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Kennecott
Eagle Minerals

August 21, 2008

Rebecca L. Harvey
United States Environmental Protection Agency
Underground Injection Control Branch
Region 5
Attention Mail Code WU-16J
77 West Jackson Boulevard
Chicago, Illinois, 60604-3590.

Dear Ms. Harvey:

RE: Kennecott Eagle Minerals Company
Response to Request for Additional Information for the Underground Injection Control Permit Application for the Treated Water Infiltration System, United States Environmental Protection Agency UIC Permit Application No. MI-103-5W20-0002

A request for additional information was received on 7/18/08 from the United States Environmental Protection Agency (EPA) to clarify, modify or supplement the information provided in the original UIC permit application. Kennecott Eagle Minerals Company has provided the attached additional information in response to the comments provided by the EPA. The attached information is included to provide the EPA with sufficient information for a permitting decision.

If you have any questions or comments, or if additional information is required during your review, please contact me at (906) 486-1257 ext 201.

Sincerely,

Jonathan C. Cherry, P.E.
General Manager

cc: Vicky Peacey, Kennecott Eagle Minerals Company
Steve Donohue, Foth Infrastructure & Environment
Kris Baran, Foth Infrastructure & Environment

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Request for Additional Information

Permit Application for the Kennecott Eagle Minerals Company Treated Water Infiltration System, United State Environmental Protection Agency Underground Injection Control Permit Application #MI-103-5W20-0002.

Comment No. 1: The certification statement that appears on the EPA Underground Injection Control Permit Application (Form 7520-6) is different from the one found in Title 40 of the Code of Federal Regulations (40 CFR) Section 144.32(d). We realize that you used the official EPA form; nonetheless, please submit a certification statement that matches the requirements of 40 CFR 144.32(d).

Certification Statement from 40 CFR 144.32(d):

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Response to No. 1: *A certification statement that matches requirements of 40 CFR 144.32(d) is included as Attachment 1.*

Comment No. 2: App. A, Section 2.2.4, Hydraulic Characteristics of Quaternary Formations (p. 15): "At this location, the average D zone transmissivity is about 6,100 gpd/ft and is generally consistent throughout most of the pumping area." What is the basis for this assertion?

Response to Comment No. 2: *Section 2 of Appendix A in the UIC application provides background data collected as part of the environmental baseline study (EBS). The hydraulic testing results referred to in this section were completed as part of the EBS, prior to the supplemental hydrogeological study performed for the proposed groundwater discharge area. The discussion of the D zone transmissivity refers to the results obtained for a multi-well pumping test performed as part of the EBS. This test was located south of the area proposed for discharge. The test was completed in a glacial outwash formation of very similar depositional environment, lithology, and grain size characteristics as those present beneath the proposed discharge area. Further discharge area-specific testing was then performed within the saturated portion of this formation beneath the proposed discharge area, as reported in Section 4.3.3 of Appendix A in the UIC application.*

Comment No. 3: App. A, Section 3.1: Double ring infiltrometer tests are only useful for measuring soil properties for the first few meters below ground surface. Given the thickness of the injection zone at this site (at least 70 feet or 21 meters) and the heterogeneity and anisotropy of soil properties at this site, larger scale tests would be more appropriate for providing a realistic infiltration rate under operating conditions for the TWIS. Permeability should be measured via monitoring wells screened in the unsaturated zone. (Cadmus, p. 5) Please provide data justifying use of the value measured by the double ring infiltrometer to the entire injection zone.

Response to Comment No. 3: *The design hydraulic loading or TWIS application rate was set by Michigan R 323.2233(4)(a)(v):*

> *The design hydraulic loading or application rate, whether daily, monthly, or annual, shall not be more than 7% of the permeability of the most restrictive soil layer within the solum over the area of the discharge as determined by the saturated hydraulic conductivity method or 12% of the permeability as determined by the basin infiltration method. The design annual hydraulic loading rate shall not be more than 3% of the permeability of the solum when determined by either the cylinder infiltration method or air entry permeameter test method. The methods referenced in this paragraph for determining soil permeability are adopted by reference in these rules and are contained in the publication entitled "Methods of Soil Analysis, Part 1, Physical and Mineralogical Properties," Second Edition, American Society of Agronomy, 1986. The publication may be purchased from the American Society of Agronomy, 677 South Segoe Road, Madison, Wisconsin 53711-1086, or the Michigan Department of Environmental Quality, Waste Management Division, P.O. Box 30241, Lansing, Michigan 48909, at a cost at the time of adoption of these rules of $65, plus shipping and handling. A discharger, if utilizing published information, shall determine the methodology used to measure the reported hydraulic conductivity. If published information is utilized and if it is given as a range of expected values, then a discharger shall use the minimum value given the most restrictive soil layer within the solum when calculating the hydraulic loading or application rate.*

The solum is defined as soil from the ground surface to a maximum depth of 60 inches.

The infiltrometer tests were performed in accordance with the Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer (ASTM D 3385-03), under constant head conditions. Due to the relatively high infiltration rates, open-topped 55-gallon drums fitted with outflow gate valves and tubing were used to introduce water to the infiltrometers in place of standard volume Mariotte tubes specified in the ASTM Standard. The ASTM standard is very similar to the ASA method referenced in R 323.2233(4) and the MDEQ has accepted the test results submitted as part of the Groundwater Discharge Permit Application. The measured infiltration rates ranged from 24-38 in./h (48-76 ft/d), and 3% of the infiltration ranged from 1.4 to 2.3 ft/d. For reference, 3% of the average measured infiltration rate (62 ft/d) would be 1.8 ft/d.

Measured hydraulic conductivities for the A-zone ranged from 44-61 ft/d (horizontal) and 7% of 44 ft/d is 3.1 ft/d. The application rate was conservatively set to 0.5 ft/d. With conservative selection of TWIS loadings and aquifer hydraulic parameters, the results of various analytical and numerical mounding models (including verification of the analytical modeling by Cadmus) showed that mounding is not expected to be a problem.

It is important to note that, while there is some apparent anisotropy, and a minor finer-grained layer (silty sand or clay) at depths of 60 feet or more, it is clear that infiltration behavior at the TWIS site will be dominated by the reasonably homogeneous sand for much of the depth below ground surface. This was one of the reasons the TWIS was sited in this location.

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There are several reasons why a larger-scale infiltration test at the TWIS site is not needed:

- *Design infiltration rates (0.5 ft/d) were already reduced by more than a factor of 100 from the average of measured infiltration rates (62 ft/d) which were measured at 8 separate locations (North Jackson Co., "Supplemental Hydrogeological Study for Groundwater Discharge," Prepared for Kennecott Minerals Company, January 2006).*

- *In terms of assessing site variability, providing infiltration tests at eight locations is generally preferable to providing larger diameter tests at fewer locations.*

- *The measured rates ranged from 48 to 76 ft/d, and the measured variation over 8 locations does not indicate a significant degree of heterogeneity.*

- *The designed infiltration at scale will not be dictated significantly by the lower measured infiltration rates, since water will flow in the path of least resistance. This will generally lead to a higher-than-average rate of infiltration at scale.*

- *The sealed double-ring infiltrometer (SDRI) had an inner and outer diameter of 12 inches and 24 inches, respectively, and flows were approximately 1 gpm. Much larger SDRI diameters would lead to much higher flow rates and, in our judgment, would lead to some experimental difficulty in supplying enough water for the tests, since the tests generally last for several hours.*

The significance of flow resistance under unsaturated conditions is likely minimal. Given that the design infiltration rate (0.5 ft/d) is considerably less than the measured infiltration rate of 62 ft/d, it is unlikely that a fully saturated condition would be satisfied near the surface. However, the flow-versus-time data record from the infiltration tests shows that a steady flow rate is achieved relatively quickly. If there was a large resistance from unsaturated conditions, there would be a noticeable lag period as the infiltration rate increased to a near-saturated condition.

Comment No. 4: App. A, Section 4.2.2, Quaternary Deposit, fifth paragraph, referencing Figure 19, states that the observed thickness of the vadose zone increases towards the south east. Figure 19 clearly shows thickness increasing to the north east. Similarly, referencing Figure 20, the text states that "These confining units are not significantly present in approximately the southeastern two-thirds of the proposed discharge area." Review of Figure 20 shows thinning of the confining unit to the northeast of the Treated Water Infiltration System (TWIS). Please explain.

Response to Comment No. 4: *The confusion implied by this comment appears to be caused by the reference to the orientation of the proposed discharge area, which is oriented with its long axis generally from northwest to southeast. This orientation was selected in order to situate this axis perpendicular to the water table horizontal gradient (which is towards the northeast). As shown in Figure 19 (Unsaturated Isopach), with respect to the proposed orientation of the discharge area (or TWIS), the unsaturated zone isopach does thicken from northwest (about 70 feet thick minimum) to southeast (about 105 to 110 feet maximum). Also, as shown on Figure 20 (confining unit isopach), the confining unit between the A zone water table hydrostratigraphic unit and the D zone hydrostratigraphic unit also thins from a maximum thickness of 27 feet at location QAL008 (in the northwest portion of the TWIS area) to 0 feet in the southeast portion of*

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the TWIS (locations QAL041 and QAL042). On a regional basis (ignoring the proposed TWIS orientation) the confining unit does pinch out and thin towards the northeast.

Comment No. 5: App. A, Figure 9, 10, and 26-29 show groundwater flow direction in the pre-operational state. To what extent will the presence of the groundwater mound modeled in App. E change these flow patterns?

Response to Comment No. 5: *The modeling of mounding and implications to groundwater flow patterns was addressed in several ways. First, an analytical model was applied (Appendix E of UIC Application). Here, a conservative approximation to changes in heads is found by superposition. A numerical mounding model (using MODFLOW) was then applied, and later updated (also in Appendix E of UIC Application). This model provided an estimate for mounding conditions and provided particle tracking results showing flow from the TWIS to the northeast. Additional sensitivity analysis was also completed on the numerical model and to mine inflow predictions and effects on hydraulic conductivity.*

It is important to note that the main objective for the mounding models was to understand potential impacts from a sustained infiltration rate. In fact, the loading imposed by the model was 50 gpm higher than the permitted maximum discharge (and treatment capacity) of 350 gpm. The idea was that, if mounding impacts were deemed acceptable under this loading, the influence on the groundwater from lower application rates would also be acceptable.

The MODFLOW model shows that the regional groundwater flow is expected toward the northeast, although flow nearest the mound would divert in all directions away from the mound. Superposition was used with the analytical mounding solution, to yield the same general conclusion – that mounding would not be so significant to change the regional groundwater flow toward the seeps to the northeast.

Comment No. 6: App. A, Section 4.4.2 Groundwater Quality: We are concerned about possible reaction between introduced water and the native groundwater in this area. Table 5 presents data about pH but not Eh or dissolved oxygen: have these properties been measured? How will these parameters in the effluent compare to the background values of the water in the aquifer? What will be the impact of adding this volume of water with these characteristics to the aquifer? Please provide information about the mineralogic composition of the injection zone. Do these sediments contain significant concentrations of metals available for mobilization? (Cadmus pp.8-9)

Response to Comment No. 6: *KEMC has assembled all major- and trace-element analyses of soil samples from the proposed TWIS injection zone. The soils are Quaternary glacial outwash that is primarily poorly-graded sand, with minor components ranging from silt to cobbles. The soils are slightly acidic, ranging form soil pH of 4.2 to 6.6, with a mean of 5.1. Table 1 included as Attachment 2, assembles the data and presents the descriptive statistics for the chemically-analyzed soils. This table also compiles data on average concentrations of elements in rocks of the upper continental crust from Rudnick, R.H., and S. Gao, 2003, Composition of the Continental Crust, in R.L. Rudnick (ED). The Crust, Volume 3 of H.D. Holland and K.K. Turekian (Eds.), Treatise on Geochemistry. New York: Elsevier, p. 1-64 (Rudnick and Gao, 2003).*

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Attachment 3 includes Table 5 from Appendix A of the Class V Permit Application, which presents the shallow (i.e. QAL004A) and deep (i.e. QAL004D) water chemistry form four groundwater monitoring wells in the vicinity of the proposed injection zone.

Attachment 4 is a report of sediment mineralogy prepared for KEMC by Dr. Rodney C. Johnson in 2008 called Mineralogy of Till Samples from Hole QAL-041. Petrographic Report KEMC 08-003.

Because meteoric precipitation (rain and snowmelt) is always very dilute as stated in Berner, E.K. and R.A. Berner, 1996. Global Environment: Water, Air and Geochemical Cycles, Upper Saddle River, NJ: Prentice Hall[1]*, solutes in groundwater must derive predominantly from water-rock interactions that occur after infiltration. To understand the potential, if any, for generation of adverse water-quality due to water-rock interaction, it is appropriate to consider the chemistry and mineralogy of the injection zone.*

The most recent authoritative compilation of crustal abundances of elements is that of Rudnick and Gao (2003). In their Tables 1 and 2 (p. 5-6), they compile and critically evaluate data for the upper continental crust, the most appropriate general comparison for purposes of a site like Eagle. Because the glacial sediments derive from the Canadian Shield geologic province and represent a large-scale homogenization of heterogeneous sources from which the parent materials were plucked before transport and re-deposition, it is reasonable that the glacial-outwash sediments closely resemble average upper-crustal rocks.

*Values compiled in Attachment 2, Table 1, show that the Eagle Project's intrusive rocks are, on average, comparable to, though generally lower in essentially all elements than are average upper continental crustal rocks. Because the mean and median values for the sediment samples are very close to the same, we can consider that it is likely that the populations form which the samples were drawn is approximately normally distributed, which also is reasonable given the general homogeneity of the sediments. If the normal-distribution assumption is a good approximation, then one can consider the 95th-percentile confidence interval as defined by Student's-t distribution. There are 17 samples, so there are 16 degrees of freedom, and the critical-t value for 16 degrees of freedom is 2.120, as stated in Wonnacott, T.H. and R.J.H. Wonnacott, 1977. Introductory Statistics for Business and Economics, 2nd Ed., New York, John Wiley & Sons. For all measured parameters, even Se in this data set, the average continental-crust value falls within the 95th percentile range around the mean value (i.e., mean +/- 2.120*StDev) of the data set. Thus, we can conclude that there are no elemental anomalies in the sediments to serve as significant sources of potential adverse impact to groundwater.*

The ambient groundwater chemistry of the shallow system into which treated water would discharge is dilute, with most parameters less than detection (Attachment 3, Table 5). This is consistent with the elemental chemistry of the solids. Although the soil pH is less than 7 and it also is likely that rainwater has a pH of 5.5 or less (the Minnesota sample cited in footnote 1 had a pH of 4.67), the injection-zone sediments clearly contain some available alkalinity, because the shallow groundwater pH values range from 5.4 to 9.1, with a single value (summer base-flow in

[1] A typical inland-US precipitation relevant to the site is available from Hovland, in eastern Minnesota. It has a pH: 4.67; Na: 0.14 mg/L; K: 0.13 mg/L; Mg: 0.13 mg/L; Ca: 0.40 mg/L; Cl 0.19 mg/L; SO4: 1.89 mg/L; NH4 0.67 mg/L. Trace metals and metalloids are all far below detection limits. Data from Berner and Berner, 1996, Table 3.1, p. 73)

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QAL006A) less than pH 5. Well QAL004A evidently has a carbonate mineral in the matrix, because it produces titratable carbonate alkalinity ranging form 40 to 50 mg/L as HCO3- and discernable concentrations of Ca and Mg in solution. In the other two shallow groundwater wells, titratable alkalinity is low to undetectable, but the pH (except for the single base-flow value) is as high or higher than the probable pH of the precipitation. Because rain water and snow melt are very poorly buffered solutions, this small difference in pH indicates that the rock samples are essentially inert in acid-base terms. The dissolved-oxygen concentrations of the shallow zone indicates that the ambient groundwater is well oxygenated and therefore oxidizing; this is confirmed by comparing the ferrous-ion to the total iron concentrations in the shallow completions

The mineralogy of the shallow glacial outwash sediments is very simple and entirely consistent with provenance from the grantic terrain of the Canadian Shield: quartz, potassium feldspar and plagioclase, with minor mica and amphibole and trace levels of simple, mechanically-resistant oxides (magnetie-hematite-ilmenite-zircon) and apatite. The mineral grains are subrounded to subangular, in keeping with the geologic history of the deposits. Scanning electron microscopy of the sediments show no significant evidence of secondary ferric hydroxides or oxyhydroxides that could serve as a reservoir for adsorbed metals (such as) that might be mobilized if a new water enters the slow system; this is confirmed by the energy-dispersive spectrometry. The simple mineralogy and lack of secondary sinks for trace metals are consistent with the low concentrations of trace metals seen in the water chemistry of Attachment 3, Table 5.

Finally, the available information on the water-treatment system indicates that the discharge water also will be well oxygenated and circumneutral. Therefore the thermodynamic tendency would be for the new water to move the heterogeneous system closer to stability with respect to ferric oxides. The chemical potential gradients would maintain any sorbed and co-precipitated metals or metalloids in the solid phase, and in fact provide a potential for further control of dissolved metals in solution.

Because (a) the injection-zone sediments have a simple and chemically-0stabel mineralogy and (b) concentrations of elements in the glacial sands of the injection-zone are overwhelmingly lower in concentration than are average crustal rocks, there is no basis to suppose that the sediments could produce solutions that have elevated concentrations with respect to commonly observed ranges in any water:rock reaction. This is confirmed by ambient conditions across a range of naturally-occurring pH from 4.4 to 9.1. The injected solution will be compatible with the pH and Eh of the ambient groundwater, and is very unlikely to cause increased geochemical reactions of any sort.

The concern regarding possible reactions between the TWIS discharge water and the native groundwater is an appropriate consideration, which may be best judged by the characteristics of the treated discharge and the native groundwater. The discharge is planned in an area with a relatively thick and conductive glacial outwash of fine sands, exposed by thousands of years of rainfall and snowmelt. The water quality in the Quaternary aquifer is excellent, with low hardness, low alkalinity, low organic content, low salinity, and low concentrations of trace metals. Water quality results are shown in Table 5 (Appendix A of the UIC Application). Most trace metals in the A-zone wells have been consistently below detection limits. In some A-zone wells, low levels of barium (< 30 ug/L), low level mercury (<0.4 ng/L), and dissolved iron (< 400 ug/L) have been detected. The water has a low alkalinity and hardness, like the discharge.

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Although deeper, some D-level wells show trace levels of arsenic (< 10 ug/L), these wells are located significantly upgradient of the mine site and TWIS.

Since the water is very high quality and the geologic history has included thousands of years of rainfall and snowmelt through the sands, the sands are not expected to contain high levels of trace metals that would be mobilized by the operation of the TWIS.

It should be noted that monitoring plan for the TWIS will include monitoring of the nearby groundwater for trace metals. Trends in the concentrations of trace metals will be tracked carefully.

Comment No. 7: App. C, Table 1-1, Wastewater composition. Drinking water standards include maximum contaminant levels (MCLs) for some contaminants not listed in this table. Will there be any organics or cyanide in the wastewater from any of the various sources? Will there be any alpha particle, beta particle or photon emitters (e.g., radium, thorium, uranium) from the inflow to the mine? Have any of the fluids that will contribute to the wastewater been analyzed for these contaminants?

Response to Comment No. 7: *KEMC has assembled all trace-element analyses of drill core from the project to date. The dominant intrusive rock is peridotite; there is minor pyroxenite. Country rock is sandstone and siltstone; near the intrusive contact the sedimentary rocks are thermally metamorphosed to hornfels.*

Table 1a summarizes the statistics of thorium (Th) and uranium (U) values (in mg/kg, or ppm) for both the Eagle and East Eagle drill core. Hornfels samples are considered as sediments for this summary.

Table 1a

Thorium and Uranium in Eagle Deposit Rocks

		Th (ppm)	U (ppm)
Eagle Peridotite	MEAN	1.36	0.45
	HIGH VALUE	8.60	4.20
	LOW VALUE	0.80	0.20
	STD. DEV.	0.90	0.44
	COUNT	82.00	82.00
Eagle Pyroxenite	MEAN	1.51	0.44
	HIGH VALUE	2.00	0.60
	LOW VALUE	1.00	0.30
	STD. DEV.	0.36	0.10
	COUNT	7.00	7.00
Eagle Sediments	MEAN	9.79	4.84
	HIGH VALUE	13.40	10.80
	LOW VALUE	3.80	1.40
	STD. DEV.	1.99	2.31
	COUNT	45.00	45.00

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Table 1b produces the same data for peridotites, pyroxenites, and sediments at the East Eagle deposit. Hornfels samples are considered as sediments for this summary.

Table 1b
Th and U – East Eagle

		Th (ppm)	U (ppm)
East Eagle Peridotite	MEAN	1.50	0.56
	HIGH VALUE	9.80	4.60
	LOW VALUE	0.20	0.10
	STD. DEV.	1.49	0.77
	COUNT	42.00	42.00
East Eagle Pyroxenite	MEAN	1.80	0.57
	HIGH VALUE	2.00	0.70
	LOW VALUE	1.40	0.40
	STD. DEV.	0.35	0.15
	COUNT	3.00	3.00
East Eagle Sediments	MEAN	9.07	5.57
	HIGH VALUE	10.80	10.10
	LOW VALUE	4.40	1.70
	STD. DEV.	1.88	2.59
	COUNT	19.00	19.00

Taking all samples as a super-set, the descriptive statistics for all 199 Eagle and East Eagle samples are summarized in Table 2.

Table 2:
Descriptive Statistics, Thorium and Uranium – All Eagle Samples

	Th (ppm)	U (ppm)
min	0.2	0.1
5%	0.8	0.3
10%	1.0	0.3
25%	1.0	0.3
Median	1.4	0.5
Mean	4.0	2.0
75%	8.4	3.3
90%	10.5	5.4
95%	11.2	8.0
Max	13.4	10.8
StDev	4.08	2.57
Count	199	199

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Figures 1 and 2 are histograms of the full suite of Eagle and East Eagle samples.

Figure 1 Thorium (ppm) – All Eagle and East Eagle Samples

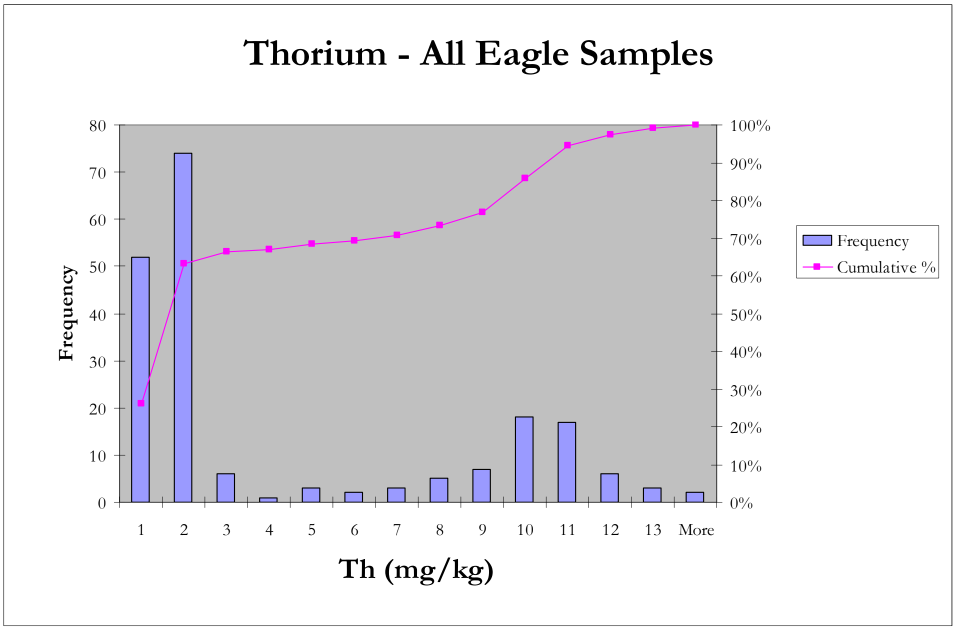
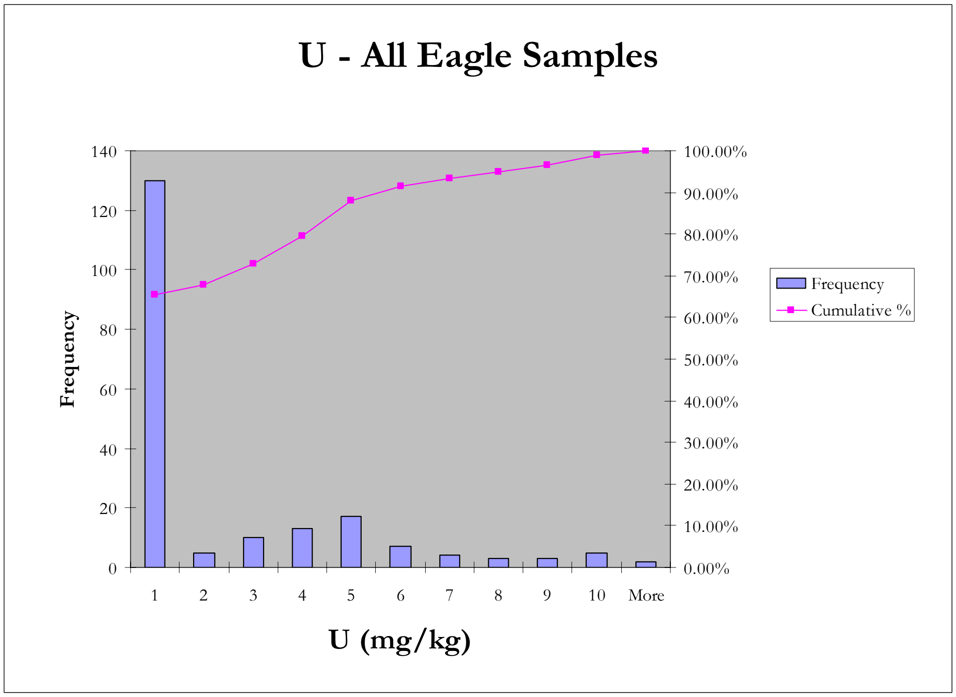


Figure 2 Uranium (ppm) – All Eagle and East Eagle Samples



The most recent authoritative compilation of crustal abundances of elements is included in Rudnick, R.L. and S. Gao, 2003, Composition of the Continental Crust, in R.L. Rudnick (Ed), The Crust, Volume 3 of H.D. Holland and K.K. Turekian (Eds.), Treatise on Geochemistry. New York: Elsevier, p.1-64. In their Table 2 (p. 6), they compile and critically evaluate data for the

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upper continental crust, the most appropriate general comparison for purposes of a site like Eagle. Rudnick and Gao recommend values of 10.5 ppm for Th and 2.7 ppm for U.

Values compiled in Tables 1a, 1b, and 2 show that the Eagle Project's intrusive rocks are, on average, substantially lower in Th and U than are average upper continental crustal rocks. The sedimentary rocks at Eagle are higher in Th and U than are the intrusives. In these, the average Th is still less than average upper crust, and average U is within a factor of 2 of the crustal average. Table 2 shows that, for the entire set of analytical data, 90% of all rocks have Th and U concentrations less than the average continental crust

The histograms (Figures 1 and 2) show clearly that there are two populations of Th and U, with one population centered on very low values (These are the intrusive rocks form which ore will be mined), a second population with higher mean and median values, and small tails at the uppermost end of the higher-valued population.

Although the test work did not analyze radium, it is clear, since the radium isotopes are daughters of uranium and thorium, that the radium concentrations must have distributions that mimic those of their parents because the rocks can be safely presumed to be in secular equilibrium. That is, the radium concentrations of the Eagle rocks must also be dominated by average or lower-than-average concentrations.

Because the concentrations of Th and U in the rocks of the Eagle District are so much lower than the concentrations in average crustal rocks, there is no basis to suppose that natural weathering of such rocks could produce solutions that have elevated concentrations of alpha-emitting natural radionuclides.

Beta particles and photons are not expected in the discharge, since these are anthropogenic and no significant sources from the operation would lead to the discharge. Cyanide will not be utilized to process ore at the Eagle site, therefore no significant sources will be present in the wastewater. Organics such as fuel oil or diesel will not be stored underground during operations of the Eagle mine with the exception of small quantities in operating mine equipment. The small quantities will be managed by utilizing on site best management practices as detailed in spill prevention plans.

Treatability testing of the water treatment system did not include a study of removal for radiological contaminants, but did show very effective removal of heavy metals by the combined processes of precipitation and reverse osmosis treatment. Uranium and Thorium should be bound with metal precipitates and would have high levels of rejection by RO. Radon gas, if present, would also be removed effectively by the CO_2 *stripper.*

Given that sources for alpha emitters (and certainly for beta particles and photons) are limited, and the level of removal by water treatment is expected to be excellent, the potential for exceeding MCLs for radiological parameters at the TWIS is considered remote.

Comment No. 8: App. C, Figure 1 shows a "Treated Water Pump" but this does not seem to be described in the text. App. D, Figure 1 shows a direct pipeline from the WWTP to the TWIS but App. D, Figure 2 says "Treated Wastewater from Discharge Lagoon". Which one is correct? If there will be a pump, how does capacity of pump compare with the design capacity of the TWIS?

Response to Comment No. 8: *The treated water pump will pump treated water from the water treatment plant to the TWIS. The capacity of the pump will be rated at a capacity consistent with the capacity of the TWIS. See the response to comment 20 for additional details regarding management of discharge flow.*

Comment No. 9: App. D, Page 2, Section 2.2: 400 gpm * 60 min/hr * 24 hr/day * 0.13368 ft^3/gal = 77,000 ft^3/day. At 0.5 ft/day application, this requires 154,000 ft^2, not 153,000 ft^2. Sec. 2.3 has the area of the TWIS as 150 * 1020 = 153,000 ft^2. Please explain this discrepancy. Given that one of the five cells comprising the TWIS will be resting at any given time, in theory only 153,000 * 4/5 = 122,400 ft^2 will be available at any given time. If the need arises, can all five cells be used at once? What contingency plans have been made for periods when not all five cells are operable?

Response to Comment No. 9: *The percent difference between 153,000 ft^2 and 154,000 ft^2 is less than 0.7%. The discrepancy is most likely due to precision used for units conversion. Considering that the precision of infiltration rates and discharge flows used in the calculation is implied at 10%, the difference is not significant. In addition, the influence of rotating the cells on mounding will be minimal, because the mounding depends mostly on the quantity of discharge over a specified time (which was conservatively selected) and the ability of the sands to distribute the mound, rather than the concentrated area of the mound. This is because the applied infiltration rate is much less than the infiltration capacity.*

The analytical mounding model (Appendix E, of the application) was used to check the influence of reducing the applied area to 4/5^{ths} of the TWIS area. Instead of an infiltration rate of 0.50 ft/d, the infiltration rate would be 0.625 ft/d for the same 400 gpm discharge. The infiltration rate of 0.625 ft/d is approximately 100 times less than the average measured infiltration rate. Using the analytical model in same parameterization for the analytical mounding solution for Scenario 2 in Table 3 of Appendix E of the application, the maximum mounding expected increases from 29.6 feet to 31.5 feet. Since the application of the infiltration will be applied in 4 cells, but rotated over all five cells, the increase of mounding should be less.

It is important to note that the application uses a conservatively selected discharge rate of 400 gpm as the design outflow, even though the maximum discharge rate from the water treatment facility is limited to 350 gpm. Using 350 gpm, 4/5^{ths} of the TWIS area, and (otherwise) the same parameterization for the analytical solution, the maximum mounding is 29.4 feet. Given these results, no contingency plan is needed for periods when not all five cells are operable.

Comment No. 10: App. E, Golder Associates Report, page 4, section 2.4, first paragraph, last sentence, referencing Figs. 8 and 9, says that groundwater is flowing to the northwest in both Zone A and Zone D. These figures show flow to the northeast. Please explain this discrepancy.

Response to Comment No. 10: *This is an inadvertent typographical error. We understand that the results of the analysis show groundwater flow to be towards the north<u>east</u>. We have noted the error.*

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Comment No. 11: App. E, Golder Associates Report, page 9, Section 4.1, Infiltration Rate: Did modeling take into account the planned operation having only four cells active at any one time? If not, what effect would this have?

Response to Comment No. 11: *This question is similar to that raised in Comment 9. The modeling did not take into account a reduced area implied by rotating operation of the TWIS cells. Given results from the analytical solution, it is very unlikely that this would be a significant effect at scales relevant to the application.*

Comment No. 12: App. E, Golder Associates Report, page 11, section 6.0, Conclusions: third paragraph says that particle tracking shows infiltrated water will migrate to the northwest. Figs. 20 and 22 show flow to the northeast. Please explain the discrepancy.

Response to Comment No. 12: *This is an inadvertent typographical error. We understand that the results of the analysis show groundwater flow to be towards the north<u>east</u>. We have noted the error.*

Comment No. 13: App. E, Figure 16 and Figure 18 appear to be identical. Superimposing these figures on a light table shows the water table line to overlap exactly. There is no sign of a mound, even under the infiltration site. Are both of these figures correct? If the difference is that small, please plot them together at a scale which shows the difference.

Response to Comment No. 13: *The amount of mounding at the TWIS is expected to be near 10-14 feet, which would scale vertically to approximately 1.3-1.5 mm on the figure. It would be hard to discern differences in the figure at this scale. Corrections to the figure, if needed, would be minor. A more descriptive figure for the changes in water table from mounding is Figure 19.*

Comment No. 14: App. E, Golder Associates Report, Fig. 19: This figure, particularly the 2 ft contour, is very different from Fig. 7 and Fig. 14 in the 2/06 Fletcher & Driscoll Report (App. B-7 of Environmental Impact Assessment submitted to the Michigan DEQ). The first is a steady-state 400 gpm simulation, the second a 10 year simulation apparently using 74.3 gpm base case and the third the upper bound case. Please discuss the significance of the differences.

Response to Comment No. 14: *These and other modeling outcomes depend on different assumptions for boundary conditions, parameterization, and methods of calculation. It wouldn't be appropriate to compare solutions without first demonstrating similar solutions for similar inputs. However, the significance of deviations is considered minor. The same general conclusions were found for every mounding analysis conducted for the TWIS, that there is ample storage and flow within the Quaternary aquifer to transmit the discharge, so that mounding is not likely to be a problem.*

Comment No. 15: App. E, Golder Associates Report, Figs. 20 and 22 differ from Figs. 8 and 15 in the Fletcher and Driscoll report. Please discuss the significance of the differences.

Response to Comment No. 15: *See response for comment 14.*

Comment No. 16: Please explain why additional sensitivity analyses were not provided or run more sensitivity analyses to respond to the concerns stated in the Cadmus report (pp. 18-19).

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Response to Comment No. 16: *Each modeling exercise for the TWIS was conducted with a parameter sensitivity analysis. Additional sensitivity analyses were not run, because the main conclusions regarding mounding and flow direction were not expected to change significantly. The review report by Cadmus provides the same conclusion. The Cadmus report states that, "Overall the level of sensitivity analysis is judged as being marginally adequate for the modeling purposes." In addition, Cadmus (3.2.3, p.18) states, "The analytical model parameters selected are generally conservative." Most importantly, the Cadmus report (p. 26) states in conclusion that:*

The model does provide reasonable evidence that the glacial deposits do provide adequate hydrogeologic capacity to assimilate the additional infiltration without inundating the site. In other words, the calculations show that a mound will be created raising the water table, and will probably maintain a significant unsaturated zone beneath the site.

Comment No. 17: MODFLOW modeling: Please provide demonstrations of convergence of the solution, closure and mass balance and any other calculational checks that were performed. Was the water table option used? (Cadmus, pp. 22-25)

Response to Comment No. 17: *MODFLOW 2000 was run within GMS (Aquaveo), using the Layer Property Flow (LPF) package and the preconditioned conjugate gradient (PCG2) solver. The maximum number of interations was 50 for outer nodes and 75 for inner nodes. The convergence criteria for head was 0.05 feet and the residual criteria for flow was 0.1 cubic feet per day. Mass balance errors were -0.78 cubic feet per day (<0.01%) for the quasi-calibration run and -0.25 cubic feet per day (<0.01%) for the recharge (TWIS run) case. The model converged for each reported run case.*

Within the LPF package in GMS, the convertible (type 3) condition was applied, so that layers can switch between unconfined and confined conditions depending on the position of the piezometric surface and top layer surface. Except for the far southwest, constant-head boundary, the upper layer was always unconfined during the simulation and the outcomes for mounding heads represent the expected response to the water table.

Comment No. 18: Please provide information about the calibration of the numerical model. (Cadmus, p. 25)

Response to Comment No. 18: *No formal calibration exercise was performed, as the conceptualization for the MODFLOW model was rather simple and the objective was to model principal components of the system to obtain a rational estimate of the infiltration response. Several features not modeled include natural infiltration, conductance features at the seeps and streams, return flow back to mine inflow, bedrock outcrops, and more complex boundary conditions. For these reasons, it may not be appropriate to simply allow a numerical calibration routine to optimize hydraulic conductivities, for example, to obtain a better fit to observed heads. The main hydraulic parameters (Table 1 of Appendix E) were selected from results of baseline studies and uniform boundary heads were assigned to generally match the observed heads. This was deemed adequate in terms of capturing the mounding response near the TWIS, and for capturing general flow directions. A sensitivity analysis was used to better understand model sensitivity (primarily in the amount of mounding) from changes in hydraulic conductivity and porosity parameters.*

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Comment No. 19: The monitoring program presented in App. F is inadequate because it fails to demonstrate compliance with the non-endangerment requirement of 40 CFR 144.82(a)(1). Please propose a monitoring program which meets this requirement. It should include the location of the sampling and a justification for the parameters and the frequency of monitoring. The monitoring program must demonstrate that any interaction between the effluent and native water in the USDW does not endanger the USDW.

Response to Comment No. 19: *The "Eagle Project Groundwater Discharge Permit Application" was prepared in accordance with Part 31 of the Natural Resources and Environmental Protection (NREPA) Act, 1994 PA 451; and Part 22 Rules of the Michigan Administrative Code which regulates the land application of treated water. It is our understanding that the Act and Part 22 Rules meet or exceed applicable federal regulations, including the non-endangerment requirements of 40 CFR 144.82(a)(1).*

40 CFR 144.82 (a)(1) states "your injection activity cannot allow the movement of fluid containing any contaminant in USDWs, if the presence of that contaminant may cause a violation of the primary drinking water standards under 40 CFR part 141, other health based standards, or may otherwise adversely affect the health of persons." To comply with the stipulated rule a comprehensive water treatment system groundwater monitoring program has been submitted and approved by the MDEQ. We have attached the Groundwater Discharge Permit (GW1810162), issued by the MDEQ as Attachment 5. Monitoring locations identified in the groundwater monitoring program are illustrated in Figure 1 of the Groundwater Discharge Permit, included as Attachment 5. Justification for the groundwater monitoring parameters and frequency are also included in the approved groundwater monitoring plan submitted as part of the groundwater discharge permit application. MDEQ has determined that the permit meets "provisions of Michigan's Natural Resources and Environmental Protection Act, 1994 P.A. 451, as amended (NREPA), Part 31, Water Resources Protection and Part 41, Sewerage Systems". Details of the monitoring program are provided in the permit. The monitoring program includes monitoring of groundwater near the TWIS. Trends in concentrations of trace metals and other contaminants of concern will be carefully tracked in order to understand interactions between the effluent and native water in the USDW. Regular monitoring will be conducted at the discharge, at wells near the TWIS, and at surface water monitoring locations, as well as at background monitoring locations. The permit also addresses the compliance program that will be used to protect USDW and other resources.

Comment No. 20: App. F, page 1, section 1.1. "If the measured specific conductance in the treated effluent tank exceeds operational thresholds,…." What are these thresholds? App. C, section 12, indicated that water will be in compliance with Michigan's Part 22 Groundwater Water Quality Standards – how will monitoring only specific conductance demonstrate compliance? Will samples of waste water be taken from any other locations? If water exceeds operational thresholds, how quickly will the flow be returned to the WWTP? How will the system guarantee that water which does not met appropriate standards does not enter the USDW?

Response to Comment No. 20: *The primary purpose for continuous monitoring of specific conductance is to quickly identify a treatment system malfunction, such as from a RO membrane defect. Routine monitoring of specific conductance and pressures are commonplace in practice. Under normal function of the treatment system, the specific conductance should be routinely low*

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and a malfunction, although unlikely, is likely to show a sudden, sustained, and significant signal relative to the baseline and normal noise if a malfunction occurred. The specific thresholds to be established will depend on baseline characteristics found during operation, as well as the frequency characteristics of the specific conductance signal, but will likely be 5 to 10 times the standard deviation above the baseline signal. An abnormal specific conductance signal does not necessarily indicate that Michigan's Part 22 Groundwater Quality Standards have been exceeded. However, before discharge to the rapid infiltration beds, the water can immediately be diverted back to the contact water storage basins, the treatment system can be checked, and water quality samples can be collected. Therefore, the role of specific conductance measurement is not primarily to demonstrate compliance, but as a precaution and contingency for a sudden change in treatment system performance.

It is important to note that the system will not guarantee that appropriate standards will not be exceeded. The emphasis on effective treatment deals primarily with routine maintenance and operations of the treatment plant according to established best practices in the industry.

In addition, consistent with MDEQ regulations for groundwater discharge, compliance is measured at the compliance point through the monitoring of groundwater monitoring wells.

Comment No. 21: Please provide a cost estimate for the closure of the TWIS. Section 9 of the application only discusses financial assurance for the State of Michigan and does not include any breakdown of the $17,000,000 figure set forth in the application. If Kennecott proposes to use a single mechanism to meet both State of Michigan and Federal requirements, Kennecott must submit documentation of the financial mechanism to allow determination whether the state mechanism is at least equivalent to the mechanisms specified in 40 CFR Subpart F and submit a "Letter Requesting the Use of a State Bond" (40 CFR 144.65(a)).

Response to Comment No. 21: *The closure costs of the TWIS are included as part of the reclamation and monitoring presented in the Mine Permit Application, Volume 2, February 2006. Table 7-6, Reclamation and Monitoring Cost Estimate, includes TWIS closure costs in year 10 (closure) and year 17. Based upon an 8 acre facility the break down of reclamation costs for the TWIS is as follows:*

Re-grading site (approx 1.5 ft); 20,000cy x$3.00/cy		*= $60,000*
Seed/Mulch; 8 acresx$2500/acre		*= $20,000*
Removal of mechanical equipment (5 distribution valves and valve boxes); Lump sum		*= $10,000*
Disposal of non-salvageable materials; 5 tons x $40/ton		*= $200*
Grout below grade distribution piping; 2000ft x $5.00/ft		*= $10,000*
	Subtotal	*= $100,200*
	Contingency@20%	*=$20,040*
	Total	***=$120,240***

Documentation of the financial mechanism will be provided to the EPA for verification that the state mechanism is equivalent to the mechanism specified in 40 CFR Subpart F. A letter requesting the use of state bond will also be submitted including the facilities EPA identification number, name, address, and the amounts of funds for abandonment coverage assured by the mechanism.

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Attachment 1

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Certification Statement from 40 CFR 144.32(d)

I, Jonathan C. Cherry certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Jonathan C. Cherry, P.E.

8-21-08

Date

Attachment 2

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SAMPLE LOCATION	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Mg %
ABL-026	0.05	4.95	4.9	570	0.56	0.13	0.34	0.07	30.6	4.1	44	1.22	9	3.84	10.7	0.11	4.2	0.07	0.022	2.39	19.8	7.6	0.24
ABL-027	0.06	4.07	4.2	520	0.56	0.14	0.35	0.08	37.9	5.2	57	0.91	8.6	6.76	7.71	0.13	3.8	0.03	0.021	2.38	18.8	5.7	0.26
ABL-028	0.08	4.51	9	510	0.62	0.18	0.26	0.09	34.5	4.1	35	1.44	9.5	3.69	12.65	0.14	5.1	0.08	0.029	2.42	19.9	9.5	0.21
ABL-029	0.1	4.73	4.1	570	0.68	0.12	0.34	0.09	44.6	5.1	30	1.23	10.7	3.27	10.9	0.14	5	0.06	0.022	2.59	24.5	9.6	0.26
ABL-036	0.07	4.12	3.9	570	0.53	0.12	0.33	0.06	28.3	4.2	32	0.94	6.8	3.44	7.61	0.1	2.9	0.04	0.019	2.51	18	6.2	0.23
ABL-037	0.08	4.86	4.4	560	0.85	0.13	0.44	0.1	42.3	6.3	45	1.38	13.5	4.01	11.45	0.13	5.2	0.05	0.025	2.54	23	11.8	0.29
ABL-038	0.04	4.02	3.1	500	0.63	0.08	0.45	0.07	33.4	4.3	39	0.93	6	3.81	7.59	0.1	3.3	0.03	0.014	2.25	15.8	5.5	0.26
ABL-039	0.14	4.8	4.9	510	0.88	0.18	0.52	0.12	55	8.3	55	1.57	12.9	4.99	13.1	0.16	4.7	0.05	0.032	2.18	32.9	13.4	0.34
ABL-040	0.29	5.19	8.6	440	0.87	0.19	0.46	0.27	40	9.6	46	1.5	18	4.79	12.8	0.14	4.5	0.15	0.038	1.79	23.8	14.5	0.32
DPR-021	0.05	3.88	3.1	580	0.54	0.09	0.27	0.07	30.2	4.1	24	1.16	7.1	2.35	8.68	0.1	3.3	0.03	0.015	2.65	16	7.3	0.19
DPR-022	0.06	3.63	3.3	550	0.59	0.09	0.27	0.06	34.8	4.4	22	1.08	7.9	2.54	8.16	0.11	5.1	0.03	0.016	2.53	19.6	7.3	0.2
DPR-023	0.09	3.15	3.5	560	0.55	0.11	0.36	0.08	42.4	3.7	24	0.8	7.1	2.58	6.8	0.12	3.6	0.01	0.016	2.61	19	4.9	0.21
DPR-024	0.06	3.7	3.2	550	0.66	0.11	0.36	0.07	43.6	5.3	30	0.89	8.6	3.46	7.77	0.13	4.6	0.01	0.016	2.56	21.4	6	0.24
DPR-025	0.05	4.05	2.9	540	0.7	0.1	0.44	0.06	32.4	5.1	27	0.96	7.6	2.98	8.79	0.11	3.3	0.03	0.015	2.37	17	7.1	0.24
DPR-026	0.05	3.75	2.7	590	0.56	0.06	0.27	0.05	35	4	18	0.98	7.1	1.78	7.33	0.1	2.9	0.03	0.012	2.72	15	6.5	0.19
DPR-027	0.06	4.68	3.8	510	0.77	0.11	0.51	0.07	44	5.6	33	0.99	11.9	3.46	9.53	0.15	5.2	0.03	0.019	2.2	21.9	8.4	0.28
DPR-028	0.05	3.85	3	540	0.62	0.11	0.39	0.07	34.5	5.7	33	0.97	6.5	3.27	8.69	0.12	3.5	0.01	0.016	2.41	18.6	6.8	0.24

	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Mg %
Count	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Min	0.04	3.15	2.7	440	0.53	0.06	0.26	0.05	28.3	3.7	18	0.80	6.0	1.78	6.80	0.10	2.9	0.01	0.012	1.79	15.0	4.9	0.19
5%	0.05	3.53	2.9	488	0.54	0.08	0.27	0.06	29.8	3.9	21	0.87	6.4	2.24	7.22	0.10	2.9	0.01	0.014	2.10	15.6	5.4	0.19
10%	0.05	3.67	3.0	506	0.55	0.09	0.27	0.06	30.4	4.1	23	0.90	6.7	2.46	7.49	0.10	3.1	0.01	0.015	2.19	15.9	5.6	0.20
25%	0.05	3.85	3.1	510	0.56	0.10	0.33	0.07	33.4	4.1	27	0.94	7.1	2.98	7.71	0.11	3.3	0.03	0.016	2.37	18.0	6.2	0.21
Median	**0.06**	**4.07**	**3.8**	**550**	**0.62**	**0.11**	**0.36**	**0.07**	**35.0**	**5.1**	**33**	**0.99**	**8.6**	**3.46**	**8.69**	**0.12**	**4.2**	**0.03**	**0.019**	**2.42**	**19.6**	**7.3**	**0.24**
Average	**0.08**	**4.23**	**4.3**	**539**	**0.66**	**0.12**	**0.37**	**0.09**	**37.9**	**5.2**	**35**	**1.11**	**9.3**	**3.59**	**9.43**	**0.12**	**4.1**	**0.04**	**0.020**	**2.42**	**20.3**	**8.1**	**0.25**
75%	0.08	4.73	4.4	570	0.70	0.13	0.44	0.09	42.4	5.6	44	1.23	10.7	3.84	10.90	0.14	5.0	0.05	0.022	2.56	21.9	9.5	0.26
90%	0.12	4.90	6.4	574	0.86	0.18	0.48	0.11	44.2	7.1	50	1.46	13.1	4.87	12.71	0.14	5.1	0.07	0.030	2.63	24.1	12.4	0.30
95%	0.17	5.00	8.7	582	0.87	0.18	0.51	0.15	46.7	8.6	55	1.51	14.4	5.34	12.86	0.15	5.2	0.09	0.033	2.66	26.2	13.6	0.32
Max	0.29	5.19	9.0	590	0.88	0.19	0.52	0.27	55.0	9.6	57	1.57	18.0	6.76	13.10	0.16	5.2	0.15	0.038	2.72	32.9	14.5	0.34
StDev	0.06	0.57	1.8	37	0.12	0.04	0.08	0.05	6.8	1.6	11	0.24	3.2	1.15	2.09	0.02	0.8	0.03	0.007	0.22	4.3	2.8	0.04
C.V.	73%	13%	43%	7%	18%	30%	22%	58%	18%	30%	32%	21%	34%	32%	22%	15%	21%	78%	35%	9%	21%	34%	17%
IQR	0.03	0.88	1.3	60	0.14	0.03	0.11	0.02	9.0	1.5	17	0.29	3.6	0.86	3.19	0.03	1.7	0.02	0.006	0.19	3.9	3.3	0.05

Composition of the Upper Continental Crust, Tables 1 and 2 in R.L. Rudnick and S. Gao, Composition of the Continental Crust, in R.L. Rudnicj (Ed.),*The Crus* t, Volume 3 in H.D. Holland and K.K. Turekian (Eds.), *Treati on Geochemistry* . New York: Elsevier,

	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg
Upper Continental Crust	**0.053**	**8.15**	**4.8**	**624**	**2.1**	**0.16**	**2.57**	**0.09**	**63**	**17.3**	**92**	**4.9**	**28**	**3.96**	**17.5**	**1.4**	**5.3**	**0.05**	**0.056**	**2.32**	**31**	**21**	**1.5**
% metal																							
		15.4					3.59							5.04						2.8			2.48
Table 1 form		Al2O3					CaO							FeO						K2O			MgO

Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
357	0.76	0.54	8.1	10	500	14	65.7	<0.002	0.02	0.82	2	1.3	83.2	0.49	<0.05	5.8	0.47	0.35	1.6	97	0.6	15.1	36	166.5
676	0.63	0.46	8.5	8.6	460	13.4	59.3	<0.002	0.01	0.89	2	1.6	71.4	0.57	<0.05	6.2	0.79	0.31	1.7	181	0.7	18.7	45	215
447	0.99	0.39	8.6	7.8	740	18.3	75.6	<0.002	0.02	0.86	2	1.6	72.5	0.6	0.05	7.8	0.46	0.44	2.1	86	0.8	14.1	36	156.5
341	0.72	0.49	8.4	10.8	550	13.8	70.6	<0.002	0.03	0.62	2	1.3	86.5	0.55	<0.05	8.6	0.47	0.38	1.8	80	0.6	13.6	32	178
367	0.63	0.52	7.7	7.7	370	11.8	56.6	<0.002	0.01	0.74	1	1.4	79.8	0.48	<0.05	5	0.45	0.3	1.4	84	0.7	14.1	29	115.5
387	0.77	0.62	8.7	12.2	460	15.3	79.1	<0.002	0.01	0.73	2	1.4	110.5	0.54	<0.05	8.6	0.44	0.46	2	99	0.7	13.1	36	211
431	0.4	0.6	5.8	7.8	420	11.3	58.1	<0.002	0.01	0.55	1	1.1	89.4	0.47	<0.05	13.5	0.43	0.27	1.3	88	0.4	11.5	44	159
476	0.83	0.67	11.7	14.7	490	17.3	74.8	<0.002	0.01	0.86	2	1.7	120.5	2.72	<0.05	10.5	0.53	0.45	2.1	126	0.9	14.8	47	168
772	1.16	0.55	9.9	16.5	960	20.8	59.8	<0.002	0.03	0.92	3	1.8	100.5	0.61	0.05	9.2	0.52	0.4	2	118	0.9	13.4	68	181.5
334	0.45	0.41	6.5	7.2	360	12.7	80.3	<0.002	0.01	0.57	1	1.1	74.7	0.44	<0.05	5.1	0.35	0.46	1.4	56	0.6	10.5	32	132
318	0.52	0.41	6.8	8.4	240	12.4	76.8	<0.002	0.01	0.61	1	1.1	76.6	0.41	<0.05	6.1	0.41	0.43	1.6	63	0.5	10.9	23	190.5
383	0.36	0.39	7.4	6.1	360	12.2	77	<0.002	0.01	0.89	1	1.1	79	0.47	<0.05	5.4	0.46	0.4	1.4	62	0.7	13	16	143
407	0.5	0.47	7.7	8.9	210	13.1	73.3	<0.002	0.01	0.69	1	1.3	82	0.54	<0.05	6.5	0.5	0.37	1.8	84	0.6	14.4	23	177.5
317	0.41	0.66	6.2	9	280	12.9	70.3	<0.002	0.01	0.57	1	1.1	113	0.44	<0.05	4.8	0.36	0.37	1.3	69	0.5	9.5	21	126
253	0.34	0.41	5.4	7	210	11.8	80.8	<0.002	0.01	0.51	1	0.9	74.2	0.35	<0.05	4.3	0.28	0.44	1.3	40	0.5	13.1	18	113
385	0.57	0.68	7.4	10.2	420	14.7	62.4	<0.002	0.01	0.57	2	1.2	114.5	0.51	<0.05	9.2	0.42	0.34	1.9	80	0.5	13.2	29	184.5
374	0.43	0.53	7	16	430	12.7	70.7	<0.002	0.01	0.61	1	1.2	92.2	0.47	<0.05	5.5	0.39	0.37	1.4	76	0.6	11.7	25	130.5

Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn	Zr
ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
253	0.34	0.39	5.4	6.1	210	11.3	56.6	<0.002	0.01	0.51	1	0.9	71.4	0.35	<0.05	4.3	0.28	0.27	1.3	40	0.4	9.5	16.0	113.0
304	0.36	0.39	5.7	6.8	210	11.7	57.8	<0.002	0.01	0.54	1	1.1	72.3	0.40	<0.05	4.7	0.34	0.29	1.3	53	0.5	10.3	17.6	115.0
318	0.38	0.40	6.0	7.1	228	11.8	58.8	<0.002	0.01	0.56	1	1.1	73.5	0.43	<0.05	4.9	0.36	0.31	1.3	60	0.5	10.7	19.8	121.8
341	0.43	0.41	6.8	7.8	360	12.4	62.4	<0.002	0.01	0.57	1	1.1	76.6	0.47	<0.05	5.4	0.41	0.35	1.4	69	0.5	11.7	23.0	132.0
383	**0.57**	**0.52**	**7.7**	**8.9**	**420**	**13.1**	**70.7**	**<0.002**	**0.01**	**0.69**	**1**	**1.3**	**83.2**	**0.49**	**<0.05**	**6.2**	**0.45**	**0.38**	**1.6**	**84**	**0.6**	**13.2**	**32.0**	**166.5**
413	**0.62**	**0.52**	**7.8**	**9.9**	**439**	**14.0**	**70.1**	**<0.002**	**0.01**	**0.71**	**2**	**1.3**	**89.4**	**0.63**	**<0.05**	**7.2**	**0.45**	**0.38**	**1.7**	**88**	**0.6**	**13.2**	**32.9**	**161.6**
431	0.76	0.60	8.5	10.8	490	14.7	76.8	<0.002	0.01	0.86	2	1.4	100.5	0.55	<0.05	8.6	0.47	0.44	1.9	97	0.7	14.1	36.0	181.5
556	0.89	0.66	9.2	15.2	626	17.7	79.6	<0.002	0.02	0.89	2	1.6	113.6	0.60	<0.05	9.7	0.52	0.45	2.0	121	0.8	14.9	45.8	198.7
695	1.02	0.67	10.3	16.1	784	18.8	80.4	<0.002	0.03	0.90	2	1.7	115.7	1.03	<0.05	11.1	0.58	0.46	2.1	137	0.9	15.8	51.2	211.8
772	1.16	0.68	11.7	16.5	960	20.8	80.8	<0.002	0.03	0.92	3	1.8	120.5	2.72	0.05	13.5	0.79	0.46	2.1	181	0.9	18.7	68.0	215.0
129	0.23	0.10	1.5	3.2	189	2.6	8.2	NA	0.01	0.14	1	0.2	16.3	0.54		2.5	0.11	0.06	0.3	32	0.1	2.1	12.9	31.2
31%	38%	19%	20%	32%	43%	18%	12%		52%	20%	41%	19%	18%	87%		34%	24%	15%	18%	37%	22%	16%	39%	19%
90	0.33	0.19	1.7	3.0	130	2.3	14.4		0.00	0.29	1	0.3	23.9	0.08		3.2	0.06	0.09	0.5	28.00	0.2	2.4	13.0	49.5
775	**1.1**	**2.43**	**12**	**47**	**650**	**17**	**84**	**0.0002**	**0.06**	**0.4**	**0.09**	**2.1**	**320**	**0.9**		**10.5**	**0.39**	**0.9**	**2.7**	**97**	**1.9**	**21**	**67**	**193**
0.078					0.065																			
0.1		3.27			0.15				621								0.64							
MnO		Na2O			P2O5				as ppm								TiO2							

US EPA ARCHIVE DOCUMENT

Attachment 3

US EPA ARCHIVE DOCUMENT

Table 5
Groundwater Quality Data
Quaternary Deposit Monitoring Location QAL004
Eagle Project

Parameter	Units	QAL004A								QAL004D							
		Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow	Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow
		4/14/04	8/17/04	9/21/04	10/19/04	12/15/04	2/24/05	4/27/05	8/17/05	4/14/04	8/17/04	9/21/04	10/19/04	12/15/04	2/25/05	4/27/05	8/17/05
Field Parameters																	
Temperature	°C	**7.1**	**7.2**	**7.2**	**7.0**	**7.0**	**7.2**	**7.1**	**7.3**	**7.5**	**7.6**	**7.7**	**7.4**	**7.4**	**7.3**	**7.5**	**7.5**
Specific Conductance	µmhos/ cm @ 25°C	**90**	**94**	**92**	**90**	**91**	**84**	**85**	**78**	**155**	**156**	**155**	**156**	**154**	**151**	**151**	**157**
pH	SU	**8.9**	**9.1**	**9.1**	**9.0**	**9.1**	**9.1**	**9.6**	**8.5**	**8.6**	**7.9**	**8.4**	**8.2**	**8.5**	**8.5**	**8.9**	**8.4**
D.O.	ppm	**5**	**7**	**5**	**6**	**6**	**5**	**5**	**4**	<0.001	<0.001	<0.001	<0.001	**0.002**	<0.001	<0.001	<0.05
Ferrous Iron	mg/L	**0.15**	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.15**	**0.15**	**0.2**	**0.1**	**0.1**	**0.2**	**0.2**	**0.2**
Metals/Inorganics																	
Aluminum, Dissolved	µg/L	<100	<100	<100	<100	<100	<50	<50	<50	<100	<100	<100	<100	<100	<50	<50	<50
Antimony, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic, Dissolved	µg/L	**4.8**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**8.4**	**8.5**	**8.7**	**8.7**	**7.6**	**9.8**	**9.4**	**8.6**
Barium, Dissolved	µg/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Beryllium, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron, Dissolved	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium, Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Chromium, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Copper, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron, Dissolved	µg/L	<20	<20	<20	<20	<20	<20	<20	<20	**100**	**100**	**110**	**110**	**110**	**110**	**99**	**100**
Lead, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<8.0	<10	<10	<10	<10	<10	<10	<10	<8.0
Manganese, Dissolved	µg/L	<20	<20	<20	<20	<20	<20	<20	<20	**52**	**53**	**55**	**56**	**54**	**54**	**58**	**54**
Mercury, Dissolved	ng/L	**0.267**	**0.100 U**	**0.209 B,s**	**0.344 a,s**	**0.194 B,s**	**0.191 B,s**	**0.100 U**	**0.100 U**	**0.322**	**0.100 U**	**0.293 s**	**0.179 a,B,s**	**0.190 B,s**	**0.181 B,s**	**0.100 U**	**0.170 B,s**
Molybdenum, Dissolved	µg/L	**40**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Nickel, Dissolved	µg/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Selenium, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver, Dissolved	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Strontium, Dissolved	µg/L	NM	NM	NM	NM	NM	NM	NM	<50	NM	NM	NM	NM	NM	NM	NM	**56**
Zinc, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5
Groundwater Quality Data
Quaternary Deposit Monitoring Location QAL004
Eagle Project

Parameter	Units	QAL004A								QAL004D							
		Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow	Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow
		4/14/04	8/17/04	9/21/04	10/19/04	12/15/04	2/24/05	4/27/05	8/17/05	4/14/04	8/17/04	9/21/04	10/19/04	12/15/04	2/25/05	4/27/05	8/17/05
Major Anions																	
Alkalinity, Bicarbonate	mg/L	**50**	**44**	**53**	**45 a**	**46**	**42**	**44**	**42**	**89**	**97**	**79**	**84 a**	**80**	**87**	**81**	**78**
Alkalinity, Carbonate	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total	mg/L	NM	NM	NM	NM	NM	NM	NM	**42**	NM	NM	NM	NM	NM	NM	NM	**78**
Chloride	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	**1.1**	<1.0	**0.56**	<1.0	<1.0	**1.1**	<1.0	<1.0	<1.0	<1.0	**1.9**
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.20	<0.10
Nitrogen, Ammonia	mg/L	NM	NM	NM	NM	NM	NM	NM	<0.020	NM	NM	NM	NM	NM	NM	NM	**0.095**
Nitrogen, Nitrate	mg/L	**0.08**	**0.21**	**0.16**	**0.13**	**0.12**	**0.18**	**0.19**	**0.20**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050
Phosphorus, Total	mg/L	NM	NM	NM	NM	NM	NM	NM	**0.0112**	NM	NM	NM	NM	NM	NM	NM	**0.0423**
Sulfate	mg/L	<5.0	<5.0	**9.3**	<5.0	<5.0	<5.0	<5.0	**3.5**	<5.0	<0.05	<5.0	<5.0	<5.0	<5.0	<5.0	<2.0
Sulfide	mg/L	NM	NM	NM	NM	NM	NM	NM	<1.0	NM	NM	NM	NM	NM	NM	NM	<1.0
Major Cations																	
Calcium, Dissolved	mg/L	**12**	**14**	**14**	**14**	**14**	**13**	**13**	**12**	**25**	**23**	**24**	**26**	**25**	**25**	**25**	**23**
Magnesium, Dissolved	mg/L	**2.1**	**2.3**	**2.4**	**2.5**	**2.3**	**2.1**	**2.3**	**2.2**	**3.2**	**3.0**	**3.1**	**3.3**	**3.1**	**3.2**	**3.3**	**3.1**
Potassium, Dissolved	mg/L	**0.73**	<0.50	**0.62**	**0.55**	**0.57**	**0.52**	**0.54**	**0.60**	**1.3**	**0.81**	**1.0**	**0.79**	**0.95**	**0.88**	**0.93**	**0.91**
Sodium, Dissolved	mg/L	**1.8**	**0.66**	**0.97**	**0.63**	**0.86**	**0.80**	**0.87**	**0.79**	**2.8**	**2.0**	**2.1**	**1.9**	**2.1**	**2.2**	**2.2**	**1.9**
General Chemistry																	
Hardness, (calculated) as CaCO3	mg/L	**39**	**44**	**45**	**45**	**44**	**41**	**42**	**39**	**76**	**70**	**73**	**79**	**75**	**76**	**76**	**70**
Residue, Dissolved @ 180°C	mg/L	**62**	**72**	**72**	**60**	<50 a	<50	**60**	**50**	**84**	**104**	**118**	**138**	<50 a	**81**	**104**	**104**
Tritium	TU	NM	NM	NM	**9.08**	NM	NM	NM	NM	NM	NM	NM	<0.8	NM	NM	NM	NM

a Estimated value. Duplicate precision for this parameter exceeded quality control limit.
B Estimated value because sample result is above the method detection limit of 0.10 ng/L but below the reporting limit of 0.25 ng/L.
NM Not measured.
s Potential false positive value. Compound present in blank sample.
U Result was below the reporting limit and reported at the method detection limit.

Table 5
Groundwater Quality Data
Quaternary Deposit Monitoring Location QAL005
Eagle Project

Parameter	Units	QAL005A								QAL005D							
		Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow	Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow
		4/15/04	8/17/04	10/6/04	10/20/04	12/15/04	2/24/05	4/26/05	8/17/05	4/15/04	8/17/04	9/16/04	10/20/04	12/15/04	2/23/05	4/26/05	8/17/05
Field Parameters																	
Temperature	°C	**6.6**	**7.1**	**7.7**	**7.7**	**7.9**	**7.2**	**6.6**	**7.4**	**7.6**	**7.8**	**7.9**	**7.7**	**7.6**	**7.5**	**7.6**	**7.9**
Specific Conductance	µmhos/cm @ 25°C	**22**	**18**	**18**	**18**	**17**	**17**	**16**	**17**	**169**	**163**	**163**	**168**	**166**	**165**	**85**	**101**
pH	SU	**7.1**	**5.6**	**5.4**	**5.5**	**5.5**	**5.5**	**5.6**	**5.5**	**8.0**	**7.8**	**8.2**	**8.0**	**8.0**	**8.0**	**8.3**	**7.7**
D.O.	ppm	**2**	**2**	**2**	**1.5**	**1.5**	**2**	**1.5**	**3**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.6**	**0.7**
Ferrous Iron	mg/L	**0.3**	**0.3**	**0.3**	**0.3**	**0.4**	**0.2**	**0.2**	**0.3**	**0.4**	**0.7**	**0.8**	**1.0**	**0.7**	**1.0**	**0.6**	**1.0**
Metals/Inorganics																	
Aluminum, Dissolved	µg/L	<100	<100	<100	<100	<100	<50	<50	<50	<100	<100	<100	<100	<100	<50	<50	<50
Antimony, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic, Dissolved	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**3.1**	**3.7**	**3.4**	**3.6**	**3.8**	**3.7**	**3.3**
Barium, Dissolved	µg/L	**27**	<20	<20	**21**	**20**	**23**	<20	<20	<20	**28**	**30**	**33**	**31**	**32**	**30**	**28**
Beryllium, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron, Dissolved	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium, Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Chromium, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Copper, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron, Dissolved	µg/L	**240**	**350**	**380**	**350**	**420**	**240**	**120**	**200**	**540**	**710**	**790**	**720**	**740**	**740**	**670**	**670**
Lead, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<8.0	<10	<10	<10	<10	<10	<10	<10	<8.0
Manganese, Dissolved	µg/L	**140**	**24**	<20	<20	<20	<20	<20	<20	**180**	**200**	**210**	**190**	**200**	**210**	**200**	**190**
Mercury, Dissolved	ng/L	**0.274**	**0.100 U**	**0.277 s**	**0.103 a,B,s**	**0.253 s**	**0.182 B,s**	**0.187 B,s**	**0.190 B,s**	**0.340**	**0.100 U**	**0.252 s**	**0.126 a,B,s**	**0.114 B,s**	**0.208 B,s**	**0.100 U**	**0.100 U**
Molybdenum, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Nickel, Dissolved	µg/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Selenium, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver, Dissolved	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Strontium, Dissolved	µg/L	NM	NM	NM	NM	NM	NM	NM	<50	NM	NM	NM	NM	NM	NM	NM	<50
Zinc, Dissolved	µg/L	<10	13	<10	<10	<10	<10	<10	<10	<10	**18**	<10	<10	<10	<10	<10	<10

Table 5
Groundwater Quality Data
Quaternary Deposit Monitoring Location QAL005
Eagle Project

Parameter	Units	QAL005A								QAL005D							
		Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow	Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow
		4/15/04	8/17/04	10/6/04	10/20/04	12/15/04	2/24/05	4/26/05	8/17/05	4/15/04	8/17/04	9/16/04	10/20/04	12/15/04	2/23/05	4/26/05	8/17/05
Major Anions																	
Alkalinity, Bicarbonate	mg/L	**6.5**	**4.7**	**6.1**	**6.9 a**	<2.0	**4.5**	**2.8**	**2.4**	**96**	**96**	**86**	**93 a**	**89**	**110**	**86**	**85**
Alkalinity, Carbonate	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total	mg/L	NM	NM	NM	NM	NM	NM	NM	**2.4**	NM	NM	NM	NM	NM	NM	NM	**85**
Chloride	mg/L	**1.0**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**1.1**	**1.4**	<1.0	<1.0	<1.0	**1.3**	<1.0	<1.0
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.16**	<0.10
Nitrogen, Ammonia	mg/L	NM	NM	NM	NM	NM	NM	NM	<0.020	NM	NM	NM	NM	NM	NM	NM	**0.068**
Nitrogen, Nitrate	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05 b	<0.050	<0.05	<0.05	**0.16**	<0.05	<0.05	<0.05	<0.05 b	<0.050
Phosphorus, Total	mg/L	NM	NM	NM	NM	NM	NM	NM	<0.0100	NM	NM	NM	NM	NM	NM	NM	**0.0354**
Sulfate	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.3	<5.0	<5.0	**6.1**	<5.0	<5.0	<5.0	<5.0	<5.0
Sulfide	mg/L	NM	NM	NM	NM	NM	NM	NM	<1.0	NM	NM	NM	NM	NM	NM	NM	<1.0
Major Cations																	
Calcium, Dissolved	mg/L	**1.7**	**1.2**	**1.1**	**1.2**	**1.2**	**1.3**	**1.3**	**1.0**	**28**	**27**	**29**	**27**	**28**	**28**	**28**	**26**
Magnesium, Dissolved	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**3.3**	**2.9**	**3.2**	**2.8**	**2.9**	**2.9**	**2.9**	**2.8**
Potassium, Dissolved	mg/L	**0.73**	**0.69**	**0.71**	**0.66**	**0.81**	**0.68**	**0.60**	**0.62**	**1.0**	**0.53**	**0.65**	**0.66**	**0.61**	**0.57**	**0.58**	**0.67**
Sodium, Dissolved	mg/L	**0.89**	<0.50	**0.89**	**0.78**	**0.66**	**0.58**	**0.69**	**0.63**	**1.5**	**1.4**	**1.3**	**1.2**	**1.4**	**1.5**	**1.4**	**1.3**
General Chemistry																	
Hardness, (calculated) as CaCO3	mg/L	**5**	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**84**	**79**	**86**	**79**	**82**	**82**	**82**	**76**
Residue, Dissolved @ 180°C	mg/L	<50	<50	<50	<50	**52 a**	<50	<50	<20	**104**	**114**	**122**	**124**	**96 a**	**92**	**94**	**110**
Tritium	TU	NM	NM	NM	**8.98**	NM	NM	NM	NM	NM	NM	NM	**7.07**	NM	NM	NM	NM

a Estimated value. Duplicate precision for this parameter exceeded quality control limit.
b Estimated value. Sample received after EPA-established hold time expired.
B Estimated value because sample result is above the method detection limit of 0.10 ng/L but below the reporting limit of 0.25 ng/L.
NM Not measured.
s Potential false positive value. Compound present in blank sample.
U Result was below the reporting limit and reported at the method detection limit.

Table 5
Groundwater Quality Data
Quaternary Deposit Monitoring Location QAL006
Eagle Project

Parameter	Units	QAL006A								QAL006B							
		Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow	Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow
		4/28/04	8/17/04	9/16/04	10/18/04	12/28/04	2/22/05	4/27/05	8/17/05	4/28/04	8/17/04	10/6/04	10/18/04	12/28/04	2/22/05	4/27/05	8/17/05
Field Parameters																	
Temperature	°C	5.9	7.8	8.5	9.0	8.1	7.1	6.1	8.4	8.0	8.2	8.1	7.8	7.9	7.9	7.8	8.4
Specific Conductance	µmhos/ cm @ 25°C	19	16	16	15	15	18	16	16	198	167	177	179	172	169	168	176
pH	SU	6.1	5.4	5.5	5.4	5.4	5.3	5.3	4.4	6.9	6.9	6.9	6.9	6.9	7.0	7.3	6.9
D.O.	ppm	4	7	5	>1	2.5	2	4	3	<0.001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.1	<0.05
Ferrous Iron	mg/L	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	12	15	30	18	16	27	16	15
Metals/Inorganics																	
Aluminum, Dissolved	µg/L	<100	<100	<100	<100	100	150	120	72	<100	<100	<100	<100	<100	67	<50	67
Antimony, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Arsenic, Dissolved	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Barium, Dissolved	µg/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Beryllium, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron, Dissolved	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium, Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Chromium, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Copper, Dissolved	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Iron, Dissolved	µg/L	<20	<20	<20	<20	<20	<20	<20	<20	16,500	15,100	14,400	15,200	13,400	14,300	13,800	13,000
Lead, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lithium, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<8.0	<10	<10	<10	<10	<10	<10	<10	<8.0
Manganese, Dissolved	µg/L	<20	<20	<20	<20	<20	<20	<20	<20	150	140	150	150	130	140	140	130
Mercury, Dissolved	ng/L	0.628	0.494 s	0.551	0.546 a,s	0.511	0.420	0.463 s	0.420	0.443	0.454 s	0.250 s	0.147 a,B,s	0.290 s	0.159 B,s	0.100 U	0.100 U
Molybdenum, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Nickel, Dissolved	µg/L	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
Selenium, Dissolved	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver, Dissolved	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.20
Strontium, Dissolved	µg/L	NM	NM	NM	NM	NM	NM	NM	<50	NM	NM	NM	NM	NM	NM	NM	<50
Zinc, Dissolved	µg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 5
Groundwater Quality Data
Quaternary Deposit Monitoring Location QAL006
Eagle Project

Parameter	Units	QAL006A								QAL006B							
		Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow	Spring Snowmelt Runoff	Summer Baseflow	Fall Rain Runoff		Winter Baseflow		Spring Snowmelt Runoff	Summer Baseflow
		4/28/04	8/17/04	9/16/04	10/18/04	12/28/04	2/22/05	4/27/05	8/17/05	4/28/04	8/17/04	10/6/04	10/18/04	12/28/04	2/22/05	4/27/05	8/17/05
Major Anions																	
Alkalinity, Bicarbonate	mg/L	**3.1**	<2.0	<2.0	<2.0 a	<2.0	<2.0	**3.2**	**6.1**	**87**	**109**	**85**	**78 a**	**71**	**77**	**71**	**66**
Alkalinity, Carbonate	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total	mg/L	NM	NM	NM	NM	NM	NM	NM	**6.1**	NM	NM	NM	NM	NM	NM	NM	**66**
Chloride	mg/L	**3.7**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**0.57**	**1.8**	**2.1**	**2.1**	**1.0**	<1.0	**1.8**	**1.4**	**1.4**
Fluoride	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.15**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.17**	<0.10
Nitrogen, Ammonia	mg/L	NM	NM	NM	NM	NM	NM	NM	<0.020	NM	NM	NM	NM	NM	NM	NM	**0.070**
Nitrogen, Nitrate	mg/L	**0.20**	**0.15**	<0.05	**0.17**	**0.15**	**0.18**	**0.14**	**0.16 e**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050
Phosphorus, Total	mg/L	NM	NM	NM	NM	NM	NM	NM	<0.0100	NM	NM	NM	NM	NM	NM	NM	**0.0232**
Sulfate	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**3.2**	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	**2.2**
Sulfide	mg/L	NM	NM	NM	NM	NM	NM	NM	<1.0	NM	NM	NM	NM	NM	NM	NM	<1.0
Major Cations																	
Calcium, Dissolved	mg/L	**1.2**	**0.86**	**0.87**	**0.89**	**1.0**	**1.0**	**1.0**	**1.0**	**20**	**17**	**18**	**20**	**17**	**18**	**18**	**17**
Magnesium, Dissolved	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**5.4**	**5.1**	**5.7**	**5.8**	**5.0**	**5.4**	**5.2**	**5.1**
Potassium, Dissolved	mg/L	<0.50	<0.50	**0.50**	<0.50	**0.74**	<0.50	<0.50	**0.60**	**0.79**	**0.67**	**0.67**	**0.70**	**0.73**	**0.68**	**0.62**	**0.57**
Sodium, Dissolved	mg/L	**0.51**	**0.62**	**0.72**	<0.50	**0.58**	**0.63**	**0.62**	**0.63**	**4.3**	**2.1**	**2.4**	**1.7**	**1.8**	**1.7**	**1.6**	**1.5**
General Chemistry																	
Hardness, (calculated) as CaCO3	mg/L	**4**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**72**	**63**	**68**	**74**	**63**	**67**	**66**	**63**
Residue, Dissolved @ 180°C	mg/L	**52**	<50	<50	<50	**54 a**	<50	<50	**130**	**158**	**144**	**131**	**138**	**204 a**	**100**	**126**	**50**
Tritium	TU	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM

a Estimated value. Duplicate precision for this parameter exceeded quality control limit.
B Estimated value because sample result is above the method detection limit of 0.10 ng/L but below the reporting limit of 0.25 ng/L.
e Estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.
NM Not measured.
s Potential false positive value. Compound present in blank sample.
U Result was below the reporting limit and reported at the method detection limit.

Attachment 4

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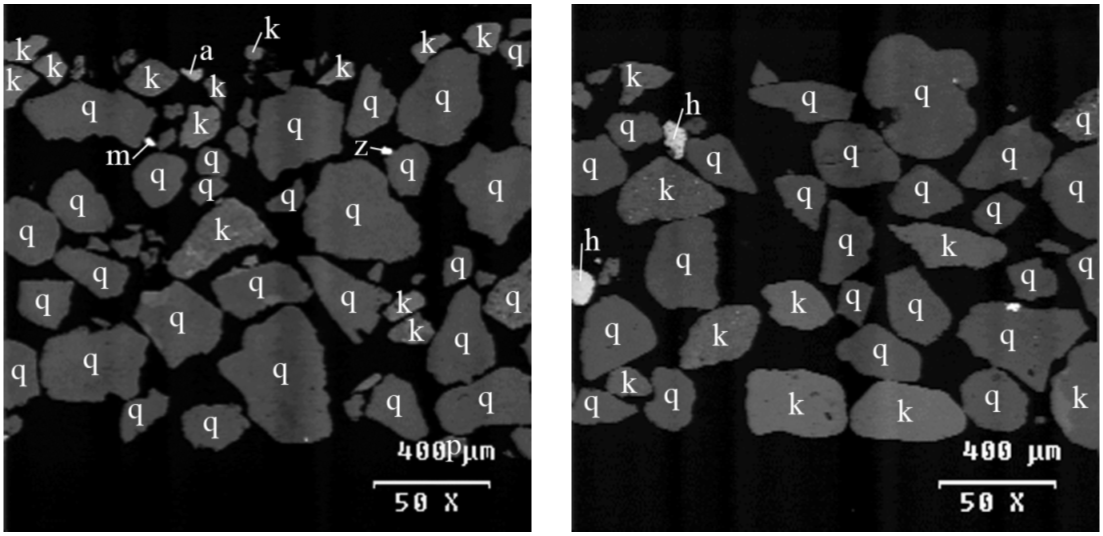
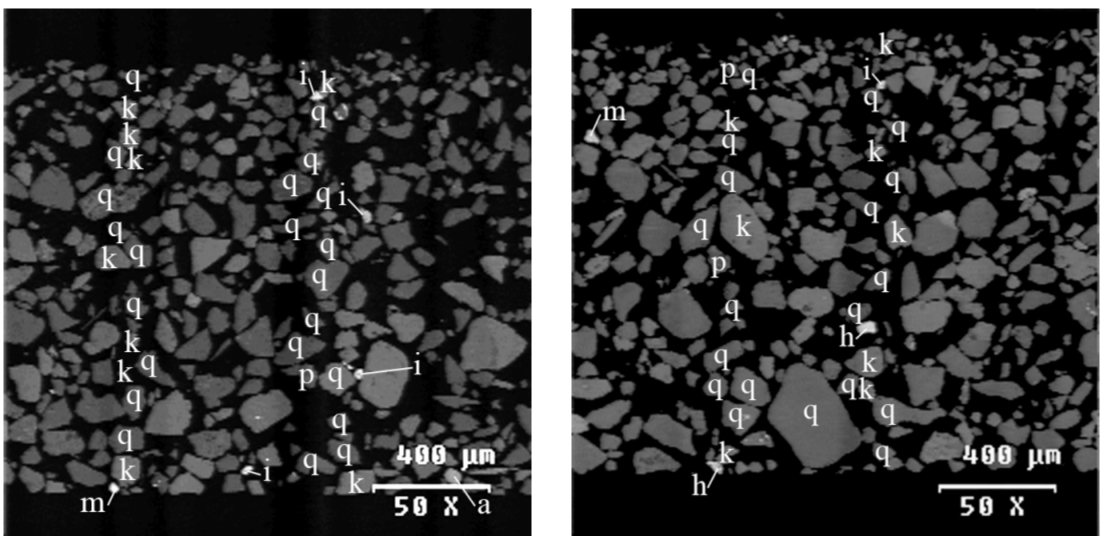
Petrographic Report: KEMC-08-003



Mineralogy of Till Samples from Hole QAL-041



August 11, 2008

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Introduction

Four samples of till from hole QAL-041 were examined in this study. The purpose of this petrographic analysis was to identify the mineralogy of the till samples.

Methods

Four samples of till were provided by Andrew Ware of Kennecott Eagle Mining Company (Table 1). Each sample consisted of a screened and unscreened portion. The samples were dried and weighed. A twenty gram sample was split from either the screened or unscreened sample. The splits were washed to remove ultra-fine particles and clean particle surfaces to improve the quality of grain mounts. The washed splits were dried. Polished mounts were prepared by pouring an initial epoxy mount. After the initial mounts cured they were cut in half and recast to provide a cross section of the grains. This two stage mounting technique allows the petrographer to observe the stratification of mineral grains due to differences in grain size and/or density.

The polished mounts were prepared at Rod Johnson and Associates, Inc. in Negaunee, Michigan. The polished mounts were analyzed with reflected light with an Olympus BX60 petrographic microscope. Images were collected using a Canon 5D digital SLR and processed using Adobe Photoshop C3 Extended. Cursory image analysis was also performed using Adobe Photoshop CS3 Extended.

Polished mounts were also examined using a JEOL 840-JXA scanning electron microscope. Backscattered images were collected using a Kevex Sigma EDS (energy dispersive spectrometry) system. EDS spectra were collected using a PulseTorr EDS detector. EDS spectra were collected with a 20kV accelerating voltage maintaining 25 to 30 seconds dead time for 30 seconds live time

Table 1. Till samples from QAL-041. The unscreened sample from QAL-041 16 and QAL-041 26 and the screened sample from QAL-041 52 and QAL-041 56 were selected for mineralogy determination.

			Sample Weight		Screened Split Weights		Unscreened Split Weights	
Sample ID	**From (ft)**	**To (ft)**	**Screened**	**Unscreened**	**Pre-Washed**	**Washed**	**Pre-Washed**	**Washed**
QAL-041 16	14	18	337.23	309.36			20.09	19.38
QAL-041 26	24	28	216.41	65.03			20.04	19.78
QAL-041 52	52	54	32.77	249.52	20.01	14.28		
QAL-041 56	54	58	63.94	124.51	20.00	16.13		

Minerals were identified using their optical properties in reflected light or by interpretation of their EDS spectra.

Results

Grain Size

QAL-041 16 and QAL-041 26 are coarser than both QAL-041 52 and QAL-041 56 (Figure 1). The difference in weights lost during washing also reflect that QAL-041 52 and QAL-041 56 contained more clay size particles than either QAL-041 16 or QAL-041 26. Particles are generally sub-rounded to sub-angular.

Mineralogy

Minerals and their abundances as determined by EDS are summarized in Table 2. The till samples are composed dominantly of quartz and feldspar. Note that the abundance of feldspars increases with depth. Mica, amphibole, apatite, zircon, and iron –oxides are present in minor amounts. If iron-oxide grains contained only Fe they were classified as hematite (Figure 2). If the grains contained Fe with minor Ti they were classified as (titaniferous) magnetite. If the iron-oxide grains were composed of Ti and Fe where Ti was greater than Fe they were classified as ilmenite. No sulfides were observed with either reflected light microscopy or scanning electron microscopy and EDS.

Table 2. Summary of till samples and mineralogy determined from scanning electron microscopy and EDS analysis.

	n	Quartz	K-Spar	Plag	Mica	Amph	Apatite	Mt	Hematite	Ilmenite	Zircon
QAL-041 16	102	74.5%	16.7%	0.0%	1.0%	0.0%	3.9%	0.0%	1.0%	2.0%	1.0%
QAL-041 26	103	76.7%	15.5%	2.9%	0.0%	0.0%	0.0%	1.9%	1.9%	1.0%	0.0%
QAL-041 52	100	50.0%	40.0%	2.0%	0.0%	3.0%	0.0%	1.0%	2.0%	2.0%	0.0%
QAL-041 56	100	52.0%	31.0%	7.0%	4.0%	0.0%	1.0%	2.0%	0.0%	1.0%	2.0%

Respectfully Submitted,

Rodney C. Johnson, Ph.D.
Rod Johnson & Associates, Inc.

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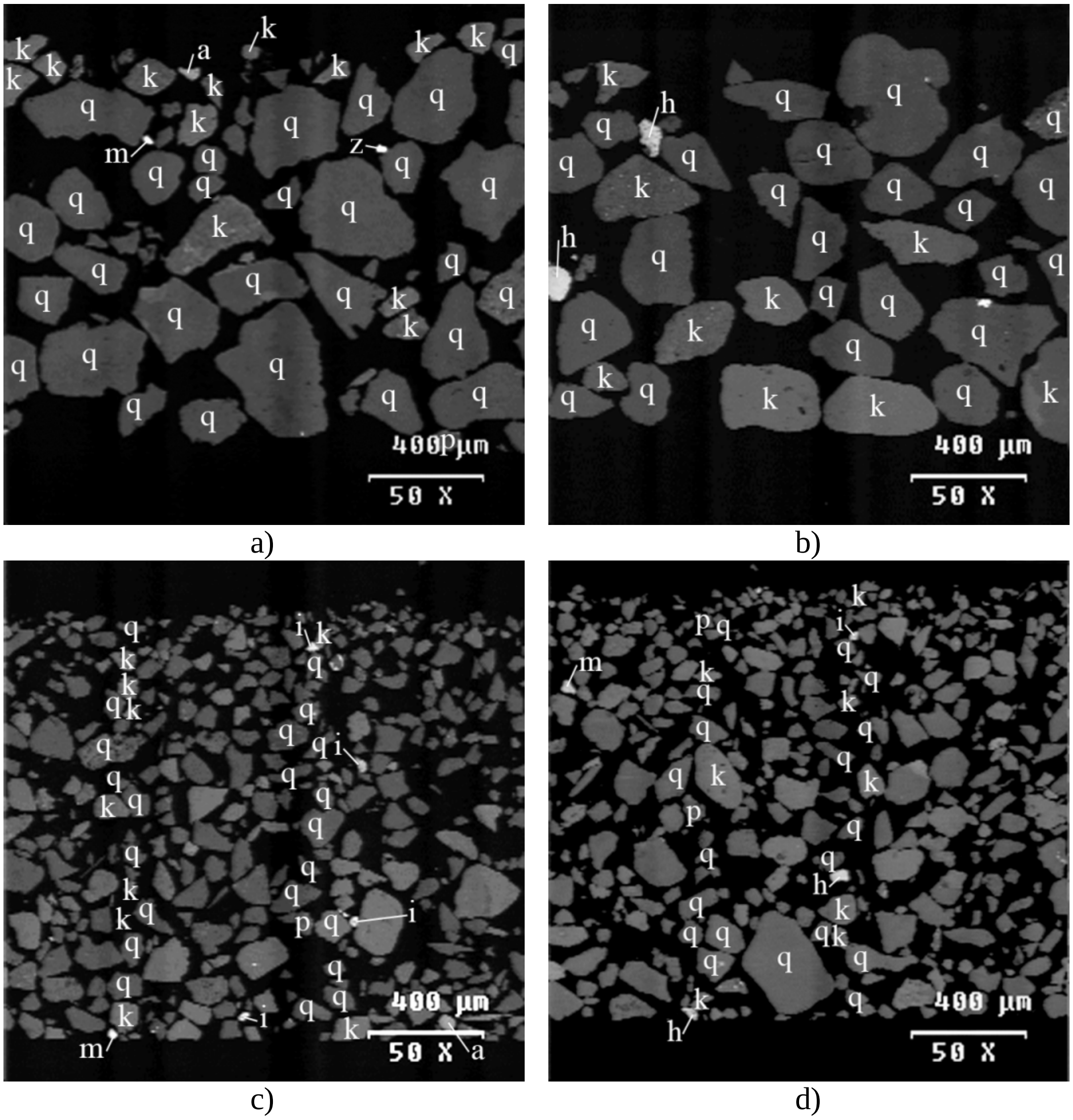

Figure 1. Backscattered images of till samples from hole QAL-041. a) Backscattered image of QAL-041 16 unscreened till sample. Sample is composed dominantly of sub-rounded to sub-angular quartz (gray) and sub-rounded to sub-angular k-feldspar (medium-gray) grains. b) Backscattered image of QAL-041 26 unscreened till sample. Sample is composed dominantly sub-rounded to sub-angular quartz (gray) and sub-rounded to sub-angular k-feldspar (medium-gray) grains. c) Backscattered image of QAL-041 52. Sample is composed dominantly sub-rounded to sub-angular quartz (gray, sub-rounded to sub-angular k-feldspar (medium-gray) and minor plagioclase (medium-gray) grains. d) Backscattered image of QAL-041 56. Sample is composed dominantly sub-rounded to sub-angular quartz (gray, sub-rounded to sub-angular k-feldspar (medium-gray) and minor plagioclase (medium-gray) grains. Note that QAL-041 16 and QAL-041 26 are coarser-grained than QAL-041 52 and QAL-041 56. Note also that feldspar grains are a slightly lighter shade of gray in the backscattered images. Minerals are identified by the following letters: q-quartz, k-k-feldspar, p-plagioclase, z-zircon, a-apatite, h-hematite, m-magnetite, i-ilmenite.

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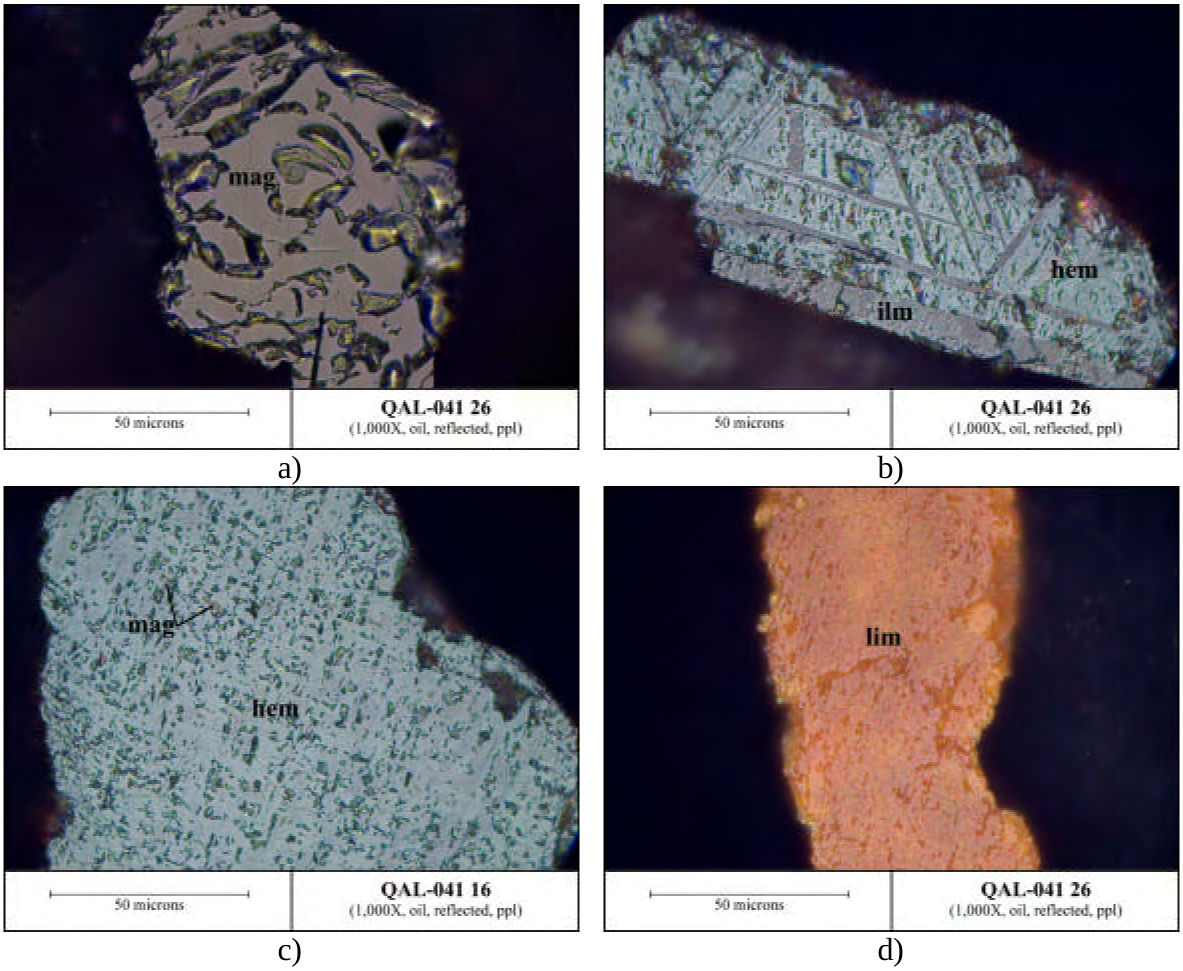

Figure 2. Photomicrographs of iron-oxides in QAL-041. a) Photomicrograph of magnetite grain. Pits in the surface of the grain are due to poor polish of the mineral surface. b) Photomicrograph of magnetite grain oxidized to hematite (white) and ilmenite (gray). Note the relict magnetite crystal structure. c) Photomicrograph of magnetite grain oxidized to hematite (white) with relict magnetite (brown). d) Photomicrograph of limonite.

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Attachment 5

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PART I

PERMIT NO. GW1810162

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
GROUNDWATER DISCHARGE PERMIT

In compliance with the provisions of Michigan's Natural Resources and Environmental Protection Act, 1994 P.A. 451, as amended (NREPA), Part 31, Water Resources Protection, and Part 41, Sewerage Systems,

Kennecott Eagle Minerals Company
1004 Harbor Hills Drive, Suite 103
Marquette, Michigan 49855

is authorized to discharge 504,000 gallons per day, 184,000,000 gallons per year, of process wastewater from the Eagle Project Mine Wastewater Treatment System located at:

Michigamme Township, Marquette County
Section 12, T50N, R29W of Michigamme Township, Marquette County

to the groundwater of the State of Michigan in accordance with effluent limitations, monitoring requirements and other conditions set forth in this permit.

Rule Authorization:	**2218**
Wastewater Type:	Mine Contact Water
Wastewater Treatment Method:	Metals precipitation/sedimentation, filtration, reverse osmosis, microfiltration, ion exchange, evaporation/crystallization
Wastewater Disposal Method:	Rapid Infiltration Basins

The issuance of this permit does not authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Michigan Department of Environmental Quality (Department) permits, or approvals from other units of government as may be required by law.

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Upper Peninsula District Supervisor of the Water Bureau. The Upper Peninsula District Office is located at DEQ-Water Bureau, 420 5th Street, Gwinn, Michigan 49841. Telephone: 906-346-8300. Fax: 906-346-4480.

In accordance with Section 324.3122 of the NREPA, the permittee shall make payment of an annual permit fee to the Department for each December 15 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by March 1 for notices mailed by January 15. The fee is due no later than 45 days after receiving the notice for notices mailed after January 15.

Any person who is aggrieved by this permit may file a sworn petition with the Office of Administrative Hearings of the Department, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department may reject any petition filed more than 60 days after issuance as being untimely.

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This permit is based on an original application submitted on February 22, 2006, as amended through December 14, 2007.

This permit takes effect on January 1, 2008. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules.

This permit and the authorization to discharge shall expire at midnight, January 1, 2013. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department by July 5, 2012.

Issued December 14, 2007.

James R. Janiczek, Chief
Groundwater Permits Unit
Permits Section, Water Bureau

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PART I

1. Initial Effluent Limitations

During the period beginning on the effective date of this permit and lasting until at least 90-days after start-up of the wastewater treatment system and the wastewater treatment system has demonstrated compliance in meeting initial permit effluent limitations, the permittee is authorized to discharge a maximum of 504,000 gallons per day, 184,000,000 gallons per year, of Mine Contact Water from the monitoring points listed below to the groundwater in the NW ¼ of the NE ¼, Section 12, T50N, R29W, Michigamme Township, Marquette County, Michigan. The discharge shall be limited and monitored by the permittee as specified below.

Parameter	Monthly Ave Limit	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
INFLUENT: Monitoring Point **IF-1**					
Flow		Report	GPD	Daily	Report Total
EFFLUENT: Monitoring Point **EQ-1**					
Flow		504,000	GPD	Daily	Report Total
Flow		184,000,000	GPY	Annually	Calculation
Biochemical Oxygen Demand (BOD_5)		10	mg/l	Daily	Grab
Dissolved Oxygen		Report	mg/l	Daily	Grab
Ammonia Nitrogen		Report	mg/l	Daily	Grab
Nitrate Nitrogen		Report	mg/l	Daily	Grab
Nitrite Nitrogen		Report	mg/l	Daily	Grab
pH (Minimum)		6.5	S.U.	Continuous	Grab
pH (Maximum)		9.0	S.U.	Continuous	Grab
Total Phosphorus		Report	mg/l	Daily	Grab
Total Chloride		Report	mg/l	Daily	Grab
Total Sodium		Report	mg/l	Daily	Grab
Specific Conductance		Report*	umhos/cm	Continuous	Measurement
Total Aluminum		Report	mg/l	Daily	Grab
Total Antimony**		Report	ug/l	Daily	Grab
Total Arsenic**	6.0	10	ug/l	Daily	Grab
Total Barium**		Report	ug/l	Daily	Grab
Total Beryllium**		Report	ug/l	Daily	Grab
Total Boron***		250	ug/l	Daily	Grab
Total Cadmium**	3.0	5	ug/l	Daily	Grab
Total Chromium**		Report	ug/l	Daily	Grab
Total Cobalt**		Report	ug/l	Daily	Grab
Total Copper**	10	21	ug/l	Daily	Grab
Total Fluoride		Report	ug/l	Daily	Grab
Total Iron		Report	ug/l	Daily	Grab
Total Lead**		Report	ug/l	Daily	Grab
Total Lithium**		Report	ug/l	Daily	Grab
Total Manganese**		Report	ug/l	Daily	Grab

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Parameter	Monthly Ave Limit	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
Total Mercury	0.0021***	Report	ug/l	Daily	Grab
Total Molybdenum**		Report	ug/l	Daily	Grab
Total Nickel***		Report	ug/l	Daily	Grab
Total Potassium		Report	ug/l	Daily	Grab
Total Selenium**	5	25	ug/l	Daily	Grab
Total Silver***	0.4	17	ug/l	Daily	Grab
Total Strontium**		Report	ug/l	Daily	Grab
Total Sulfate		Report	ug/l	Daily	Grab
Total Thallium**		Report	ug/l	Daily	Grab
Total Vanadium**		Report	ug/l	Daily	Grab
Total Zinc**		Report	ug/l	Daily	Grab

* **Specific Conductance**

a) The permittee must monitor specific conductance continuously, record the daily average and submit the results to the Department along with the monthly Compliance Monitoring Reports. The permittee must calibrate the specific conductance meter weekly, and keep a log on site of the calibration results. The log must contain the calibration results, date of calibration and the person that performed the calibration. The log shall be made immediately available to the Department upon request.

b) On or before any discharge to the rapid infiltration beds, the permittee shall correlate results from the continuous specific conductance testing to an effluent quality that meets the Effluent Limits in Part 1, Section 1 of this permit and Expected Effluent Quality described in Attachment I. The permittee shall submit written verification of the correlation, including all related effluent quality and specific conductance data, meter sensitivity and error, and the range of specific conductance values whereby the treatment system will meet the Expected Effluent Quality. The authorized range of specific conductance values from this testing will be referred to as the “Allowable Operational Range” for specific conductance.

** **Method Quantification Level**

a) The appropriate Method Quantification Levels and Methodology are listed in Attachment II unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination. Upon approval of the Department, the permittee may use alternate analytical methods.

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*** **Mercury**

a) Compliance with the Total Mercury Effluent Limit (TMEL) shall be determined as a 12-month rolling average. The 12-month rolling average shall be determined by adding the present monthly average result to the preceding 11 monthly average results then dividing the sum by 12. The monthly average is the sum of the results of all data obtained in a given month divided by the total number of samples taken. If the 12-month rolling average for any month is less than the TMEL the permittee will be considered to be in compliance for total mercury for that month.

b) The analytical protocol for total mercury testing requirements shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry". The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

c) The use of clean technique sampling procedures is strongly recommended. Guidance for clean technique sampling is contained in: EPA Method 1669*, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance),* EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

d) The permittee may request a reduction in the monitoring frequency if the data indicate that the 12-month rolling average mercury concentration is less than the TMEL. This request shall contain an explanation as to why the reduced monitoring is appropriate and shall be submitted to the Department. Upon receipt of written approval and consistent with such approval, the permittee may reduce the monitoring frequency for total mercury indicated in Section1 of this permit. The Department may revoke the approval for reduced monitoring at any time upon notification to the permittee.

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Parameter	**Limit**	**Units**	**Frequency of Analysis**	**Sample Type**
Monitoring Point **LA-1**				
Application Rate	10	gallons/sq ft	Daily	Calculation

a) Sampling Locations
Influent flow, effluent flow, effluent quality and land application rate shall be measured in accordance with the approved sampling plan. The location and method of collecting and analyzing effluent quality and soil samples shall be in accordance with the approved sampling plan. The Department may approve alternate sampling locations which are demonstrated by the permittee to be representative.

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2. Final Effluent Limitations

During the period beginning at least 90 days after start-up of the wastewater treatment system, and the wastewater treatment system has demonstrated compliance in meeting initial permit effluent limitations; the permittee is authorized to discharge a maximum of 504,000 gallons per day, 184,000,000 gallons per year, of Mine Contact Water from the monitoring points listed below to the groundwater in the NW ¼ of the NE ¼, Section 12, T50N, R29W, Michigamme Township, Marquette County, Michigan. The discharge shall be limited and monitored by the permittee as specified below.

Parameter	Monthly Ave Limit	Maximum Daily Limit	Units	Frequency of Analysis*	Sample Type
INFLUENT: Monitoring Point **IF-1**					
Flow		Report	GPD	Daily	Report Total
EFFLUENT: Monitoring Point **EQ-1**					
Flow		504,000	GPD	Daily	Report Total
Flow		184,000,000	GPY	Annually	Calculation
Biochemical Oxygen Demand (BOD_5)		10	mg/l	Weekly	24 hr composite
Dissolved Oxygen		Report	mg/l	Monthly	24 hr composite
Ammonia Nitrogen		Report	mg/l	Monthly	24 hr composite
Nitrate Nitrogen		Report	mg/l	Monthly	24 hr composite
Nitrite Nitrogen		Report	mg/l	Monthly	24 hr composite
pH (Minimum)		6.5	S.U	Continuous	Grab
pH (Maximum)		9.0	S.U	Continuous	Grab
Total Phosphorus		Report	mg/l	Monthly	24 hr composite
Total Chloride		Report	mg/l	Monthly	24 hr composite
Total Sodium		Report	mg/l	Monthly	24 hr composite
Specific Conductance		Report**	umhos/cm	Continuous	Measurement
Total Aluminum		Report	mg/l	Monthly	24 hr composite
Total Antimony***		Report	ug/l	Monthly	24 hr composite
Total Arsenic***	6.0	10	ug/l	Weekly	24 hr composite
Total Barium***		Report	ug/l	Monthly	24 hr composite
Total Beryllium***		Report	ug/l	Monthly	24 hr composite
Total Boron***		285	ug/l	Weekly	24 hr composite
Total Cadmium***	3.0	5	ug/l	Weekly	24 hr composite
Total Chromium***		Report	ug/l	Monthly	24 hr composite
Total Cobalt***		Report	ug/l	Monthly	24 hr composite
Total Copper***	10	21	ug/l	Weekly	24 hr composite
Total Fluoride		Report	ug/l	Monthly	24 hr composite
Total Iron		Report	ug/l	Monthly	24 hr composite
Total Lead***		Report	ug/l	Monthly	24 hr composite
Total Lithium***		Report	ug/l	Monthly	24 hr composite
Total Manganese***		Report	ug/l	Monthly	24 hr composite
Total Mercury	0.0021****	Report	ug/l	Weekly	Grab
Total Molybdenum***		Report	ug/l	Monthly	24 hr composite

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Parameter	Monthly Ave Limit	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
Total Nickel***		Report	ug/l	Monthly	24 hr composite
Total Potassium		Report	ug/l	Monthly	24 hr composite
Total Selenium***	5	25	ug/l	Weekly	24 hr composite
Total Silver***	0.4	17	ug/l	Weekly	24 hr composite
Total Strontium***		Report	ug/l	Monthly	24 hr composite
Total Sulfate		Report	ug/l	Monthly	24 hr composite
Total Thallium***		Report	ug/l	Monthly	24 hr composite
Total Vanadium***		Report	ug/l	Monthly	24 hr composite
Total Zinc***		Report	ug/l	Monthly	24 hr composite

* **Reduction in Monitoring Frequency**

a) After the submittal of six (6) months of data, the permittee may request, in writing, Department approval of a reduction in monitoring frequency for parameters other than flow, pH, specific conductance and mercury. This request shall contain an explanation as to why the reduced monitoring is appropriate. Upon receipt of written approval and consistent with such approval, the permittee may reduce the monitoring frequency indicated in Part I, Section 1 of this permit. The monitoring frequency for parameters other than mercury shall not be reduced to less than monthly. The Department may revoke the approval for reduced monitoring at any time upon notification to the permittee.

** **Specific Conductance**

a) The permittee must monitor specific conductance continuously, record the daily average and submit the results to the Department along with the monthly Compliance Monitoring Reports. The permittee must calibrate the specific conductance meter weekly, and keep an on site log of the calibration results. The log must contain the calibration results, date of calibration and the person that performed the calibration. The log shall be made immediately available to the Department upon request.

b) On or before any discharge to the rapid infiltration beds, the permittee shall correlate results from the continuous specific conductance testing to an effluent quality that meets the Effluent Limits in Part 1, Section 1 of this permit and Expected Effluent Quality described in Attachment I. The permittee shall submit written verification of the correlation, including all related effluent quality and specific conductance data, meter sensitivity and error, and the range of specific conductance values whereby the treatment system will meet the Expected Effluent Quality. The authorized range of specific conductance values from this testing will be referred to as the "Allowable Operational Range" for specific conductance.

c) If specific conductance levels fall outside the Allowable Operational Range, the permittee must notify the department within 24 hours, and within 7 days submit a report indicating the source of the results and steps taken to bring the specific conductance back within the Allowable Operational Range. The permittee must also collect effluent quality samples at the frequency and for the parameters listed in Part I, Section 1 of this permit until they demonstrate that the effluent quality is in compliance with the limitations described in Part I, Section 2 of this permit. If sample results indicate a specific permit

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limit has been exceeded or the expected effluent quality is detected at concentrations greater than five times the Expected Effluent Quality listed in Attachment I, the permittee must also include in the written notification the steps taken to bring the treatment system back into compliance with this permit. Once the permittee has demonstrated compliance with this permit, the sampling frequency will revert to that described in Part I, Section 2 of this permit.

*** **Method Quantification Level**

a) The appropriate Method Quantification Levels and Methodology are listed in Attachment II unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination. Upon approval of the Department, the permittee may use alternate analytical methods.

**** **Mercury**

a) Compliance with the Total Mercury Effluent Limit (TMEL) shall be determined as a 12-month rolling average. The 12-month rolling average shall be determined by adding the present monthly average result to the preceding 11 monthly average results then dividing the sum by 12. The monthly average is the sum of the results of all data obtained in a given month divided by the total number of samples taken. If the 12-month rolling average for any month is less than the TMEL the permittee will be considered to be in compliance for total mercury for that month.

b) The analytical protocol for total mercury testing requirements shall be in accordance with EPA Method 1631, Revision E, “Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry”. The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

c) The use of clean technique sampling procedures is strongly recommended. Guidance for clean technique sampling is contained in: EPA Method 1669*, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance),* EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

d) The permittee may request a reduction in the monitoring frequency if the data indicate that the 12-month rolling average mercury concentration is less than the TMEL. This request shall contain an explanation as to why the reduced monitoring is appropriate and shall be submitted to the Department. Upon receipt of written approval and consistent with such approval, the permittee may reduce the monitoring frequency for total mercury indicated in Section1 of this permit. The Department may revoke the approval for reduced monitoring at any time upon notification to the permittee.

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LAND APPLICATION

Parameter	Limit	Units	Frequency of Analysis	Sample Type
Monitoring Point **LA-1**				
Application Rate	10	gallons/sq ft	Daily	Calculation

a) Sampling Locations
Influent flow, effluent flow, effluent quality and land application rate shall be measured in accordance with the approved sampling plan. The location and method of collecting and analyzing effluent quality and soil samples shall be in accordance with the approved sampling plan. The Department may approve alternate sampling locations which are demonstrated by the permittee to be representative.

3. Groundwater Monitoring and Limitations
During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee shall sample the groundwater from the **hydraulically upgradient and side gradient groundwater monitor wells** QAL026A, QAL026D, QAL029A, QAL029D, QAL053A, QAL055A and QAL056A as described below:

Parameter	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
Static Water Elevation	Report	USGS-Ft	Quarterly	Measured
Bicarbonate	Report	mg/l	Quarterly	Grab
Dissolved Oxygen	Report	mg/l	Quarterly	Grab
Ammonia Nitrogen	Report	mg/l	Quarterly	Grab
Nitrate Nitrogen	report	ug/l	Quarterly	Grab
Nitrite Nitrogen	report	ug/l	Quarterly	Grab
pH	Report	S.U.	Quarterly	Grab
Total Phosphorus	Report	mg/l	Quarterly	Grab
Specific Conductance	Report	umhos/cm	Quarterly	Grab
Sulfate	Report	mg/l	Quarterly	Grab
Chloride	Report	mg/l	Quarterly	Grab
Sodium	Report	mg/l	Quarterly	Grab
Antimony	Report	ug/l	Quarterly	Grab
Arsenic	Report	ug/l	Quarterly	Grab
Barium	Report	ug/l	Quarterly	Grab
Beryllium	Report	ug/l	Quarterly	Grab
Boron	Report	ug/l	Quarterly	Grab
Cadmium	Report	ug/l	Quarterly	Grab
Calcium	Report	mg/l	Quarterly	Grab
Chromium	Report	ug/l	Quarterly	Grab
Cobalt	Report	ug/l	Quarterly	Grab
Copper	Report	ug/l	Quarterly	Grab
Iron	Report	mg/l	Quarterly	Grab
Lead	Report	ug/l	Quarterly	Grab
Lithium	Report	ug/l	Quarterly	Grab

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Parameter	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
Magnesium	Report	mg/l	Quarterly	Grab
Manganese	Report	mg/l	Quarterly	Grab
Mercury	Report	ug/l	Quarterly	Grab
Molybdenum	Report	ug/l	Quarterly	Grab
Nickel	Report	ug/l	Quarterly	Grab
Potassium	Report	mg/l	Quarterly	Grab
Selenium	Report	ug/l	Quarterly	Grab
Silver	Report	ug/l	Quarterly	Grab
Strontium	Report	ug/l	Quarterly	Grab
Thallium	Report	ug/l	Quarterly	Grab
Vanadium	Report	ug/l	Quarterly	Grab
Zinc	Report	ug/l	Quarterly	Grab

a) **Sampling Locations**
Quarterly groundwater sampling shall be conducted during the months of February, May, August and November. Groundwater samples shall be collected and analyzed from each of the specified monitoring wells in accordance with the methods approved by the Department in the Sampling and Analysis Plan. The Department may approve or require alternate sampling locations which are demonstrated to be representative.

4. **Groundwater Monitoring and Limitations**
During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee shall sample the groundwater from **hydraulically downgradient groundwater monitor wells**. The discharge of treated wastewater shall not cause the groundwater in monitor wells QAL008A, QAL008D, QAL050A, QAL051A, QAL051D, QAL052A, QAL057A, and QAL057D to exceed the limitations below.

Parameter	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
Static Water Elevation	Report	USGS-Ft	Quarterly	Measured
Bicarbonate	Report	mg/l	Quarterly	Grab
Dissolved Oxygen	Report	mg/l	Quarterly	Grab
Ammonia Nitrogen	10.0	mg/l	Quarterly	Grab
Nitrate Nitrogen	10.0	mg/l	Quarterly	Grab
Nitrite Nitrogen	Report	mg/l	Quarterly	Grab
pH (Minimum)	6.5	S.U.	Quarterly	Grab
pH (Maximum)	9.0	S.U.	Quarterly	Grab
Total Phosphorus	Report	mg/l	Quarterly	Grab
Specific Conductance	Report	umhos/cm	Quarterly	Grab
Sulfate	250	mg/l	Quarterly	Grab
Chloride	250	mg/l	Quarterly	Grab
Sodium	120	mg/l	Quarterly	Grab
Antimony	5.0	ug/l	Quarterly	Grab
Arsenic	6.0	ug/l	Quarterly	Grab

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Parameter	Maximum Daily Limit	Units	Frequency of Analysis	Sample Type
Barium	1000	ug/l	Quarterly	Grab
Beryllium	3	ug/l	Quarterly	Grab
Boron	285	ug/l	Quarterly	Grab
Cadmium	3.0	ug/l	Quarterly	Grab
Calcium	Report	mg/l	Quarterly	Grab
Chromium	52	ug/l	Quarterly	Grab
Cobalt	23	ug/l	Quarterly	Grab
Copper	10	ug/l	Quarterly	Grab
Iron	Report	mg/l	Quarterly	Grab
Lead	3.0	ug/l	Quarterly	Grab
Lithium	88	ug/l	Quarterly	Grab
Magnesium	Report	mg/l	Quarterly	Grab
Manganese	50	ug/l	Quarterly	Grab
Mercury	Report	ug/l	Quarterly	Grab
Molybdenum	22	ug/l	Quarterly	Grab
Nickel	57	ug/l	Quarterly	Grab
Potassium	Report	mg/l	Quarterly	Grab
Selenium	5.0	ug/l	Quarterly	Grab
Silver	0.4	ug/l	Quarterly	Grab
Strontium	2300	ug/l	Quarterly	Grab
Thallium	1.0	ug/l	Quarterly	Grab
Vanadium	2.2	ug/l	Quarterly	Grab
Zinc	1200	ug/l	Quarterly	Grab

a) Sampling Locations
Quarterly groundwater sampling shall be conducted during the months of February, May, August and November. Groundwater samples shall be collected and analyzed from each of the specified monitoring wells in accordance with the methods approved by the Department in the Sampling and Analysis Plan. The Department may approve or require alternate sampling locations which are demonstrated to be representative.

5. Schedule of Compliance
The permittee shall comply with the following schedule. Submittals shall comply with Rule 323.2218. All submittals shall be to the Department.

a) On or before 180 days prior to discharge, the permittee shall submit for review and approval Sampling and Analysis Plans (SAP) pursuant to Rule 2223 for both effluent and groundwater monitoring.

b) On or before 30 days following completion of construction of wastewater treatment facility, pursuant to Rule 2218(4)(a) the permittee shall submit a certification that a quality control and quality assurance program was utilized and the facilities constructed were built consistent with standard construction practices to comply with the permit and the NREPA. This certification shall be by an engineer licensed under Act 299 of the Public Acts of 1980.

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c) On or before 45 days following completion of construction of wastewater treatment facility, the permittee shall submit for review and approval an Operations and Maintenance Manual pursuant to Rule 2218(4)(b). A guidance document is available via the Internet at: http://www.michigan.gov/deq/0,1607,7-135-3313_4117-9782--,00.html.

d) On or before 30 days following the issuance of this permit, the permittee shall submit for review and approval a work plan for the installation of the remaining upgradient and downgradient monitoring wells.

e) On or before 60 days following approval of the Monitor Well Work Plan, the permittee shall install the monitoring wells.

f) On or before 90 days following installation of the monitor wells required in Section 4.e of this permit, the permittee shall submit a report of monitor well installation. The report shall contain a work plan for establishment of background groundwater quality in the monitor wells.

g) On or before before 180 days following installation of the monitor wells required by Section 4.e of this permit, the permittee shall submit monitoring well sampling results which establish background water quality.

6. Operator Certification
The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA.

7. Facility Operation and Maintenance
During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee shall comply with the inspection, operation and maintenance program requirements specified below.

Location	Condition	Measurement Frequency	Sample Type
Contact Water Basins	Freeboard -2 foot minimum	Weekly	Visual Observation
	Control Structures	Weekly	Visual Observation
	Dike Integrity	Weekly	Visual Observation
	Vegetation Control	Weekly	Visual Observation
	Nuisance Animals	Weekly	Visual Observation
	Odors	Weekly	Olfactory Observation
Rapid Infiltration Beds	Vegetation Control	Weekly	Visual Observation

a) Contact Water Basin Inspection
These inspections shall include:
(1) the lagoon dikes for vegetative growth, erosion, slumping, animal burrowing or breakthrough;

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(2) the depth of the water in each cell and the freeboard with a minimum two (2) feet of freeboard being maintained at all times;
(3) the control structures and pump stations to assure that valves, gates and alarms are set correctly and properly functioning;
(4) the lagoon security fence and warning signs.

b) Facility Maintenance
The permittee shall implement a Facility Maintenance Program that incorporates the following management practices unless otherwise authorized by the Department.
(1) Vegetation shall be maintained at a height not more than six (6) inches above the ground on lagoon dikes.
(2) Not more than 10 percent of the water surface shall be covered by floating vegetation and not more than 10 percent of the water perimeter may have emergent rooted aquatic plants.
(3) Dike damage caused by erosion, slumping or animal burrowing shall be corrected immediately and steps taken to prevent occurrences in the future.
(4) The integrity of the lagoon liner shall be protected. Liner damages shall be corrected immediately and steps taken to prevent future occurrences.
(5) A schedule for the inspection and maintenance of the collection system, lift stations, mechanical and electrical systems, transfer stations, and control structures shall be developed and implemented.

c) Contact Water Basin Drawdown Conditions
The permittee shall observe the following conditions when drawing down a cell for transfer or discharge unless otherwise authorized by the Department.
(1) Water discharged shall be removed from the cell at a rate of less than 500 GPM.
(2) The permittee shall maintain a minimum of two feet of freeboard in all cells at all times. Upon written notification, the Department may require a minimum of three feet of freeboard for larger systems.
(3) The permittee shall maintain a minimum of two feet of water in all cells at all times, except with the approval of the DEQ.

8. Submittal Requirements for Self-Monitoring Data

The permittee shall submit self-monitoring data monthly on the Department's Compliance Monitoring Report (CMR) for each calendar month of the authorized discharge period to:

NMS-CMR-Data Entry-Groundwater
Water Bureau
Michigan Department of Environmental Quality
P.O. Box 30273
Lansing, Michigan, 48909-7773

and

Upper Peninsula District Office
DEQ-Water Bureau
420 5th Street
Gwinn, Michigan 49841

The forms shall be postmarked no later than 30 days following each month of the authorized discharge period(s).

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Alternative Daily Discharge Monitoring Report formats may be used if they provide equivalent reporting details and are approved by the Department.

9. General Conditions

a) The discharge shall not be, or not be likely to become, injurious to the protected uses of the waters of the state.
b) The discharge shall not cause runoff to, ponding on, or flooding of adjacent property, shall not cause erosion, and shall not cause nuisance conditions.
c) The point of discharge shall be located not less than 100 feet inside the boundary of the property where the discharge occurs, unless a lesser distance is specifically authorized in writing by the Department.
d) The discharge shall not create a facility as defined in Part 201, Environmental Response, of the NREPA.
e) Thirty days prior to the start of construction of the wastewater treatment facility, the permittee shall provide documentation to the Department that they have legal authority to discharge on state land owned by the Michigan Department of Natural Resources.

10. Other Conditions

a) **Basis of Design** - The discharge shall be treated in accordance with the approved basis of design pursuant to Rule 2218(2).
b) **Wastewater Characterization** - The chemical, biological, and physical quality of the influent wastewater shall not be altered such that the treatment system will no longer produce an effluent that is in compliance with the limitations described in Part I, Section 2 of this permit.
c) **Land Application:**
Rapid Infiltration
(1) The system shall consist of two (2) or more cells or absorption areas that can be alternately loaded and rested or consist of one (1) cell or absorption area preceded by an effluent storage or stabilization pond system. If only one (1) cell or absorption area is provided, then the storage or stabilization pond shall be operated on a fill and draw basis and have sufficient capacity to allow intermittent loading of the cell or absorption area.
(2) For a system that has more than one (1) cell or absorption area, an individual cell or absorption area of the system shall be capable of being taken out of service without disrupting application to other cells or absorption areas of the system.
(3) An appropriate hydraulic loading cycle shall be developed and implemented to maximize long-term infiltration rates and allow for periodic maintenance.
d) **Notification of Changes in Discharge** – If any chemical listed in Attachment I is detected in the effluent monitoring at concentrations greater than 5 times the Expected Effluent Quality specified in Attachment I, the permittee shall notify the Department, in writing, within 10 days of receiving such analytical results. The Department will evaluate the data and notify the permittee in writing if additional monitoring, treatment or other corrective actions are necessary.
e) **Boron Notification** - Should boron levels in the effluent or groundwater reach or exceed 285 ug/l, the permittee must notify the department within 24 hours, and within 7 days submit a report indicating the source of the results and describe the steps taken to bring boron levels back into compliance with this permit.

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f) **Sampling Frequency Reduction** - Pursuant to Rule 2223(1), the Department may modify the effluent or groundwater monitoring parameters or frequency requirements of this permit, or they may be modified upon the request of the permittee with adequate supporting documentation.

11. Discharge Management Plan (DMP)

a) A land treatment system shall be designed, constructed, and operated as follows:
   (1) The system shall be designed and constructed to prevent surface runoff from either entering or exiting the system.
   (2) The system shall be designed and constructed to provide even distribution of wastewater during application. A header ditch, where used, shall be designed and constructed to allow for complete drainage after each wastewater loading or shall be lined to prevent seepage.
   (3) If vegetative cover is utilized and is considered part of the overall treatment system, then the design and construction of the system shall allow for the mechanical harvesting of vegetative cover.
   (4) The system shall be designed, constructed, and operated to allow an appropriate loading cycle. An appropriate loading cycle allows time between loadings for all of the following:
      (a) Soil organisms to biologically decompose organic constituents in the wastewater.
      (b) Organic solids on the soil surface to decompose.
      (c) The soil to become aerated.
      (d) Vegetative cover to utilize available nutrients provided through the application of the wastewater.
      (e) Soil conditions to become unsaturated and aerobic.

b) The design hydraulic loading or application rate, whether daily, monthly, or annual, shall not be more than one of the following:
   (1) Three percent of the permeability of the most restrictive soil layer within the solum over the area of the discharge when determined by either the cylinder infiltration method or air entry permeameter test method.
   (2) Seven percent of the permeability of the most restrictive soil layer within the solum over the area of the discharge as determined by the saturated hydraulic specific conductance method.
   (3) Twelve percent of the permeability of the most restrictive soil layer within the solum over the area of the discharge as determined by the basin infiltration method.
   (4) If published information is utilized, the discharger shall determine the methodology used to measure the reported hydraulic specific conductance. If the hydraulic specific conductance is given as a range of expected values, then a discharger shall use the minimum value given the most restrictive soil layer within the solum when calculating the hydraulic loading or application rate.

c) The system shall be designed, constructed, and operated so as to prevent the development of sodic conditions within the solum of the discharge area. Sodic conditions are considered to exist in the solum when the exchangeable sodium percentage, which is the percentage of the cation exchange capacity of a soil occupied by sodium, is more than 15 percent.

d) All of the following operation and maintenance requirements shall be met:
   (1) Portions of the wastewater distribution system shall be capable of being taken out of service for maintenance and other operational activities and to provide rest to portions of the irrigation area without disrupting applications to other areas of the system.
   (2) All areas within a system shall be accessible for maintenance equipment.

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(3) For slow rate and overland flow treatment systems, the pH of the plow layer within the discharge area shall be maintained between 6.0 and 7.5 standard units.

e) The discharge to a land treatment system shall be limited so that the discharge volume combined with the precipitation from a 10-year frequency, 24-hour duration rainfall event does not overflow the designed discharge area.

f) If any modifications are made to the management practices or specifications for the land application of wastewater, including but not limited to changes in crops grown, yield goal for those crops, or supplemental fertilization provided by the permittee or a third party, the permittee shall submit a revised DMP on or before November 30 of the year prior to making the proposed change. Based on this submittal, the Department may modify this permit in accordance with applicable rules and laws.

12. Compliance Requirements

Compliance with all applicable requirements set forth in Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance with concentration limitations of effluent or groundwater shall be reported as follows.

a) The permittee shall notify the Department of all instances of noncompliance within 24 hours of making a determination that a limit has been exceeded; and shall include all of the following: 1) the name of the substance(s) for which a limit was exceeded; 2) the concentration at which the substance was found; and 3) the location(s) at which the limit was exceeded.

b) Within 24 hours from the time the permittee becomes aware of the noncompliance, the permittee shall resample the monitoring point at which the limit was exceeded for the substance for which a limit was exceeded.

c) Within 7 days of resampling, the permittee shall submit a written report that shall include all of the following: 1) the results of the confirmation sampling; 2) an evaluation of the cause for the limit being exceeded and the impact of that event to the groundwater; and 3) a proposal detailing steps taken or to be taken to prevent recurrence.

d) In accordance with applicable rules, the Department may require additional activities including, but not limited, to the following:
   (1) Change the monitoring program, including increasing the frequency of effluent monitoring or groundwater sampling, or both.
   (2) Develop and implement a groundwater monitoring program if one is not in place.
   (3) If the discharge is in a designated wellhead protection area, assess the affects of the discharge on the public water supply system.
   (4) Review the operational or treatment procedures, or both, at the facility.
   (5) Define the extent to which groundwater quality exceeds the applicable criteria that would designate the site as a facility under Part 201.
   (6) Revise the operational procedures at the facility.
   (7) Change the design or construction of the wastewater operations at the facility.
   (8) Initiate an alternative method of waste treatment or disposal.
   (9) If the standard is established by Rule 2222(5), reduce or eliminate use of the substance.
   (10) Close the facility or end the discharge that resulted in the applicable standard being exceeded.
   (11) Remediate contamination to comply with the terms of Part 201, if applicable.

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e) If the Department determines there is a change in groundwater quality from a normal operating baseline that indicates the concentration of a substance in groundwater may exceed an applicable limit, then the discharger shall take the following actions if required by the Department:
   (1) Change the monitoring program, including increasing the frequency of effluent sampling or groundwater sampling, or both.
   (2) Review the operational or treatment procedures, or both, at the facility.

13. Request for Discharge of Water Treatment Additives

In the event a permittee proposes to discharge water treatment additives (WTAs) to groundwater, the permittee shall submit a request to discharge WTAs to the Department for approval. Such requests shall be sent to the Surface Water Assessment Section, Water Bureau, Department of Environmental Quality, P.O. Box 30273, Lansing, Michigan 48909, with a copy to the Department contact listed on the cover page of this permit. Instructions to submit a request electronically may be obtained via the Internet (http://www.michigan.gov/deq and on the left side of the screen click on Water, Water Quality Monitoring, and Assessment of Michigan Waters; then click on the Water Treatment Additive List which is under the Information banner). Written approval from the Department to discharge such WTAs at specified levels shall be obtained prior to discharge by the permittee. Failure to obtain approval prior to discharging any WTA is a violation of this permit. Additional monitoring and reporting may be required as a condition for the approval to discharge the WTA. WTAs include such chemicals as herbicides used to kill weeds and grasses as part of lagoon maintenance.

A request to discharge WTAs to groundwater shall include all of the following:

a) product Information:
   (1) name of the product;
   (2) Material Safety Data Sheet;
   (3) product function (i.e. microbiocide, flocculants, etc.);
   (4) specific gravity if the product is a liquid ; and
   (5) annual product use rate (liquids in gallons per year and solids in pounds per year);
b) ingredient information:
   (1) name of each ingredient;
   (2) CAS number for each ingredient; and
   (3) fractional content by weight for each product;
c) the monitoring point from which the WTA is to be discharged;
d) the proposed WTA discharge concentration;
e) the discharge frequency (i.e., number of hours per day and number of days per year);
f) the type of removal treatment, if any, that the WTA receives prior to discharge;
g) relevant mammalian toxicity studies for the product or all of its constituents (if product toxicity data are submitted, the applicant shall provide information showing that the product tested has the same composition as the product listed under Item “a” above. Preferred studies are subchronic or chronic in duration, use the oral route of exposure, examine a wide array of endpoints and identify a no-observable-adverse-effect-level. Applicants are strongly encouraged to provide the preferred data. If preferred data are not available, then the minimum information needed is an oral rat LD50 study. In addition, an environmental fate analysis that predicts the mobility of the product/ingredients and their potential to migrate to groundwater may be provided.

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h) If the discharge of the WTA to groundwater is within 1,000 feet of a surface water body, the following information shall also be provided:
   (1) a 48-hour LC50 or EC50 for a North American freshwater planktonic crustacean (either Ceriodaphnia sp., Daphnia sp., or Simocephalus sp.); and
   (2) the results of a toxicity test for one other North American freshwater aquatic species (other than a planktonic crustacean) that meets a minimum requirement of Rule 323.1057(2) of the Water Quality Standards.

Prior to submitting the request, the permittee may contact the Surface Water Assessment Section by telephone at 517-335-1180 or via the Internet at the address given above to determine if the Department has the product toxicity data required by Item "g" above. If the Department has the data, the permittee will not need to submit product toxicity data.

14. Definitions

This list of definitions may include terms **not applicable** to this individual permit.

Annual frequency of analysis refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

Biosolids are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

Bulk biosolids means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

By-Pass means any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit.

Class B Biosolids refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Daily Maximum is the maximum concentration of any individual sample taken during any calendar day. If the parameter concentration in any sample is less than the quantification limit, regard that value as zero when calculating the daily concentration.

For pH, report the maximum value of any individual sample taken during the month and the minimum value of any individual sample taken during the month.

Department means the Michigan Department of Environmental Quality.

Detection Level means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Flow Proportioned sample is a composite sample with the sample volume proportional to the effluent flow.

Furrow stream is the volume, in gallons per unit time, usually per minute, of wastewater discharged into the furrow.

GPD means gallons per day.

GPY means gallons per year.

Grab sample is a single sample taken at neither a set time nor flow.

MGD means million gallons per day.

Mg/l is a unit of measurement and means milligrams per liter.

Mine Contact Water means mine dewatering water, contact storm water from the main operations area, water from the temporary development rock storage area; truck wash water and water from the crusher operations.

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Monthly Average is the sum of the results of all data obtained in a given month divided by the total number of samples taken.

Monthly frequency of analysis refers to a calendar month. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

POTW is a publicly owned treatment works.

Quantification level means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

Quarterly frequency of analysis refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

Report means there is no limit associated with the individual substance for the medium that is being sampled, that the permittee must only report the result of the laboratory analysis.

Weekly frequency of analysis refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

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1. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24-hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a) that an upset occurred and that the permittee can identify the specific cause(s) of the upset;
b) that the permitted wastewater treatment facility was, at the time, being properly operated; and
c) that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

2. By-Pass Prohibition and Notification

a) By-Pass Prohibition – By-pass is prohibited unless: 1) by-pass was unavoidable to prevent loss of life, personal injury, or severe property damage; 2) there were no feasible alternatives to the by-pass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a by-pass; and 3) the permittee submitted notices as required under b. or c. below.
b) Notice of Anticipated By-pass - If the permittee knows in advance of the need for a by-pass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the by-pass, and provide information about the anticipated by-pass as required by the Department. The Department may approve an anticipated by-pass, after considering its adverse effects, if it will meet the three (3) conditions listed in 12.a. above.
c) Notice of Unanticipated By-pass - The permittee shall submit notice to the Department of an unanticipated by-pass by calling the Department at the number indicated on the first page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.
d) Written Report of By-pass - A written submission shall be provided within five (5) working days of commencing any by-pass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the by-pass and its cause; the period of by-pass, including exact dates and times, and if the by-pass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the by-pass; and other information as required by the Department.
e) By-pass Not Exceeding Limitations - The permittee may allow any by-pass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These by-passes are not subject to the provisions of a., b., c., and d., above. This provision does not relieve the permittee of any notification responsibilities under Part II. Item 11 of this permit.
f) Definitions:
   (1) By-pass means the intentional diversion of waste streams from any portion of a treatment facility.
   (2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a by-pass. Severe property damage does not mean economic loss caused by delays in production.

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3. Start-up Notification
If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

4. Schedule of Compliance Notification
Within 14 days of every Schedule of Compliance date specified in this permit, the permittee shall submit a written notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

5. Notification of Changes in Discharge, Treatment or Facility Operations
If proposing to modify the quantity or effluent characteristics of the discharge or the treatment process for the discharge, the permittee shall notify the Department of the proposed modification prior to its occurrence. Significant modifications require the permittee to submit an application. A permit modification shall be processed in accordance with applicable rules and laws prior to implementation of the modification.

6. Transfer of Ownership or Control
In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

7. Representative Samples
Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. Guidance on how to collect representative samples is contained in Guidesheet III, “Characterization of Wastewater”, which is available via the Internet at http://www.deq.state.mi.us/documents/deq-wmd-gwp-P22GuidshtIII.pdf.

8. Test Procedures
Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to either SW-846, 3rd edition, September 1986, “Test Methods for the Evaluation of Solid Waste, Physical-Chemical Methods,” or Section 304(h) of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et seq), 40 CFR Part 136 - Guidelines Establishing Test Procedures for the Analysis of Pollutants, unless specified otherwise in this permit. Requests to use test procedures not defined here shall be submitted to the Department for review and approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee’s laboratory Quality Control/Quality Assurance program.

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9. Instrumentation
The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

10. Recording Results
For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

11. Records Retention
All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Department.

12. Additional Monitoring by Permittee
If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Compliance Monitoring Report. Such increased frequency shall also be indicated.

If the permittee monitors any pollutant not required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the reporting of the values required in the Compliance Monitoring Report.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (1987 P.A. 96) for assurance of proper facility operation shall be submitted as required by the Department.

13. Spill Notification
The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwater of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (Rules 324.2001 through 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the first page of this permit, or if the notice is provided after regular working hours call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from out-of-state dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventative measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

14. Facilities Operation
The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

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15. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a) provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or
b) upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

16. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (Rules 324.2001 through 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

17. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit or other pollutants) removed from or resulting from treatment or control of wastewaters, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwater of the state.

18. Treatment System Closure

a) In the event that discharges from a treatment system are planned to be eliminated, the permittee shall do the following:
   (1) Eliminate all physical threats associated with discharge related facilities not later than five (5) days after use of the facility has ceased.
   (2) Not less than 75 days before cessation of discharge related activities, characterize any wastewater, sediments and sludges related to the discharge, pursuant to Rule 2226(4)(a)(i-iii).

b) Within 30 days of completing the characterization, the discharger shall submit a closure plan to the Department for review and approval that describes how the wastewater, sediments and sludges associated with the discharge will be handled in accordance with Part 31, Part 115, Part 111, or Part 201, as appropriate.

c) Closure activities must be initiated within 30 days of Department approval of the Closure Plan, and must be completed within one (1) year of approval of the Closure Plan.

d) If the groundwater exceeds a standard established by the Department that would result in the site qualifying as a facility under Part 201, then the discharger shall comply with the requirements of Part 201.

e) The Department may require post closure monitoring activities to evaluate the effectiveness of the closure activities. Any wastewater or residual disposal inconsistent with the approved plan shall be considered a violation of this permit. After proper closure of the treatment system, this permit may be terminated.

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f) The discharger must certify completion of the approved closure plan. Certification shall be by a qualified person described as follows:
   (1) An engineer licensed under Act No. 299 of the Public Acts of 1980, as amended, being §339.101 et seq. Of the Michigan Compiled Laws, and known as the occupational code.
   (2) A professional geologist certified by the American Institute of Professional Geologists, 7828 Vance Drive, Suite 103, Arvada, Colorado 80003.
   (3) A professional hydrologist certified by the American Institute of Hydrology, 2499 Rice Street, Suite 135, St. Paul, Minnesota 55113.
   (4) A groundwater professional certified by the National Ground Water Association, Association of Groundwater Scientists and Engineers Division, 601 Dempsey Road, Westerville, Ohio 43081.
   (5) Another groundwater professional certified by an organization approved by the Department.

19. Right of Entry

The permittee shall allow the Department or any agent appointed by the Department, upon the presentation of credentials:

a) to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b) at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any effluent discharge, discharge of pollutants, and groundwater monitoring wells and soils associated with the discharge.

20. Availability of Reports

Except for data determined to be confidential under Rule 323.2128 of the Michigan Administrative Code, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department. Effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Sections 3112, 3115, 4106 and 4110 of the NREPA.

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PART III
DISCHARGE PROHIBITIONS

1. Discharge to the Surface Waters
This permit does not authorize any direct discharge to the surface waters. The permittee is responsible for obtaining any permits required by federal or state laws or local ordinances.

2. State Laws
Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation.

3. Property Rights
The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits or approvals as may be required by law.

4. Duty to Comply
All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Conditions, or terms of this permit constitutes a violation of the NREPA and constitutes grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of an application for permit renewal.

5. Civil and Criminal Liability
Except as provided in permit conditions on "Bypass" (Part II.12.), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

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ATTACHMENT I
KENNECOTT EAGLE MINE
GROUNDWATER DISCHARGE PERMIT NO. GW1810162

Expected Effluent Quality*

PARAMETER	EXPECTED EFFLUENT QUALITY (µg/L)
Aluminum	1.9
Antimony	1
Barium	1.4
Beryllium	0.05
Chloride	44000
Chromium	0.5
Cobalt	9.2
Fluoride	41
Iron	3.2
Lead	0.5
Lithium	4.2
Manganese	2.4
Molybdenum	1.1
Nickel	4.9
Nitrogen, Ammonia	2328
Nitrate	30
Phosphorus	0.8
Potassium	1200
Sodium	30000
Strontium	95
Sulfate	1700
Thallium	0.4
Vanadium	0.3
Zinc	18

The values listed in Attachment I, Expected Effluent Quality, are all below discharge standards specified in Rule 2222 of the Part 22 Rules. The values are the effluent limits that the permittee has indicated can be achieved by the treatment process approved pursuant to the Basis of Design required in Rule 2218(2).

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ATTACHMENT II
KENNECOTT EAGLE MINE
GROUNDWATER DISCHARGE PERMIT NO. GW1810162

Maximum Method Quantification Levels* for comparison with Michigan's Water Quality Standards**

Pollutant	Analytical Methods USEPA/SW-846	QL (µg/L)
Antimony	200.8/6020	1
Arsenic	200.8/6020	1
Barium	200.8/6020	5
Beryllium	200.8/6020	1
Boron	200.8/6020	20
Cadmium	200.8/6020	0.2
Chromium	200.8/6020	1
Copper	200.8/6020	1
Cobalt	200.8/6020	15
Lead	200.8/6020	1
Lithium	200.8/6020	8
Manganese	200.8/6020	5
Molybdenum	200.8/6020	25
Nickel	200.8/6020	2
Selenium	200.8/6020	1
Silver	200.8/6020	0.2
Strontium	200.8/6020	5
Thallium	200.8/6020	2
Vanadium	200.8/6020	2
Zinc	200.8/6020	10

* **Quantification level** means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

****Water Quality Standards** means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of Act No. 451 of the Public Acts of 1994, as amended, being Rules 323.1041 through 323.1117 of the Michigan Administrative Code.

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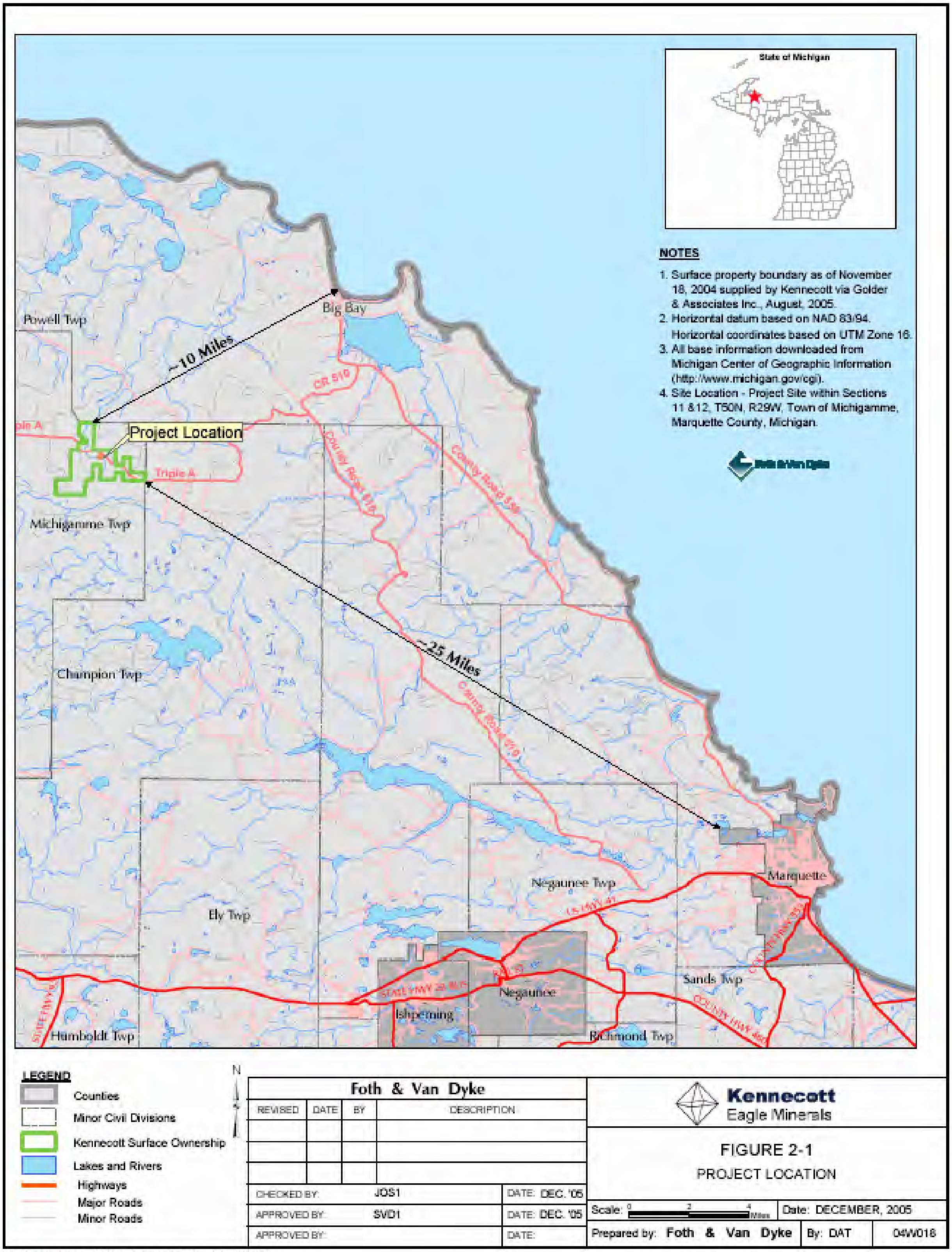
ATTACHMENT III
SITE MAP



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ATTACHMENT IV
SITE PLAN

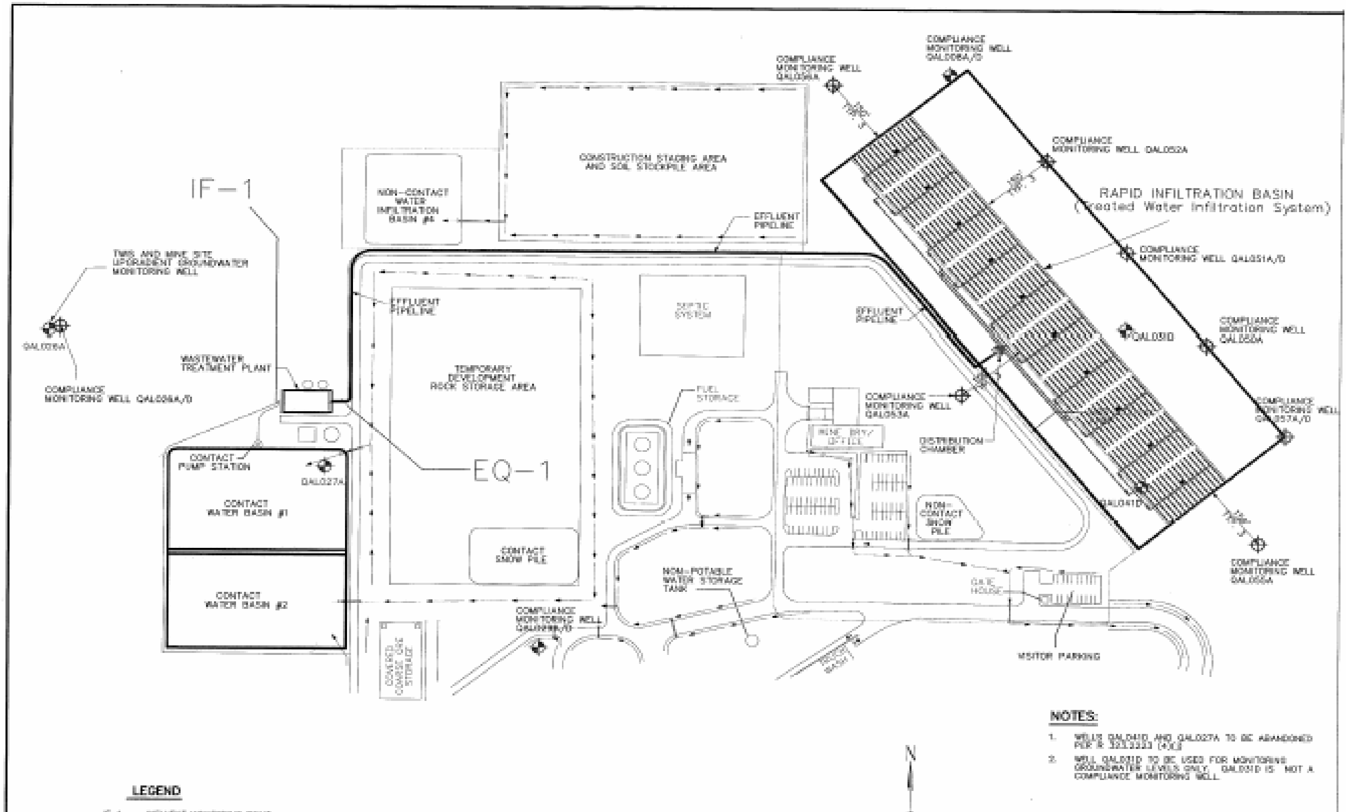

FIGURE 1

TREATED WATER INFILTRATION SYSTEM COMPLIANCE MONITORING POINTS

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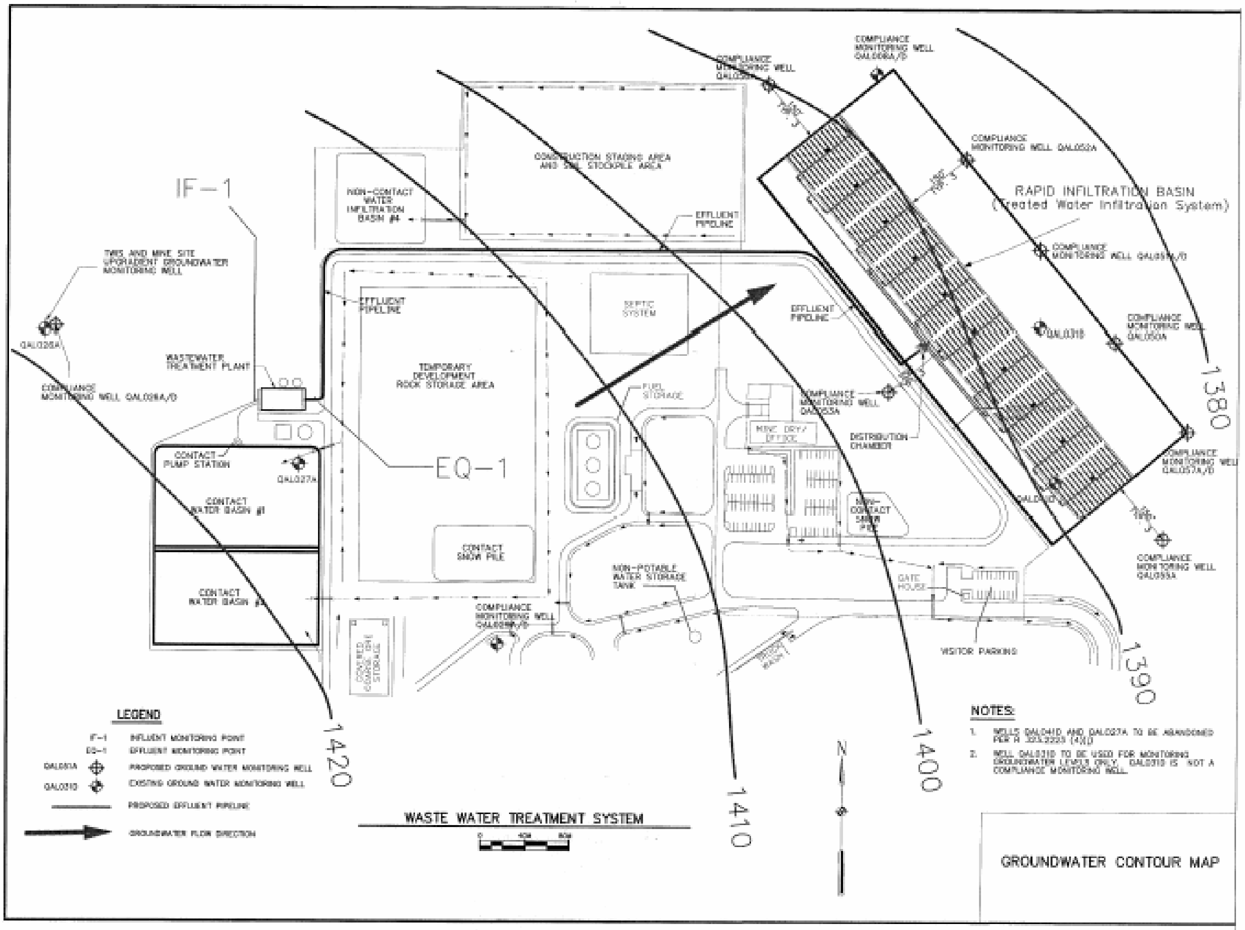
ATTACHMENT V
GROUNDWATER CONTOUR MAP



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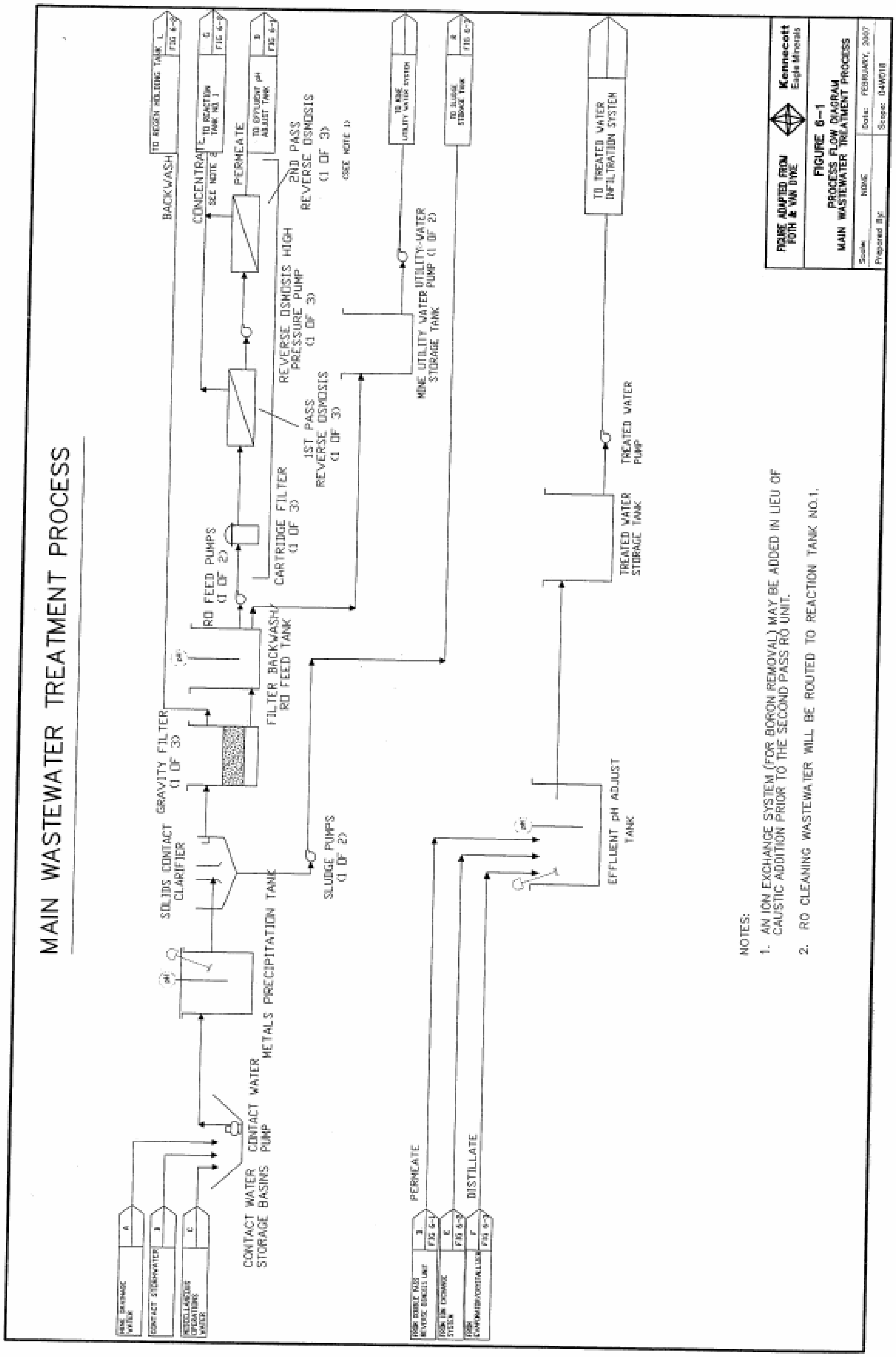
ATTACHMENT VI-A
FLOW DIAGRAM



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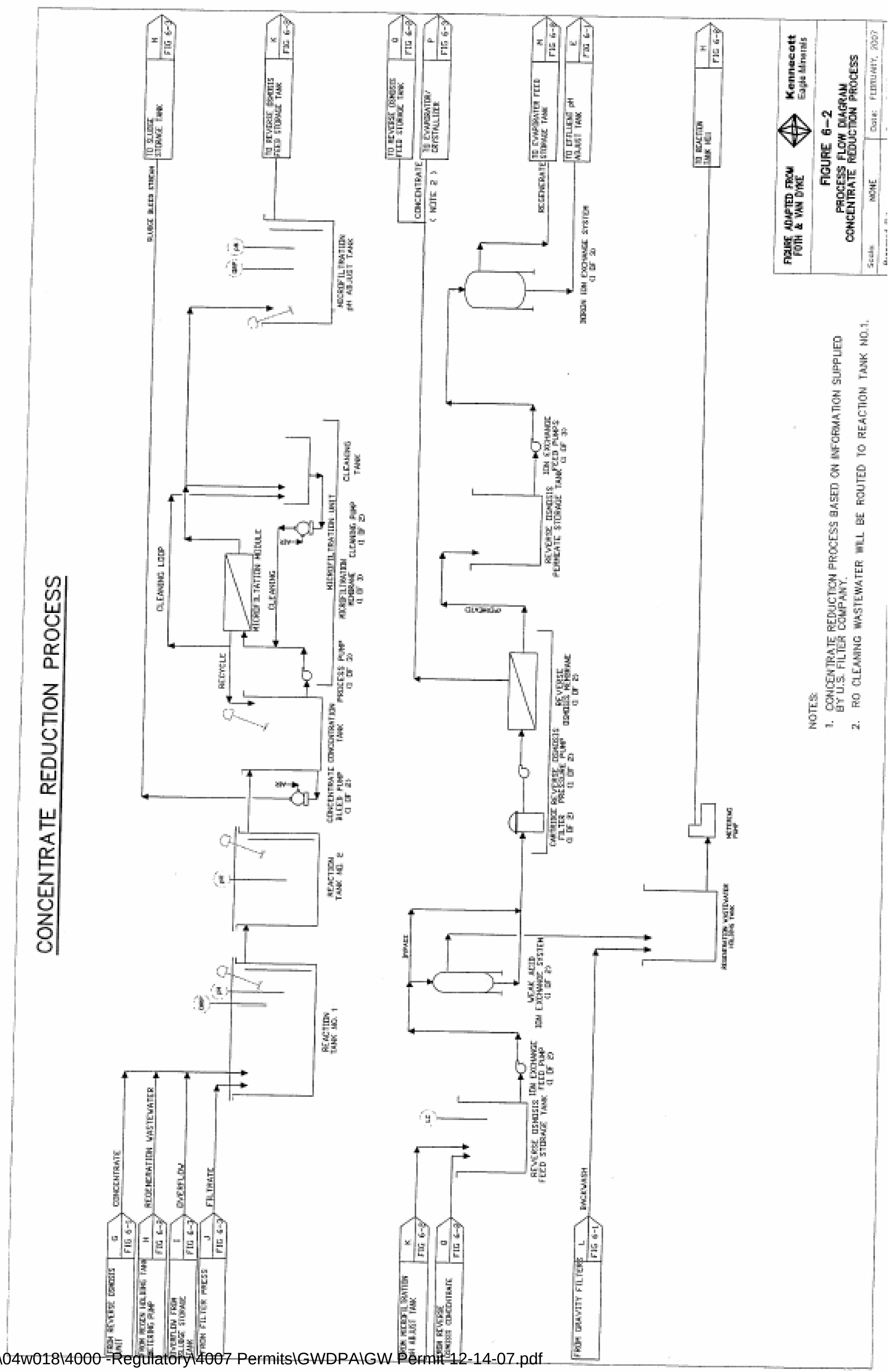
ATTACHMENT VI-B
FLOW DIAGRAM



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