0.016 B
Cobalt	µg/L	6.68	6.23	7.07	6.79
Copper	µg/L	1.90	1.67	2.04	1.77
Gold	µg/L	1.20 e	1.15 e	1.04 e	1.02 e
Iron	µg/L	212	29.6	214	<1.4
Lead	µg/L	0.016 B	<0.015	<0.015	<0.015
Lithium	µg/L	3.64	3.60	3.77	3.89
Manganese	µg/L	477	471	528	509
Mercury	ng/L	0.19 B,s	<0.15	<0.15	<0.15
Molybdenum	µg/L	17.5	17.5	18.7	18.1
Nickel	µg/L	42.3	42.9	51.4	50.9
Selenium	µg/L	0.194	0.189	0.191	0.190
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	237	234	249	237
Thallium	µg/L	0.004 B	0.004 B	0.004 B	0.004 B
Uranium	µg/L	2.01	1.90	2.01	1.97
Vanadium	µg/L	0.019 B	<0.010	0.025 B	0.012 B
Zinc	µg/L	0.761	0.709	0.774	0.717
Major Anions					
Alkalinity, Bicarbonate	mg/L	110	--	110	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	15	--	15	--
Fluoride	mg/L	0.21	--	0.19	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.012	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	2.6	--	2.6	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	160	--	150	--
Major Cations					
Calcium	mg/L	53	54	54	54
Magnesium	mg/L	26	26	27	27
Potassium	mg/L	11	11	11	11
Sodium	mg/L	16	17	17	17
General					
Hardness	mg/L	239	242	246	246
TDS	mg/L	400	--	354	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 29 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	**0.1**	--	**0.08**	--
pH	SU	**6.1**	--	**7.0**	--
SC	mmhos/ cm @ 25°C	**580**	--	**579**	--
WT	°C	**4.0**	--	**4.0** e	--
Metals					
Aluminum	µg/L	**0.58** B,s	**0.25** B,s	**0.55** B	**0.16** B
Antimony	µg/L	**14.1**	**14.3**	**13.6**	**13.9**
Arsenic	µg/L	**0.358**	**0.230**	**0.414**	**0.219**
Barium	µg/L	**8.29**	**8.25**	**8.09**	**8.23**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**112**	**138**	**101**	**109**
Cadmium	µg/L	**0.054**	**0.054**	**0.049**	**0.052**
Chromium	µg/L	**0.027** s	**0.023**	**0.038** s	**0.017** B
Cobalt	µg/L	**8.11**	**8.20**	**8.22**	**8.48**
Copper	µg/L	**1.92**	**1.74**	**2.09**	**1.80**
Gold	µg/L	**1.50** e	**1.49** e	**1.23** e	**1.22** e
Iron	µg/L	**156**	**27.9**	**163**	<1.4
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.64**	**3.67**	**3.77**	**3.88**
Manganese	µg/L	**706**	**750**	**711**	**735**
Mercury	ng/L	**0.32** B	**0.26** B	<0.15	<0.15
Molybdenum	µg/L	**23.9**	**24.0**	**22.5**	**22.4**
Nickel	µg/L	**71.4**	**73.8**	**75.8**	**76.4**
Selenium	µg/L	**0.196**	**0.194**	**0.187**	**0.191**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**243**	**243**	**238**	**232**
Thallium	µg/L	**0.005** B	**0.006** B	**0.005** B	**0.006** B
Uranium	µg/L	**1.97**	**1.99**	**2.04**	**2.04**
Vanadium	µg/L	**0.013** B	<0.010	**0.022** B	<0.010
Zinc	µg/L	**0.858**	**0.853**	**0.838**	**0.791**
Major Anions					
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**16**	--	**16**	--
Fluoride	mg/L	**0.22**	--	**0.21**	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.013	--
Nitrogen, Ammonia	mg/L	**0.051**	--	**0.086**	--
Nitrogen, Nitrate	mg/L	**3.0**	--	**2.9**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**170**	--	**150**	--
Major Cations					
Calcium	mg/L	**53**	**54**	**55**	**54**
Magnesium	mg/L	**27**	**27**	**28**	**27**
Potassium	mg/L	**12**	**12**	**12**	**12**
Sodium	mg/L	**19**	**19**	**19**	**18**
General					
Hardness	mg/L	**243**	**246**	**252**	**246**
TDS	mg/L	**394**	--	**376**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 32 m
Humboldt Mill HTDF Monitoring

Parameter	**Unit**	**Feb 2010 Total**	**Feb 2010 Dissolved**	**Mar 2010 Total**	**Mar 2010 Dissolved**
Field					
DO	ppm	<0.1	--	<0.1	--
pH	SU	**6.0**	--	**7.1**	--
SC	mmhos/ cm @ 25°C	**618**	--	**620**	--
WT	°C	**4.1**	--	**4.2** e	--
Metals					
Aluminum	µg/L	**0.56** B,s	**0.26** B,s	**0.67** B	**0.21** B
Antimony	µg/L	**21.2**	**20.9**	**22.0**	**21.8**
Arsenic	µg/L	**0.345**	**0.242**	**0.429**	**0.262**
Barium	µg/L	**8.98**	**8.88**	**9.48**	**9.29**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**130**	**139**	**125**	**127**
Cadmium	µg/L	**0.074**	**0.076**	**0.079**	**0.075**
Chromium	µg/L	**0.030** s	**0.031**	**0.028** s	**0.013** B
Cobalt	µg/L	**11.9**	**11.5**	**12.3**	**12.1**
Copper	µg/L	**2.21**	**1.97**	**2.36**	**2.04**
Gold	µg/L	**2.11** e	**2.05** e	**1.78** e	**1.75** e
Iron	µg/L	**132**	**28.1**	**129**	<1.4
Lead	µg/L	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.57**	**3.68**	**3.81**	**3.73**
Manganese	µg/L	**1250**	**1260**	**1270**	**1280**
Mercury	ng/L	**0.19** B,s	**0.16** B	<0.15	<0.15
Molybdenum	µg/L	**36.3**	**35.4**	**33.3**	**32.5**
Nickel	µg/L	**124**	**124**	**136**	**134**
Selenium	µg/L	**0.232**	**0.235**	**0.220**	**0.216**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**264**	**260**	**237**	**235**
Thallium	µg/L	**0.008** B	**0.009** B	**0.008** B	**0.008** B
Uranium	µg/L	**2.12**	**2.12**	**2.09**	**2.10**
Vanadium	µg/L	**0.011** B	<0.010	**0.019** B	<0.010
Zinc	µg/L	**1.12**	**1.07**	**1.06**	**1.00**
Major Anions					
Alkalinity, Bicarbonate	mg/L	**130**	--	**120**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	**20**	--	**18**	--
Fluoride	mg/L	**0.25**	--	**0.23**	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.012	--
Nitrogen, Ammonia	mg/L	**1.0**	--	**1.2**	--
Nitrogen, Nitrate	mg/L	**2.6**	--	**2.4**	--
Nitrogen, Nitrite	mg/L	**0.074**	--	**0.062**	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	**170**	--	**160**	--
Major Cations					
Calcium	mg/L	**53**	**54**	**57**	**55**
Magnesium	mg/L	**28**	**28**	**30**	**28**
Potassium	mg/L	**15**	**14**	**16**	**15**
Sodium	mg/L	**22**	**22**	**24**	**22**
General					
Hardness	mg/L	**247**	**250**	**266**	**252**
TDS	mg/L	**422**	--	**350**	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 40 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	<0.1	--	<0.1	--
pH	SU	5.7	--	6.9	--
SC	mmhos/ cm @ 25°C	667	--	663	--
WT	°C	4.3	--	4.3 e	--
Metals					
Aluminum	µg/L	0.95 B,s	0.19 B,s	1.08	0.18 B
Antimony	µg/L	29.2	29.3	30.2	29.8
Arsenic	µg/L	0.345	0.287	0.398	0.298
Barium	µg/L	10.1	10.2	10.7	10.6
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	162	168	146	143
Cadmium	µg/L	0.108	0.108	0.108	0.104
Chromium	µg/L	0.040 s	0.017 B	0.030 s	0.039
Cobalt	µg/L	15.5	15.7	16.6	16.8
Copper	µg/L	2.34	2.10	2.58	2.15
Gold	µg/L	2.77 e	2.74 e	2.35 e	2.33 e
Iron	µg/L	80.6	28.4	79.1	<1.4
Lead	µg/L	0.022 B	<0.015	0.018 B	<0.015
Lithium	µg/L	3.68	3.68	3.74	3.54
Manganese	µg/L	1850	1870	1900	1910
Mercury	ng/L	0.26 B,s	0.17 B	<0.15	<0.15
Molybdenum	µg/L	49.7	50.2	45.9	44.5
Nickel	µg/L	183	183	194	195
Selenium	µg/L	0.274	0.263	0.265	0.273
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	278	281	258	245
Thallium	µg/L	0.013	0.013	0.013	0.013
Uranium	µg/L	2.28	2.29	2.25	2.21
Vanadium	µg/L	0.013 B	<0.010	0.014 B	<0.010
Zinc	µg/L	1.28	1.24	1.23	1.20
Major Anions					
Alkalinity, Bicarbonate	mg/L	140	--	140	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	24	--	21	--
Fluoride	mg/L	0.28	--	0.27	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.014	--
Nitrogen, Ammonia	mg/L	2.5	--	2.6	--
Nitrogen, Nitrate	mg/L	2.0	--	1.9	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	190	--	170	--
Major Cations					
Calcium	mg/L	54	55	56	55
Magnesium	mg/L	29	30	30	29
Potassium	mg/L	17	18	18	18
Sodium	mg/L	27	27	27	27
General					
Hardness	mg/L	254	261	263	256
TDS	mg/L	462	--	402	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1
Analytical Results HPL002 at 50 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Feb 2010 Total	Feb 2010 Dissolved	Mar 2010 Total	Mar 2010 Dissolved
Field					
DO	ppm	<0.1	--	<0.1	--
pH	SU	5.4	--	6.2	--
SC	mmhos/ cm @ 25°C	713	--	711	--
WT	°C	4.6	--	4.6 e	--
Metals					
Aluminum	µg/L	1.28	0.35 B,s	1.18	0.22 B
Antimony	µg/L	33.5	33.5	35.1	35.3
Arsenic	µg/L	0.424	0.371	0.464	0.381
Barium	µg/L	13.5	13.5	14.3	14.6
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	188	176	148	151
Cadmium	µg/L	0.131	0.141	0.137	0.146
Chromium	µg/L	0.047 s	0.020 B	0.122 s	0.026
Cobalt	µg/L	19.9	20.0	21.0	21.1
Copper	µg/L	2.49	2.04	2.68	2.16
Gold	µg/L	3.11 e	3.04 e	2.65 e	2.61 e
Iron	µg/L	91.1	29.5	62.8	<1.4
Lead	µg/L	0.042 B	<0.015	0.034 B	<0.015
Lithium	µg/L	3.70	3.84	4.10	3.54
Manganese	µg/L	2820	2820	2810	2850
Mercury	ng/L	0.26 B,s	0.21 B	0.20 B,s	<0.15
Molybdenum	µg/L	63.2	63.9	57.2	58.3
Nickel	µg/L	224	223	242	241
Selenium	µg/L	0.327	0.319	0.327	0.322
Silver	µg/L	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	301	305	265	270
Thallium	µg/L	0.016	0.016	0.015	0.016
Uranium	µg/L	2.50	2.55	2.47	2.42
Vanadium	µg/L	0.014 B	0.012 B	0.017 B	0.012 B
Zinc	µg/L	1.30	1.32	1.26	1.20
Major Anions					
Alkalinity, Bicarbonate	mg/L	160	--	160	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--
Chloride	mg/L	27	--	24	--
Fluoride	mg/L	0.37	--	0.25	--
Hydrogen Sulfide	mg/L	<0.020	--	<0.018	--
Nitrogen, Ammonia	mg/L	4.0	--	4.3	--
Nitrogen, Nitrate	mg/L	1.1	--	1.1	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--
Sulfate	mg/L	190	--	170	--
Major Cations					
Calcium	mg/L	55	55	55	55
Magnesium	mg/L	30	31	31	31
Potassium	mg/L	21	20	21	20
Sodium	mg/L	31	31	31	30
General					
Hardness	mg/L	261	265	265	265
TDS	mg/L	474	--	448	--
TSS	mg/L	NM		<3.3	--

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 1 m
Humboldt Mill HTDF Monitoring

PARAMETER	**UNIT**	**Apr 2010 04/29/10 Total**	**Apr 2010 04/29/10 Dissolved**	**May 2010 05/18/10 Total**	**May 2010 05/18/10 Dissolved**	**Jun 2010 06/15/10 Total**	**Jun 2010 06/15/10 Dissolved**
	Actual Depth:	*1 m*	*1 m*	*1 m*	*1 m*	*1 m*	*1 m*
Field							
D.O.	ppm	**11**	**--**	**10**	**--**	**9.4**	**--**
pH	SU	**8.0**	**--**	**8.0**	**--**	**8.3**	**--**
Specific Conductance	µhos/cm @ 25^{o}C	**506**	**--**	**512**	**--**	**538**	**--**
Temperature	^{o}C	**8.3**	**--**	**13**	**--**	**17**	**--**
Metals							
Aluminum	µg/L	**1.99** a,e	**5.75** a,e	**1.92** a	**0.35** B	**1.58**	**0.45** B
Antimony	µg/L	**5.77**	**5.64**	**5.27**	**5.19**	**6.17**	**6.20**
Arsenic	µg/L	**0.442** e	**0.791** e	**0.757**	**0.513**	**0.829**	**0.670**
Barium	µg/L	**8.14**	**7.82**	**7.84**	**7.52**	**7.84**	**7.31**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**87.7**	**91.6**	**81.5**	**87.1**	**76.4**	**76.6**
Cadmium	µg/L	**0.023**	**0.020**	**0.024**	**0.023**	**0.031**	**0.023**
Chromium	µg/L	**0.031** s	**0.058**	**0.066**	**0.032**	**0.121**	**0.050**
Cobalt	µg/L	**3.05**	**2.85**	**2.97**	**2.84**	**2.79**	**2.62**
Copper	µg/L	**1.26** e	**1.79** e	**1.70**	**1.19**	**1.31**	**0.968**
Gold	µg/L	**0.641**	**0.633**	**0.552**	**0.559**	**0.553**	**0.557**
Iron	µg/L	**470**	**38.9**	**358**	**35.9**	**266**	**48.6**
Lead	µg/L	**0.016** B	<0.015	**0.020** B	<0.015	**0.035** B	<0.015
Lithium	µg/L	**3.54**	**4.02**	**3.69**	**4.17**	**3.56**	**3.37**
Manganese	µg/L	**242**	**213**	**208**	**188**	**182**	**144**
Mercury	ng/L	<0.15	<0.15	**0.21** B,s	<0.15	**1.25**	**1.43** s
Molybdenum	µg/L	**9.92**	**9.84**	**9.92**	**9.83**	**9.75**	**9.64**
Nickel	µg/L	**12.9**	**13.0**	**12.5**	**12.0**	**10.1**	**9.25**
Selenium	µg/L	**0.187**	**0.210**	**0.215**	**0.201**	**0.163**	**0.151**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**213**	**211**	**212**	**215**	**207**	**211**
Thallium	µg/L	**0.003** B	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium	µg/L	**1.64**	**1.65**	**1.53**	**1.56**	**1.45**	**1.53**
Vanadium	µg/L	**0.029** B	**0.012** B	**0.034**	**0.032**	**0.035**	**0.035**
Zinc	µg/L	**0.122** B,s	**0.297** a	**0.964** s	**0.754** s	**0.761** s	**0.610**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	**--**	**110**	**--**	**100**	**--**
Alkalinity, Carbonate	mg/L	<2.0	**--**	<2.0	**--**	<2.0	**--**
Chloride	mg/L	**13**	**--**	**11**	**--**	**11**	**--**
Fluoride	mg/L	**0.19**	**--**	**0.17**	**--**	**0.16**	**--**
Hydrogen Sulfide	mg/L	<0.0030	**--**	<0.0020	**--**	<0.0010	**--**
Nitrogen, Ammonia	mg/L	<0.050 e	**--**	<0.050	**--**	<0.050	**--**
Nitrogen, Nitrate	mg/L	**1.7**	**--**	**1.8**	**--**	**1.6**	**--**
Nitrogen, Nitrite	mg/L	<0.050	**--**	<0.050	**--**	<0.050	**--**
Phosphorus, Total	mg/L	<0.0100	**--**	<0.0100	**--**	<0.0100	**--**
Sulfate	mg/L	**130**	**--**	**130**	**--**	**130**	**--**
Major Cations							
Calcium	mg/L	**51**	**51**	**52**	**52**	**50**	**52**
Magnesium	mg/L	**25**	**25**	**25**	**25**	**24**	**25**
Potassium	mg/L	**7.6**	**8.0**	**8.3**	**8.3**	**7.7**	**8.3**
Sodium	mg/L	**12**	**12**	**13**	**13**	**12**	**13**
General							
DOC	mg/L	**--**	**--**	**--**	**--**	**2.5**	**--**
Hardness	mg/L	**230**	**230**	**233**	**233**	**223**	**233**
TDS	mg/L	**314**	**--**	**298**	**--**	**318**	**--**
TOC	mg/L	**--**	**--**	**--**	**--**	**2.6**	**--**
TSS	mg/L	<3.3	**--**	<3.3	**--**	<3.3	**--**

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 3 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*3 m*	*3 m*	*3 m*	*3 m*	*3 m*	*3 m*
Field							
D.O.	ppm	**11**	--	**10**	--	**9.4**	--
pH	SU	**8.1**	--	**8.0**	--	**8.3**	--
Specific Conductance	µhos/cm @ 25°C	**506**	--	**512**	--	**538**	--
Temperature	°C	--	--	**11**	--	**17**	--
Metals							
Aluminum	µg/L	**2.02** a	**0.35** a,B	**2.29** a	**0.34** B	**1.73**	**0.60** B
Antimony	µg/L	**5.76**	**5.69**	**5.27**	**5.19**	**6.16**	**6.01**
Arsenic	µg/L	**0.801**	**0.438**	**0.759**	**0.523**	**0.785**	**0.667**
Barium	µg/L	**8.17**	**7.86**	**7.91**	**7.58**	**7.81**	**7.34**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**96.1**	**97.3**	**85.5**	**88.9**	**80.4**	**76.9**
Cadmium	µg/L	**0.021**	**0.020**	**0.020** B	**0.021**	**0.032**	**0.025**
Chromium	µg/L	**0.061** s	**0.027** B	**0.060**	**0.029** B	**0.145**	**0.061**
Cobalt	µg/L	**2.97**	**2.83**	**2.97**	**2.88**	**2.87**	**2.68**
Copper	µg/L	**1.82**	**1.26**	**1.71**	**1.21**	**1.28**	**0.970**
Gold	µg/L	**0.626**	**0.627**	**0.557**	**0.554**	**0.548**	**0.555**
Iron	µg/L	**460**	**36.4**	**378**	**39.2**	**252**	**44.1**
Lead	µg/L	<0.015	<0.015	**0.021** B	<0.015	**0.031** B	<0.015
Lithium	µg/L	**3.71**	**3.97**	**4.18**	**4.31**	**3.85**	**3.29**
Manganese	µg/L	**237**	**212**	**215**	**191**	**184**	**145**
Mercury	ng/L	<0.15	<0.15	<0.15	**0.17** B,s	**1.47**	**1.44** s
Molybdenum	µg/L	**9.90**	**9.89**	**10.0**	**9.94**	**9.78**	**9.67**
Nickel	µg/L	**13.1**	**12.7**	**12.6**	**12.1**	**9.72**	**9.28**
Selenium	µg/L	**0.200**	**0.207**	**0.228**	**0.183**	**0.181**	**0.162**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**211**	**212**	**217**	**215**	**211**	**209**
Thallium	µg/L	<0.002	**0.003** B	<0.002	<0.002	<0.002	**0.003** B
Uranium	µg/L	**1.66**	**1.63**	**1.57**	**1.58**	**1.43**	**1.55**
Vanadium	µg/L	**0.033**	**0.011** B	**0.047**	**0.019** B	**0.035**	**0.025** B
Zinc	µg/L	**0.326** s	**0.121** a,B	**1.07** s	**0.915** s	**0.852** s	**0.608**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**120**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**11**	--	**12**	--	**12**	--
Fluoride	mg/L	**0.19**	--	**0.18**	--	**0.17**	--
Hydrogen Sulfide	mg/L	<0.0020	--	<0.0020	--	<0.0010	--
Nitrogen, Ammonia	mg/L	<0.050 e	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.7**	--	**1.8**	--	**1.6**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	**0.0129**	--
Sulfate	mg/L	**130**	--	**130**	--	**140**	--
Major Cations							
Calcium	mg/L	**53**	**52**	**50**	**52**	**50**	**53**
Magnesium	mg/L	**25**	**25**	**24**	**25**	**23**	**25**
Potassium	mg/L	**7.8**	**8.0**	**7.9**	**8.3**	**7.6**	**8.3**
Sodium	mg/L	**13**	**12**	**12**	**13**	**12**	**13**
General							
DOC	mg/L	--	--	--	--	**2.5**	--
Hardness	mg/L	**235**	**233**	**223**	**233**	**219**	**235**
TDS	mg/L	**304**	--	**294**	--	**268**	--
TOC	mg/L	--	--	--	--	**2.5**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 5 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*5 m*	*5 m*	*5 m*	*5 m*	*5 m*	*5 m*
Field							
D.O.	ppm	**11**	--	**10**	--	**12**	--
pH	SU	**8.1**	--	**8.1**	--	**8.2**	--
Specific Conductance	µhos/cm @ 25°C	**506**	--	**511**	--	**537**	--
Temperature	°C	**7.4**	--	**9.9**	--	**12**	--
Metals							
Aluminum	µg/L	**2.07** a	**0.35** a,B	**1.89** a	**0.29** B	**1.01** B	**0.24** B
Antimony	µg/L	**5.77**	**5.71**	**5.27**	**5.18**	**6.01**	**5.97**
Arsenic	µg/L	**0.767**	**0.407**	**0.747**	**0.495**	**0.549**	**0.496**
Barium	µg/L	**8.10**	**7.77**	**7.87**	**7.63**	**7.57**	**7.36**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**98.1**	**96.4**	**82.5**	**89.5**	**81.1**	**77.1**
Cadmium	µg/L	**0.022**	**0.022**	**0.023**	**0.022**	**0.030**	**0.017**
Chromium	µg/L	**0.051** s	**0.023** B	**0.054** s	**0.027** B	**0.143**	**0.065**
Cobalt	µg/L	**2.93**	**2.79**	**3.01**	**2.88**	**2.89**	**2.79**
Copper	µg/L	**1.82**	**1.29**	**1.70**	**1.20**	**1.34**	**1.28**
Gold	µg/L	**0.637**	**0.641**	**0.556**	**0.548**	**0.576**	**0.565**
Iron	µg/L	**434**	**31.9**	**367**	**38.3**	**130**	**34.5**
Lead	µg/L	<0.015	<0.015	**0.017** B	<0.015	**0.017** B,s	<0.015
Lithium	µg/L	**3.98**	**4.08**	**4.00**	**4.17**	**3.91**	**3.24**
Manganese	µg/L	**232**	**206**	**213**	**191**	**170**	**150**
Mercury	ng/L	<0.15	<0.15	**0.16** B,s	<0.15	**1.31**	**1.23** s
Molybdenum	µg/L	**9.97**	**9.86**	**9.80**	**10.1**	**9.62**	**9.77**
Nickel	µg/L	**13.0**	**12.8**	**12.5**	**12.1**	**11.4**	**12.6**
Selenium	µg/L	**0.215**	**0.208**	**0.209**	**0.191**	**0.148**	**0.179**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**210**	**211**	**215**	**219**	**209**	**211**
Thallium	µg/L	<0.002	<0.002	<0.002	**0.003** B	<0.002	**0.003** B
Uranium	µg/L	**1.65**	**1.66**	**1.56**	**1.58**	**1.42**	**1.57**
Vanadium	µg/L	**0.033**	**0.013** B	**0.027** B	**0.017** B	**0.023** B	**0.018** B
Zinc	µg/L	**0.295** s	**0.116** a,B	**1.54** s	**1.84** s	**0.685** s	**0.658**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**11**	--	**12**	--	**12**	--
Fluoride	mg/L	**0.20**	--	**0.18**	--	**0.16**	--
Hydrogen Sulfide	mg/L	<0.0020	--	<0.0020	--	<0.0020	--
Nitrogen, Ammonia	mg/L	<0.050 e	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.7**	--	**1.8**	--	**1.6**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**130**	--	**130**	--	**130**	--
Major Cations							
Calcium	mg/L	**51**	**52**	**52**	**52**	**50**	**53**
Magnesium	mg/L	**25**	**24**	**25**	**25**	**24**	**25**
Potassium	mg/L	**7.6**	**8.0**	**8.2**	**8.3**	**7.8**	**8.3**
Sodium	mg/L	**12**	**12**	**13**	**13**	**12**	**13**
General							
DOC	mg/L	--	--	--	--	**2.4**	--
Hardness	mg/L	**230**	**228**	**233**	**233**	**223**	**235**
TDS	mg/L	**296**	--	**286**	--	**310**	--
TOC	mg/L	--	--	--	--	**2.4**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 10 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*10 m*	*10 m*	*10 m*	*10 m*	*10 m*	*10 m*
Field							
D.O.	ppm	**11**	--	**10**	--	**11**	--
pH	SU	**7.8**	--	**7.7**	--	**7.9**	--
Specific Conductance	µhos/cm @ 25°C	**507**	--	**511**	--	**538**	--
Temperature	°C	**6.6**	--	**8.4**	--	**8.2**	--
Metals							
Aluminum	µg/L	**2.29** a	**0.37** a,B	**2.35** a	**0.38** B	**0.72** B	<0.13
Antimony	µg/L	**5.79**	**5.72**	**5.43**	**5.20**	**6.15**	**6.13**
Arsenic	µg/L	**0.758**	**0.388**	**0.729**	**0.458**	**0.483**	**0.381**
Barium	µg/L	**8.05**	**7.76**	**7.99**	**7.48**	**7.70**	**7.45**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**98.1**	**96.6**	**85.3**	**88.4**	**77.3**	**78.5**
Cadmium	µg/L	**0.020**	**0.022**	**0.020** B	**0.024**	**0.024**	**0.023**
Chromium	µg/L	**0.048** s	**0.024** B	**0.058** s	**0.023** B	**0.052**	**0.039**
Cobalt	µg/L	**2.93**	**2.74**	**3.01**	**2.81**	**2.82**	**2.75**
Copper	µg/L	**1.87**	**1.36**	**1.87**	**1.36**	**1.55**	**1.30**
Gold	µg/L	**0.641**	**0.631**	**0.544**	**0.558**	**0.580**	**0.563**
Iron	µg/L	**431**	**35.4**	**354**	**32.3**	**138**	**32.0**
Lead	µg/L	**0.018** B	<0.015	**0.017** B	<0.015	<0.015	<0.015
Lithium	µg/L	**3.90**	**3.87**	**4.10**	**4.31**	**3.25**	**3.39**
Manganese	µg/L	**230**	**200**	**214**	**183**	**185**	**161**
Mercury	ng/L	<0.15	<0.15	<0.15	**0.16** B,s	**0.89** s	**2.14**
Molybdenum	µg/L	**9.88**	**9.89**	**10.2**	**9.88**	**9.99**	**9.95**
Nickel	µg/L	**13.1**	**12.9**	**12.4**	**12.1**	**11.7**	**11.5**
Selenium	µg/L	**0.218**	**0.215**	**0.203**	**0.201**	**0.158**	**0.161**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**210**	**211**	**218**	**212**	**213**	**211**
Thallium	µg/L	**0.003** B	<0.002	**0.003** B	**0.003** B	<0.002	<0.002
Uranium	µg/L	**1.67**	**1.66**	**1.61**	**1.58**	**1.58**	**1.61**
Vanadium	µg/L	**0.030** B	**0.011** B	**0.035**	**0.019** B	**0.021** B	**0.014** B
Zinc	µg/L	**0.337** s	**0.303** a	**1.39** s	**1.29** s	**0.983** s	**0.908**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**120**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**11**	--	**11**	--	**12**	--
Fluoride	mg/L	**0.20**	--	**0.18**	--	**0.17**	--
Hydrogen Sulfide	mg/L	<0.0040	--	<0.0050	--	<0.0030	--
Nitrogen, Ammonia	mg/L	<0.050 e	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.7**	--	**1.8**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	**0.0110**	--
Sulfate	mg/L	**130**	--	**130**	--	**130**	--
Major Cations							
Calcium	mg/L	**53**	**51**	**51**	**52**	**48**	**52**
Magnesium	mg/L	**25**	**25**	**25**	**25**	**23**	**25**
Potassium	mg/L	**7.8**	**8.0**	**8.2**	**8.4**	**7.5**	**8.2**
Sodium	mg/L	**13**	**12**	**13**	**13**	**12**	**13**
General							
DOC	mg/L	--	--	--	--	**2.4**	--
Hardness	mg/L	**235**	**230**	**230**	**233**	**214**	**233**
TDS	mg/L	**306**	--	**304**	--	**322**	--
TOC	mg/L	--	--	--	--	**2.4**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 20 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*20 m*	*20 m*	*20 m*	*20 m*	*20 m*	*20 m*
Field							
D.O.	ppm	**8.8**	--	**8.2**	--	**8.8**	--
pH	SU	**6.3**	--	**6.5**	--	**7.4**	--
Specific Conductance	µhos/cm @ 25°C	**520**	--	**529**	--	**555**	--
Temperature	°C	**4.3**	--	**4.4**	--	**4.5**	--
Metals							
Aluminum	µg/L	**2.78** a	**0.44** a,B	**2.92** a	**0.16** B	**1.12**	<0.13
Antimony	µg/L	**6.52**	**6.36**	**6.24**	**6.25**	**7.29**	**7.01**
Arsenic	µg/L	**0.696**	**0.302**	**0.637**	**0.282**	**0.485**	**0.244**
Barium	µg/L	**8.22**	**7.89**	**7.99**	**7.65**	**7.94**	**7.82**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**99.3**	**98.8**	**91.6**	**91.4**	**80.8**	**80.9**
Cadmium	µg/L	**0.024**	**0.020**	**0.024**	**0.024**	**0.027**	**0.023**
Chromium	µg/L	**0.076** s	**0.042**	**0.057** s	**0.029** B	**0.049**	**0.045**
Cobalt	µg/L	**3.36**	**3.05**	**3.86**	**3.67**	**3.78**	**3.56**
Copper	µg/L	**1.81**	**1.48**	**1.93**	**1.55**	**1.77**	**1.47**
Gold	µg/L	**0.696**	**0.697**	**0.627**	**0.614**	**0.651**	**0.642**
Iron	µg/L	**443**	**51.0**	**406**	**49.8**	**299**	**45.5**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.93**	**3.95**	**4.35**	**4.20**	**3.35**	**3.40**
Manganese	µg/L	**280**	**246**	**306**	**289**	**291**	**263**
Mercury	ng/L	<0.15	<0.15	**0.16** B,s	<0.15	**0.97** s	**0.95** s
Molybdenum	µg/L	**10.9**	**10.7**	**11.4**	**11.4**	**11.1**	**11.2**
Nickel	µg/L	**17.7**	**17.3**	**20.6**	**20.6**	**19.1**	**18.3**
Selenium	µg/L	**0.196**	**0.188**	**0.211**	**0.212**	**0.173**	**0.160**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**218**	**215**	**225**	**222**	**219**	**220**
Thallium	µg/L	**0.003** B	**0.003** B	<0.002	**0.003** B	**0.003** B	<0.002
Uranium	µg/L	**1.72**	**1.73**	**1.67**	**1.64**	**1.68**	**1.65**
Vanadium	µg/L	**0.028** B	<0.010	**0.042**	**0.011** B	**0.063**	**0.013** B
Zinc	µg/L	**0.320** e,s	**0.984** a,e	**1.55** s	**1.63** s	**1.33** s	**1.27**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**11**	--	**12**	--
Fluoride	mg/L	**0.20**	--	**0.19**	--	**0.17**	--
Hydrogen Sulfide	mg/L	<0.018	--	<0.017	--		--
Nitrogen, Ammonia	mg/L	<0.050 e	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**1.9**	--	**1.8**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**130**	--	**130**	--	**140**	--
Major Cations							
Calcium	mg/L	**52**	**52**	**53**	**53**	**51**	**53**
Magnesium	mg/L	**25**	**24**	**26**	**26**	**24**	**26**
Potassium	mg/L	**8.0**	**8.4**	**8.9**	**9.1**	**8.3**	**8.8**
Sodium	mg/L	**13**	**13**	**14**	**14**	**13**	**13**
General							
DOC	mg/L	--	--	--	--	**2.3**	--
Hardness	mg/L	**233**	**228**	**239**	**239**	**226**	**239**
TDS	mg/L	**356**	--	**306**	--	**286**	--
TOC	mg/L	--	--	--	--	**2.4**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 25 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*25 m*	*25 m*	*25 m*	*25 m*	*25 m*	*25 m*
Field							
D.O.	ppm	**6.7**	--	**6.0**	--	**5.7**	--
pH	SU	**5.4**	--	**6.3**	--	**7.3**	--
Specific Conductance	µhos/cm @ 25°C	**538**	--	**548**	--	**579**	--
Temperature	°C	**4.1**	--	**4.2**	--	**4.1**	--
Metals							
Aluminum	µg/L	**1.09** a	<0.13 e	**1.47** a	**0.25** B	**0.99** B	<0.13
Antimony	µg/L	**8.50**	**7.85**	**8.26**	**8.08**	**9.93**	**10.0**
Arsenic	µg/L	**0.648**	**0.264**	**0.602**	**0.270**	**0.479**	**0.237**
Barium	µg/L	**8.21**	**7.93**	**8.08**	**7.72**	**8.06**	**7.96**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**107**	**105**	**98.0**	**97.2**	**88.6**	**89.0**
Cadmium	µg/L	**0.029**	**0.029**	**0.028**	**0.036**	**0.033**	**0.035**
Chromium	µg/L	**0.063** s	**0.033**	**0.057** s	**0.036**	**0.048**	**0.033**
Cobalt	µg/L	**4.64**	**4.07**	**5.18**	**4.90**	**5.62**	**5.43**
Copper	µg/L	**1.96**	**1.52**	**2.04**	**1.70**	**1.96**	**1.62**
Gold	µg/L	**0.898**	**0.835**	**0.788**	**0.793**	**0.852**	**0.845**
Iron	µg/L	**432**	**41.7**	**380**	**48.2**	**319**	**45.5**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**4.03**	**3.95**	**4.36**	**4.11**	**3.46**	**3.49**
Manganese	µg/L	**424**	**355**	**449**	**425**	**477**	**451**
Mercury	ng/L	<0.15	<0.15	<0.15	**0.21** B,s	**1.13** s	**1.18** s
Molybdenum	µg/L	**14.0**	**13.1**	**14.8**	**14.5**	**15.3**	**15.3**
Nickel	µg/L	**34.7**	**30.1**	**37.6**	**37.3**	**39.5**	**38.4**
Selenium	µg/L	**0.199**	**0.198**	**0.230**	**0.201**	**0.157**	**0.159**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**224**	**223**	**231**	**229**	**232**	**235**
Thallium	µg/L	**0.003** B	**0.003** B	**0.003** B	**0.004** B	**0.004** B	**0.004** B
Uranium	µg/L	**1.87**	**1.86**	**1.76**	**1.75**	**1.83**	**1.83**
Vanadium	µg/L	**0.044**	<0.010	**0.036**	**0.042**	**0.028** B	<0.010
Zinc	µg/L	**0.494** s	**0.392** a	**1.78** s	**1.93** s	**1.39** s	**1.43**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**13**	--	**13**	--	**13**	--
Fluoride	mg/L	**0.21**	--	**0.20**	--	**0.18**	--
Hydrogen Sulfide	mg/L	<0.020	--	<0.018	--	<0.010	--
Nitrogen, Ammonia	mg/L	0.084 e	--	0.088	--	**0.064**	--
Nitrogen, Nitrate	mg/L	**2.0**	--	**2.1**	--	**2.2**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	**0.0111**	--
Sulfate	mg/L	**140**	--	**130**	--	**140**	--
Major Cations							
Calcium	mg/L	**53**	**51**	**51**	**54**	**51**	**53**
Magnesium	mg/L	**25**	**25**	**25**	**26**	**25**	**26**
Potassium	mg/L	**9.0**	**9.2**	**9.4**	**10**	**9.4**	**10**
Sodium	mg/L	**14**	**14**	**15**	**15**	**15**	**15**
General							
DOC	mg/L	--	--	--	--	**2.4**	--
Hardness	mg/L	**235**	**230**	**230**	**242**	**230**	**239**
TDS	mg/L	**316**	--	**298**	--	**342**	--
TOC	mg/L	--	--	--	--	**2.4**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 27-29 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*29 m*	*29 m*	*28 m*	*28 m*	*27 m*	*27 m*
Field							
D.O.	ppm	**2.4**	--	**3.8**	--	**4.2**	--
pH	SU	**5.2**	--	**6.0**	--	**7.3**	--
Specific Conductance	µhos/cm @ 25°C	**574**	--	**569**	--	**594**	--
Temperature	°C	**4.0**	--	**4.1**	--	**4.1**	--
Metals							
Aluminum	µg/L	**0.89** a,B	<0.13	**1.29** a	**10.6**	**0.92** B	<0.13
Antimony	µg/L	**14.7**	**14.1**	**11.3**	**10.7**	**12.1**	**11.9**
Arsenic	µg/L	**0.500**	**0.251**	**0.523**	**0.262**	**0.452**	**0.264**
Barium	µg/L	**8.42**	**8.17**	**7.99**	**7.94**	**8.22**	**7.85**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**123**	**121**	**106**	**103**	**92.2**	**92.6**
Cadmium	µg/L	**0.054**	**0.051**	**0.044**	**0.038**	**0.041**	**0.044**
Chromium	µg/L	**0.052** s	**0.031**	**0.068**	**0.034**	**0.070**	**0.036**
Cobalt	µg/L	**7.97**	**7.76**	**7.14**	**6.72**	**6.66**	**6.45**
Copper	µg/L	**2.40**	**2.03**	**2.28**	**1.91**	**2.04**	**2.09**
Gold	µg/L	**1.43**	**1.36**	**1.04**	**1.03**	**1.01**	**0.980**
Iron	µg/L	**283**	**39.4**	**311**	**45.6**	**293**	**43.7**
Lead	µg/L	<0.015	<0.015	**0.017**	**0.016**	**0.017**	<0.015
Lithium	µg/L	**4.11**	**4.04**	**4.20**	**4.30**	**3.40**	**3.56**
Manganese	µg/L	**845**	**805**	**667**	**628**	**609**	**593**
Mercury	ng/L	<0.15	<0.15	<0.15	**0.18**	**2.35**	**1.59**
Molybdenum	µg/L	**24.7**	**23.8**	**20.0**	**19.2**	**18.4**	**18.1**
Nickel	µg/L	**86.1**	**82.9**	**66.0**	**62.7**	**53.9**	**64.5**
Selenium	µg/L	**0.194**	**0.186**	**0.211**	**0.214**	**0.165**	**0.203**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**253**	**251**	**242**	**239**	**239**	**235**
Thallium	µg/L	**0.007**	**0.006**	**0.004**	**0.004**	**0.004**	**0.005**
Uranium	µg/L	**2.21**	**2.19**	**1.95**	**1.91**	**1.89**	**1.87**
Vanadium	µg/L	**0.019** B	<0.010	**0.027** B	**0.012**	**0.026** B	<0.010
Zinc	µg/L	**0.867** s	**0.768** a	**2.25** s	**2.30**	**1.58** s	**1.86**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**120**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**15**	--	**14**	--	**14**	--
Fluoride	mg/L	**0.24**	--	**0.21**	--	**0.20**	--
Hydrogen Sulfide	mg/L	<0.020	--	<0.019	--	<0.010	--
Nitrogen, Ammonia	mg/L	0.47 e	--	0.26	--	**0.17**	--
Nitrogen, Nitrate	mg/L	**2.4**	--	**2.3**	--	**2.3**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**140**	--	**130**	--	**150**	--
Major Cations							
Calcium	mg/L	**53**	**52**	**53**	**53**	**50**	**54**
Magnesium	mg/L	**26**	**29**	**27**	**26**	**25**	**27**
Potassium	mg/L	**11**	**12**	**11**	**11**	**10**	**11**
Sodium	mg/L	**18**	**19**	**17**	**17**	**15**	**17**
General							
DOC	mg/L	--	--	--	--	**2.4**	--
Hardness	mg/L	**239**	**249**	**243**	**239**	**228**	**246**
TDS	mg/L	**366**	--	**348**	--	**364**	--
TOC	mg/L	--	--	--	--	**2.4**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 29-32 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*32 m*	*32 m*	*30 m*	*30 m*	*29 m*	*29 m*
Field							
D.O.	ppm	**0.3**	--	**2.6**	--	**2.3**	--
pH	SU	**5.7**	--	**6.6**	--	**7.2**	--
Specific Conductance	µhos/cm @ 25°C	**617**	--	**580**	--	**614**	--
Temperature	°C	**4.1**	--	**4.1**	--	**4.1**	--
Metals							
Aluminum	µg/L	**1.04** a	<0.13	**1.19** a	<0.13	**1.27**	<0.13
Antimony	µg/L	**19.4**	**19.3**	**13.6**	**13.3**	**14.6**	**14.3**
Arsenic	µg/L	**0.435**	**0.249**	**0.483**	**0.258**	**0.433**	**0.243**
Barium	µg/L	**8.64**	**8.52**	**8.27**	**8.05**	**8.25**	**8.13**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**137**	**136**	**112**	**109**	**95.6**	**95.5**
Cadmium	µg/L	**0.073**	**0.073**	**0.049**	**0.049**	**0.051**	**0.047**
Chromium	µg/L	**0.043** s	**0.028** B	**0.049** s	**0.030** B	**0.098**	**0.040**
Cobalt	µg/L	**10.5**	**10.4**	**8.66**	**8.24**	**8.53**	**8.18**
Copper	µg/L	**2.66**	**2.37**	**2.37**	**2.07**	**2.14**	**1.85**
Gold	µg/L	**1.80**	**1.80**	**1.19**	**1.15**	**1.25**	**1.18**
Iron	µg/L	**219**	**33.8**	**279**	**43.8**	**256**	**41.1**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015	**0.019** B,s	<0.015
Lithium	µg/L	**4.09**	**4.02**	**3.98**	**4.09**	**3.30**	**3.32**
Manganese	µg/L	**1230**	**1220**	**858**	**831**	**820**	**787**
Mercury	ng/L	<0.15	<0.15	**0.17** B,s	**0.20** B,s	**1.02** s	**1.08** s
Molybdenum	µg/L	**32.7**	**32.7**	**24.3**	**23.8**	**22.4**	**23.0**
Nickel	µg/L	**128**	**128**	**86.4**	**84.2**	**74.9**	**75.9**
Selenium	µg/L	**0.211**	**0.203**	**0.225**	**0.227**	**0.170**	**0.176**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**265**	**266**	**252**	**250**	**243**	**250**
Thallium	µg/L	**0.009** B	**0.009** B	**0.006** B	**0.007** B	**0.006** B	**0.006** B
Uranium	µg/L	**2.33**	**2.33**	**2.00**	**1.99**	**1.97**	**2.01**
Vanadium	µg/L	**0.018** B	**0.011** B	**0.024** B	<0.010	**0.037**	**0.012** B
Zinc	µg/L	**1.09** s	**1.02** a	**2.46**	**2.66**	**1.74** s	**1.82**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**130**	--	**120**	--	**120**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**18**	--	**15**	--	**15**	--
Fluoride	mg/L	**0.27**	--	**0.22**	--	**0.20**	--
Hydrogen Sulfide	mg/L	<0.019	--	<0.016	--	<0.010	--
Nitrogen, Ammonia	mg/L	1.1 e	--	0.42	--	**0.33**	--
Nitrogen, Nitrate	mg/L	**2.3**	--	**2.4**	--	**2.5**	--
Nitrogen, Nitrite	mg/L	**0.064**	--	**0.051**	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**140**	--	**150**	--
Major Cations							
Calcium	mg/L	**54**	**54**	**51**	**53**	**53**	**54**
Magnesium	mg/L	**28**	**28**	**26**	**26**	**27**	**27**
Potassium	mg/L	**14**	**14**	**11**	**12**	**12**	**12**
Sodium	mg/L	**22**	**21**	**18**	**18**	**18**	**18**
General							
DOC	mg/L	--	--	--	--	**2.4**	--
Hardness	mg/L	**250**	**250**	**234**	**239**	**243**	**246**
TDS	mg/L	**386**	--	**370**	--	**360**	--
TOC	mg/L	--	--	--	--	**2.3**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 32-35 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*35 m*	*35 m*	*35 m*	*35 m*	*32 m*	*32 m*
Field							
D.O.	ppm	<0.1	--	<0.1	--	**0.2**	--
pH	SU	**5.5**	--	**6.2**	--	--	--
Specific Conductance	µhos/cm @ 25°C	**638**	--	**646**	--	**657**	--
Temperature	°C	**4.2**	--	**4.3**	--	**4.2**	--
Metals							
Aluminum	µg/L	**6.94** a	**0.37** a,B	**0.95** a,B	<0.13	**0.96** B	**0.50** B
Antimony	µg/L	**24.5**	**24.1**	**21.9**	**21.8**	**20.8**	**20.7**
Arsenic	µg/L	**0.411**	**0.262**	**0.394**	**0.272**	**0.381**	**0.252**
Barium	µg/L	**9.20**	**9.10**	**9.22**	**9.01**	**8.54**	**8.61**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**150**	**148**	**127**	**131**	**108**	**107**
Cadmium	µg/L	**0.092**	**0.084**	**0.082**	**0.081**	**0.072**	**0.072**
Chromium	µg/L	**0.048** s	**0.032**	**0.038** s	**0.025** B	**0.053**	**0.031**
Cobalt	µg/L	**13.2**	**12.8**	**13.7**	**13.6**	**11.2**	**11.4**
Copper	µg/L	**2.83**	**2.49**	**2.80**	**2.58**	**2.42**	**2.19**
Gold	µg/L	**2.18**	**2.15**	**1.82**	**1.79**	**1.58**	**1.59**
Iron	µg/L	**185**	**31.8**	**164**	**36.5**	**185**	**37.7**
Lead	µg/L	**0.018** B	<0.015	**0.042** B	<0.015	**0.016** B,s	<0.015
Lithium	µg/L	**4.15**	**4.05**	**3.94**	**4.07**	**3.32**	**3.34**
Manganese	µg/L	**1640**	**1590**	**1610**	**1620**	**1270**	**1260**
Mercury	ng/L	<0.15	<0.15	**0.20** B,s	**0.23** B,s	**0.90** s	**1.42** s
Molybdenum	µg/L	**41.6**	**40.6**	**39.9**	**40.0**	**32.0**	**32.3**
Nickel	µg/L	**169**	**163**	**163**	**167**	**121**	**120**
Selenium	µg/L	**0.248**	**0.220**	**0.266**	**0.247**	**0.203**	**0.217**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**280**	**278**	**284**	**283**	**258**	**264**
Thallium	µg/L	**0.012**	**0.012**	**0.011**	**0.010** B	**0.008** B	**0.008** B
Uranium	µg/L	**2.46**	**2.46**	**2.23**	**2.21**	**2.16**	**2.20**
Vanadium	µg/L	**0.016** B	<0.010	**0.016** B	<0.010	**0.025** B	<0.010
Zinc	µg/L	**1.24** e,s	**1.59** a,e	**2.61**	**2.83**	**2.04** s	**2.06**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**130**	--	**130**	--	**120**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**20**	--	**19**	--	**18**	--
Fluoride	mg/L	**0.29**	--	**0.26**	--	**0.22**	--
Hydrogen Sulfide	mg/L	<0.020	--	<0.018	--	<0.0070	--
Nitrogen, Ammonia	mg/L	1.6 e	--	1.4	--	**0.87**	--
Nitrogen, Nitrate	mg/L	**2.2**	--	**2.2**	--	**2.5**	--
Nitrogen, Nitrite	mg/L	<0.050	--	**0.065**	--	**0.056**	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**160**	--	**140**	--	**160**	--
Major Cations							
Calcium	mg/L	**53**	**55**	**57**	**55**	**54**	**54**
Magnesium	mg/L	**28**	**29**	**31**	**29**	**28**	**28**
Potassium	mg/L	**15**	**16**	**16**	**16**	**14**	**15**
Sodium	mg/L	**24**	**24**	**26**	**24**	**21**	**22**
General							
DOC	mg/L	--	--	--	--	**2.4**	--
Hardness	mg/L	**247**	**256**	**270**	**256**	**250**	**250**
TDS	mg/L	**404**	--	**368**	--	**394**	--
TOC	mg/L	--	--	--	--	**2.4**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 40 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*40 m*	*40 m*	*40 m*	*40 m*	*40 m*	*40 m*
Field							
D.O.	ppm	<0.1	--	<0.1	--	<0.1	--
pH	SU	**5.4**	--	**6.4**	--	**7.3**	--
Specific Conductance	µhos/cm @ 25°C	**670**	--	**670**	--	**705**	--
Temperature	°C	**4.3**	--	**4.4**	--	**4.3**	--
Metals							
Aluminum	µg/L	**2.82** a	<0.13	**1.51** a	<0.13	**1.14**	<0.13
Antimony	µg/L	**28.9**	**28.7**	**25.8**	**25.4**	**29.8**	**29.3**
Arsenic	µg/L	**0.430**	**0.300**	**0.406**	**0.300**	**0.351**	**0.262**
Barium	µg/L	**10.1**	**10.2**	**9.88**	**9.75**	**10.1**	**10.1**
Beryllium	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	**164**	**162**	**141**	**140**	**125**	**125**
Cadmium	µg/L	**0.106**	**0.104**	**0.098**	**0.108**	**0.102**	**0.097**
Chromium	µg/L	**0.057** s	**0.041**	**0.044** s	**0.027** B	**0.040** s	**0.026**
Cobalt	µg/L	**15.6**	**15.6**	**16.4**	**16.1**	**16.3**	**16.4**
Copper	µg/L	**2.99**	**2.58**	**2.98**	**2.67**	**2.77**	**2.39**
Gold	µg/L	**2.55**	**2.56**	**1.90**	**2.04**	**2.14**	**2.15**
Iron	µg/L	**169**	**32.4**	**141**	**34.8**	**132**	**35.7**
Lead	µg/L	**0.028** B	<0.015	**0.020** B	<0.015	**0.029** B	<0.015
Lithium	µg/L	**4.18**	**4.24**	**4.11**	**4.09**	**3.43**	**3.53**
Manganese	µg/L	**2060**	**2060**	**2000**	**1970**	**2070**	**2040**
Mercury	ng/L	<0.15	<0.15	**0.30** B,s	**0.23** B,s	**0.93** s	**1.00** s
Molybdenum	µg/L	**49.9**	**50.0**	**47.2**	**47.7**	**47.7**	**47.1**
Nickel	µg/L	**209**	**207**	**200**	**201**	**186**	**190**
Selenium	µg/L	**0.236**	**0.243**	**0.291**	**0.263**	**0.241**	**0.231**
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**294**	**295**	**296**	**299**	**290**	**286**
Thallium	µg/L	**0.015**	**0.015**	**0.012**	**0.012**	**0.013**	**0.013**
Uranium	µg/L	**2.58**	**2.58**	**2.32**	**2.31**	**2.37**	**2.39**
Vanadium	µg/L	**0.016** B	<0.010	**0.019** B	<0.010	**0.016** B	**0.011** B
Zinc	µg/L	**1.36** s	**1.29** a	**2.86**	**3.01**	**2.23** s	**2.17**
Major Anions							
Alkalinity, Bicarbonate	mg/L	**150**	--	**140**	--	**140**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**22**	--	**21**	--	**22**	--
Fluoride	mg/L	**0.32**	--	**0.28**	--	**0.26**	--
Hydrogen Sulfide	mg/L	<0.020	--	<0.018	--	<0.0090	--
Nitrogen, Ammonia	mg/L	2.7 e	--	2.4	--	**2.4**	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**1.9**	--	**2.1**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**150**	--	**160**	--
Major Cations							
Calcium	mg/L	**56**	**55**	**55**	**55**	**51**	**54**
Magnesium	mg/L	**30**	**30**	**30**	**29**	**28**	**30**
Potassium	mg/L	**17**	**18**	**18**	**18**	**16**	**18**
Sodium	mg/L	**28**	**27**	**27**	**26**	**25**	**27**
General							
DOC	mg/L	--	--	--	--	**2.5**	--
Hardness	mg/L	**263**	**261**	**261**	**256**	**242**	**258**
TDS	mg/L	**390**	--	**418**	--	**438**	--
TOC	mg/L	--	--	--	--	**2.6**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Potential false positive value. Compound present in blank sample.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (2nd Quarter)
Analytical Profile Results HPL002 at 50 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Apr 2010 04/29/10 Total	Apr 2010 04/29/10 Dissolved	May 2010 05/18/10 Total	May 2010 05/18/10 Dissolved	Jun 2010 06/15/10 Total	Jun 2010 06/15/10 Dissolved
	Actual Depth:	*50 m*	*50 m*	*50 m*	*50 m*	*50 m*	*50 m*
Field							
D.O.	ppm	<0.1	--	<0.1	--	<0.1	--
pH	SU	5.0	--	6.3	--	7.5	--
Specific Conductance	μhos/cm @ 25°C	706	--	711	--	746	--
Temperature	°C	4.5	--	4.5	--	4.5	--
Metals							
Aluminum	μg/L	1.96 a	<0.13	2.50 a	<0.13	2.45	<0.13
Antimony	μg/L	32.3	31.7	29.6	29.2	33.4	33.7
Arsenic	μg/L	0.516	0.348	0.480	0.352	0.422	0.309
Barium	μg/L	14.0	13.1	12.9	12.7	13.0	12.7
Beryllium	μg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Boron	μg/L	181	179	151	156	138	132
Cadmium	μg/L	0.125	0.123	0.131	0.127	0.135	0.122
Chromium	μg/L	0.075 s	0.031	0.070	0.019 B	0.094	0.036
Cobalt	μg/L	19.5	19.0	20.5	20.8	20.9	19.8
Copper	μg/L	3.20	2.54	3.15	2.61	2.92	2.37
Gold	μg/L	2.79	2.65	2.37	2.31	2.41	2.39
Iron	μg/L	210	36.2	178	38.1	156	38.5
Lead	μg/L	0.061	<0.015	0.076	<0.015	0.066	<0.015
Lithium	μg/L	4.15	4.14	4.06	4.17	3.54	3.39
Manganese	μg/L	2960	2820	2850	2850	2910	2790
Mercury	ng/L	0.17 B,s	<0.15	0.29 B,s	0.31 B	0.73 s	1.06 s
Molybdenum	μg/L	62.5	61.0	58.8	58.5	58.3	57.5
Nickel	μg/L	249	246	248	249	229	232
Selenium	μg/L	0.288	0.278	0.303	0.290	0.302	0.258
Silver	μg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	μg/L	316	312	318	314	303	307
Thallium	μg/L	0.016	0.016	0.014	0.015	0.015	0.014
Uranium	μg/L	2.78	2.72	2.50	2.57	2.57	2.53
Vanadium	μg/L	0.018 B	<0.010	0.016 e	0.012 B	0.020 B	<0.010
Zinc	μg/L	1.34 s	1.27 a	2.90	2.92	2.17 s	2.15
Major Anions							
Alkalinity, Bicarbonate	mg/L	160	--	140	--	160	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	25	--	24	--	24	--
Fluoride	mg/L	0.35	--	0.30	--	0.28	--
Hydrogen Sulfide	mg/L	<0.020	--	<0.018	--	<0.0080	--
Nitrogen, Ammonia	mg/L	3.9 e	--	3.7	--	3.7	--
Nitrogen, Nitrate	mg/L	1.2	--	1.3	--	1.3	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	160	--	150	--	170	--
Major Cations							
Calcium	mg/L	55	55	54	56	54	56
Magnesium	mg/L	30	30	30	31	30	31
Potassium	mg/L	20	20	20	21	20	20
Sodium	mg/L	30	30	30	31	30	30
General							
DOC	mg/L	--	--	--	--	2.7	--
Hardness	mg/L	261	261	258	267	258	267
TDS	mg/L	444	--	428	--	454	--
TOC	mg/L	--	--	--	--	2.6	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--

a Estimated value. Duplicate precision for this parameter exceeded quality control limit.

B Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.

e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.

s Potential false positive value. Compound present in blank sample.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 1 m
Humboldt Mill HTDF Monitoring

Parameter	**Unit**	**Jul 2010 07/20/10 Total**	**Jul 2010 07/20/10 Dissolved**	**Aug 2010 08/24/10 Total**	**Aug 2010 08/24/10 Dissolved**	**Sep 2010 09/27/10 Total**	**Sep 2010 09/27/10 Dissolved**
	Actual Depth:	*1 m*		*1 m*		*1 m*	
Field							
D.O.	ppm	**8.2**	--	**8.2**	--	**9.9**	--
pH	SU	**8.2**	--	**8.9**	--	**8.2**	--
Specific Conductance	µmhos/cm @ 25°C	**500**	--	**512**	--	**505**	--
Temperature	°C	**22**	--	**21**	--	**14**	--
Metals							
Aluminum	µg/L	**4.80**	**2.81**	**2.37**	**1.08** a	**3.36** a	**1.73**
Antimony	µg/L	**5.58**	**5.49**	**5.51**	**5.43**	**5.90**	**5.86**
Arsenic	µg/L	**0.874**	**0.742**	**0.886**	**0.830**	**1.25** e	**1.08** e
Barium	µg/L	--	--	**6.92**	**6.72**	**6.72**	**6.91**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**80.7**	**85.9**	**88.6**	**93.1**
Cadmium	µg/L	--	--	**0.018** a	**0.017**	**0.023**	**0.029**
Chromium	µg/L	**0.085** s	**0.063**	**0.090**	**0.117**	**0.097**	**0.041**
Cobalt	µg/L	--	--	**1.66**	**1.46**	**2.08**	**2.01**
Copper	µg/L	--	--	**1.28**	**1.08**	**1.58**	**1.35**
Gold	µg/L	--	--	**0.523**	**0.443**	**0.539**	**0.383**
Iron	µg/L	**184**	**29.5**	**194**	**19.6**	**169**	**14.0**
Lead	µg/L	**0.031** B	<0.015	**0.026** B	<0.015	**0.024** B	<0.015
Lithium	µg/L	**3.30**	**3.42**	**3.59**	**3.80**	**2.84**	**2.99**
Manganese	µg/L	**86.4**	**39.5**	**23.6**	**1.02**	**50.7**	**40.4**
Mercury	µg/L	--	--	**0.51** e	**0.76** e	<0.15	**0.29** B
Molybdenum	µg/L	--	--	**9.67**	**9.67**	**9.41**	**9.44**
Nickel	µg/L	**7.86**	**7.04**	**5.46**	**5.18**	**6.03**	**6.45**
Selenium	µg/L	**0.183**	**0.209**	**0.189**	**0.176**	**0.265**	**0.236**
Silver	µg/L	--	--	<0.005	<0.005	**0.006** B	**0.020** B
Strontium	µg/L	**235**	**238**	**215**	**214**	**206**	**214**
Thallium	µg/L	--	--	<0.002	**0.003** B	<0.002	<0.002
Uranium	µg/L	**1.56**	**1.55**	**1.52**	**1.49**	**1.45**	**1.54**
Vanadium	µg/L	--	--	**0.049** e	**0.038** e	**0.042**	**0.028** B
Zinc	µg/L	**1.11** s	**0.955**	**0.803** s	**1.07** R,s	**0.937** s	**2.24** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**100**	--	**100**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**11**	--	**11**	--	**11**	--
Fluoride	mg/L	**0.17**	--	**0.23**	--	**0.15**	--
Hydrogen Sulfide	mg/L	<0.0010	--	<0.0010	--	<0.0010	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.5**	--	**1.5**	--	**1.4**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	**0.0102** s	--	**0.0107** s	--
Sulfate	mg/L	**130**	--	**120**	--	**130**	--
Major Cations							
Calcium	mg/L	**44**	**50**	**45**	**46**	**42** e	**44** e
Magnesium	mg/L	**21**	**24**	**22**	**22**	**20** e	**21** e
Potassium	mg/L	**7.2**	**7.4**	**6.4**	**6.4**	**6.3** e	**6.7** e
Sodium	mg/L	**11**	**12**	**11**	**11**	**9.8**	**10**
General							
Hardness	mg/L	**196**	**223**	**203**	**205**	**187**	**196**
TOC	mg/L	**2.5**	--	**2.6**	--	**2.6**	--
DOC	mg/L	**2.6**	--	**2.7**	--	**2.8**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**268**	--	**370**	--	**324**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 3 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*3 m*		*3 m*		*3 m*	
Field							
D.O.	ppm	**8.2**	--	**8.4**	--	**9.8**	--
pH	SU	**8.2**	--	**8.3**	--	**8.2**	--
Specific Conductance	µmhos/cm @ 25°C	**498**	--	**510**	--	**505**	--
Temperature	°C	**22**	--	**21**	--	**14**	--
Metals							
Aluminum	µg/L	**4.69**	**2.71**	**2.39**	**0.83** a,B	**3.52** a	**1.88**
Antimony	µg/L	**5.48**	**5.52**	**5.49**	**5.49**	**5.93**	**5.88**
Arsenic	µg/L	**0.842**	**0.728**	**0.958**	**0.775**	**1.25** e	**1.04** e
Barium	µg/L	--	--	**6.98**	**6.91**	**7.06**	**6.95**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**88.3**	**90.9**	**94.8**	**93.6**
Cadmium	µg/L	--	--	**0.022** a	**0.018**	**0.023**	**0.029**
Chromium	µg/L	**0.096** s	**0.050**	**0.087**	**0.033**	**0.071**	**0.034**
Cobalt	µg/L	--	--	**1.72**	**1.48**	**2.01**	**1.97**
Copper	µg/L	--	--	**1.24**	**1.02**	**1.43**	**1.30**
Gold	µg/L	--	--	**0.527**	**0.458**	**0.539**	**0.430**
Iron	µg/L	**208**	**30.0**	**199**	**19.8**	**162**	**11.5**
Lead	µg/L	**0.030** B	<0.015	**0.045** B	<0.015	**0.023** B	<0.015
Lithium	µg/L	**3.36**	**3.37**	**3.96**	**4.04**	**3.07**	**2.76**
Manganese	µg/L	**88.7**	**40.8**	**25.0**	**1.20**	**54.8**	**41.9**
Mercury	µg/L	--	--	**0.40** B	**0.50** e	<0.15	<0.15
Molybdenum	µg/L	--	--	**9.73**	**9.72**	**9.52**	**9.40**
Nickel	µg/L	**8.12**	**6.73**	**5.72**	**5.04**	**5.96**	**5.83**
Selenium	µg/L	**0.211**	**0.201**	**0.188**	**0.184**	**0.248**	**0.228**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**240**	**244**	**216**	**219**	**214**	**215**
Thallium	µg/L	--	--	**0.003** B	**0.003** B	<0.002	**0.003** B
Uranium	µg/L	**1.53**	**1.57**	**1.50**	**1.53**	**1.53**	**1.52**
Vanadium	µg/L	--	--	**0.043** e	**0.036** e	**0.041**	**0.027** B
Zinc	µg/L	**1.13** s	**0.979**	**0.860** s	**0.549** R,s	**0.878** s	**3.18** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**100**	--	**100**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**11**	--	**11**	--
Fluoride	mg/L	**0.17**	--	**0.23**	--	**0.15**	--
Hydrogen Sulfide	mg/L	<0.0010	--	<0.0010	--	<0.0010	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.5**	--	**1.5**	--	**1.4**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	**0.0183**	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**120**	--	**120**	--	**130**	--
Major Cations							
Calcium	mg/L	**45**	**50**	**43**	**46**	**42** e	**40** e
Magnesium	mg/L	**22**	**24**	**21**	**22**	**20** e	**19** e
Potassium	mg/L	**7.3**	**7.5**	**6.2**	**6.6**	**6.4** e	**6.0** e
Sodium	mg/L	**11**	**12**	**10**	**11**	**9.7**	**9.4**
General							
Hardness	mg/L	**203**	**223**	**194**	**205**	**187**	**178**
TOC	mg/L	**2.5**	--	**2.6**	--	**2.6**	--
DOC	mg/L	**2.5**	--	**2.7**	--	**2.8**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**290**	--	**356**	--	**342**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 5 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*5 m*		*5 m*		*5 m*	
Field							
D.O.	ppm	10	--	9.6	--	9.8	--
pH	SU	7.9	--	7.9	--	8.2	--
Specific Conductance	µmhos/cm @ 25°C	509	--	513	--	505	--
Temperature	°C	17	--	18	--	14	--
Metals							
Aluminum	µg/L	2.27	0.90 B	2.27	0.95 a,B	3.77 a	1.78
Antimony	µg/L	5.87	5.84	5.78	5.74	5.91	5.89
Arsenic	µg/L	0.695	0.646	0.748	0.695	1.19 e	1.06 e
Barium	µg/L	--	--	6.97	6.90	7.07	6.95
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	90.6	88.0	97.2	98.2
Cadmium	µg/L	--	--	0.020 a	0.026	0.023	0.024
Chromium	µg/L	0.065 s	0.044	0.090	0.044	0.063	0.036
Cobalt	µg/L	--	--	2.03	1.81	2.01	1.97
Copper	µg/L	--	--	1.83	1.61	1.46	1.19
Gold	µg/L	--	--	0.529	0.475	0.536	0.429
Iron	µg/L	93.3	28.6	138	19.0	164	11.3
Lead	µg/L	0.022 B	<0.015	0.026 B	0.062	0.022 B	<0.015
Lithium	µg/L	3.48	3.40	3.24	3.67	3.01	3.04
Manganese	µg/L	87.2	65.4	30.4	3.54	55.3	39.8
Mercury	µg/L	--	--	0.42 e	0.36 B	<0.15	<0.15
Molybdenum	µg/L	--	--	10.0	9.95	9.36	9.36
Nickel	µg/L	9.04	9.25	7.67	7.27	6.07	5.45
Selenium	µg/L	0.258	0.240	0.205	0.215	0.226	0.205
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	248	251	222	224	212	212
Thallium	µg/L	--	--	0.003 B	0.003 B	0.003 B	<0.002
Uranium	µg/L	1.70	1.69	1.68	1.71	1.52	1.52
Vanadium	µg/L	--	--	0.050 e	0.047 e	0.040	0.030 B
Zinc	µg/L	1.20 s	1.28	1.32 s	2.07 R,s	0.895 s	0.904 R
Major Anions							
Alkalinity, Bicarbonate	mg/L	110	--	100	--	110	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	12	--	11	--	11	--
Fluoride	mg/L	0.18	--	0.19	--	0.16	--
Hydrogen Sulfide	mg/L	<0.0020	--	<0.0020	--	<0.0010	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	1.6	--	1.6	--	1.4	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	0.0103 s	--	<0.0100	--
Sulfate	mg/L	130	--	120	--	130	--
Major Cations							
Calcium	mg/L	43	51	44	45	42 e	41 e
Magnesium	mg/L	21	24	22	22	20 e	20 e
Potassium	mg/L	7.3	7.8	6.3	6.6	6.4 e	6.3 e
Sodium	mg/L	11	12	11	11	9.9	9.6
General							
Hardness	mg/L	194	226	200	203	187	185
TOC	mg/L	2.5	--	2.6	--	2.7	--
DOC	mg/L	2.6	--	2.7	--	2.7	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	320	--	334	--	316	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 10 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*10 m*		*10 m*		*10 m*	
Field							
D.O.	ppm	**9.8**	--	**10**	--	**9.9**	--
pH	SU	**7.6**	--	**7.6**	--	**8.2**	--
Specific Conductance	µmhos/cm @ 25°C	**514**	--	**524**	--	**522**	--
Temperature	°C	**8.1**	--	**8.8**	--	**8.7**	--
Metals							
Aluminum	µg/L	**2.00**	**0.20** B,s	**1.06**	**0.23** a,B	**0.93** a,B	**0.48** B
Antimony	µg/L	**5.75**	**5.69**	**5.53**	**5.45**	**6.06**	**5.96**
Arsenic	µg/L	**0.502**	**0.385**	**0.473**	**0.402**	**0.587** e	**0.535** e
Barium	µg/L	--	--	**7.80**	**7.71**	**7.29**	**7.32**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**91.3**	**91.2**	**103**	**103**
Cadmium	µg/L	--	--	**0.020** a	**0.021**	**0.023**	**0.034**
Chromium	µg/L	**0.058** s	**0.041**	**0.060**	**0.030**	**0.068**	**0.041**
Cobalt	µg/L	--	--	**2.58**	**2.38**	**2.61**	**2.55**
Copper	µg/L	--	--	**1.87**	**1.62**	**1.69**	**1.63**
Gold	µg/L	--	--	**0.575**	**0.482**	**0.588**	**0.468**
Iron	µg/L	**156**	**22.7**	**120**	**17.4**	**54.9**	**4.23**
Lead	µg/L	**0.022** B	<0.015	**0.021** B	<0.015	<0.015	<0.015
Lithium	µg/L	**3.32**	**3.32**	**3.72**	**3.87**	**3.06**	**3.04**
Manganese	µg/L	**179**	**152**	**171**	**128**	**102**	**91.6**
Mercury	µg/L	--	--	**0.29** B,s	**0.36** B	<0.15	<0.15
Molybdenum	µg/L	--	--	**9.90**	**9.77**	**9.65**	**9.48**
Nickel	µg/L	**12.6**	**12.4**	**11.8**	**11.5**	**10.7**	**10.3**
Selenium	µg/L	**0.232**	**0.235**	**0.189**	**0.188**	**0.199**	**0.220**
Silver	µg/L	--	--	<0.005	**0.006** B	<0.005	<0.005
Strontium	µg/L	**258**	**260**	**230**	**229**	**220**	**220**
Thallium	µg/L	--	--	<0.002	<0.002	<0.002	<0.002
Uranium	µg/L	**1.72**	**1.74**	**1.68**	**1.70**	**1.65**	**1.67**
Vanadium	µg/L	--	--	**0.024** B	**0.018** B	**0.023** B	**0.013** B
Zinc	µg/L	**1.41** s	**1.60**	**1.25** s	**2.99** R,s	**1.21** s	**4.38** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**11**	--	**12**	--
Fluoride	mg/L	**0.18**	--	**0.20**	--	**0.15**	--
Hydrogen Sulfide	mg/L	<0.0060	--	<0.0050	--	<0.0020	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.6**	--	**1.7**	--	**1.7**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	**0.0109** s	--	<0.0100	--
Sulfate	mg/L	**130**	--	**130**	--	**130**	--
Major Cations							
Calcium	mg/L	**44**	**51**	**48**	**47**	**45** e	**42** e
Magnesium	mg/L	**21**	**25**	**23**	**23**	**21** e	**20** e
Potassium	mg/L	**7.4**	**7.9**	**6.8**	**6.9**	**7.0** e	**6.5** e
Sodium	mg/L	**11**	**13**	**12**	**11**	**11**	**10**
General							
Hardness	mg/L	**196**	**230**	**214**	**212**	**199**	**187**
TOC	mg/L	**2.4**	--	**2.6**	--	**2.5**	--
DOC	mg/L	**2.6**	--	**2.6**	--	**2.6**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**324**	--	**318**	--	**340**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 20 m
Humboldt Mill HTDF Monitoring

Parameter	**Unit**	**Jul 2010 07/20/10 Total**	**Jul 2010 07/20/10 Dissolved**	**Aug 2010 08/24/10 Total**	**Aug 2010 08/24/10 Dissolved**	**Sep 2010 09/27/10 Total**	**Sep 2010 09/27/10 Dissolved**
	Actual Depth:	*20 m*		*20 m*		*20 m*	
Field							
D.O.	ppm	**8.5**	--	**8.1**	--	**8.1**	--
pH	SU	**6.6**	--	**7.1**	--	**7.5**	--
Specific Conductance	µmhos/cm @ 25°C	**529**	--	**540**	--	**541**	--
Temperature	°C	**4.5**	--	**4.5**	--	**4.5**	--
Metals							
Aluminum	µg/L	**0.98** B	**0.18** B,s	**0.69** B	**0.17** a,B	**0.75** a,B	<0.13
Antimony	µg/L	**6.64**	**6.66**	**6.60**	**6.53**	**7.45**	**7.30**
Arsenic	µg/L	**0.354**	**0.225**	**0.306**	**0.227**	**0.404** e	**0.294** e
Barium	µg/L	--	--	**8.02**	**7.91**	**7.91**	**7.78**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**95.2**	**94.8**	**109**	**108**
Cadmium	µg/L	--	--	**0.021** a	**0.027**	**0.026**	**0.025**
Chromium	µg/L	**0.044** s	**0.031**	**0.039** s	**0.023**	**0.059** s	**0.032**
Cobalt	µg/L	--	--	**3.27**	**3.27**	**3.74**	**3.67**
Copper	µg/L	--	--	**2.02**	**2.06**	**1.85**	**1.80**
Gold	µg/L	--	--	**0.687**	**0.573**	**0.707**	**0.636**
Iron	µg/L	**184**	**27.7**	**133**	**19.5**	**105**	**4.69**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015	**0.018** B	<0.015
Lithium	µg/L	**3.30**	**3.26**	**3.98**	**4.05**	**3.17**	**3.42**
Manganese	µg/L	**289**	**277**	**277**	**261**	**296**	**287**
Mercury	µg/L	--	--	**0.27** B,s	**0.55** e	<0.15	<0.15
Molybdenum	µg/L	--	--	**11.5**	**11.4**	**11.2**	**11.3**
Nickel	µg/L	**21.7**	**21.2**	**21.7**	**21.8**	**21.3**	**21.0**
Selenium	µg/L	**0.198**	**0.218**	**0.167**	**0.194**	**0.205**	**0.172**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**264**	**268**	**236**	**235**	**230**	**230**
Thallium	µg/L	--	--	<0.002	<0.002	<0.002	**0.003** B
Uranium	µg/L	**1.68**	**1.66**	**1.74**	**1.75**	**1.68**	**1.67**
Vanadium	µg/L	--	--	**0.024** e	**0.016** B	**0.014** B	<0.010
Zinc	µg/L	**1.47** s	**1.54**	**1.60** s	**9.76** R,s	**1.35** s	**7.58** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**12**	--	**12**	--	**13**	--
Fluoride	mg/L	**0.17**	--	**0.20**	--	**0.17**	--
Hydrogen Sulfide	mg/L	<0.016	--	<0.012	--	<0.0070	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**1.9**	--	**2.0**	--	**2.0**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	**0.0128** s	--	<0.0100	--
Sulfate	mg/L	**130**	--	**130**	--	**130**	--
Major Cations							
Calcium	mg/L	**47**	**52**	**46**	**48**	**44** e	**45** e
Magnesium	mg/L	**23**	**26**	**23**	**24**	**21** e	**22** e
Potassium	mg/L	**8.1**	**8.4**	**7.1**	**7.4**	**7.3** e	**7.5** e
Sodium	mg/L	**12**	**14**	**12**	**13**	**11**	**12**
General							
Hardness	mg/L	**212**	**237**	**209**	**218**	**196**	**203**
TOC	mg/L	**2.4**	--	**2.4**	--	**2.5**	--
DOC	mg/L	**2.4**	--	**2.5**	--	**2.6**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**316**	--	**312**	--	**346**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 25 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*25 m*		*25 m*		*25 m*	
Field							
D.O.	ppm	**5.8**	--	**5.2**	--	**5.3**	--
pH	SU	**6.4**	--	**6.9**	--	**7.3**	--
Specific Conductance	µmhos/cm @ 25°C	**550**	--	**557**	--	**564**	--
Temperature	°C	**4.2**	--	**4.2**	--	**4.2**	--
Metals							
Aluminum	µg/L	**0.85** B	<0.13	**0.75** B	**0.17** a,B	**0.53** a,B	**0.20** B
Antimony	µg/L	**9.05**	**9.11**	**9.13**	**9.22**	**9.58**	**9.56**
Arsenic	µg/L	**0.362**	**0.218**	**0.304**	**0.195**	**0.406** e	**0.274** e
Barium	µg/L	--	--	**8.16**	**8.09**	**7.36**	**7.85**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**102**	**103**	**118**	**116**
Cadmium	µg/L	--	--	**0.029** a	**0.034**	**0.042**	**0.037**
Chromium	µg/L	**0.051** s	**0.029**	**0.038** s	**0.037**	**0.063**	**0.032**
Cobalt	µg/L	--	--	**5.06**	**4.98**	**5.48**	**5.25**
Copper	µg/L	--	--	**2.20**	**2.09**	**1.98**	**1.88**
Gold	µg/L	--	--	**0.914**	**0.647**	**0.888**	**0.729**
Iron	µg/L	**248**	**32.1**	**160**	**20.6**	**136**	**5.21**
Lead	µg/L	<0.015	<0.015	**0.020** B	<0.015	<0.015	<0.015
Lithium	µg/L	**3.26**	**3.20**	**4.15**	**4.20**	**3.03**	**3.24**
Manganese	µg/L	**468**	**468**	**454**	**452**	**418**	**434**
Mercury	µg/L	--	--	**0.34** B,s	**0.32** B,s	<0.15	<0.15
Molybdenum	µg/L	--	--	**15.7**	**15.9**	**14.3**	**14.5**
Nickel	µg/L	**48.0**	**43.8**	**44.5**	**46.4**	**38.4**	**37.2**
Selenium	µg/L	**0.212**	**0.195**	**0.190**	**0.157**	**0.184**	**0.187**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**278**	**277**	**250**	**249**	**222**	**238**
Thallium	µg/L	--	--	**0.003** B	**0.003** B	**0.003** B	**0.003** B
Uranium	µg/L	**1.80**	**1.77**	**1.95**	**1.96**	**1.75**	**1.84**
Vanadium	µg/L	--	--	**0.033** e	**0.013** B	**0.021** B	<0.010
Zinc	µg/L	**2.04** s	**1.92**	**1.78** s	**2.25** R,s	**1.51** s	**4.32** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**110**	--	**110**	--	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**13**	--	**13**	--	**14**	--
Fluoride	mg/L	**0.21**	--	**0.21**	--	**0.18**	--
Hydrogen Sulfide	mg/L	<0.018	--	<0.014	--	<0.0090	--
Nitrogen, Ammonia	mg/L	<0.050	--	<0.050	--	<0.050	--
Nitrogen, Nitrate	mg/L	**2.2**	--	**2.4**	--	**2.2**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	**0.0297**	--	**0.0123** s	--	<0.0100	--
Sulfate	mg/L	**140**	--	**140**	--	**130**	--
Major Cations							
Calcium	mg/L	**47**	**53**	**46**	**49**	**44** e	**43** e
Magnesium	mg/L	**23**	**26**	**23**	**24**	**21** e	**21** e
Potassium	mg/L	**9.2**	**9.6**	**8.1**	**8.4**	**7.9** e	**7.9** e
Sodium	mg/L	**14**	**15**	**13**	**15**	**12**	**12**
General							
Hardness	mg/L	**212**	**239**	**209**	**221**	**196**	**194**
TOC	mg/L	**2.4**	--	**2.4**	--	**2.5**	--
DOC	mg/L	**2.4**	--	**2.5**	--	**2.5**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**326**	--	**328**	--	**378**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 27-29 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*27 m*		*29 m*		*27 m*	
Field							
D.O.	ppm	3.2	--	0.9	--	3.0	--
pH	SU	6.3	--	6.8	--	7.2	--
Specific Conductance	µmhos/cm @ 25°C	567	--	590	--	577	--
Temperature	°C	4.2	--	4.2	--	4.2	--
Metals							
Aluminum	µg/L	0.91 B	<0.13	0.61 B	<0.13 a	0.51 a,B	<0.13
Antimony	µg/L	11.6	11.7	14.7	14.5	11.8	11.7
Arsenic	µg/L	0.360	0.221	0.313	0.205	0.399 e	0.276 e
Barium	µg/L	--	--	8.38	8.37	7.70	7.36
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	118	117	124	121
Cadmium	µg/L	--	--	0.055 a	0.054	0.046	0.048
Chromium	µg/L	0.036 s	0.023	0.037 s	0.026	0.050 s	0.028
Cobalt	µg/L	--	--	8.48	8.39	6.84	6.72
Copper	µg/L	--	--	2.55	2.49	2.09	2.00
Gold	µg/L	--	--	1.26	1.13	1.06	0.864
Iron	µg/L	203	29.6	129	21.6	144	4.70
Lead	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	3.23	3.19	4.07	4.19	3.22	3.12
Manganese	µg/L	660	644	915	901	587	577
Mercury	µg/L	--	--	0.28 B,s	0.36 B	<0.15	<0.15
Molybdenum	µg/L	--	--	26.0	25.7	18.0	17.6
Nickel	µg/L	62.2	64.1	101	102	55.9	55.1
Selenium	µg/L	0.220	0.218	0.183	0.189	0.211	0.205
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	291	289	269	268	241	233
Thallium	µg/L	--	--	0.007 B	0.006 B	0.004 B	0.004 B
Uranium	µg/L	1.84	1.83	2.17	2.17	1.91	1.86
Vanadium	µg/L	--	--	0.017 e	0.012 B	0.013 B	<0.010
Zinc	µg/L	1.94 s	2.12	2.23 s	12.0 R,s	1.78 s	6.06 R
Major Anions							
Alkalinity, Bicarbonate	mg/L	110	--	120	--	110	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	15	--	16	--	15	--
Fluoride	mg/L	0.22	--	0.27	--	0.21	--
Hydrogen Sulfide	mg/L	<0.018	--	<0.015	--	<0.011	--
Nitrogen, Ammonia	mg/L	0.11	--	0.31	--	<0.050	--
Nitrogen, Nitrate	mg/L	2.4	--	2.7	--	2.5	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	0.0117 s	--	<0.0100	--
Sulfate	mg/L	140	--	150	--	140	--
Major Cations							
Calcium	mg/L	46	53	49	48	44 e	44 e
Magnesium	mg/L	23	27	25	25	22 e	22 e
Potassium	mg/L	10	11	10	10	8.9 e	8.9 e
Sodium	mg/L	15	17	18	17	14	14
General							
Hardness	mg/L	209	243	225	223	200	200
TOC	mg/L	2.4	--	2.5	--	2.5	--
DOC	mg/L	2.4	--	2.6	--	2.5	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	360	--	348	--	376	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 29-32 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*29 m*		*32 m*		*29 m*	
Field							
D.O.	ppm	**1.3**	--	**0.1**	--	**1.2**	--
pH	SU	**6.6**	--	**7.1**	--	**7.1**	--
Specific Conductance	µmhos/cm @ 25°C	**589**	--	**635**	--	**592**	--
Temperature	°C	**4.2**	--	**4.2**	--	**4.2**	--
Metals							
Aluminum	µg/L	**0.78** B,s	<0.13	**0.60** B	**0.18** a,B	**0.66** a,B	**0.24** B
Antimony	µg/L	**14.6**	**14.9**	**19.4**	**19.1**	**14.3**	**14.6**
Arsenic	µg/L	**0.353**	**0.236**	**0.290**	**0.233**	**0.383** e	**0.281** e
Barium	µg/L	--	--	**8.87**	**8.94**	**7.93**	**7.76**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**127**	**126**	**130**	**133**
Cadmium	µg/L	--	--	**0.074** a	**0.072**	**0.052**	**0.055**
Chromium	µg/L	**0.043** s	**0.025**	**0.035** s	**0.028**	**0.057** s	**0.030**
Cobalt	µg/L	--	--	**10.9**	**11.0**	**7.82**	**8.07**
Copper	µg/L	--	--	**2.87**	**2.76**	**2.21**	**2.22**
Gold	µg/L	--	--	**1.71**	--	**1.26**	**1.08**
Iron	µg/L	**176**	**26.1**	**138**	**24.9**	**87.3**	**4.91**
Lead	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Lithium	µg/L	**3.16**	**3.23**	**4.28**	**4.30**	**3.31**	**3.26**
Manganese	µg/L	**850**	**841**	**1330**	**1320**	**708**	**724**
Mercury	µg/L	--	--	**0.33** B,s	**0.48** e	<0.19	<0.15
Molybdenum	µg/L	--	--	**34.5**	**34.3**	**22.2**	**22.7**
Nickel	µg/L	**90.5**	**90.0**	**149**	**146**	**75.8**	**80.4**
Selenium	µg/L	**0.242**	**0.224**	**0.212**	**0.224**	**0.169**	**0.177**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**300**	**303**	**283**	**283**	**258**	**254**
Thallium	µg/L	--	--	**0.009** B	**0.009** B	**0.005** B	**0.006** B
Uranium	µg/L	**1.91**	**1.95**	**2.33**	**2.31**	**2.07**	**2.04**
Vanadium	µg/L	--	--	**0.023** B	**0.016** B	**0.012** B	<0.010
Zinc	µg/L	**2.31**	**2.34**	**2.34** s	**12.1** R,s	**2.13** s	**10.0** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**120**	--	**130**	--	**120**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**16**	--	**19**	--	**16**	--
Fluoride	mg/L	**0.22**	--	**0.23**	--	**0.20**	--
Hydrogen Sulfide	mg/L	<0.016	--	<0.012	--	<0.012	--
Nitrogen, Ammonia	mg/L	**0.24**	--	**0.93**	--	**0.11**	--
Nitrogen, Nitrate	mg/L	**2.6**	--	**2.5**	--	**2.6**	--
Nitrogen, Nitrite	mg/L	<0.050	--	**0.12**	--	<0.050	--
Phosphorus, Total	mg/L	**0.0945**	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**140**	--	**160**	--	**140**	--
Major Cations							
Calcium	mg/L	**48**	**54**	**48**	**49**	**46** e	**46** e
Magnesium	mg/L	**25**	**28**	**25**	**26**	**23** e	**23** e
Potassium	mg/L	**12**	**12**	**12**	**12**	**10** e	**10** e
Sodium	mg/L	**17**	**19**	**20**	**21**	**16**	**16**
General							
Hardness	mg/L	**223**	**250**	**223**	**229**	**209**	**209**
TOC	mg/L	**2.4**	--	**2.5**	--	**2.5**	--
DOC	mg/L	**2.5**	--	**2.6**	--	**2.8**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**364**	--	**366**	--	**380**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 32-35 m
Humboldt Mill HTDF Monitoring

Parameter	**Unit**	**Jul 2010 07/20/10 Total**	**Jul 2010 07/20/10 Dissolved**	**Aug 2010 08/24/10 Total**	**Aug 2010 08/24/10 Dissolved**	**Sep 2010 09/27/10 Total**	**Sep 2010 09/27/10 Dissolved**
	Actual Depth:	*32 m*		*35 m*		*32 m*	
Field							
D.O.	ppm	<0.1	--	<0.1	--	<0.1	--
pH	SU	**6.6**	--	**7.0**	--	**7.2**	--
Specific Conductance	µmhos/cm @ 25°C	**625**	--	**658**	--	**636**	--
Temperature	°C	**4.2**	--	**4.4**	--	**4.2**	--
Metals							
Aluminum	µg/L	**0.80** B,s	<0.13	**0.83** B	**0.14** a,B	**0.62** a,B	**0.26** B
Antimony	µg/L	**20.1**	**20.4**	**22.6**	**22.4**	**21.5**	**21.3**
Arsenic	µg/L	**0.347**	**0.247**	**0.283**	**0.198**	**0.444** e	**0.336** e
Barium	µg/L	--	--	**9.47**	**9.39**	**8.67**	**8.38**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**132**	**135**	**149**	**150**
Cadmium	µg/L	--	--	**0.085** a	**0.082**	**0.084**	**0.086**
Chromium	µg/L	**0.033** s	**0.017** B	**0.029** s	**0.016** B	**0.042** s	**0.028**
Cobalt	µg/L	--	--	**12.4**	**12.7**	**11.7**	**11.9**
Copper	µg/L	--	--	**3.01**	**2.79**	**2.53**	**2.43**
Gold	µg/L	--	--	**1.88**	**1.71**	**1.76**	**1.47**
Iron	µg/L	**154**	**24.6**	**115**	**21.9**	**93.5**	**5.28**
Lead	µg/L	<0.015	<0.015	**0.016** B	<0.015	<0.015	**0.031** B
Lithium	µg/L	**3.16**	**3.20**	**4.30**	**4.38**	**3.35**	**3.35**
Manganese	µg/L	**1350**	**1380**	**1690**	**1670**	**1330**	**1320**
Mercury	µg/L	--	--	**0.36** B	**0.34** B	<0.15	<0.15
Molybdenum	µg/L	--	--	**41.1**	**40.8**	**34.0**	**33.7**
Nickel	µg/L	**140**	**133**	**177**	**175**	**137**	**136**
Selenium	µg/L	**0.244**	**0.247**	**0.221**	**0.237**	**0.203**	**0.233**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**283**	**319**	**296**	**295**	**275**	**269**
Thallium	µg/L	--	--	**0.011**	**0.011**	**0.009** B	**0.008** B
Uranium	µg/L	**2.02**	**2.02**	**2.39**	**2.38**	**2.22**	**2.18**
Vanadium	µg/L	--	--	**0.014** e	**0.016** B	<0.010	<0.010
Zinc	µg/L	**2.26**	**2.15**	**2.42** s	**9.96** R,s	**2.11** s	**9.97** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**130**	--	**130**	--	**120**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**18**	--	**20**	--	**18**	--
Fluoride	mg/L	**0.25**	--	**0.27**	--	**0.22**	--
Hydrogen Sulfide	mg/L	**0.019**	--	<0.013	--	<0.011	--
Nitrogen, Ammonia	mg/L	**0.91**	--	**1.6**	--	**0.90**	--
Nitrogen, Nitrate	mg/L	**2.4**	--	**2.2**	--	**2.4**	--
Nitrogen, Nitrite	mg/L	**0.10**	--	**0.089**	--	**0.12**	--
Phosphorus, Total	mg/L	**0.0327**	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**150**	--	**160**	--	**150**	--
Major Cations							
Calcium	mg/L	**47**	**54**	**48**	**49**	**46** e	**45** e
Magnesium	mg/L	**25**	**29**	**26**	**26**	**24** e	**24** e
Potassium	mg/L	**13**	**14**	**13**	**13**	**12** e	**12** e
Sodium	mg/L	**20**	**22**	**22**	**22**	**19**	**19**
General							
Hardness	mg/L	**220**	**254**	**227**	**229**	**213**	**211**
TOC	mg/L	**2.4**	--	**2.6**	--	**2.6**	--
DOC	mg/L	**3.8**	--	**2.6**	--	**2.7**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**380**	--	**398**	--	**398**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 40 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*40 m*		*40 m*		*40 m*	
Field							
D.O.	ppm	<0.1	--	<0.1	--	<0.1	--
pH	SU	**6.8**	--	**6.9**	--	**7.3**	--
Specific Conductance	µmhos/cm @ 25°C	**670**	--	**677**	--	**680**	--
Temperature	°C	**4.3**	--	**4.4**	--	**4.3**	--
Metals							
Aluminum	µg/L	**1.14**	**0.23** B	**0.94** B	**1.52** a	**0.45** a,B	**0.27** B
Antimony	µg/L	**26.6**	**28.3**	**26.4**	**26.7**	**29.0**	**28.7**
Arsenic	µg/L	**0.316**	**0.245**	**0.265**	**0.220**	**0.395** e	**0.324** e
Barium	µg/L	--	--	**10.4**	**10.5**	**9.01**	**9.68**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**143**	**142**	**169**	**169**
Cadmium	µg/L	--	--	**0.099** a	**0.103**	**0.118**	**0.119**
Chromium	µg/L	**0.036** s	**0.021**	**0.037** s	**0.021**	**0.039** s	**0.031**
Cobalt	µg/L	--	--	**15.4**	**15.5**	**16.6**	**16.0**
Copper	µg/L	--	--	**3.26**	**2.92**	**2.82**	**2.78**
Gold	µg/L	--	--	**2.12**	**1.96**	**2.25**	**1.96**
Iron	µg/L	**118**	**23.9**	**91.9**	**20.5**	**65.6**	**5.73**
Lead	µg/L	**0.019** B	<0.015	**0.025** B	<0.015	**0.017** B	<0.015
Lithium	µg/L	**3.26**	**3.21**	**4.39**	**4.41**	**3.18**	**3.33**
Manganese	µg/L	**2040**	**2170**	**2030**	**2030**	**2240**	**2250**
Mercury	µg/L	--	--	**0.38** B	**0.34** B	<0.15	**0.16** B
Molybdenum	µg/L	--	--	**48.7**	**48.6**	**45.9**	**46.8**
Nickel	µg/L	**224**	**209**	**216**	**216**	**199**	**200**
Selenium	µg/L	**0.331**	**0.310**	**0.245**	**0.267**	**0.285**	**0.248**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**310**	**348**	**307**	**306**	**269**	**289**
Thallium	µg/L	--	--	**0.012**	**0.013**	**0.012**	**0.012**
Uranium	µg/L	**2.19**	**2.19**	**2.56**	**2.55**	**2.28**	**2.38**
Vanadium	µg/L	--	--	**0.015** B	**0.014** B	<0.010	<0.010
Zinc	µg/L	**2.97**	**2.35**	**2.59** s	**4.43** R,s	**2.25** s	**14.6** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**140**	--	**140**	--	**140**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**21**	--	**22**	--	**21**	--
Fluoride	mg/L	**0.27**	--	**0.33**	--	**0.29**	--
Hydrogen Sulfide	mg/L	<0.015	--	<0.014	--	<0.0090	--
Nitrogen, Ammonia	mg/L	**2.4**	--	**2.3**	--	**2.2**	--
Nitrogen, Nitrate	mg/L	**1.8**	--	**2.0**	--	**2.0**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	**0.0198** s	--	<0.0100	--
Sulfate	mg/L	**160**	--	**160**	--	**150**	--
Major Cations							
Calcium	mg/L	**47**	**55**	**49**	**50**	**46** e	**45** e
Magnesium	mg/L	**26**	**30**	**27**	**27**	**24** e	**25** e
Potassium	mg/L	**16**	**17**	**14**	**15**	**14** e	**14** e
Sodium	mg/L	**23**	**27**	**24**	**25**	**22**	**22**
General							
Hardness	mg/L	**224**	**261**	**233**	**236**	**213**	**215**
TOC	mg/L	**2.6**	--	**2.6**	--	**2.6**	--
DOC	mg/L	**2.8**	--	**2.7**	--	**2.8**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**392**	--	**398**	--	**430**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Results HPL002 at 50 m
Humboldt Mill HTDF Monitoring

Parameter	Unit	Jul 2010 07/20/10 Total	Jul 2010 07/20/10 Dissolved	Aug 2010 08/24/10 Total	Aug 2010 08/24/10 Dissolved	Sep 2010 09/27/10 Total	Sep 2010 09/27/10 Dissolved
	Actual Depth:	*50 m*		*50 m*		*50 m*	
Field							
D.O.	ppm	<0.1	--	<0.1	--	<0.1	--
pH	SU	**7.0**	--	**7.9**	--	**7.4**	--
Specific Conductance	µmhos/cm @ 25°C	**709**	--	**721**	--	**721**	--
Temperature	°C	**4.5**	--	**4.6**	--	**4.5**	--
Metals							
Aluminum	µg/L	**3.25**	<0.13	**3.01**	**0.17** a,B	**1.90** a	<0.13
Antimony	µg/L	**30.5**	**29.3**	**30.4**	**30.3**	**33.5**	**33.4**
Arsenic	µg/L	**0.389**	**0.300**	**0.397**	**0.314**	**0.503** e	**0.403** e
Barium	µg/L	--	--	**13.7**	**13.7**	**13.0**	**11.8**
Beryllium	µg/L	--	--	<0.012	<0.012	<0.012	<0.012
Boron	µg/L	--	--	**155**	**155**	**184**	**186**
Cadmium	µg/L	--	--	**0.197** a	**0.126**	**0.150**	**0.135**
Chromium	µg/L	**0.083** s	**0.018** B	**0.069**	**0.023**	**0.073**	**0.028**
Cobalt	µg/L	--	--	**19.6**	**19.4**	**20.0**	**20.6**
Copper	µg/L	--	--	**3.23**	**2.86**	**3.03**	**2.65**
Gold	µg/L	--	--	**2.33**	**2.24**	**2.57**	**2.34**
Iron	µg/L	**123**	**24.8**	**99.9**	**22.3**	**76.4**	**7.94**
Lead	µg/L	**0.055**	<0.015	**0.063**	<0.015	**0.055**	<0.015
Lithium	µg/L	**3.22**	**3.21**	**4.46**	**4.47**	**3.39**	**3.25**
Manganese	µg/L	**2850**	**2980**	**2880**	**2870**	**3220**	**3190**
Mercury	µg/L	--	--	**0.45** B	**0.56** e	<0.15	<0.15
Molybdenum	µg/L	--	--	**60.5**	**60.6**	**59.2**	**58.1**
Nickel	µg/L	**253**	**262**	**255**	**260**	**244**	**240**
Selenium	µg/L	**0.342**	**0.329**	**0.306**	**0.290**	**0.312**	**0.279**
Silver	µg/L	--	--	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	**333**	**376**	**326**	**327**	**317**	**286**
Thallium	µg/L	--	--	**0.015**	**0.016**	**0.013**	**0.013**
Uranium	µg/L	**2.31**	**2.29**	**2.76**	**2.75**	**2.60**	**2.47**
Vanadium	µg/L	--	--	**0.019** B	**0.013** B	<0.010	<0.010
Zinc	µg/L	**2.42**	**2.54**	**2.35** s	**12.8** R,s	**2.22** s	**18.1** R
Major Anions							
Alkalinity, Bicarbonate	mg/L	**160**	--	**160**	--	**160**	--
Alkalinity, Carbonate	mg/L	<2.0	--	<2.0	--	<2.0	--
Chloride	mg/L	**24**	--	**24**	--	**24**	--
Fluoride	mg/L	**0.29**	--	**0.34**	--	**0.27**	--
Hydrogen Sulfide	mg/L	<0.013	--	<0.0040	--	<0.0080	--
Nitrogen, Ammonia	mg/L	**3.7**	--	**3.5**	--	**3.3**	--
Nitrogen, Nitrate	mg/L	**1.2**	--	**1.2**	--	**1.1**	--
Nitrogen, Nitrite	mg/L	<0.050	--	<0.050	--	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--	<0.0100	--	<0.0100	--
Sulfate	mg/L	**160**	--	**170**	--	**170**	--
Major Cations							
Calcium	mg/L	**46**	**55**	**49**	**47**	**46** e	**46** e
Magnesium	mg/L	**26**	**31**	**27**	**27**	**26** e	**26** e
Potassium	mg/L	**18**	**19**	**16**	**16**	**17** e	**17** e
Sodium	mg/L	**26**	**30**	**27**	**27**	**25**	**25**
General							
Hardness	mg/L	**222**	**265**	**233**	**228**	**222**	**222**
TOC	mg/L	**2.7**	--	**2.7**	--	**2.8**	--
DOC	mg/L	**2.8**	--	**2.8**	--	**2.9**	--
TSS	mg/L	<3.3	--	<3.3	--	<3.3	--
TDS	mg/L	**442**	--	**412**	--	**444**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (3rd Quarter)
Analytical Profile Footnote Explanations
Humboldt Mill HTDF Monitoring

Footnote	Explanation
a	Potential false positive value. Compound present in blank sample.
B	Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.
e	Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.
R	Rejected value.
s	Potential false positive value. Compound present in blank sample.
Note:	For sampling events from Feb-Jul a 0.45 micron filter was used. For sampling events from Aug-Oct a 0.2 micron filter was used.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 1 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*1 m*	*1 m*
Field			
D.O.	ppm	**10**	**--**
pH	SU	**8.1**	**--**
Specific Conductance	µhos/cm @ 25°C	**501**	**--**
Temperature	°C	**12**	**--**
Metals			
Aluminum	µg/L	**2.76**	**1.37**
Antimony	µg/L	**5.60**	**5.57**
Arsenic	µg/L	**0.921** e	**0.783** e
Barium	µg/L	**7.06**	**6.91**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**74.3**	**72.5**
Cadmium	µg/L	**0.022**	**0.027**
Chromium	µg/L	**0.086** s	**0.029**
Cobalt	µg/L	**2.09**	**2.03**
Copper	µg/L	**1.65**	**1.49**
Gold	µg/L	**0.573**	**0.439**
Iron	µg/L	**171**	**12.3**
Lead	µg/L	**0.025** B	<0.015
Lithium	µg/L	**2.90**	**2.93**
Manganese	µg/L	**65.8**	**54.8**
Mercury	ng/L	**0.20** B	<0.15
Molybdenum	µg/L	**9.38**	**9.40**
Nickel	µg/L	**6.39**	**6.07**
Selenium	µg/L	**0.247** e	**0.229** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**211**	**210**
Thallium	µg/L	<0.002	**0.003** B
Uranium	µg/L	**1.49**	**1.52**
Vanadium	µg/L	**0.047**	**0.035**
Zinc	µg/L	**0.999** s	**4.17** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**100**	**--**
Alkalinity, Carbonate	mg/L	<2.0	**--**
Chloride	mg/L	**11**	**--**
Fluoride	mg/L	**0.18**	**--**
Hydrogen Sulfide	mg/L	<0.0020	**--**
Nitrogen, Ammonia	mg/L	<0.010	**--**
Nitrogen, Nitrate	mg/L	**1.8**	**--**
Nitrogen, Nitrite	mg/L	<0.050	**--**
Phosphorus, Total	mg/L	<0.0100	**--**
Sulfate	mg/L	**130**	**--**
Major Cations			
Calcium	mg/L	**55**	**47**
Magnesium	mg/L	**27**	**23**
Potassium	mg/L	**8.3**	**7.1**
Sodium	mg/L	**13**	**11**
General			
Hardness	mg/L	**248**	**212**
TOC	mg/L	**2.9**	**--**
DOC	mg/L	**3.0**	**--**
TSS	mg/L	<3.3	**--**
TDS	mg/L	**334**	**--**

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 3 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*3 m*	*3 m*
Field			
D.O.	ppm	**10**	--
pH	SU	**8.2**	--
Specific Conductance	µhos/cm @ 25°C	**502**	--
Temperature	°C	**12**	--
Metals			
Aluminum	µg/L	**2.42**	**1.34**
Antimony	µg/L	**5.66**	**5.50**
Arsenic	µg/L	**0.908** e	**0.769** e
Barium	µg/L	**7.13**	**6.96**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**72.9**	**72.4**
Cadmium	µg/L	**0.025**	**0.024**
Chromium	µg/L	**0.042** s	**0.024**
Cobalt	µg/L	**2.06**	**2.01**
Copper	µg/L	**1.51**	**1.27**
Gold	µg/L	**0.529**	**0.434**
Iron	µg/L	**172**	**13.4**
Lead	µg/L	**0.022** B	<0.015
Lithium	µg/L	**2.89**	**2.87**
Manganese	µg/L	**66.6**	**53.8**
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	**9.51**	**9.50**
Nickel	µg/L	**6.21**	**5.81**
Selenium	µg/L	**0.247** e	**0.233** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**209**	**210**
Thallium	µg/L	<0.002	<0.002
Uranium	µg/L	**1.53**	**1.54**
Vanadium	µg/L	**0.038**	**0.038**
Zinc	µg/L	**1.36** s	**1.85** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**100**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**11**	--
Fluoride	mg/L	**0.16**	--
Hydrogen Sulfide	mg/L	<0.0020	--
Nitrogen, Ammonia	mg/L	<0.010	--
Nitrogen, Nitrate	mg/L	**1.6**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	**0.0111** s	--
Sulfate	mg/L	**130**	--
Major Cations			
Calcium	mg/L	**54**	**46**
Magnesium	mg/L	**26**	**23**
Potassium	mg/L	**8.2**	**7.0**
Sodium	mg/L	**13**	**11**
General			
Hardness	mg/L	**242**	**209**
TOC	mg/L	**2.6**	--
DOC	mg/L	**3.0**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**328**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 5 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*5 m*	*5 m*
Field			
D.O.	ppm	9.9	--
pH	SU	8.3	--
Specific Conductance	µhos/cm @ 25^{o}C	502	--
Temperature	^{o}C	12	--
Metals			
Aluminum	µg/L	2.66	1.69
Antimony	µg/L	5.64	5.56
Arsenic	µg/L	0.892 e	0.770 e
Barium	µg/L	7.13	6.96
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	73.5	72.6
Cadmium	µg/L	0.023	0.024
Chromium	µg/L	0.045 s	0.028
Cobalt	µg/L	2.02	1.97
Copper	µg/L	1.43	1.21
Gold	µg/L	0.538	0.427
Iron	µg/L	169	13.6
Lead	µg/L	0.018 B	<0.015
Lithium	µg/L	2.92	2.88
Manganese	µg/L	65.8	53.7
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	9.54	9.44
Nickel	µg/L	5.90	6.00
Selenium	µg/L	0.231 e	0.227 e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	209	207
Thallium	µg/L	<0.002	<0.002
Uranium	µg/L	1.53	1.52
Vanadium	µg/L	0.051	0.037
Zinc	µg/L	1.01 s	1.13 R
Major Anions			
Alkalinity, Bicarbonate	mg/L	110	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	11	--
Fluoride	mg/L	0.32	--
Hydrogen Sulfide	mg/L	<0.0010	--
Nitrogen, Ammonia	mg/L	<0.010	--
Nitrogen, Nitrate	mg/L	1.6	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	0.0126 s	--
Sulfate	mg/L	130	--
Major Cations			
Calcium	mg/L	51	48
Magnesium	mg/L	25	23
Potassium	mg/L	7.7	7.3
Sodium	mg/L	12	11
General			
Hardness	mg/L	230	214
TOC	mg/L	2.7	--
DOC	mg/L	2.9	--
TSS	mg/L	<3.3	--
TDS	mg/L	328	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 10 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
Actual Depth:		*10 m*	*10 m*
Field			
D.O.	ppm	**9.7**	--
pH	SU	**8.1**	--
Specific Conductance	µhos/cm @ 25°C	**511**	--
Temperature	°C	**11**	--
Metals			
Aluminum	µg/L	**2.12**	**1.27**
Antimony	µg/L	**5.71**	**5.69**
Arsenic	µg/L	**0.745** e	**0.632** e
Barium	µg/L	**7.25**	**7.14**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**73.4**	**73.3**
Cadmium	µg/L	**0.024**	**0.024**
Chromium	µg/L	**0.049** s	**0.029**
Cobalt	µg/L	**2.25**	**2.16**
Copper	µg/L	**1.67**	**1.49**
Gold	µg/L	**0.564**	**0.450**
Iron	µg/L	**136**	**10.1**
Lead	µg/L	**0.022** B	<0.015
Lithium	µg/L	**2.90**	**2.89**
Manganese	µg/L	**77.9**	**65.2**
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	**9.68**	**9.74**
Nickel	µg/L	**8.10**	**7.51**
Selenium	µg/L	**0.238** e	**0.235** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**210**	**213**
Thallium	µg/L	**0.003** B	<0.002
Uranium	µg/L	**1.55**	**1.55**
Vanadium	µg/L	**0.044**	**0.030** B
Zinc	µg/L	**1.18** s	**3.57** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**11**	--
Fluoride	mg/L	**0.16**	--
Hydrogen Sulfide	mg/L	<0.0020	--
Nitrogen, Ammonia	mg/L	<0.010	--
Nitrogen, Nitrate	mg/L	**1.6**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--
Sulfate	mg/L	**140**	--
Major Cations			
Calcium	mg/L	**51**	**47**
Magnesium	mg/L	**25**	**22**
Potassium	mg/L	**7.9**	**7.1**
Sodium	mg/L	**12**	**11**
General			
Hardness	mg/L	**230**	**208**
TOC	mg/L	**2.5**	--
DOC	mg/L	**2.9**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**304**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 20 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*20 m*	*20 m*
Field			
D.O.	ppm	**7.7**	--
pH	SU	**7.3**	--
Specific Conductance	µhos/cm @ 25°C	**538**	--
Temperature	°C	**4.6**	--
Metals			
Aluminum	µg/L	**2.30**	**0.18** B
Antimony	µg/L	**7.08**	**6.99**
Arsenic	µg/L	**0.315** e	**0.197** e
Barium	µg/L	**7.84**	**7.70**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**78.4**	**79.1**
Cadmium	µg/L	**0.029**	**0.032**
Chromium	µg/L	**0.103** s	**0.038**
Cobalt	µg/L	**3.91**	**3.94**
Copper	µg/L	**1.93**	**1.76**
Gold	µg/L	**0.695**	**0.623**
Iron	µg/L	**152**	**4.11**
Lead	µg/L	**0.021** B	<0.015
Lithium	µg/L	**2.89**	**2.91**
Manganese	µg/L	**326**	**328**
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	**11.4**	**11.3**
Nickel	µg/L	**21.0**	**21.3**
Selenium	µg/L	**0.293** e	**0.282** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**225**	**224**
Thallium	µg/L	**0.003** B	**0.003** B
Uranium	µg/L	**1.64**	**1.64**
Vanadium	µg/L	**0.021** B	**0.013** B
Zinc	µg/L	**1.44** s	**4.80** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**12**	--
Fluoride	mg/L	**0.17**	--
Hydrogen Sulfide	mg/L	<0.0090	--
Nitrogen, Ammonia	mg/L	<0.010	--
Nitrogen, Nitrate	mg/L	**2.2**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--
Sulfate	mg/L	**140**	--
Major Cations			
Calcium	mg/L	**54**	**48**
Magnesium	mg/L	**26**	**24**
Potassium	mg/L	**8.9**	**8.0**
Sodium	mg/L	**14**	**12**
General			
Hardness	mg/L	**242**	**218**
TOC	mg/L	**2.5**	--
DOC	mg/L	**2.8**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**316**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 25 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*25 m*	*25 m*
Field			
D.O.	ppm	**4.8**	--
pH	SU	**7.2**	--
Specific Conductance	µhos/cm @ 25°C	**557**	--
Temperature	°C	**4.3**	--
Metals			
Aluminum	µg/L	**0.85** B,s	**0.60** B
Antimony	µg/L	**9.39**	**9.13**
Arsenic	µg/L	**0.301** e	**0.196** e
Barium	µg/L	**7.92**	**7.77**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**86.2**	**86.9**
Cadmium	µg/L	**0.040**	**0.037**
Chromium	µg/L	**0.088** s	**0.035**
Cobalt	µg/L	**5.43**	**5.19**
Copper	µg/L	**1.98**	**1.88**
Gold	µg/L	**0.871**	**0.706**
Iron	µg/L	**152**	**4.55**
Lead	µg/L	<0.015	<0.015
Lithium	µg/L	**2.97**	**2.99**
Manganese	µg/L	**467**	**444**
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	**15.1**	**14.6**
Nickel	µg/L	**39.2**	**37.6**
Selenium	µg/L	**0.367** e	**0.356** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**236**	**236**
Thallium	µg/L	**0.003** B	**0.003** B
Uranium	µg/L	**1.84**	**1.81**
Vanadium	µg/L	**0.017** B	**0.011** B
Zinc	µg/L	**1.73** s	**9.86** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**14**	--
Fluoride	mg/L	**0.16**	--
Hydrogen Sulfide	mg/L	<0.011	--
Nitrogen, Ammonia	mg/L	<0.010	--
Nitrogen, Nitrate	mg/L	**2.5**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--
Sulfate	mg/L	**150**	--
Major Cations			
Calcium	mg/L	**55**	**49**
Magnesium	mg/L	**27**	**24**
Potassium	mg/L	**10**	**8.9**
Sodium	mg/L	**16**	**14**
General			
Hardness	mg/L	**248**	**221**
TOC	mg/L	**2.5**	--
DOC	mg/L	**2.8**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**354**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 28 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*28 m*	*28 m*
Field			
D.O.	ppm	**1.1**	--
pH	SU	**7.1**	--
Specific Conductance	μhos/cm @ 25°C	**585**	--
Temperature	°C	**4.2**	--
Metals			
Aluminum	μg/L	**0.87** B,s	**0.43** B
Antimony	μg/L	**13.4**	**13.3**
Arsenic	μg/L	**0.291** e	**0.219** e
Barium	μg/L	**7.78**	**7.81**
Beryllium	μg/L	<0.012	<0.012
Boron	μg/L	**97.2**	**99.4**
Cadmium	μg/L	**0.054**	**0.058**
Chromium	μg/L	**0.046** s	**0.028**
Cobalt	μg/L	**7.58**	**7.60**
Copper	μg/L	**2.18**	**2.07**
Gold	μg/L	**1.24**	**1.01**
Iron	μg/L	**84.1**	**3.30**
Lead	μg/L	<0.015	<0.015
Lithium	μg/L	**3.08**	**3.10**
Manganese	μg/L	**697**	**730**
Mercury	ng/L	<0.15	<0.15
Molybdenum	μg/L	**21.9**	**22.2**
Nickel	μg/L	**73.3**	**72.7**
Selenium	μg/L	**0.542** e	**0.527** e
Silver	μg/L	<0.005	<0.005
Strontium	μg/L	**250**	**252**
Thallium	μg/L	**0.005** B	**0.005** B
Uranium	μg/L	**2.00**	**2.04**
Vanadium	μg/L	**0.016** B	**0.011** B
Zinc	μg/L	**1.99** s	**6.82** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**110**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**15**	--
Fluoride	mg/L	**0.18**	--
Hydrogen Sulfide	mg/L	<0.012	--
Nitrogen, Ammonia	mg/L	**0.046**	--
Nitrogen, Nitrate	mg/L	**2.8**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	**0.0106** s	--
Sulfate	mg/L	**160**	--
Major Cations			
Calcium	mg/L	**55**	**49**
Magnesium	mg/L	**28**	**26**
Potassium	mg/L	**12**	**11**
Sodium	mg/L	**19**	**17**
General			
Hardness	mg/L	**252**	**229**
TOC	mg/L	**2.5**	--
DOC	mg/L	**2.7**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**328**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 32 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total		Oct 2010 10/14/10 Dissolved	
	Actual Depth:	*32 m*		*32 m*	
Field					
D.O.	ppm	**0.05**		--	
pH	SU	**7.1**		--	
Specific Conductance	µhos/cm @ 25°C	**626**		--	
Temperature	°C	**4.2**		--	
Metals					
Aluminum	µg/L	**0.88**	B,s	**0.77**	B
Antimony	µg/L	**19.7**		**19.7**	
Arsenic	µg/L	**0.323**	e	**0.240**	e
Barium	µg/L	**8.57**		**8.51**	
Beryllium	µg/L	<0.012		<0.012	
Boron	µg/L	**111**		**112**	
Cadmium	µg/L	**0.081**		**0.082**	
Chromium	µg/L	**0.048**	s	**0.024**	
Cobalt	µg/L	**11.2**		**11.2**	
Copper	µg/L	**2.49**		**2.37**	
Gold	µg/L	**1.64**		**1.26**	
Iron	µg/L	**99.8**		**4.23**	
Lead	µg/L	**0.028**	B	<0.015	
Lithium	µg/L	**3.15**		**3.10**	
Manganese	µg/L	**1260**		**1320**	
Mercury	ng/L	<0.15		<0.15	
Molybdenum	µg/L	**33.3**		**33.8**	
Nickel	µg/L	**125**		**130**	
Selenium	µg/L	**0.819**	e	**0.831**	e
Silver	µg/L	<0.005		<0.005	
Strontium	µg/L	**272**		**272**	
Thallium	µg/L	**0.008**	B	**0.008**	B
Uranium	µg/L	**2.16**		**2.14**	
Vanadium	µg/L	**0.018**	B	**0.012**	B
Zinc	µg/L	**2.41**		**9.02**	R
Major Anions					
Alkalinity, Bicarbonate	mg/L	**130**		--	
Alkalinity, Carbonate	mg/L	<2.0		--	
Chloride	mg/L	**18**		--	
Fluoride	mg/L	**0.21**		--	
Hydrogen Sulfide	mg/L	<0.012		--	
Nitrogen, Ammonia	mg/L	**0.77**		--	
Nitrogen, Nitrate	mg/L	**2.7**		--	
Nitrogen, Nitrite	mg/L	**0.070**		--	
Phosphorus, Total	mg/L	<0.0100		--	
Sulfate	mg/L	**160**		--	
Major Cations					
Calcium	mg/L	**57**		**52**	
Magnesium	mg/L	**30**		**28**	
Potassium	mg/L	**15**		**14**	
Sodium	mg/L	**23**		**21**	
General					
Hardness	mg/L	**266**		**245**	
TOC	mg/L	**2.6**		--	
DOC	mg/L	**3.1**		--	
TSS	mg/L	<3.3		--	
TDS	mg/L	**382**		--	

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 35 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*35 m*	*35 m*
Field			
D.O.	ppm	<0.1	**--**
pH	SU	**7.2**	**--**
Specific Conductance	µhos/cm @ 25°C	**647**	**--**
Temperature	°C	**4.3**	**--**
Metals			
Aluminum	µg/L	**1.20** s	**0.39** B
Antimony	µg/L	**23.8**	**23.5**
Arsenic	µg/L	**0.308** e	**0.233** e
Barium	µg/L	**9.15**	**9.10**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**120**	**122**
Cadmium	µg/L	**0.095**	**0.101**
Chromium	µg/L	**0.045** s	**0.073**
Cobalt	µg/L	**13.3**	**13.4**
Copper	µg/L	**2.65**	**2.49**
Gold	µg/L	**1.82**	**1.61**
Iron	µg/L	**85.8**	**4.77**
Lead	µg/L	**0.019** B	<0.015
Lithium	µg/L	**3.19**	**3.18**
Manganese	µg/L	**1720**	**1680**
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	**40.0**	**40.4**
Nickel	µg/L	**161**	**161**
Selenium	µg/L	**0.979** e	**0.988** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**281**	**280**
Thallium	µg/L	**0.010** B	**0.010** B
Uranium	µg/L	**2.25**	**2.25**
Vanadium	µg/L	**0.015** B	<0.010
Zinc	µg/L	**2.53**	**9.26** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**130**	**--**
Alkalinity, Carbonate	mg/L	<2.0	**--**
Chloride	mg/L	**19**	**--**
Fluoride	mg/L	**0.30**	**--**
Hydrogen Sulfide	mg/L	<0.011	**--**
Nitrogen, Ammonia	mg/L	**1.4**	**--**
Nitrogen, Nitrate	mg/L	**2.2**	**--**
Nitrogen, Nitrite	mg/L	**0.088**	**--**
Phosphorus, Total	mg/L	<0.0100	**--**
Sulfate	mg/L	**170**	**--**
Major Cations			
Calcium	mg/L	**57**	**50**
Magnesium	mg/L	**30**	**27**
Potassium	mg/L	**16**	**14**
Sodium	mg/L	**25**	**22**
General			
Hardness	mg/L	**266**	**236**
TOC	mg/L	**2.7**	**--**
DOC	mg/L	**3.0**	**--**
TSS	mg/L	<3.3	**--**
TDS	mg/L	**402**	**--**

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 40 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*40 m*	*40 m*
Field			
D.O.	ppm	<0.1	--
pH	SU	**7.2**	--
Specific Conductance	µhos/cm @ 25°C	**675**	--
Temperature	°C	**4.3**	--
Metals			
Aluminum	µg/L	**1.65**	**0.49** B
Antimony	µg/L	**28.2**	**27.8**
Arsenic	µg/L	**0.317** e	**0.254** e
Barium	µg/L	**10.1**	**10.0**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**131**	**132**
Cadmium	µg/L	**0.116**	**0.119**
Chromium	µg/L	**0.056** s	**0.025**
Cobalt	µg/L	**15.6**	**15.5**
Copper	µg/L	**2.77**	**2.62**
Gold	µg/L	**2.38**	**1.73**
Iron	µg/L	**71.4**	**3.96**
Lead	µg/L	**0.030** B	<0.015
Lithium	µg/L	**3.25**	**3.27**
Manganese	µg/L	**1970**	**1920**
Mercury	ng/L	<0.15	**0.85**
Molybdenum	µg/L	**48.6**	**48.3**
Nickel	µg/L	**196**	**196**
Selenium	µg/L	**1.16** e	**1.17** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**296**	**294**
Thallium	µg/L	**0.013**	**0.012**
Uranium	µg/L	**2.38**	**2.40**
Vanadium	µg/L	**0.019** B	<0.010
Zinc	µg/L	**2.42**	**8.46** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**140**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**21**	--
Fluoride	mg/L	**0.23**	--
Hydrogen Sulfide	mg/L	<0.011	--
Nitrogen, Ammonia	mg/L	**2.2**	--
Nitrogen, Nitrate	mg/L	**2.0**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--
Sulfate	mg/L	**170**	--
Major Cations			
Calcium	mg/L	**55**	**53**
Magnesium	mg/L	**30**	**28**
Potassium	mg/L	**17**	**17**
Sodium	mg/L	**27**	**26**
General			
Hardness	mg/L	**261**	**247**
TOC	mg/L	**2.7**	--
DOC	mg/L	**3.4**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**426**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Results HPL002 at 50 m
Humboldt Mill HTDF Monitoring

PARAMETER	UNIT	Oct 2010 10/14/10 Total	Oct 2010 10/14/10 Dissolved
	Actual Depth:	*50 m*	*50 m*
Field			
D.O.	ppm	<0.1	--
pH	SU	**7.4**	--
Specific Conductance	µhos/cm @ 25°C	**715**	--
Temperature	°C	**4.6**	--
Metals			
Aluminum	µg/L	**3.82**	**0.53** B
Antimony	µg/L	**31.9**	**31.9**
Arsenic	µg/L	**0.392** e	**0.315** e
Barium	µg/L	**13.2**	**13.2**
Beryllium	µg/L	<0.012	<0.012
Boron	µg/L	**145**	**143**
Cadmium	µg/L	**0.147**	**0.144**
Chromium	µg/L	**0.074** s	**0.048**
Cobalt	µg/L	**19.4**	**19.2**
Copper	µg/L	**2.87**	**2.44**
Gold	µg/L	**2.33**	**2.01**
Iron	µg/L	**72.5**	**4.61**
Lead	µg/L	**0.058**	<0.015
Lithium	µg/L	**3.37**	**3.35**
Manganese	µg/L	**3200**	**3250**
Mercury	ng/L	<0.15	<0.15
Molybdenum	µg/L	**60.3**	**60.2**
Nickel	µg/L	**240**	**240**
Selenium	µg/L	**1.42** e	**1.40** e
Silver	µg/L	<0.005	<0.005
Strontium	µg/L	**315**	**317**
Thallium	µg/L	**0.014**	**0.015**
Uranium	µg/L	**2.62**	**2.61**
Vanadium	µg/L	**0.017** B	**0.018** B
Zinc	µg/L	**2.47**	**9.31** R
Major Anions			
Alkalinity, Bicarbonate	mg/L	**160**	--
Alkalinity, Carbonate	mg/L	<2.0	--
Chloride	mg/L	**24**	--
Fluoride	mg/L	**0.26**	--
Hydrogen Sulfide	mg/L	<0.0080	--
Nitrogen, Ammonia	mg/L	**3.6**	--
Nitrogen, Nitrate	mg/L	**1.1**	--
Nitrogen, Nitrite	mg/L	<0.050	--
Phosphorus, Total	mg/L	<0.0100	--
Sulfate	mg/L	**170**	--
Major Cations			
Calcium	mg/L	**58**	**50**
Magnesium	mg/L	**33**	**27**
Potassium	mg/L	**21**	**18**
Sodium	mg/L	**32**	**27**
General			
Hardness	mg/L	**280**	**236**
TOC	mg/L	**2.9**	--
DOC	mg/L	**3.2**	--
TSS	mg/L	<3.3	--
TDS	mg/L	**440**	--

Footnote explanations and notes are included at the end of this table.

Table 1 (4th Quarter)
Analytical Profile Footnote Explanations
Humboldt Mill HTDF Monitoring

Footnote	Explanation
a	Potential false positive value. Compound present in blank sample.
B	Detected by the instrument. Result is > MRL but </= MDL. Result is reported and considered an estimate.
e	Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.
R	Rejected value.
s	Potential false positive value. Compound present in blank sample.
Note:	For sampling events from Feb-Jul a 0.45 micron filter was used. For sampling events from Aug-Oct a 0.2 micron filter was used.

HTDF Sediment Trap Study
April - October 2010

Parameter (mg/Kg)	15 m Result	35 m Result	50 m Result	Buoy Result
Iron, Total	208000	246000	203000	10400
Manganese, Total	33400	22800	16000	5590
Calcium, Total	9610	11600	10500	9810
Aluminum, Total	6920	7500	7490	266
Magnesium, Total	6080	6510	7340	566
Potassium, Total	1870	1950	1930	178
Nickel, Total	768	1180	1220	122
Copper, Total	408	442	410	22
Barium, Total	239	223	209	32.5
Sodium, Total	194	216	308	15
Arsenic, Total	187	204	191	10.6
Antimony, Total	98.5	170	188	9.2
Lead, Total	38.5	41.2	47.6	1.94
Boron, Total	6.23	16.8	12.1	8.95
Lithium, Total	4.08	4.85	4.71	0.19
Selenium, Total	2.56	3.81	3.76	0.3
Cadmium, Total	0.435	0.423	0.428	0.028

The accumulation rate in the surface to 15 meters trap -- 0.0229 g/M of water column
The rate for the 15 to 35 meter trap -- 0.0086 g/M of water column
The rate for the 35 to 50 meter trap -- 0.0182 g/M of water column

HPLD001_15 = 0.3432 g
HPLD001_35 = 0.5147 g
HPLD001_50 = 0.7869 g

The % organic carbon results for the solids (centrifuged from the sediment trap samples) are all <5%:

15 M = 3.6 %
35 M = 3.2 %
50 M = 3.6 %

This translates to 3.3, 4.4 and 7.6 g of organic carbon/year per square meter for the 15 M, 35 M and 50 M depth traps respectively

Productivity Study Results – Humboldt Pit - 2010

Date	Chlorophyll *a*	Net Productivity	Gross Productivity	Secchi Depth
4/28/10	---	ND	ND	---
5/20/10	0.7	1.56	3.51	3.2
6/23/10	0.4	1.95	2.57	3.3
7/21/10	ND	2.18	2.74	3.5
8/18/10	0.4	3.27	4.05	4.5
9/22/10	ND	ND	ND	6.8
10/11/10	0.4	0.16	0.31	5.7

Chlorophyll *a* is reported in mg/m3

Net Productivity and Gross Productivity are reported in mg C/m3/hr. These values represent the average of all detectable productivity samples.

Secchi Depth is reported in meters

ND = Not detected

APPENDIX E

SURFACE WATER QUALITY DATA

	Date	2/3/16	6/29/16	8/10/16	10/6/16	7/12/16	2/22/17	6/28/17	9/6/17	10/15/17	7/20/17	Wildlife Value
	Type of Sample	WTP Influent	WTP Influent	WTP Influent	WTP Influent	Surface Water	WTP Influent	WTP Influent	WTP Influent	WTP Influent	Surface Water	
Physical Parameters	**Units**											
Temp	F	34.8	66.4	74	59.8	69.44	36.4	64.9	61.5	54.9	71.69	
Conductivity	us/cm	663	621.6	624	603	763.6	677	640	642	664	622.3	
Dissolved Oxygen	mg/L	nm	8.61	8.03	8.79	8.58	9.68	8.42	8.67	8.87	8.6	
pH	-	7.68	7.92	7.93	7.82	7.72	7.33	7.9	7.88	7.55	7.97	
Turbidity	FNU	7.91	8.91	2.93	2.9	1.65	15.4	8.5	4.43	3.64	2.13	
Chemical Parameters	**Units**											
Total Dissolved Solids	mg/L	420	490	480	310	460	450	410	420	410	402	
Total Suspended Solids	mg/L	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	
Mercury	ng/L	<0.5	<0.5	<0.5	<0.5	0.564	<0.5	0.672	<0.5	<0.5	<0.500	1.3
Aluminum	ug/L					<50					<50.0	
Calcium	mg/L					48					46,600	
Iron	ug/L		490	220	310	260	1,100	624	405	280	315	
Lithium	ug/L					<8.0					<8.0	
Magnesium	mg/L					22					20,900	
Potassium	mg/L					7.7					7140	
Sodium	mg/L		31	29	31	28	41	40	37.9	42.8	36,800	
Antimony	ug/L					3.2					2.2	
Arsenic	ug/L					<1.0					<1.0	
Barium	ug/L					10					11.0	
Boron	ug/L					83					92.9	
Cadmium	ug/L					<0.20					<0.20	
Chromium	ug/L					<1.0					<1.0	
Cobalt	ug/L					4.1					2.6	
Copper	ug/L	1.1	1.8	1.2	1.8	1.4	2.8	4	2.3	2.5	3.8	
Lead	ug/L					<1.0					<1.0	
Manganese	ug/L	730	630	400	370	610	970	583	349	461	503	
Molybdenum	ug/L					<25					<25.0	
Nickel	ug/L	65	65	43	57	59	83	68.9	82.2	93.7	65.5	
Selenium	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	
Strontium	ug/L					210					177	
Zinc	ug/L					<10					<10.0	
Available Cyanide	mg/L					<0.002					<2.0	
Cyanide, Free	ug/L					nm					<2.0	
Alkalinity, Bicarbonate (CaCO3)	mg/L					85					72.7	

Alkalinity, Carbonate (CaCO3)	mg/L					<2.0					<20.0	
Cyanide	mg/L					nm					<0.0050	
Amenable Cyanide	mg/L					nm					<0.0050	
Chloride	mg/L		26	28	28	27	30	32	34.3	33.4	33.4	
Fluoride	mg/L					0.14					146	
Nitrogen, Ammonia	mg/L					0.2					0.17	
Nitrogen, NO2 plus NO3	mg/L					nm					0.60	
Nitrogen, Nitrate	mg/L					0.94					0.59	
Nitrogen, Nitrite	mg/L					<0.05					0.010	
Phosphorus	mg/L					<0.01					<0.010	
Sulfate	mg/L	180	170	170	160	170			179	209	183	
BOD, 5 day	mg/L					nm					<0.80	