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TO: Internal File

FROM: James D. Smith, Sr. Reclamation Specialist/Hydrogeology, Team Lead JDS

RE: Technical Analysis for Amending the Reclamation Plan – Lower Pad (Phase 2), Energy West Mining Company, Des-Bee-Dove Mine, C/015/017-AM01D-1

SUMMARY:

The Deseret, Beehive, and Little Dove Mines were temporarily sealed in 1987. The permit was taken out of temporary cessation in 1999 in order to begin reclamation. The reclamation plan is being modified because the Tipple pad, which was to be left basically unreclaimed under the old plan, has been excavated to recover coal that was used in its construction.

Proposed amendment C/015/017-AM01D is for reclamation of what Energy West calls the Phase 2 area, which is the road from the permit area boundary (where the county road ends) to the Tipple pad, the Deseret Mine portals and pad, the Bathhouse pad, the remainder of the Tipple pad, and related roads within the permit area. Initial reclamation of the Phase 1 area – the Little Dove and Beehive pad, the water tank pad, the substation pad, and related roads – was completed in May 2002. Neither Phase 1 nor Phase 2 includes reclamation of the sedimentation pond.

Utah Coal Mining Rules require a coal-mine operator to demonstrate steps to be taken to minimize disturbance to the hydrologic balance within the permit and adjacent areas and to prevent material damage outside the permit area. This TA is for Phase 2 only.

TECHNICAL ANALYSIS:

RECLAMATION PLAN

HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

Analysis:

General

The Des-Bee-Dove Mines are in a small, unnamed canyon that is tributary to Grimes Wash and part of the Cottonwood Canyon Creek drainage. Hydrologic resources of the entire East Mountain area, which includes the Cottonwood/Wilberg, Deer Creek, and Des-Bee-Dove Mines, are described in Volume 9 - Hydrologic Section.

No ground-water resources have been documented in the Des-Bee-Dove area, the strata east of the Deer Creek Canyon fault being essentially dry. There are some small springs farther down the canyon that will not be affected by this reclamation.

The pad for the Beehive and Little Dove Mines was built across three ephemeral channels at the head of the drainage. Flow from the two northernmost channels was captured on the Beehive - Little Dove pad and diverted around the Deseret and Tipple pads, through culverts and ditches, to the edge of the disturbed area and into the natural channel leading to the sedimentation pond. The undisturbed channel at the south end of the Beehive - Little Dove pad was diverted around that pad by a berm, but a ditch on the Deseret pad captured flow and carried it to the natural channel. All three of these channels were restored to approximate premining configuration during Phase 1 reclamation, and discharge will now simply flow over the ledge separating the Phase 1 and Phase 2 areas and drop directly to the Phase 2 area.

Phase 2 reclamation will result in stable areas where water from the Phase 1 area will flow in a constructed channel through the reclaimed Tipple pad area, into to the undisturbed channel, and to the sedimentation pond. Until Phase 2 is completed, any discharge will flow to the low spot left from the Tipple pad excavation. If there is enough water, it will breach the edge of that excavation and report to the sedimentation pond. The sedimentation pond was designed for total containment of runoff from not only the disturbed area but also from a large undisturbed area around the mines.

Materials used to construct the channels will be gradational from fine material at bottom to coarse at top, as shown in Drawing CS1819A (Phase 1), and on Plate 4 - 1 - sheet 2 of 5 in Volume 4. The engineered channels will be embedded into the fill. Beyond merely separating out boulders, some method will be needed on site to obtain adequately graded materials for filter and riprap. Boulders and coarse materials need to be placed so as to be stable, not just dumped.

For reclamation of the Des-Bee-Dove mine, channel and slope stability are more important than getting the fill all the way to the top of cut-slopes. Channels and filled slopes need to be designed and built so that water cannot saturate and destabilize fill materials.

Diversions

All diversions and drainage control structures constructed for mine operations will be removed and the areas reclaimed. Flows will be returned to natural channels or constructed channels at the approximate locations of the original, natural channels.

Calculations for peak storm discharge and volume, needed to design the constructed channels, are in Appendix A of the Phase 1 amendment. Calculations were done using the STORM program, which is available through OSMRE's TIPS program. An SCS Upland Curve 7 - ephemeral channel - was used. The parameters and method are discussed on pages 20 to 24 and results are summarized in Table 7-1 on page 24 of the Phase 2 amendment.

Calculations for channel design, including filter and riprap sizing, were done using FlowMaster (version 5.13), which is based on Manning's equation. Parameters and calculation methodology for channel design are explained on pages 25 through 30. Channel dimensions, expected flow characteristics, and D_{50} riprap requirements are summarized in Table 7-2 on page 29. Results of channel design by Hansen, Allen & Luce, Inc. are in Appendix A The design work in Appendix A is not certified, but the same designs are on Drawing 500-2, which is certified by David Hansen, PE.

Channel design for Phase 2 has been done for Upper, Intermediate, and Lower Zones. Phase 2 reclamation will begin at the top and work downstream

The Upper Zone includes natural sandstone cliffs between the Beehive - Little Dove pad and the Deseret pad. This zone is approximately 120 feet long. To dissipate the energy of water dropping onto the Deseret pad, boulders and riprap will be used to cover portals, coal seams, and highwalls or faceups. Where drainage from above is not expected, available, ungraded fill will be used and compacted in lifts.

The Intermediate Zone is on rock outcrop. It is approximately 450 feet long. It will approximate the natural, pre-mining channel and involve no riprap or engineered channel design. Large boulders will generally not be placed within the channel because they can obstruct and divert flow, causing erosion of adjacent reclaimed areas. Water will flow over outcrops and energy will be dissipated as natural drop structures develop.

The Lower Zone is the longest, approximately 1,200 feet, extending from the lowest outcrop of the Intermediate Zone to the disturbed area boundary. This zone will be reclaimed through construction of a trapezoidal channel. The channel will be graded to approximate original contour (AOC) and then lined with riprap. To maintain or establish stable slopes

adjacent to this channel, part of this channel will be constructed on placed and compacted fill.

The method used to determine riprap and filter gradation requirements is referred to on page 30 of the amendment. Table 7-3 contains the riprap and filter gradations determined for what the permittee considers the two most probable channel-slopes that will be constructed in the Lower Zone, 13.1% and 32.3%. These slopes were determined from current survey and topographic information; however, it is expected that some rock outcrops will be encountered during construction that will necessitate modifications to the design, such as the small drops structures and pools shown in the "alternate riprap channel design" on Drawing 500-2.

Materials for constructing these channels are to be obtained on-site. Riprap sizes must be varied rather than uniform. The Procedural Steps of Reclamation Table in Section 540 states that sieve analysis will be done to assure riprap gradation meets design criteria.

Riprap should be angular rather than rounded: boulders that will be excavated on-site may be more rounded than is desirable and a method of breaking them into more angular material may be needed. The permittee states in the September 15 cover letter to the second Phase 1 submittal that they do not anticipate a need to crush or break boulders available on site to obtain appropriate angular material because most available boulders are the result of recent weathering and tend to be angular rather than rounded.

Drawing 500-2 shows cross-sections and profiles of various typical structures. Drawing 500-1 shows where these typical structures are to be built.

Schematic cross-sections of engineered channels on Drawing CS1819A in the Phase 1 amendment show that the soil immediately adjacent to the channels will overlap the uppermost riprap and cover the upper edge of the engineered channel to provide a transition from the constructed channel to soil and avoid a visible, hard edge. This transition will not only be visually more like existing natural channels but will promote growth of stabilizing, anchoring vegetation in the coarser material and eliminate an edge that could facilitate and concentrate erosion parallel to the channel: there is no analogous design in the Phase 2 amendment, but the Division expects similar design and construction criteria to be used at all stages of reclamation construction.

A small, undisturbed drainage at the south end of the Bathhouse pad is segregated from the disturbed drainage system by a 30-inch culvert that passes beneath the pad. Discharges from several other small undisturbed drainages flow onto the pad and become mixed with the disturbed drainage. All these small drainages will be reestablished in a similar manner: the pad will be excavated to bedrock, the channels will be recontoured, and the adjacent slopes will be blended to resemble the natural drainage above the pad. To prevent erosion, these channels will be armored where they lie on fill, but the plan does not have an engineered design or indicate the use of riprap in these channels.

Experience has shown that channels built on fill are subject to many problems, including failure, if not constructed correctly. Acknowledging that it is the permittee who has the authority to control, direct, and supervise construction of the reclamation channels, the Division would like to have a hydrologist or other Division representative present during placement of the filter and riprap. The permittee has stated, in the cover letter dated September 15, 2001, that they expect division representatives to be at the site as much as possible during construction to facilitate communication, and that they will make every effort to keep the division informed on progress and timing of construction.

Sediment control measures

Contouring, pocking, and vegetation are the methods to be used to keep sediment in place on reclaimed surfaces. Weed-free alfalfa hay will be incorporated into the soil at a rate of 2,000 lbs/acre (R645-301-341). Surfaces will be roughened by pocking or deep gouging to retain sediment and moisture and to mix the straw mulch into the upper portion of the soil. Hydroseeded areas will receive wood-fiber mulch. A soil tackifier will be applied to protect against erosion until vegetation is established (R645-301-244). Rock litter on the surface will also aid in sediment control, enhance vegetation establishment, create micro-habitats, and help provide a natural aesthetic appearance (R645-301-244). If erosion is identified during routine monitoring or monitoring after precipitation events, silt fence will be installed and, if needed, the surface will be enhanced and reseeded.

Success of the sediment control measures will be evaluated by examination in the field. There is no other method or standard proposed to directly determine the success of the sediment-control.

Sediment concentrations above background are not expected (R645-301-242.130); however, background levels for this site are not known. There are no water-quality or sediment load baseline data for this Des-Bee-Dove drainage that allow a comparison similar to the one done at Deer Creek Mine: this lack of baseline or background data will need to be accounted for in any evaluation of the effectiveness of sediment control measures. Such an evaluation may indicate that the measures are not adequate and more robust methods of sediment control are needed for this steep, dry, rocky, exposed site.

In the following discussion, "Appendix B" and "Appendix C" refer respectively to:

- Appendix B of Section R645-301-700 – Hydrology in Appendix XIV - Phase 1 Reclamation Plan; and
- Appendix C of Section R645-301-200 - Soils in Appendix XIV - Phase 1 Reclamation Plan.

Predictions of soil loss are found in Appendix B. The map in that appendix shows two of the profiles used to calculate soil loss - A31D and A32D - are in the Phase 2 area. The Applicant used RUSLE, developed by the NRCS, to estimate sediment contribution from reclaimed and

undisturbed watersheds at Des-Bee-Dove, similar to what was done at the nearby Deer Creek Mine. RUSLE is not intended for calculations of soil loss from steep slopes, but provides at least a calculated estimate of the expected sediment levels as a starting point should further evaluation be needed.

Information in Appendix B is summarized below in Table TA-1. A soil-erodibility or K value of 0.206 (K_U in Table TA-1) was used in the RUSLE soil-loss calculations for all undisturbed areas, a value based on information for the Kenilworth Series in the Soil Survey of the Carbon – Emery Area. RUSLE calculated the soil loss (A_U in Table TA-1) to be 0.05 tons/year/acre for all undisturbed areas (there was little variation between undisturbed areas for any of the input parameters).

TABLE TA-1, based on information in Appendix B

K – RUSLE Soil Erodibility Factor
A - RUSLE Calculated Soil Loss in tons/year/acre

Disturbed Areas			Undisturbed Areas		
Soil Profile ID from Appendix B	K_{SA} Calculated by RUSLE Using Soil Analysis Data but with Very-fine Sand Fraction Missing	A_{SA}	K_U For All Undisturbed Areas	A_U For All Undisturbed Areas	Percent Difference Between A_{SA} and A_U
DBDA11D	0.394	0.092	0.208	0.05	+84%
DBDA21D	0.394	0.044	0.208	0.05	-12%
DBDA22D	0.361	0.03	0.208	0.05	-40%
DBDA23D	0.262	0.054	0.208	0.05	+8%
DBDA31D	0.262	0.034	0.208	0.05	-32%
DBDA32D	0.389	0.052	0.208	0.05	+4%

Using the soil-analysis data from the Des-Bee-Dove site, values of K for the disturbed areas were also calculated in RUSLE, (K_{SA} in Table TA-1); however, the soil analyses that were used as input to these calculations did not include the very-fine sand fraction now included in Exhibit B of Appendix C, so the input K and output A values in Appendix B do not account for this size-fraction.

Disturbed soil profiles DBDA11D shows a predicted sediment losses 84% greater than the undisturbed areas, while soil loss is predicted to be much less in DBDA22D and DBDA31D. Predictions for the other three areas show soil loss might be roughly equivalent to that in the undisturbed areas. Longer slope-length and cover management appear to be important factors

where predicted soil-loss is greater in disturbed areas than in undisturbed areas, support practice (surface roughening) where it is less.

The Permittee needs to do the RUSLE soil-loss calculations using the laboratory soil testing results in Exhibit B of Appendix C that include the very-fine sand fraction.

Siltation structures

There is a commitment on page 30 in Section 763 to retain and maintain all temporary sedimentation structures, including the berm along the access road, until completion of sequenced reclamation. Basins, traps, straw bales, etc. are proposed for sediment control during the construction phase of reclamation. When reclamation grading and construction are complete, the resulting pocked and roughened surface, littered with rocks and boulders, will assist in sediment control until vegetation becomes established.

Reclaimed areas will continue to report to the sedimentation pond (R645-301-553.100, p. 17). Removal of the sedimentation pond is not included in Phase 1 or Phase 2 reclamation, and the sedimentation pond will remain until vegetation is established and the Division approves its removal (R645-301-541, page 500-2). (Henry Austin of OSM has expressed his opinion that if the sedimentation pond is to be used for sediment control, the entire drainage between the mine-site and the pond needs to be permitted. A letter from Mary Ann Wright, dated August 29, 2001 clarifies the Division's position that there will be no requirement to permit the wash that connects the disturbed area pad to the sediment pond.)

Sedimentation Ponds

Ultimate treatment of runoff from the mine site is at the sedimentation pond. Energy West is planning on reclaiming the sedimentation pond as the final step in reclamation. Until other sediment control measures are effective in the Phase I and Phase 2 areas, total containment of all runoff in the sedimentation pond will remain the primary sediment control. Removal of the sedimentation pond is not planned at this time.

Ponds, Impoundments, Banks, Dams, and Embankments

A large hole or depression was left by the removal of coal from the Tipple pad, and although most of this hole was filled with sediment during a storm in late summer of 2001, a small depression or impoundment remains. Additional runoff and sediment will report to this low point. The Permittee does not consider this hole to be a sediment-control structure or impoundment. It is not a designed structure; it will probably fail, possibly suddenly, should there be a large storm event before reconstruction of this part of the channel is completed. Reconstruction of the channel will be from north to south, so this will be the last section of channel to be rebuilt.

Findings:

Reclamation Hydrologic Information is not adequate to meet the minimum requirements of the Coal Mining Rules. Prior to approval, the Permittee must provide the following information in accordance with:

R645-301-752, The Permittee needs to do the RUSLE soil-loss calculations using the laboratory soil testing results in Exhibit B of Appendix C that include the very-fine sand fraction.

RECOMMENDATIONS:

Prior to approval, the requirements of the Coal Mining Rules must be provided as outlined above.

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