

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

June 27, 2008

TO: Internal File

THRU: Jim D. Smith, Permit Supervisor *DS 07/07/08*
Wayne Western, Team Lead *WHW*

FROM: Steve Christensen, Hydrologist *SICC*

RE: Midterm Review, Andalex Resources, Inc., West Ridge Mine, C/007/041, Task ID #2960 Previous Task ID #2690

SUMMARY:

The Division of Oil, Gas and Mining initiated a mid-term review for the West Ridge Mine (the Permittee) on November 13, 2006 (Task ID #2692). On April 22, 2008, the Division received the responses to the initial technical review. The initial review included an examination of the MRP to ensure that the plan contains commitments for application of the best technology currently available (BTCA) to prevent additional contributions of suspended solids to stream flows outside of the permit area.

The previous hydrologic review identified three deficiencies that have been addressed with this submittal. The midterm review for the West Ridge Mine should be approved.

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TECHNICAL ANALYSIS:

OPERATION PLAN

HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

Analysis:

Water-Quality Standards And Effluent Limitations

The Utah Division of Water Quality (DWQ) has issued UPDES (Utah Pollution Discharge Elimination System) Permit No. UT0025640 for the West Ridge Mine. The permit specifies the reporting and self-monitoring requirements for two UPDES points: UPDES 001 – discharge from the sediment pond to ‘C’ Canyon ephemeral drainage; and UPDES 002 – discharge from the underground workings to the ‘C’ Canyon ephemeral drainage. Effluent limitations set by the permit include total suspended solids (TSS) limits of 70.0 mg/L for a daily maximum discharge, 35 mg/L for a 7-day average discharge, and 25 mg/L for a 30-day average discharge. Total dissolved solids (TDS) limitations are set at one ton (2,000 lbs) per day from grab samples collected twice per month.

Since the West Ridge Mine began discharging mine water in February 2003, average daily flow has increased from 111 gallons per minute (gpm) to a maximum of 700 gpm. Calculated TDS concentrations have exceeded the one-ton per day limit for many of the months since discharge began. To mitigate the repeated TDS exceedence, DWQ has allowed the mine to participate in a salinity offset program. Subsequently, the UPDES permit has been reissued for the West Ridge Mine effective May 1, 2006, and expires at midnight, April 30, 2011. The previous technical analysis had identified a deficiency relative to the UPDES permit. The UPDES permit had been modified and the new permit had not been added to MRP. The Permittee has provided the current UPDES Permit (No. UT0025640 to replace the old permit in Appendix 7-10 of the MRP. The UPDES permit was modified to reflect the relocation of Outfall 002.

Diversions: General

All diversions (drainage controls) within the permit area are located at the facility area, and consist of culverts and ditches. Maps 7-1 and 7-2 identify drainages and disturbed and undisturbed area diversions. With the exception of the alternative sediment control areas (ASCAs), all disturbed area drainage will be diverted to the sedimentation pond. All the diversions are temporary and will be removed during reclamation. The diversions consist of undisturbed area bypass culverts, disturbed area culverts, and undisturbed and disturbed area ditches.

Tables 1 through 4 of Appendix 7-4 describe the hydrologic characteristics of the drainages. The information in the tables is used to calculate the flow capacity for each structure. To calculate drainage peak flows and ditch capacities, the Permittee used the computer program by the "Office of Surface Mining Watershed Model" Storm Version 6.20. To calculate culvert capacities, the Permittee used the computer program Haestad Methods, Flowmaster I, Version 3.43. Computer calculations are provided at the end of Appendix 7-4.

In general, upon review of the MRP, it appears all diversions have been designed, located, constructed, and used to prevent, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area.

Diversions: Perennial and Intermittent Streams

'C' Canyon Creek is the only diverted perennial or intermittent stream within the permit area. Although 'C' Canyon is an ephemeral drainage, it is considered an intermittent drainage according to the R645 Coal Rules because the watershed is greater than one square mile (R645-200-100). The stream channel is diverted beneath the mine site through bypass culverts and discharges onto a protective rip-rap slope within the natural 'C' Canyon channel downstream of the disturbed area.

Drainages UA-AA, UA-DD, and UA-FF contribute runoff to the CMP right fork culverts, and drainages UA-HH and UA-JJ contribute runoff to the CMP left fork culverts. These culverts join and contribute drainage to the main canyon CMP culvert along with runoff from drainage UA-MM (Map 7-2 and Table 2 of Appendix 7-4). The culverts were designed using the calculated peak flow of a 100-year/6-hour precipitation event from the drainages of 2.0 inches. Table 6 of Appendix 7-4 lists the culvert characteristics used in calculations and Table 7 presents the culvert design summaries. The calculated minimum diameter for each culvert is shown to be smaller than constructed diameters in Table 7. The bypass culverts have been designed to handle peak flow of the 100-year/6-hour precipitation event, which exceeds the R645 requirement of a

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10-year/6-hour precipitation event for a temporary diversion of perennial and intermittent streams (R645-301-742.323).

The MRP indicates that mine water discharge of 0.51 cfs will be routed through ditches and into the sedimentation pond (Section 2.10 and Table 13 of Appendix 7-4). However, the mine is now discharging greater than 1 cfs, which is routed through the right fork bypass culvert at UC-EE as shown for UPDES 002 outfall on Map 7-2. Based on the culvert design summary (Table 7), the bypass culverts as constructed can easily handle the mine water discharge in addition to the calculated peak flow of a 100-year/6-hour precipitation event.

The previous technical analysis had requested that the MRP be updated to include the existing mine water discharge information and to indicate that the bypass culverts are adequately sized to handle the additional flow. On page 1a of Appendix 7-4, *West Ridge Mine Sedimentation and Drainage Control Plan (As Constructed)*, the Permittee discusses the additional mine water discharge. The bypass culvert calculations have been updated to reflect the potential flow increase from the mine water discharge. Structure UC-EE has been updated in Table 10, *Drainage Structures*, to reflect the additional 2.0 cfs of mine water discharge.

Diversions: Miscellaneous Flows

Besides the intermittent stream bypass culverts, The MRP identifies 33 diversions within the mine's disturbed area: two undisturbed area culverts (UC-PP and UC-RR), 13 disturbed area culverts (DC-2, DC-4a, DC-5 through DC-AR, and DC-10 through DC-13), two undisturbed area ditches (UD-Z and UD-15), and 16 disturbed area ditches (DA-1 through DA-15). Design calculations and construction diagrams are presented for each of the diversions in Appendix 7-4. The layout of the drainages and diversions are depicted on Map 7-2. Calculation methods and descriptions of culverts and ditches are presented in Sections 2.9 and 2.10 of Appendix 7-4, respectively. All diversions are temporary and will be removed upon final reclamation.

Undisturbed Area Ditches

Ditches UD-15 and UD-W are designed to divert runoff from undisturbed drainages at the south end of the mine site within ASCAs W and Z, respectively. The ditch design summaries are shown in Table 5 of Appendix 7-4. Designs are shown from calculations based on the peak flows from a 10-year/24-hour precipitation event (Table 5 and Figure 3). The ditches designs are triangular with 2:1 side slopes and minimum freeboards of 0.5 feet. The ditch designs exceed the required design to handle peak flows of a 2-year/6-hour precipitation event for a temporary diversion (R645-301-742.333). According to the MRP, the ditches are to be protected by rip-rap or concrete if the flow velocity exceeds 6 fps. Calculated flow velocities are below 6 fps and do not require protection.

Disturbed Area Ditches

Thirteen ditches (DD-1 through DD-13, and DD-4A) are proposed to divert disturbed drainage to the sedimentation pond. Drainages and ditches contributing to each respective ditch are presented in Table 10 of Appendix 7-4. Table 11 presents the peak flows and Table 12 summarized the ditch characteristics used to calculate the ditch designs. Designs are shown from calculations based on the peak flows from a 10-year/24-hour precipitation event (Table 13 and Figures 3, 4, and 5). The ditch designs are triangular with 2:1 side slopes and minimum freeboards of 0.5 feet. This design exceeds the required design to handle peak flow from a 2-year/6-hour precipitation event for a temporary diversion (R645-301-742.333).

According to the Application, a 6 fps limiting velocity is used for unlined ditches. Table 13 shows that four ditches have calculated flows in excess of 6 fps (DD-1, DD-4, DD-6, and DD8A). Ditch DD-1 has a calculated flow velocity of 6.02 fps and will remain unlined unless it exhibits erosion. Ditch DD-4 is protected with the use of wire gabion energy dissipaters and ditch DD-8A is protected with rip-rap. Ditch DD-6 is naturally lined with bedrock.

Undisturbed Area Culverts

Culverts UC-PP and UC-RR (three nine-inch CMPs) divert runoff from undisturbed drainage UA-PP beneath ASCA Z discharging to ditch UD-Z (Map 7-2 and Table 2 of Appendix 7-4). The culverts were designed to handle the calculated peak flow of a 100-yr/6-hour precipitation event from the drainage of 2.0 inches. Table 6 of Appendix 7-4 lists the culvert characteristics used in calculations and Table 7 presents the culvert design summaries. The calculated minimum diameter for each culvert is shown to be smaller than constructed diameters in Table 7. The bypass culverts have been designed to handle peak flow of the 100-year/6-hour precipitation event, which exceeds the R645 requirement of a 2-year/6-hour precipitation event for a temporary diversion (R645-301-742.333).

Culvert UC-PP has a calculated flow velocity below 6 fps for calculated peak flow less than the 100-year/6-hour event. Therefore, discharge to ditch UD-A does not require protection. The undisturbed culverts are designed with trash rack and riprap inlet structures to reduce potential obstructions and undercutting (Section 2.9 and Figure 5 of Appendix 7-4).

Disturbed Area Culverts

Thirteen culverts are proposed to divert the disturbed area drainage. Ditches contributing to the respective culverts are presented in Table 10 of Appendix 7-4. The culverts are designed and sized to collect and transmit the peak flow from a 10yr - 24hr precipitation event. Table 14 of Appendix 7-4 lists the culvert characteristics used in calculations and Table 15 presents the culvert design summaries. The calculated minimum diameter for each culvert is shown to be smaller than constructed diameters in Table 15. The culverts have been designed to handle peak

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flow of the 10-year/24-hour precipitation event, which exceeds the R645 requirement of a 2-year/6-hour precipitation event for a temporary diversion (R645-301-742.333).

Nine of the culverts have a calculated flow velocity exceeding 6 fps for calculated peak flows from the 10-year/g-hour event and/or the 10-year/24-hour event (Table 15). These ditches are shown to require rip-rap protection at their discharge. Rip-rap sizing for the culvert discharge is presented in Table 15.

Stream Buffer Zones

With the exception of the diverted section of 'C' Canyon Creek, no land within 100 feet of a perennial or intermittent stream within the permit area has been disturbed. As stated in Section 731.600 of the MRP, Stream Buffer Zones, 'C' Canyon Creek behaves as an ephemeral drainage but is considered an intermittent drainage according to the R645 Coal Rules. The Division has authorized the mine to allow the disturbed area within 100 feet of 'C' Canyon Creek with the diversion of the stream channel beneath the mine site. A buffer zone has been established and marked along the stream above and below the culvert to prevent channel disturbance by surface operations. Water quality is protected through sedimentation controls discussed in this memo below.

Sediment Control Measures

Sediment control measures are designed to prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area; meet the more stringent of applicable State or Federal effluent limitations; and, minimize erosion to the extent possible. Structures used for the run-off control plan for the permit area include disturbed and undisturbed area diversion channels, sedimentation ponds, containment berms, silt fences, and road diversion culverts.

Alternative Sediment Control Areas (ASCAs)

There are four alternate sediment control areas (ASCAs) described in Section R645-301-742 and Appendix 7-4, and depicted on Plate 7-2 of the MRP (ASCA-W, ASCA-X, ASCA-Y, and ASCA-Z). The combined ASCA areas encompass approximately 4.18 acres. The ASCAs as described in the MRP utilize either one or a combination of silt-fencing, straw bales, rip-rap, containment, and vegetative cover. These measures represent the Best Technology Currently Available (BTCA) in controlling sediment in areas that do not report to the sedimentation pond.

Siltation Structures: General

The West Ridge Mine sedimentation ponds are the only siltation structures within the permit area. The sedimentation pond design calculations are presented in Appendix 7-4 of the MRP. The operation and maintenance of the sedimentation pond is described in Section 7.42.22.

Siltation Structures: Sedimentation Ponds

The West Ridge Mine sedimentation ponds consist of two ponds in series (cells A and B). Together, they are designed to contain the runoff from contributing watersheds from a 10-year/24-hour precipitation event, along with a minimum of three years of sediment storage. According to the MRP, mine water discharge (estimated at 0.51 cfs (230 gpm)) will be routed to the sedimentation pond through disturbed area ditches. The mine water level will not be allowed to exceed the sediment pond cleanout level. However, the mine is now discharging greater than 1 cfs which is routed through the right fork bypass culvert at UC-EE as shown for UPDES 002 outfall on Map 7-2.

Appendix 7-4 presents the sediment pond design, stage volume data, and design summary. Computer backup data for the runoff and soil loss for each contributing watershed is presented in Appendix 1 of Appendix 7-4. The sediment pond plan and cross sections are provided in Maps 7-4 and 7-4A.

The following is a brief description of how the R645 Coal Rules for sedimentation pond are met.

- R645-301-711.300, All methods and calculations are provided in Appendix 7-4.
- -742.221.31, Sediment inflow and storage requirements are presented in the amendment. Sediment storage volume was calculated using the Unified Soil Loss Equation (USLE) for each contributing watershed as presented in Appendix 7-4 (pp. 40 and 41). Total yearly sediment inflow for cells A and B are calculated at 0.438 and 0.170 ac-ft, respectively. The total three-year sediment inflow for the ponds is calculated at 1.824 ac-ft. The ponds are designed to contain this amount of sediment while maintaining adequate volume to contain the 10-year/24-hour precipitation event.
- -742.221.32, Adequate detention time is accounted for to meet the required UPDES effluent limitations because the ponds are designed to fully contain the 10-year/24-hour precipitation event.
- -742.221.33, It is not clear if the pond has been designed to contain or treat the water and sediment for the 10-year/24-hour storm event because: 1) the sediment volume contribution from the storm event is not presented, 2) the sediment cleanout level is not clear and, therefore, it is not clear whether the pond volume will be adequate to contain the storm event inflow, and 3) if discharge is to occur

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- during the storm event, adequate detention time is not available and sediment concentration at the time of discharge is not presented.
- -742.221.34, Both ponds are equipped with a non-clogging dewatering device. The primary spillway for cell A is an open channel spillway and the primary and emergency spillways for cell B are both 36-inch CMP risers fitted with an oil skimmer and trash rack.
 - -742.221.35, Short-circuiting will be minimized (in the event of a discharge) because inflows are located across the pond from the spillways, as is standard practice for short circuit prevention. In addition, the ponds together are designed to fully contain a 10-year/24-hour precipitation event.
 - -742.221.36, The pond clean-out levels are presented with the stage volume data. The cleanout level is set at 60 percent of the maximum sediment level of three years of sediment inflow. Map 7-4 shows sediment markers placed in the ponds to mark the clean-out level elevations.
 - -742.221.37, Assurance that excessive settlement will not occur is provided by the Construction Specifications (Section 3.1, Appendix 7-4) that state, "Fill will be placed in lifts not to exceed 15" and compacted prior to placement of next lift (sic). Compaction of all fill materials shall be at least 95%." In addition, the Sediment Pond Summary (Section 3.4, Appendix 7-4) states, "The pond has been constructed according to the design criteria listed under 'Construction Specifications for Sedimentation Ponds'."
 - -742.221.38, Assurance that the pond will be free of sod, large roots, frozen soil, and acid- or toxic-forming coal-processing waste is provided by the Construction Specifications (Section 3.1, 7-4) that state, "Native material shall be used where practical". In addition, the Sediment Pond Summary (Section 3.4, Appendix 7-4) states, "The pond has been constructed according to the design criteria listed under 'Construction Specifications for Sedimentation Ponds'."
 - -742.221.39, Assurance that the pond will be compacted properly is provided by the Construction Specifications (Section 3.1, Appendix 7-4) that state, "Fill will be placed in lifts not to exceed 15" and compacted prior to placement of next lift (sic). Compaction of all fill materials shall be at least 95%." In addition, the Sediment Pond Summary (Section 3.4, Appendix 7-4) states, "The pond has been constructed according to the design criteria listed under 'Construction Specifications for Sedimentation Ponds'."
 - -742.222, The pond does not meet the size or other qualifying criteria of the MSHA, 30 CFR 77.216(a).
 - -742.223, The spillways have been demonstrated to safely discharge the 25-yr/6-hr precipitation event. The intercell open-channel spillway will discharge the 25-yr/6-hr precipitation event of 12.55 cfs when flow within the spillway reaches a depth of 0.83 feet as shown on Table 17A and Figure 9 of Appendix 7-4. The open-channel spillway is designed with a minimum depth of two feet. The 36-

inch CMP principal and emergency spillways will discharge the 25-yr/6-hr precipitation event at a depth of 0.89 feet over the inflow elevation as shown on Tables 18 and 19, and Figures 10 and 11 of Appendix 7-4. Each spillway can easily discharge the peak flow of a 25-yr/6-hr precipitation event because there is greater than 0.89 feet available above each of the spillway inflow elevations. The principle spillway is one-foot below the emergency spillway, and the emergency spillway is a minimum of 2 feet below the crest of the dam.

Meeting the requirements of the R645 Coal Rules for sedimentation ponds ensures that the design standards of the West Ridge Mine sedimentation pond represents BTCA to prevent additional contributions of suspended solids to stream flows outside of the permit area.

Siltation Structures: Exemptions

There are no Small Area Exemptions (SAEs) described in the West Ridge Mine MRP.

Discharge Structures

The only discharge structure for the West Ridge Mine is the rip rap outlet at the bypass culvert UC-OO described in Section 2.12 of Appendix 7-4. The discharge structure is designed to protect the natural channel from the discharge of a 100-year/6-hour precipitation event plus sedimentation pond discharge of 100.01 cfs. The structure is comprised of 12-inch D₅₀ riprap apron that is 20 feet long and tapers from 4 feet at the culvert outlet to 2 feet with a 0% grade. The calculated flow velocity at the end of the outlet is 4.99 fps (calculations at the end of Appendix 7-4). Because the mine water is now discharging through the bypass culvert, the MRP was updated to reflect that the riprap discharge structure is adequate to prevent scouring of the natural drainage channel.

On page 12 of Appendix 7-4 (Section 2.12), the Permittee discusses the design considerations for designing the discharge structure. The riprap apron was designed based on Figure 7-26, Design of Outlet protection-maximum Tailwater condition, "*Applied Hydrology and Sedimentology for Disturbed Areas*", Barfield, Warner and Haan, 1983. Based on the figure, the minimum length of the apron is 15'. The length was increased to 20' to ensure adequate time for velocity reduction. The riprap apron was sized and designed to adequately dissipate energy from flow velocities of a 100-year, 6-hour precipitation event.

Findings:

The West Ridge MRP contains commitments to use the best technology currently available (BTCA) to prevent additional contributions of suspended solids to stream flows outside of the permit area. BTCA means that the operator is employing the best methods available at any one time.

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RECOMMENDATIONS:

The West Ridge Mine MRP contains commitments to use BTCA to prevent additional contributions of suspended solids to stream flows outside of the permit area. The deficiencies identified in the previous technical analysis (Task ID #2692) have been addressed by the application.

The midterm review for the West Ridge Mine should be approved.

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