GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
BRIAN C. STEED
Executive Director
Division of Oil, Gas and Mining
JOHN R. BAZA
Division Director

May 27, 2020

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

Subject: Conditional Approval of Appendix 9-1 Prime Farmland Soils, Alton Coal Development, LLC, Coal Hollow Mine, C/025/0005, Task #6141

Dear Mr. Nicholes:

The above-referenced amendment is approved conditioned upon receipt of 2 clean copies prepared for incorporation. Please submit these copies by June 26, 2020. Once we receive these copies, final approval will be granted.

A stamped incorporated copy of the approved plans will also be returned to you at that time, for insertion into your copy of the Mining and Reclamation Plan.

The Division requests notification two weeks prior to the start of nuclear density testing on prime farmlands so that a site visit can be arranged with Mr. Thapa, State Soil Scientist. Please notify Priscilla Burton by phone (435) 609-1014 or email.

If you have any questions, please call me at (385) 290-9937.

Sincerely,

Steve Christensen
Coal Program Manager

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Technical Analysis and Findings

Utah Coal Regulatory Program

PID: C0250005
TaskID: 6141
Mine Name: COAL HOLLOW
Title: APP 9-1 PRIME FARMLAND SOILS

Summary

This amendment provides the results of prime farmland soil analysis from samples taken prior to disturbance in 2018, as described in Volume 9, Section 317.400. These results are in Appendix 9-1.

Appendix 9-1 describes the use of a nuclear probe to determine density of prime farmland soils after redistribution. This application was reviewed and the method was approved by the State Soil Scientist, Bir Thapa (Incoming 04/02/2020.pdf). His comments are repeated below.

"The main concern here is whether mine operator would compact soil beyond the capacity of plant roots to penetrate. Also post mining reconstruction effort would occur as outlined in the method pre-mining in 2018. As you suggested [the] mine operator proposes using nuclear density probe to quantify bulk density of soil. Soil Scientists in general, quantify soil bulk density using core samples, but this method is very difficult to use in this case. The proposed method is mainly used by Engineers especially in road construction sites. It is rather expensive but reliable method. It may overestimate the bulk density values about 6-7% compared with core samples. My proposal is that that UDOGM soil scientist and I evaluate/observe how mine operator Engineer uses the nuclear density probe before using on the site. I have no hesitation to give our approval to use this method, but we make sure soil is not compacted when they reconstruct. I am also proposing to dig and see that roots are all well distributed throughout the A, B, C horizons. We can simply use auger for this purpose."

The Division requests notification two weeks prior to the start of nuclear density testing so that a site visit can be arranged with Mr. Thapa.

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Operation Plan

Topsoil and Subsoil

Analysis:

The application meets the State of Utah R645 requirements for Prime Farmland: Soil Survey.

Appendix 9-1 provides the 2018 North Lease pre-disturbance prime farmland soil data required by a commitment in Volume 9, Section [R645-302]-317.400. Appendix 9-1 Procedures explains how the nuclear gauge measurements were taken; why the nuclear gauge is preferable to soil laboratory data, and how the nuclear gauge measurements are the most reliable and efficient for the purpose of confirming soil redistribution density in real time.

The following information is found within Appendix 9-1:

Figure 1 shows sample locations as a “P” in a blue circle. (There is no legend on this figure.)

Table 1 and Appendix A provide the Intermountain Laboratory data.

Appendix B provides photographic documentation of each soil pit and the pedon sampled.

Appendix C provides photographs of the soil profile box made to archive each location.

Table 2 and Appendix D are the GEM Engineering field density test summary sheets.

Table 2 provides the conversion of field data dry density to dry density in g/cm3 for comparison with final nuclear gauge density.

Soil density data was gathered to add to the previously collected baseline data for prime farmland soil chemistry and density as required by R645-302-314.120. The density of the redistributed prime farmland soils is important because of its effect on yields (R645-302.317.510). Root growth decreases linearly with increasing bulk density. Bulk density is defined as the weight of dry soil per unit of volume and is expressed in g/cm^3. Roots cannot penetrate silty clay with a bulk density of 1.58 g/cm^3 or greater. Roots cannot penetrate pure clay with a bulk density of 1.47 g/cm^3. Roots cannot penetrate sand with a bulk density of 1.75 g/cm^3 or greater (NRCS).

Appendix 9-1 describes the procedure for collecting soil samples for laboratory analysis. In June 2018, soil pits were excavated to four feet deep on 2.2 acre centers. Soil samples were taken by horizon or in 12 inch increments, bagged and sent to Intermountain Laboratory (IML) in Wyoming for analysis of parameters described in Section R645-302-317.400. Soil pH was also monitored during salvage.

Table 1 presents the IML data. Most of the soils sampled had a texture of silty clay loam or silty clay. Analytical data from the IML provides an excellent record of the existing pH, EC, SAR , available water capacity and texture of the soil.

The IML bulk density data is not accurate, and not a suitable method for monitoring redistribution of prime farmland soil, because the volume of the original soil core was not recorded. To report bulk density from laboratory data, one must have a volume component. The IML bulk density data were obtained by picking out a soil clod from the 1 gallon bag. The volume of the clod was obtained by coating it in paraffin (to preserve the pore space within) and measuring its displacement in water. (The methods and results were confirmed with K. Secor , Intermountain Laboratory, 1/14/20). IML reported bulk density values were between 2.69 tand 24.5 g/cm^3. Compare those reported bulk density figures to the average bulk density of rock, 2.65 g/cm^3. (NRCS)

Gathering and preserving soil aggregates for a bulk density analysis is unsuitable for monitoring redistributed prime farmland soil density in a timely manner. Therefore, the Permittee will gather density data with a nuclear gauge data in an effort to develop a rapid analysis of compaction and a pre-disturbance data set.

Table 2 presents a lot of information, only some of which is pertinent to the density of the undisturbed prime farmland. For example, the columns of **laboratory data** relate the optimum moisture for maximum compaction and the corresponding density at maximum compaction in lbs/ft^3. [Since engineers are concerned with getting maximum compaction, the laboratory results are intended to be used when achieving maximum compaction is the goal. This situation is to be avoided on agricultural lands.]

The Table 2 columns of **field data** provides readings of pre-disturbance % compaction and moisture content, which are converted into dry density (three right hand columns of the data sheet). The dry density measurements reported in lbs/ft3 can be converted to g/cm^3 by a factor of 0.016. (i.e. 1 lb/ft^3 x 0.00058 lb/in^3 x 27.6799 g/cm^3 = 0.016 g/cm^3).

For example: Prime 1, -6” sample has a dry density value of 76.7 lbs/ft^3 . It’s dry density (at 18.3% moisture) equates to 1.23 g/cm^3. i.e. 76.7 lb/ft^3 x 0.016 = 1.23 g/cm^3. This is the particle density of the soil. The value accounts for pore space at a specified moisture content.

Citation:

NRCS publication Soil Bulk Density/Moisture/Aeration. Guides for Educators. Available online at https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053260.pdf .

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Reclamation Plan

Topsoil and Subsoil

Analysis:

The application meets the State of Utah R645 requirements for Prime Farmland: Performance Standards, Soil Reconstruction.

The plans to prevent compaction of redistributed prime farmlands are described in Volume 9, Sections [R645-302]-317.510 and 317.530.

Appendix 9-1 Summary states that if baseline density is exceeded, a disc or subsoiler/V-ripper will be used to relieve compaction. Discing soil can relieve compaction to a maximum depth of 10 inches. A subsoiler/v-ripper can relieve compaction to a depth of 22 inches.

Nuclear gauge data presented in Appendix 9-1 Table 2 and Appendix D document the pre-disturbance prime farmland baseline dry density in g/ cm^3. The Appendix 9-1 Summary provides the average prime farmland soil densities to be replicated in final reclamation. These average converted dry densities are derived from Table 2 as follows: A horizon = -1.35 g/cm^3, B horizon = 1.53 g/cm^3, C horizon = 1.62 g/cm^3. Each replaced horizon will be measured by nuclear gauge and the converted dry density will be compared to these averages.

Citation:

USDA-NRCS. 2017. Tillage Equipment. Pocket Identification Guide. p.24

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1323703.pdf accessed 3/17/20020

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