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May 11, 2015

Kirk Nicholes
Resident Agent
Alton Coal Development, LLC
463 North 100 West, Suite 1
Cedar City, Utah 84720

Dear Mr. Nicholes:

The Division has reviewed the letter titled, "Response to Division Order and Technical Memorandum re: swell factor, Coal Hollow Mine," dated March 31, 2015, wherein Alton Coal Development (ACD) replied to the Division's concerns with the GEM Geotechnical report dated January 15, 2015. Although the report lacks certain details, the swell factors determined by the GEM report are not hindered by the missing information and can be recommended for conditional approval. Verification of the compaction results are dependent on information that is missing. Pending receipt of additional laboratory test information as outlined below, the new compaction value can also be approved.

The purpose for the additional requested information is for the Division to be able to verify the laboratory results. The following discussion details how following established engineering guidelines would provide said information. General comments in the March 31, 2015 letter merit this in depth response.

- ACD's response letter incorrectly stated that the new data "*prove that the pre-mining estimates are unreliable,*" or "*replace*" pre-mining data. In evaluating the geotechnical report, the Division follows established guidelines, such as ASTM Standards. If the more recently obtained geotechnical information is comparative and/or additive to the collective subsurface knowledge of the site, prudent engineering calls for the information to be added to the original data, regardless of operational status of the mine. Even though TGE's report was pre-mining, the subsurface characteristics were not changed by mining, as evidenced by the statistically similar soil data between GEM's and TGE's sieve analysis. In the event mining operations encountered significant amounts of soil at the site that appeared to be outside a reasonable variance of the reported pre-mining subsurface properties or that "*prove that pre-mining estimates are unreliable*", then a new complete geotechnical report, including slope stability, would need to be completed before operations could continue.

The Division examined both reports to confirm that representative soils were sampled, and the reports were additive. The GEM report includes only one sample for each of the two soil types: Silty sand with gravel (119.0 pcf \pm 8.5% ω_n) and Fat clay (103.5 pcf \pm 14.5% ω_n) to represent over 342 acres. The original geotechnical report completed by Talyor Geo-Engineering (TGE), located in ACD's MRP in Appendix 5-1 includes the analysis of five new in-situ sample locations at varying depths, in addition to the four "*composite*" samples from previous samples collected by Peterson Hydraulics. The results of the TGE



geotechnical report concluded three distinct soil types: Silty Clay (110.4 pcf $\pm 17\%$ ω_n), Clay (105 pcf $\pm 8.5\%$ ω_n), and shale (100 pcf $\pm 8.5\%$ ω_n).

With the comparable Standard Proctor data presented in the new GEM geotechnical report, the Division finds that representative samples were selected for analysis.

- The Division is in agreement that the MRP disregarded the TGE Geotechnical report for the Alton site and relied on the Caterpillar Performance Handbook (CPH) for the swell factor and the MRP volume calculations. As stated in the disclaimer, the CPH provides generalized swell factors which are not intended for sole use in final volume calculations. CPH also includes a disclaimer that values presented in the table “vary with moisture content, grain size, degree of compaction etc” and that “Tests must be made to determine exact material characteristics.” The swell factor ACD selected was “midpoint” among the swell factors provided in the CPH and is calculated as an average of silty sand, clay, and shale rather than being based on site specific Geotechnical report data. To help adjust such a general factor to the site, ACD could have calculated a weighted average of separate soil types, based on the supplied bore logs.

TGE’s swell factors detailed in Section 7.0 Bulking of the geotechnical report detail the in-situ and standard proctor dry densities of the shale and silty sand/clay soil materials which are site specific and not “artificially-created” estimates. Prior to the GEM geotechnical analysis ACD could have used TGE’s swell factors instead of CPH with Division approval.

Moving forward, the Division recommends GEM’s geotechnical data be additive to the original TGE’s geotechnical report.

- When describing the source of the sampled material, statements from ACD required clarification. For instance, ACD stated, “samples of actual backfill material” were sampled, but later in the same letter ACD states, “it is a mixture of weathered and fresh shale.” From these statements the Division cannot determine what and how the samples were selected. There are established ASTM guidelines for releasing information relevant to the collection of the samples which will enable the Division to determine if the samples are “actual backfill” or “composite” samples assembled by ACD staff. ACD will provide clarification as to what and how the samples sent to GEM for analysis were collected according to established standards, such as ASTM. (See R645-301-130, -131 and R645-301-535.100)

The remaining concerns of the Division regarding the GEM geotechnical report include are outlined below. Additional information required by the Division to verify the geo-technical information provided by ACD is bolded for clarity:

1. ACD’s memo incorrectly refers to “Proctor” test, which is a broad general term used to describe two different kinds of compaction tests. Standard Proctor (ASTM D698) and Modified Proctor (D1557) tests are not equivalent tests and are not interchangeable. A basic comparison of the hammer drop height, number of blows, and input energy reveals that the energy level in the Modified Proctor compaction test is 4.5 times greater than that for the Standard Proctor compaction test (Keystone, 2014). For a given compaction curve, the same dry unit weight can be obtained at two different compaction moisture contents: one below optimum and the other

above optimum. For fine grained soils, this difference in moisture content relates to a difference in soil structure that may affect engineering properties such as shear strength and permeability. The compaction specification must be given in terms of three parameters: the compaction energy (Standard vs Modified Proctor), the desired density expressed as a percentage of the maximum dry density, and the compaction moisture content expressed as a percentage (+ or -) with respect to the optimum moisture content. These parameters are critical to be able to determine the Relative Compaction (RC). RC, also known as percent compaction, is a performance base or end product specification due to the obvious disconnect between the types of energy in the laboratory and the field. RC is simply the ratio of the desired field dry unit weight to the maximum dry density measured in the laboratory. RC is not the same as the relative density which have a relationship published in Lee and Singh (1971) of a statistical evaluation of 47 different granular soils compacted by using Modified Proctor energy of $RC(\%) = 80 + \frac{D_r(\%)}{5}$ and using Standard

Proctor energy of $RC(\%) = 85 + \frac{D_r(\%)}{5}$. The two equations show that with the same relative density a sample will have different RC depending on which proctor test is utilized. Two numbers are critical in determining relative compaction (dry density, moisture content) and must be described to be able to correctly arrive at the site's field compaction.

Based upon the information provided, the Division approves the use of the Modified Proctor tests of standard of compaction at 126.5 pcf \pm 8.0 moisture content for alluvium lifts and 112 pcf \pm 12% moisture content for shale lifts instead of TGE's original 100 pcf \pm 8.0% water content.

2. R645-301-130, -131 clearly discusses the requirements relative to the reporting of technical data. In order for the Division to evaluate the technical data provided by ACD, R645-301-131 requires that *"All technical data submitted in the permit application will be accompanied by the names of persons or organizations that collected and analyzed the data, dates of the collection and analysis of the data, and descriptions of the methodology used to collect and analyze the data."* The GEM report and information provided by ACD does not include all of this required information outlined in R645-301-131.

Additionally, R645-301-512.210 requires that a *"professional engineer experienced in the design of earth and rock fills will certify the design according to R645-301-535.100"*. R645-301-535.100 states, *"Excess spoil will be placed in designated disposal areas within the permit area in a controlled manner. The fill and abutment structures will be designed using current prudent engineering practices and will meet any design criteria established by the Division"*. Prudent engineering practices include following ASTM established guidelines in sample testing to reduce sampling error and false positive/negatives. Examples of established guidelines are ASTM standards for soil sampling are detailed in ASTM D4840. These standards state that various relevant information be documented, such as a Chain of Custody to prove proper sampling methods were used for collection, that samples were not altered, and the disclosure of relevant information such as location, time in transit (vibrations samples exposed to), etc. that may be relevant to the geotechnical analysis.

The Division requests that ACD provide the information detailed in R645-301-131 as well as following established engineering guidelines on sample collection and analysis, such as ASTM D4840.

3. The “*shale*” sample analyzed by GEM is indeed a weathered shale, which does not behave the same or have the same geophysical properties as un-weathered tropic shale, i.e. the un-weathered shale requires ACD to use explosives to loosen prior to excavation. In the General Comments section of ACD’s March 31, 2015 letter, it was discussed how GEM’s samples were superior samples to the “*composite*” samples from the original TGE’s geotechnical report, due to there not being composite samples. However, the letter goes on to state, “*it is a mixture of weathered and fresh shale.*” This is an example of information that is not presented in either the old or new GEM report and is relevant information that would have been detailed by following proper ASTM sampling guidelines.

ACD must follow prudent and established engineering guidelines, such as ASTM, for collecting samples and must provide such information in a timely manner to the Division staff upon request, R645-301-535.100. **As required by R645-301-130, -131, R645-301-535.140, -535.145, the Division also requests complete sample collection information as well as geotechnical reports, R645-301-535.140-535.145, be submitted that follow ASTM testing standards.**

4. Due to the increase in imparted compact energy, the Division agrees with the Permittee that the Modified Proctor test, achieves a higher level of desired compaction. The Division conditionally approves the Modified Proctor results as the new standard of compaction at 126.5 pcf \pm 8.0 moisture content for alluvium lifts and 112 pcf \pm 12% moisture content for shale lifts. However, the Permittee must still supply the relevant missing lab data, as required by ASTM guidelines:
 - a. Method used for the Test: The Permittee claimed that the GEM report followed ASTM D1577-12 (d) however, ASTM D1577-12 section 5.3.1 states that, “*soils containing more than 30% oversize fraction are a problem. For such soils, there is no ASTM test method to control their compaction and very few laboratories are equipped to determine the laboratory maximum unit weight of such soils (USDI Bureau of Reclamation, Denver CO and U.S. Army Corps of Engineers, Vicksburg, MS).*” Section 5.3.1.3 states, “*The use of the replacement technique (test method D1557-78 Method D), in which the oversize fraction is replaced with a finer fraction, is inappropriate to determine the maximum dry unit weight of soil containing over size fractions.*” **The Permittee must provide justification as to why Method D was utilized on soil containing oversized fraction on the original GEM report for the Modified Proctor test, and include the relevant report details as outlined in Section 12 of ASTM D1577-12.**
 - b. A summary table of results from the Standard Proctor Test, ASTM D698, was provided but the report is missing information such as the Standard Proctor Moisture Density Relationship, which details the proctor curve, preliminary density, and preliminary moisture in addition to optimum conditions. Prudent engineering includes following established guidelines (See ASTM D698). ASTM

D698 Section 12 details what information (at a minimum) should be in a test's summary report. GEM's report states that it followed ASTM D698 Method D. This method is correctly labeled as ASTM D1577-12 (d) however, ASTM D698 section 5.3.1 states that, "*soils containing more than 30% oversize fraction are a problem. For such soils, there is no ASTM test method to control their compaction and very few laboratories are equipped to determine the laboratory maximum unit weight of such soils (USDI Bureau of Reclamation, Denver CO and U.S. Army Corps of Engineers, Vicksburg, MS).*" Section 5.3.1.3 states, "*The use of the replacement technique (test method D1557-78 Method D), in which the oversize fraction is replaced with a finer fraction, is inappropriate to determine the maximum dry unit weight of soil containing over size fractions.*" **The Permittee must provide justification as to why Method D was utilized on s containing oversized fraction on the original GEM report for the Standard Proctor test, and include the relevant report details as outlined in Section 12 of ASTM D1577-12.**

5. The swell factors provided in the Shrinkage and Expansion - Summary of Test Results table, along with the newly provided test locations, meet minimum requirements of prudent engineering calculations. The Division cannot verify GEM's classification of SM, silty sand with gravel classification, which does not match to the original TGE classification of the alluvium classification as SC, silty clay with gravel. The Division is unable to make this match due to a lack of analysis of the fines as required by ASTM C136 Section 5.2 and ASTM C117, or ASTM D422. The GEM report lacks the Atterberg limits of the Alluvium sample which is required to be able to determine the classification as a silty sand with gravel or a clayey sand with gravel. **The Permittee must provide GEM's fines analysis or Atterberg limits of the alluvium sample that GEM utilized to arrive at a classification of silt sand, for comparison with the properly documented TGE's classification of a clayey sand with gravel.**

In conclusion, the Division conditionally approves the new swell/shrink factors of 11.9% for shale and 7.2% for alluvium as presented in the GEM report. Final approval of these values will be granted pending the receipt of the following requested information as outlined above:

1. Information detailed in R645-301-131 as well as following established engineering guidelines on sample collection and analysis, such as ASTM D4840, on the sample collection.
2. Complete sample collection information as well as geotechnical reports according to engineering standard guidelines and R645-301-535.140-535.145, R645-301-130, -131, R645-301-535.140, and -535.145 such as:
 - a. Descriptions of sample collection including methods, name
 - b. Supply justification as to why Method D was utilized on soil containing oversized fraction on the original GEM report for the Modified Proctor test

May 11, 2015

Subject: Re: Swell Factor, Coal Hollow Mine

- c. Include the relevant report details as outlined in Section 12 of ASTM D1577-12.
 - d. Supply justification why Method D was utilized on soil containing oversized fraction on the original GEM report for the Standard Proctor test
 - e. Include the relevant report details as outlined in Section 12 of ASTM D698.
3. Supply GEM's fines analysis/Atterberg limits results of the alluvium sample that GEM utilized to arrive at a classification of silt sand, for comparison with the properly documented TGE's classification of a clayey sand with gravel.

In order for the Division to conclude the reclamation cost determination, it's integral that the calculation utilized approved swell factor and compaction values. The Division conditionally approves the corresponding GEM conclusion for a new standard of compaction at 126.5 pcf \pm 8.0 moisture content for alluvium lifts and 112 pcf \pm 12% moisture content for shale lifts instead of TGE's original 100 pcf \pm 8.0% water content, pending receipt of the information discussed above. ACD will update the Coal Hollow MRP in regards to the new Modified Proctor compaction tests results and swell factors within the North Lease Application is submitted or asap.

Sincerely,



Cheryl Parker, M.S., P.E.

Mine Engineer



Steve Christensen
Permit Supervisor

SC/CP