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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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TO: Pam Grubaugh-Littig, Bond Release Co-coordinator *Permit Supervisor* *pgl*
THRU: Daron Haddock, Permit Supervisor *DORH*
FROM: Robert Davidson, Soils Reclamation Specialist *RAD*
RE: Phase II Bond Release, Western States Minerals, J.B. King Mine, ACT/015/002-99B, File #2, Emery County, Utah

SUMMARY:

On June 11, 1999, the Division received a Phase II and Phase III bond release request from Western States Minerals. On July 6, 1999, the Division notified Western States Minerals that the amendment would be processed for Phase II bond release only. The subsequent Division review and technical analysis on September 28, 1999, concluded that the Phase II bond release submittal was incomplete with several deficiencies identified. Western States Minerals responded on October 14, 1999 addressing each of the deficiencies, thus justifying Phase II bond release. All deficiencies associated with the soils review have been adequately addressed in this most recent submittal.

TECHNICAL ANALYSIS:

RECLAMATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-240.

Analysis:

State regulations R645-301-880.320 gives the requirements for Phase II bond release. Either of the following soils related requirements must be satisfied prior to Phase II bond release:

- **Evaluation of Erosional Soil Stabilization.** Show suspended solids or runoff outside the permit area is not in excess of the requirements set by UCA 40-10-17(j) and by R645-

301-751, for which the applicable parts of UCA 40-10-17(j) state:

(j) Minimize the disturbances to the prevailing hydrologic balance at the mine site and associated offsite areas and to the quality and quantity of water in surface and groundwater systems both during and after surface coal mining operations by:

(i) Avoiding acid or toxic mine drainage by such measures as, but not limited to:

‘p4(A) Preventing or removing water from contact with toxic-producing deposits;

- **Evaluation of Soil Productivity for Prime Farmlands.** Show soil productivity for Prime Farmlands has been returned to equivalent levels as farmed land in the surrounding area according to the requirements set by UCA 40-10-11(4) and by R645-301-200.

Acid and Toxic Drainage - UCA 40-10-17(j)

1994 Sampling Amendment

During May 1994, a drilling and sampling program was conducted at the JB King mine for the following three reasons:

- Geotechnical testing to determine acceptable side slope materials for the reclamation channels.
- Determine the toxic and/or acid forming characteristics of the channel material into which the proposed reconstructed channels could potentially erode.
- Determine the toxic and/or acid forming characteristics of any on-site refuse material.

The resulting July 1995 permit amendment (incorporated Oct. 5, 1995) provides analyses results for both the channel and refuse materials at the site. The amendment states the site will not produce acid and toxic forming material after mixing with non-toxic fills through erosion processes. Adjacent offsite areas were also sampled and were shown to be generally similar to the onsite samples, except they were non-acid forming. Sampling and conclusions were based in part on the State of Utah guidelines for topsoil and overburden management for underground and surface coal mining.¹ The amendment showed the following:

- The channel and native soil materials containing toxic levels of boron and selenium.

¹Leatherwood, J., and Duce, D., 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining.

- The refuse pile materials contained toxic levels of boron and selenium, and the refuse was shown to be acid forming.

However, the 1995 amendment contained errors with respect to reporting selenium and boron analyses. Both boron and selenium were reported as soluble, but were in fact analyzed as total. Therefore, additional boron and selenium testing were done in October 1994 using sample splits from the May 1994 samples. The resulting Hansen, Allen and Luce 1994 report to Western States Minerals is summarized as follows:

- Channel and native soil materials contained non-toxic levels of boron and selenium
- The refuse pile materials contained toxic levels of selenium.

Reclamation at the J. B. King Mine was conducted in 1985-86. The resulting convex land-form surface predisposes the soil surface to erosion. Currently no refuse is exposed at the refuse pile. However, rill and gully erosion has occurred in the general area located south of the refuse pile and north of the main drainage channels. In this east-central site area, off-site drainage flowing across the reclaimed surface has resulted in considerable rill and gully formation, often exposing buried coal refuse material (Figures 1 thru 3); this exposed coal refuse is not associated with the refuse pile. Coal waste is also exposed at the lower end, north east eroding bank of the main, right fork drainage channel (Figure 4). This east-central site area is identified as AREA 3, Figure 2, JB King Mine site Layout Transect and Area of Influence Map, Soil Loss Evaluation of the Reclaimed JB King Mine, May 1999, WSMC Engineering, Reno, Nevada.

UCA 40-10-17(j), (i), p4(A) specifies that reclamation must prevent or remove water from contact with toxic-producing deposits. As evidenced by the exposed coal refuse materials in the rills, gullies, and channel, water has been in contact with possible toxic-producing deposits. According to the October 5, 1995 incorporated amendment, harmful effects of toxic and acid forming materials should be nullified through the erosion process by mixing with other non-toxic/non-acid forming materials. The sedimentation pond captures the sediment and runoff. Over the life of reclamation, neither the Division nor Western States Minerals has ever observed or recorded any discharge from the sedimentation pond.

1992 Sampling Records

During 1992, soil and refuse samples were collected from the J.B. King site and analyzed using the Nevada Meteoric Water Mobility Procedure. The purpose of these tests were to evaluate the potential for dissolution and mobility of certain constituents from mine rock samples by meteoric water. The procedure consists of a single-pass column leach over a 24 hour period using a mine rock sample to extraction fluid (effluent) ratio of 1:1. The extraction fluid is Type II reagent grade water which is essentially deionized or distilled water. Samples included one sample from the sediment pond, three samples of the soils at the west edge of the refuse pile, and

three samples from the top of the refuse pile, which included the exposed coal on the vegetation test plots.

The report concludes that the coal refuse material appears not to present any apparent potential for degradation of the surrounding environment due to leaching of metals. Analyses of the leach liquor for Secondary Drinking Water parameters showed the following:

- Coal refuse and spoil materials are able to leach higher concentrations of TDS and sulfate than the surrounding soils. Analyses of the sediment retention pond materials show that these sediments have the lowest reported concentrations of TDS and sulfates.
- Sodium Adsorption Ratio values for all samples were in the acceptable range.
- The coal refuse and spoil materials did indicate the potential to be acid generating in two of the three samples analyzed. However, soils in the area have the capacity to neutralize any acidic runoff which may result from the coal refuse. Analyses of the sediment retention pond materials show that these sediments are non acid generating.
- The coal refuse materials when exposed to an open flame combined with sufficient oxygen will ignite. Based on the high composition of non-coal materials (~91 %), sustained combustion of the refuse pile is not likely and not considered a problem.

Erosional Stability (Soil Stabilization) - R645-301-244

Erosion Monitoring Program

The Phase II bond release application provides summary information for the "Erosion Monitoring Program". As specified in the approved Mine Reclamation Plan, the "Erosion Monitoring Program" was set up for the reclaimed JB King Mine in 1995 to monitor erosion for Bond release purposes (i.e., section UMC 817.110). Periodic monitoring has previously been submitted to the Division documenting erosion data, which includes photos and cross-sections. The monitoring data shows the geomorphic changes that have occurred over time at the site. The following observations have been submitted summarizing the geomorphic changes:

- Approximately 2/3 of the surface water that is handled at the reclaimed site (32.4 acres) is from off-site drainage (61.9 acres).
- Approximately 88% of the off-site drainage water is conveyed on-site by Ditch #1 (61%) and Ditch #2 (27%).
- The remaining 12% of the off-site drainage water flows onto the site has contributed to minor formation of rills and gullies over a broad area of the reclaimed site.

Soil Loss Evaluation - RUSLE

Western States Minerals presents a "Soil Loss Evaluation of the Reclaimed J.B. King Mine" report dated May 1999, which discusses erosive activity at the JB King Mine site as determined using the Revised Universal Soil Loss Equation (RUSLE). The "Soil Loss Evaluation" report includes (1) a prediction of the current rate of soil loss at the site, and (2) a comparison of the RUSLE prediction versus an estimate based on the sediment amounts collected in the sediment pond. As reported by Western States, the RUSLE prediction for soil loss at the reclaimed site is 1.27 tons/acre/year; average soil loss based on the sediment pond is 1.48 tons/acre/year.

RUSLE is an accepted model for determining the average annual soil erosion rates exclusive of rill, gully and channel erosion rates. The J.B. King reclaimed site was divided into six evaluation areas with each area given a representative transect based on internal similarities of soil type, vegetative cover, rock fragment composition, and topography. The "Soil Loss Evaluation" report uses previous data from 1993 that represents each of the six transects. The six transect areas were selected, in part, to correspond to the soil samples collected. An attached Soil Location Map identifies each of the six transect areas and their correspond soil sample location points. Western States Minerals state that samples JBK03 and 04 were collected off-site, but were determined to correlate with Areas #4 and #5, respectively, and were therefore, used to represent those areas. Soil samples collected off-site, from undisturbed soils, do not represent either the physical or chemical status of on-site, drastically disturbed soils and fills used for reclamation. Furthermore, Western States Minerals states that data values were adjusted for changes that have occurred over time to account for sample collection methodology. However, the two modifications that were made are only applicable for Area 2:

1. A slight increase in the percent organics, based on the addition of biosolids and revegetation success from 1993 to present
2. The percent silt and clay were decreased slightly to account for the greater proportion of rock fragments, but were not initially sampled in 1993.

These two modifications are not applicable for Areas 1, 3, 4, and 5.

Elements of the RUSLE equation (e.g., K factor) require specific soil physical parameters for determining relevant values that represent site specific soils. These soil parameters include, but are not limited to, soil permeability, soil structure, % very fine sand, coarse fragment % by weight, % rock cover, and soil density. The 1993 soil data does not report % very fine sand, soil permeability, soil density, % rock by weight, or % surface rock cover. Additional transect specific data should include % canopy cover and soil root mass that were not sampled in 1993. Since none of these parameters were included in the 1993 soil data, they were entered subjectively into the RUSLE program based on the judgement of Western States Minerals. Using non-specific and incomplete data, or averaging across the site for missing data, does not

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accurately reflect or represent each region; therefore, the resulting RUSLE results can not be validated and are at best, only approximations for soil stabilization.

Prime Farmlands Evaluation - UCA 40-10-11(4)

No prime farmlands exist on site; therefore, UCA 40-10-11(4) does not apply.

Findings:

Information provided in the application is considered adequate to meet the requirements of this section of the regulations.

RECOMMENDATIONS

The J.B. King reclaimed mine site should receive Phase II bond release based on:

- The minor rill and gullies should not disrupt the approved post mining land use or interfere with further vegetation establishment.
- The eroded sediments containing in part coal and refuse are shown not to be toxic or acid forming when diluted with other on-site sediments.
- Soil loss evaluation of the reclaimed site using RUSLE provides a best guess approximation for soil stabilization.



Figure 1. Area 3 gully erosion into coal refuse material.



Figure 2. Area 3 gully erosion into coal refuse material.



Figure 3. Area 3 gully erosion into coal refuse material.



Figure 4. Left fork channel bank has eroded exposing coal refuse.