14 October 2010 Project No. 073-81694.0022

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RE: RESPONSES TO SPECIFIC COMMENTS INCLUDED AS PART OF ATTACHMENT 1 TO CDPHE RFI #3, PIÑON RIDGE PROJECT, MONTROSE COUNTY, COLORADO

Dear Bob:

1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this letter to provide responses and additional information to specific comments from the Colorado Department of Public Health and Environment (CDPHE) in the Request for Information (RFI) #3 as provided in the letter from Steve Tarlton dated 19 August 2010. This letter includes responses prepared by Golder to specific comments included as part of Attachment 1 to RFI #3.

2.0 RESPONSES TO SPECIFIC COMMENTS

Responses have been prepared only for comments that Energy Fuels Resources Corporation (EFRC) has requested Golder's input or assistance. The specific comments and associated responses are provided in the following sections.

2.1 One-Acre Ore Pad Design Comments

Comment No. 1

License applicant has demonstrated adequate support for localized maximal loads for the steel-reinforced concrete 1-acre ore pad. Additional distributed loads due to ore piles should not be a concern. The nature of concrete is to crack over time. Joints allow for constructability and give some places for cracks to align to. Ore runoff can exit the concrete pad through developed cracks to underlying soils for infiltration prevention purposes. EF mentions a crack inspection, repair, and maintenance as a routine practice in numerous locations in the application. This should be formalized into a Division-approved plan. An alternative approach to this plan which provides an additional level of groundwater protection/soils contamination prevention is to design a HDPE (high-density polyethylene) liner w/collection system under the concrete such that even if the concrete cracks (which it eventually will), the infiltrated water and any particulates will be isolated and collected at sumps for recycle to process. Standard HDPE welding techniques and QA/QC apply. Note, that for the crack inspection, repair, and maintenance plan to be a viable replacement for the HDPE liner, the plan must be significantly robust. Please provide the plan or the HDPE liner design.

Response No. 1

Incorporation of a high-density polyethylene (HDPE) geomembrane liner beneath the concrete One-Acre Ore Pad is considered unnecessary, given the robust design of the ore pad. The concrete ore pad is designed with a minimum thickness of one foot, with continuous waterstops at closely spaced control

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joints. Therefore, EFRC will prepare a crack inspection, repair, and maintenance plan to address the Division's comment.

Comment No. 2

Construction and other crack control joints will be fitted with cast-in-place continuous waterstop. Please add this to all applicable drawings as depictions and notes for the 1-acre ore pad. Note, that this requirement could be alleviated using the HDPE liner as mentioned above.

Response No. 2

Continuous construction joints (CJ) were included in the original design of the One-Acre Ore Pad, as shown on Drawing 13 of the Revision A Design Drawings issued as part of the License Application (Golder, 2008). Details of the construction joints and waterstops were included as Details 2, 3, and 4 on Drawing 12 (Golder, 2008).

2.2 Five-Acre Ore Pad Design Comments

Comment No. 1

Re: Cushion Material Thickness Summary Sheet – The assumed 8 psi maximal stress was probably derived from the GCL vendor's information or from an additional GCL design reference. Please provide the information source to include in Attachment A as supporting documentation to the assumptions used in the calculations. Cushion pad composition of upper roadbase and lower on-site derived compacted fill is acceptable.

Response No. 1

The assumed 8-psi maximum stress assumption should be viewed in conjunction with the overliner thickness assumption, and not as a specific requirement, per se. A comprehensive overview of the situation can be found in Daniel (2004) who notes that the amount of soil cover needs to be sufficient to protect a GCL from "squeezing" of hydrated bentonite from beneath the wheels of construction equipment. If the soil cover thickness is inadequate, the passing vehicle will leave a "rut" of thinned bentonite and compromise the integrity of the material in the area of thinning. Koerner and Narejo (1995) reported that the soil cover thickness should be equal or larger than the width (diameter) of the loading surface in order to contain the bearing failure within the overburden layer, i.e., to prevent lateral squeezing of the bentonite contained in the GCL. In practice, this width of the loading surface is commonly assumed to correspond to the width of the tire of a large construction vehicle, with a typical overburden thickness about 300 to 450 mm (12 to 18 inches), depending on the specific site and anticipated equipment (Daniel, 2004). A field study confirming the validity of this assumption was conducted by Fox, et al. (1998).

For conservatism, one can assume that the vertical stresses induced by operating equipment remain below the levels observed by Koerner and Narejo (1995) to provide additional safety against the failure surface reaching the GCL layer. After considering failure loads reported by Koerner and Narejo (1995) for overburden thicknesses equal to the width of the loading surface, the vertical stress at the GCL surface can be estimated by using the Boussinesq solution for a circular footing:

$$\sigma_{z,\,failure} = q\left\{1-\left[\frac{1}{1+(R/z)^2}\right]^{3/2}\right\} = q\left\{1-\left[\frac{1}{1+(0.5H/H)^2}\right]^{3/2}\right\} = 0.284q$$

where q denotes the surface load. Conservatively assuming that 8 psi is the allowed stress on the GCL, the factor of safety of the GCL can be estimated as follows:

$$F_s = \frac{\sigma_{z,\,failure}}{\sigma_{z,allowed}} = \frac{0.284q}{8.0\,psi}$$

Using the above equation, the factor of safety (FOS) for various GCL products can be calculated from Koerner and Narejo (1995) data for a soil cover thickness 'equal' to the loading diameter, as summarized in the following table:

GCL Product	Failure Load (kN)	Surface Load (kPa)	Approx. Stress at GCL Level (kPa)	Approx. Stress at GCL Level (psi)	FOS (est.)
Adhesive Bonded e.g., Claymax®200R, Gundseal®	0.45	229.2	65.2	9.5	1.2
Needle Punched e.g., Bentomat®, Bentofix®	0.60	305.6	86.9	12.6	1.6
Stitch Bonded e.g., Claymax®500SP, NaBento®	0.55	280.1	79.7	11.6	1.4

The above table indicates that an approximate stress on the liner of 12.6 psi implies a factor of safety of 1.6 for the needle punched GCL, assuming that the width of the tire for the design loading equipment is equal or smaller than the thickness of the provided cover layer. The current design incorporates a reinforced (or needle punched) GCL, such as Bentomat® ST or Bentomat® DM, as manufactured by CETCO, or an approved equivalent material. Refer to specification Section 02776.1 for GCL material requirements.

Since the tire width of the design loading equipment (Cat 988H) is approximately 35 inches (less than 3.0 feet), the proposed cushion material thickness of 3.5 feet over the proposed reinforced GCL provides a factor of safety in excess of 1.6 against rutting, which is considered appropriate for design.

Comment No. 2

Re: Cushion Material Thickness Summary Sheet – the use of the specified articulated Cat 988H Wheel Loader, due to derived loading calculations for the cushion material thickness, will be stipulated in the license. The license applicant will be allowed to use alternative make/model same-type (articulated wheel loader) loading/moving equipment provided license applicant provides an acceptable demonstration that the loading is equivalent to or less than the Cat 988H.

Response No. 2

Golder has reviewed the design of the ore pad cushion material thickness (3.5 feet) in the context of potential equipment that may at some point access the ore pad. The details of this review are provided in Attachment 1. Preliminary evaluations were performed based on average loading conditions for each of the types of equipment using a simplified approach (see Attachment 1-1). Detailed liner stress analyses were then performed for selected types of equipment considering loads on each of the tires (see Attachment 1-2). A summary of the liner stress evaluation is provided in the following table:

No.	Type of Equipment	Model Name	Operating Weight (lbs)	Stress on Liner[a] (psi)
1	Rubber tire dozer	CAT 834H	106,844	6.8
2	Front loader	CAT 988H	112,092	7.2 (7.3[b])
3	Front loader	CAT 992	221,073	13.1 (13.1[b])
4	Bulldozer	CAT D10	148,277	7.5
5	Bulldozer	CAT D11	248,600	10.9
6	Side dump trailer	SmithCo S1-2317	25,000	4.1 (4.9[b])
7	Side dump trailer	SmithCo S2-4034	50,000	7.2 (4.9[b])
8	Side dump trailer	SmithCo S3-4234	75,000	9.0 (6.1[b])
9	Side dump trailer	SmithCo S5-4636	100,000	10.0

a Stress on liner using simplified calculations (refer to Table 1 in Attachment 1-1).
b Stress on liner using detailed calculations (utilizing specific tire, axle, and vehicle dimensions) (refer to worksheets included in Attachment 1-2).

Based on this evaluation, Golder recommends that access to the pad is restricted to the following equipment:

- Rubber tire dozers and front loaders with an operating weight below approximately 110,000 lbs using tire type 35/65R33 or tires resulting in smaller contact pressures. The largest equipment allowed to the pad in this category is a CAT 988H front-end loader.
- Bulldozers with an operating weight of 150,000 lbs or smaller exerting a surface pressure of approximately 22.4 psi of less. The largest equipment allowed to the pad in this category is a CAT D10 bulldozer (with a shoe width of 24 inches or more).
- Haul tracks and side dump trucks with a maximum 3-axle semi-trailer (SmithCo S3-4234 or equivalent). Calculations indicate that standard trucks and trailers with up to three axles (rear and/or front) may be allowed to access the pad. The weight per axle is limited to 25,000 lbs with a minimum of four tires per load-carrying axle assuming tire type 11R22.5, or tires resulting in smaller contact pressures.

Comment No. 3

Re: Cushion Material Thickness Summary Sheet – It is assumed that the Cat 988H provides the greatest loading to pad. If side dump units are allowed onto the pad due to southeast access ramp to pad and language in text that says side dump equipment could be used also, is the 988H still the limiting factor for design purposes? Please demonstrate this by providing information on heaped side loading units to be used, specifically maximal wheel load pressure for comparison along with the calculation.

Response No. 3

As discussed in the Response to Comment No. 2 above, detailed wheel load pressure calculations are provided in Attachment 1-2 to this letter for various equipment that may at some point access the Five-Acre Ore Pad. These calculations indicate that the maximum liner loading for a 3.5-foot thick cushion material (as designed) exposed to loading from a CAT 988H loader is approximately 7.3 psi; this corresponds to a factor of safety of 1.5 against frictional failure and a factor of safety in excess of 1.6 against rutting (refer to Response No. 1 in this section). Factors of safety against frictional failure reported in Attachment 1-2 were calculated as a ratio between the applied shear stress and the shear strength of the overburden material, assuming a friction angle of 30 degrees and zero cohesion, i.e., stable overburden material was required to ensure liner integrity. Note that the overburden friction, rather

than the GCL/overburden interface friction, is used in the analysis since the allowed pressure on the liner (conservatively assumed as 8 psi) and the anticipated contact load widths (the contact load width needs to be smaller than the design overburden thickness of 3.5 feet) indicate overburden failure above the GCL/overburden interface (see, e.g., Koerner and Narejo [1995] and Daniel [2004]). Liner loads and factors of safety for side dump trailers with single, double and triple rear axle designs (axle capacity of 25,000 lbs) as well as the CAT 988H loader are summarized in the following table:

Equipment	**Cushion Material Thickness = 3.5 feet**		**Cushion Material Thickness = 4.0 feet**	
	Maximum Additional Liner Load (psi)	**Factor of Safety, FOS (-)**	**Additional Liner Load (psi)**	**Factor of Safety, FOS (-)**
Front End Loader Cat 988H	7.3	1.5	5.8	1.8
Single Rear Axle Trailer Smith Co. S1-2317	4.9	1.8	3.8	2.2
Double Rear Axle Trailer Smith Co. S2-4034	4.9	1.8	3.9	2.2
Triple Rear Axle Trailer Smith Co. S3-4234	6.1	1.6	5.1	1.9

The above table demonstrates that side-dump trailers exert vertical stresses of smaller magnitudes than those resulting from a CAT 988H loader. For the designed cushion material thickness of 3.5 feet, vertical stresses on the liner caused by side-dump trailer loading are equal or less than 6.1 psi, and result in factors of safety that are greater than those calculated for access to the ore pad by a typical CAT 988H loader.

Comment No. 4

Re: GCL placement – will they be butted end-to-end and edge-to-edge or will they be overlapped? A description of the installation procedure is needed. What is the on-site QA/QC plan for acceptance and installation of the GCL mats?

Response No. 4

For placement of GCL within the limits of the Five-Acre Ore Pad, where confining pressures from overlying fill materials will be employed, the GCL panels will be overlapped in accordance with accepted industry practice. This includes a minimum overlap of 24 inches for end-of-roll seams, and a minimum overlap of 6 inches for longitudinal seams. This requirement is outlined in specification Section 02776.1 (Geosynthetic Clay Liner) for the project construction. A construction quality assurance (CQA) plan for the GCL installation is provided as specification Section 01400.2 (Geosynthetics CQA Plan). A construction quality control (CQC) plan is currently being prepared for the project, in response to other Division comments included in RFI #3, specifically Attachment 2 to RFI #3.

Comment No. 5

Re: Cushion Material Thickness Attachment B Calculation Spreadsheets – The chosen 3.5 foot cushion thickness with a computed vertical stress of 7.7 psi generates a very tight design 7.7/8.0 = 96.3% of maximal allowed vertical stress or 3.7% remaining of the maximal allowed 8.0 psi as a FOS. If as is shown in the adjacent column of the spreadsheet, 4 foot thickness is chosen, a 5.9 psi vertical loading is computed with a resulting FOS of 5.9/8.0 = 73.8% 100 – 73.8 = 26.2%, which is significantly greater than 3.7%. The condition of the underlying GCL mats is highly important for infiltration prevention purposes

especially in the long term. It is the Division's opinion that a 4-foot cushion thickness should be used and the applicable portions of the application need to be revised. With an intended design life of 40 years, it would appear that GCL longevity is an important factor.

Response No. 5

Based on the maximum tire width for the operating equipment (approximately 35 inches for a CAT 988H loader), the design cushion thickness of 3.5 feet provides a sufficient factor of safety as discussed in Response to Comment No. 1, above. The vertical stress of 7.7 psi reported in Appendix A of the Ore Pad Design Report (Golder 2008) indicates that a factor of safety against failure is in excess of 1.5.

Comment No. 6

Technical Specifications, Section 02200.0 Earthworks, C. Cushion Material, pp. 9-10 of 13 Spec 1 at 15 inches/lift conflicts with spec 4 at 12-inch max lift. Please amend spec.

Response No. 6

Golder is preparing a revision to the Technical Specifications for the project in response to Attachment 2 of the Division's RFI #3. The requested revision will be incorporated into the revised specifications.

Comment No. 7

Technical Specifications, Section 02200.0 Earthworks, C. Cushion Material, pp. 9-10 of 13 Spec 3 spreading of cover lift is to be by "…equipment that minimizes stress on the GCL". Please specify what this equipment will be, e.g., low ground pressure dozer, etc.

Response No. 7

The Technical Specifications will be amended to specify use of a "Caterpillar Model D6 LGP dozer, or equivalent" for placement of a minimum 1.0 foot thick layer of Cushion Material.

Comment No. 8

Technical Specifications, Section 02200.0 Earthworks, C. Cushion Material, pp. 9-10 of 13 Spec 5 "Cover materials with high concentrations of calcium (e.g., limestone, dolomite) are not acceptable." Please define specifically cutoff concentration or refine this definition further. This requirement is to delay the substitution of calcium ions for sodium in the bentonite GCLs. Under the proposed use scenario, what is the projected life of the GCLs? Please provide discussion and reference information/data.

Response No. 8

The Five-Acre Ore Pad is provided as a location to stockpile ore for future processing, and no significant hydraulic head will develop over the area, as surface water will drain toward the Sediment Trap and into the East Stormwater Pond. Generally, development of a hydraulic head is a requirement to cause substitution of calcium ions for sodium ions in the bentonite, as the calcium ions would need to be in solution. Based on the available literature (Benson et al., 2007), calcium solutions with concentrations below 20 millimol (mM) per liter, or 80 mg/L, are not expected to cause a significant degradation of GCL performance (i.e., permeability is likely to remain within an order of magnitude of the intact GCL permeability). Other than meteoric precipitation, the Ore Pad will be sprayed for dust suppression using water sourced from the production wells, which is anticipated to average 70 to 75 mg/L of calcium based on available monitoring data. The ore, which will be stockpiled on the pad, is very low in calcium content (0.84 to 2.99 percent; Litz [2008]).

Design of the Five-Acre Ore Pad requires that native on-site soils be placed adjacent to the GCL as the cushion material and base/underliner soils. The native on-site soils comprise the weathering product of the local sedimentary rock formations, which include the Chinle, Entrada, Summerville, Morrison, and

Burro Canyon formations, as well as the Wingate and Kayenta sandstone formations. Shawe (1968) provides a discussion of the calcite/dolomite content of sedimentary rocks of the region, which indicates that the majority of the exposed rocks in the Paradox Valley walls are comprised of the red-bed facies, with an average calcium composition of 0.3 to 10 percent by weight (most samples were comprised of less than 2.3 percent calcium by weight). In the northern portion of the Piñon Ridge site (underlying the proposed Evaporation Ponds), where the alluvium is thin or missing, soils may be formed from in-place weathering of the Paradox Evaporite member of the Hermosa Formation; this member contains gypsum, anhydrite, black shale, salt, and thin carbonates. These soils, confined to the northern portion of the property, could release calcium cations into weathering solutions; however, these soils would not be used as cover material at the Five-Acre Ore Pad as the cover materials are anticipated to be derived from excavation of Tailings Cell A where the alluvium is quite thick.

Gravel base course materials, as specified for placement above the native cushion materials, will not come into contact with the GCL. Regardless, the composition of nearby gravel sources was considered. Erosion protection gradation and durability tests for the nearby Durita site closure indicate a relatively small percentage of limestone (97% igneous rock, 1.5% limestone, and 1.5% sandstone) (refer to Golder 2010). Therefore, materials from nearby quarries are not anticipated to exhibit high concentrations of calcium.

The projected life of the GCL is difficult to evaluate, as it is highly dependent on the exposure to freeze/thaw and wetting/drying cycles, cation exchange potential, etc., and only limited research has been performed to evaluate the longevity of GCL materials. With GCL at the Piñon Ridge Project placed below 3.5 feet of soil material, the effects of freezing and thawing are considered negligible based on the design frost depth of 18 inches. Also, GCL desiccation potential at this depth is greatly reduced, as the GCL is anticipated to maintain a degree of saturation (pre-hydrated during placement). In addition, GCL used for construction of the Five-Acre Ore Pad is likely to experience considerably higher loads than those exerted solely by the cushioning material due to trafficking by loading equipment and ore stockpiling. Studies by Thiel and Criley (2005) indicate substantial benefits of GCL loading with negligible effects of cation exchange at stresses larger than 400 to 500 kPa (60 to 70 psi). While some recent studies (e.g., Benson, et al., 2007) indicate potential for degradation of GCL's hydraulic properties within a five-year period, it is important to note that the studies reporting unfavorable GCL performance are constrained to cover designs with relatively shallow thickness of soil material placed over the GCL (i.e., soil thickness over GCL of less than 3.5 feet) and/or relatively high percentage of calcium in the cover soils. A study by Mackey and Olsta (2003) conducted for two landfills in coastal Florida indicates an unsatisfactory GCL performance for covers containing soils comprised of more than 95 percent calcium, and a favorable 5-year GCL performance for a 34-inch thick cover containing approximately 67 percent calcium. Noting that (1) the average annual precipitation for coastal Florida (50 to 60 inches) is more than four times larger than expected at the Piñon Ridge site and (2) the ore and the cushioning material contain much less calcium than the cover material studied by Mackey and Olsta (2003), it would be reasonable to expect the GCL lifespan at the Piñon Ridge site to be considerably in excess of that considered by Mackey and Olsta (2003).

Comment No. 9

From the Division's perspective, it would appear that a composite (HDPE) liner would have a significantly longer lifespan that would be a better match for these mills that have long lifespans including extended periods of inactivity owing to market conditions. Please demonstrate that the lifespan of the GCL liner is equivalent to a HDPE liner as well as being as protective. The Division is concerned with the GCLs surviving for long periods under intense contact loads from vehicles that will cause the GCLs when they become wet to deform and squirm away from the tires (rutting) and over time not perform the liner function as well as fail to provide load support.

Response No. 9

High-density polyethylene (HDPE) geomembranes and geosynthetic clay liners (GCLs) are unique materials offering specific advantages. Golder's (2008) design addresses GCL protection for the Five-Acre Ore Pad by incorporating 3.5 feet of cover materials, with additional information regarding expected GCL performance provided in the above responses. As noted in Golder's Response to Comment 1, the design cushion thickness of 3.5 feet provides sufficient safety against rutting. In addition, the needle punched/reinforced bentonite at the design grades provides ample safety against liner failure (see design analyses contained in Golder [2008]).

A distinct advantage of HDPE over exposed (or shallowly buried) GCL would be better performance under wetting/drying and freezing/thawing cycles. Since the GCL is placed at 3.5 feet below the surface, neither freezing/thawing nor wetting/drying are expected to significantly affect the GCL performance for application at the Piñon Ridge project.

HDPE typically provides better protection than GCL from aggressive chemicals, and may yield lower permeabilities when installed appropriately. However, while these advantages may indicate a longer lifespan for HDPE when considering municipal and chemical waste storage facilities, the same argument is difficult to extend to the Piñon Ridge Five-Acre Ore Pad. Noting that the cushion material placed above (and protecting) the GCL is not expected to produce aggressive chemicals and the head on the liner is negligible, Golder chose a needle-punched GCL as the preferred liner material. The selected GCL material is likely to provide better performance than HDPE under dynamic loading (e.g., under stresses caused by moving equipment) because GCL is self-healing if punctured. In addition, needle-punched GCL indicates better stability than HDPE for the geometry and stress levels expected at the Piñon Ridge Ore Pad.

Comment No. 10

Technical Specifications, Section 02200.0 Earthworks, C. Cushion Material, pp. 9-10 of 13 Spec 6 Please add a sentence to this spec that stipulates cushion material will be placed in a straight line (e.g., no turns) manner to prevent transmittal of shear forces to underlying GCL mats.

Response No. 10

As part of the revision to the Technical Specifications, which is currently underway, Golder will amend Section 02200.0 to address this comment.

2.3 Ore Dumping Platform

Comment No. 1

Please provide the Hilfiker retaining wall design calculations.

Response No. 1

Based on this comment, Golder requested analytical output from Hilfiker for design of the maximum wall section (wall height, H = 10 feet) based on anticipated loading conditions from haul trucks accessing the Ore Dumping Platform. The Hilfiker retaining wall design calculation for the maximum wall section is provided in Attachment 2. Based on this analysis, the reinforcement lengths are nominally 9 feet.

Comment No. 2

Part 1 - From the design, haul vehicles (side dumps) entering the 5 acre ore pad exit through a truck decon station before leaving the site. With the ore dumping platform design, the haul vehicles can exit the site without being decontaminated. Will the haul truckloads be struck or heaped?

Part 2 - Dust from the dumping operation and any spillage over time will result in the ore dumping platform being gradually contaminated. Consequently, the ore-dumping platform should be lined and surface drainage collected.

Response No. 2

The first part of this comment has been addressed by EFRC separately in their response.

Based on the second part of the Division's comment, the design drawings have been revised to include a two percent slope on the concrete apron adjacent to the wall which slopes towards the wall (refer to revised Drawing 8 in Attachment 3). Full height slots have also been included through the wall at 50-foot horizontal spacings (refer to revised Drawing 14 in Attachment 3) to allow for any spilled ore to be pushed and/or washed onto the Five-Acre Ore Pad, thus limiting contamination of the dumping platform. Consequently, any contaminated surface drainage will report to the Five-Acre Ore Pad.

Comment No. 3

Please provide design drawings for the dust suppression system.

Response No. 3

A design for the dust suppression system has been developed, and is illustrated on Drawing 17 (included in Attachment 3). Piping will extend to above the Ore Dumping Platform with sprayers located at 50-foot on center to facilitate spraying of water on the Five-Acre Ore Pad for dust suppression.

2.4 Sediment Trap

Comment No. 1

Need design drawings including details with cross sections and supporting calculations and assumptions for sediment trap (include cleanout criteria, e.g., when, disposal/recycle, etc) adjacent to East Stormwater Pond. Please provide discussion as to function in relation to ore pad run-off and truck decon station.

Response No. 1

Structural design drawings for the sediment trap located adjacent to the East Stormwater Pond have been developed by SM&RC Engineers Inc. (SM&RC), and are included in Attachment 4-1 (Drawings S-4 and S-5), including details and cross-sections. The truck wash, constructed adjacent to the sediment trap, is used to decontaminate outgoing vehicles (haul trucks) and wash other equipment working on the pad prior to the equipment leaving the license boundary. Surface water runoff from the Ore Stockpile Pad, as well as truck wash outflow, is directed to the sediment trap to allow settlement of solids prior to discharging water to the East Stormwater Pond via a spillway connecting the sediment trap to the East Stormwater Pond. The sediment trap is divided into two rectangular cells, as shown in plan view on Drawing S-4. The cell width was designed to facilitate access by a small bobcat front loader, which will transport and deposit collected sediment within the lined limits of the Five-Acre Ore Pad. A pump station is also contained within the eastern-most portion of the sediment trap that provides pumping capacity to operate the adjacent truck wash.

Comment No. 2

Need truck decon station(s) design (inlets and outlets also), anticipated volumes of water/flow to sediment trap and hence to East Stormwater Pond and cleanout criteria.

Response No. 2

To provide clarity to the function and design of the truck wash component of the system, a typical Operation and Maintenance Manual for a truck wash station developed by a manufacturer of these systems is provided in Attachment 4-2. Included in this document are details of the truck decontamination station (i.e., truck wash) with relevant typical design drawings. Anticipated volume and water flows to the sediment trap are outlined in Table 1 included in Attachment 4-3, assuming use of an InterClean Equipment Inc. truck wash or equivalent facility with a pump capacity of 600 gallons per minute (gpm). The sediment trap capacity for fluid storage is approximately 52,000 gallons before spilling to the East Stormwater Pond (via the spillway). The daily pumping volume for the truck wash, assuming 12 hours of operation with a frequency of three (3) trucks per hour and an average truck wash duration of two (2) minutes is 43,200 gallons. As the truck wash water will be recycled and reused to the maximum extent achievable, the designed sediment trap will provide ample storage capacity.

Comment No. 3

Re Liner Details Sheet 2 of 2 Drawing 7, details (options) 1A and 1B, transition to concrete sediment trap. These alternative designs are for HDPE liner to concrete attachment. HDPE has a significant coefficient of expansion. How will this be allowed for in regards to these options to prevent tear-out when cold and excessive loose folds when temperatures are warm?

Response No. 3

Note that the Embed detail (option 1A) employs an HDPE extrusion weld similar to a standard HDPE liner connection. Hence, the Embed connection should be viewed as a “standard” detail and a preferred connection between the HDPE and concrete. Other advantages of the Embed detail is that it minimizes the local stress concentrations to concrete due to temperatures (HDPE has much lower modulus than concrete), and provide the ability for quality assurance of the connection via vacuum testing. Therefore, HDPE liner connected to the concrete sediment trap is expected to experience a similar stress regime due to temperature fluctuations as the rest of the HDPE liner placed elsewhere in the East Stormwater Pond. Possible stress concentrations and loose folds may be minimized by placing ballast on the liner (i.e., sand bags).

2.5 East and West Stormwater Ponds

Comment No. 1

Re: Drawing No. 5 East Stormwater Pond Layout, Sections, and Details, C5 Weir Box Section C to C' - Provide attachment tie-in detail for 30-inch HDPE outlet pipe to concrete weir box.

Response No. 1

As requested, this detail has been provided on revised Drawing 5 for the East Stormwater Pond and is also provided on Drawing 16 for the West Stormwater Pond (included in Attachment 3). The weir box details are referenced from CDOT Standard Plan No. M-604-11, dated July 2006.

Comment No. 2

With 3:1 sloped sides, it should be stipulated in the license that the two long sides should each have a minimum of one roughened panel to aid egress in the event of accidental personnel immersion. Repeat the requirement for West Stormwater Pond.

Response No. 2

The notes and details for the primary geomembrane liner within the East Stormwater Pond and the West Stormwater Pond have been revised to include placement of textured geomembrane liner at the pond corners (where the slope is the flattest) to facilitate egress. Please refer to revised Drawing 5 and new Drawing 16 (included in Attachment 3).

Comment No. 3

While these stormwater ponds (east and west) do collect stormwater, they also reflect contact with ores and ore-derived dust as well as occasional vehicular fluid spills due to leaks of diesel fuels, lubricants, and radiator, transmission, and hydraulic fluids. As such, they may contain heavy metals, PAHs (poly aromatic hydrocarbons), and semi-volatile organics besides uranium ore derivatives. The ponds are designed with a 60-mil HDPE primary liner with an underlying GCL secondary liner in direct contact. While the double liner provides some assurance of leak protection, it does not afford a way of ascertaining when a leak has occurred in the primary liner. A leak detection system in between the layers will provide a way of monitoring leaks of the primary liner. Please provide a revised design with appropriate drawings that reflect the addition of a leak detection system.

Response No. 3

As requested, Golder has revised the liner system design for the East Stormwater Pond and the West Stormwater Pond. The proposed liner system (from top to bottom) consists of a 60 mil HDPE geomembrane primary liner, an HDPE geonet that drains to a Leak Collection and Recovery System (LCRS) sump (at the low point), and the underlying GCL component. Details 3 and 4 on Drawing 6 have been revised to reflect this modification, and a new sheet (Drawing 15) has been added to provide the details for the LCRS sump design. Plan drawings for the East Stormwater Pond (revised Drawing 5) and West Stormwater Pond (Drawing 16) show the proposed locations of the LCRSs. New and revised drawings are provided in Attachment 3.

Comment No. 4

Comment 6 – Re Volume 1, Surface Drainage Section, Site Drainage Analysis and Design Report, Appendix C East Stormwater Pond, sheet 28 of 43, Detail B, Bubble Note states "this was eliminated based on final site grading." The channel entrance is depicted on the same sheet as Detail A. How is the water routed into the pond given the channel from the sediment trap if the entrance is eliminated? Also, see sediment trap request for design information above.

Response No. 4

A spillway connecting the Sediment Trap to the East Stormwater Pond remains, as shown on revised Drawing 5 (refer to Attachment 3) and Detail 2 on Drawing 7 (previously provided; Golder, 2008), located near the southeast corner of the pond. At the time when Golder completed the Ore Stockpile Pad design report and drawings (which included the East Stormwater Pond), the surface water drainage plan included east and west inlet channels to the East Stormwater Pond; however, during subsequent design of the surface water drainage system (by others), the west inlet channel (draining the mill pad) was modified while the east inlet channel was removed. Drawings 3 and 5 contained within Attachment 3 have been revised to reflect the appropriate modifications.

2.6 Stormwater Ponds Overflow System

Comment No. 1

For the 30 inch HDPE line from east and west stormwater ponds directing water to evaporation ponds, there is no mention of QA/QC for butt-welding the sections of pipe together.

Response No. 1

Please note that a 30-inch HDPE pipe is used to direct water from the East Stormwater Pond while an 18-inch pipe is used to convey water from the West Stormwater Pond. Specification 02710.0 (Part 3, Section 3.02) provides requirements for butt-welding of the piping connections. The Construction Quality Assurance (CQA) Plan for geosynthetic materials provided as part of the Technical Specifications have been revised to address butt welding procedures and testing of the pipes, as well as incorporation of Construction Quality Control (CQC) protocols. The revised specifications will be provided under separate cover.

Comment No. 2

Please verify there are no perforations specified in this piping (30-inch stormwater line)?

Response No. 2

Yes, it is correct that the 30-inch and 18-inch stormwater lines are not perforated pipes. A statement is added to specifications addressing the pipes connecting the East and West Stormwater Ponds to the Evaporation Ponds as solid HDPE pipes, i.e., pipes without perforations.

Comment No. 3

Re Drawing C16, Impact Basin Detail / Section L, the impact basin is to be constructed of concrete, please provide a steel reinforcement schedule with placement.

Response No. 3

As requested, structural design of the Impact Basin has been completed by SM&RC, as provided in Attachment 6 (Drawings S-6 and S-7). The invert elevation of the overflow pipeline has been raised such that the Impact Basin is now above the evaporation pond as opposed to within the pond cell itself. This modification was made such that back-up of raffinate into the overflow pipe does not occur. During the detailed design phase of the project, the overflow pipe system design grades and elevations will be modified based on the current approach.

Comment No. 4

Re Drawing C16, Impact Basin Detail / Section L, how will the 36-inch HDPE be tied into the concrete?

Response No. 4

Drawings S-6 and S-7 provided in Attachment 5 and prepared by SM&RC show how the 36-inch HDPE pipe will tie in to the impact basin concrete.

Comment No. 5

Please provide a typical manhole cross-section detail that shows construction and HDPE pipe tie in on entrance and exit.

Response No. 5

Typical manhole details showing the pipe tie in are shown on Drawing 18 (refer to Attachment 3). Manhole details are referenced from CDOT standard details. The typical details will be updated as necessary during the detailed design phase.

Comment No. 6

Please provide a cross section parallel to the pipe at the point where the stormwater pipe passes under the tailings pipe exiting the thickeners to the tailings ponds. Show ground surface and relative elevations of pipe.

Response No. 6

A crossing detail illustrating where the stormwater pipe from the East Stormwater Pond passes under the tailings pipe is provided on Drawing 18 (included in Attachment 3). The design elevations of the tailings delivery line are somewhat conceptual at this level of design, but the tailings delivery line is designed to flow in a lined trench extending from the process plant toward Tailings Cell A. Additional detail on the tailings delivery line design will be provided in Response to RFI #4 received recently from CDPHE.

Comment No. 7

Please provide plan and cross-section construction details (include angle information) on the HDPE pipe junction from each of the ponds. How will this pipe be joined, e.g., welded or other?

Response No. 7

Details 2 and C on Drawing 5 (included in Attachment 3) have been revised to illustrate the designed pipe construction angle information. The pipes will be connected to the concrete weir box in the same manner as that illustrated for the Impact Basin in Drawing S-7 (in Attachment 5).

2.7 Water Quality Swale

Comment No. 1

The Division concurs with the license applicant that the inclusion of a water quality swale at the surface water diversion ditch exit prior to entering drainage at Highway 90 reflects good practice in arresting sediment from overland flow and the ditch as well as retarding flow into the Highway drainage. However, as noted on page 8 and depicted on Drawings C7 and C8 of the Site Drainage Analysis and Design Report (Vol I), "Standard design practice and standard details were used to size the swale (flat gradient and side slopes, maximize length) within the topographic constraints available as opposed to a detailed engineering or water quality analysis. As such, no detailed calculations were completed." The Division would like to see a better match of the swale length and other characteristics to the ditch sediment and water carrying capacity. Currently, there is no way to ascertain if the swale will accomplish what it is supposed to do. Please provide an appropriate engineering analysis including the stilling basin design. In addition, please provide a maintenance plan that will address sediment removal. Table of plant species, density, and placements will also be part of this submittal. Discuss how the plants will be established with watering schedule over two growing seasons rather than one.

Response No. 1

Golder has reviewed Kleinfelder's report and design drawings regarding the water quality swale. As requested by the Division, Golder has completed design calculations and re-design of the water quality swale based on U.S. Environmental Protection Agency (EPA) design guidance. The design calculations

and design drawings for the water quality swale are provided in a stand-alone addendum (refer to Attachment 6).

3.0 CLOSING

We appreciate the opportunity to provide continued engineering services for the Piñon Ridge Project. If you have questions or comments regarding these responses, please contact the undersigned via phone at 303-980-0540, or via e-mail at kmorrison@golder.com.

Sincerely,

GOLDER ASSOCIATES INC.

Gordon Gjerapic, Ph.D., P.E.
Senior Project Engineer

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Attachments:
1 – Equipment Loading Calculations
  1-1 – Simplified Equipment Loading Calculation
  1-2 – Detailed Equipment Loading Worksheets
2 – Hilfiker Wall Design Calculation
3 – Revised Design Drawings: Ore Stockpile Pad, East Stormwater Pond, West Stormwater Pond
4 – Sediment Trap Details
  4-1 – Sediment Trap Concrete Design
  4-2 – Truck Wash Manufacturer Operations and Maintenance Manual
  4-3 – Sediment Trap Flow and Volume Calculations
5 – Impact Basin Design Drawings
6 – Water Quality Swale Design Addendum

GG/KFM/rjg

4.0 REFERENCES

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