



# State of Utah

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DIVISION OF OIL, GAS AND MINING

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TO: File

FROM: Rick P. Summers, Reclamation Hydrologist *RS*

RE: Technical Analysis-Aberdeen Facilities Drainage Control Plan (received 10-17-88), Andalex Resources, Centennial Project, ACT/007/019, Folder #2, Carbon County

## INTRODUCTION:

This review is specific to the diversions (DD-4, UD-4, UD-5, UD-2), culverts (C-15, CD-7), and sediment pond E proposed for the development of the Aberdeen mine facilities. It does not include the remainder of the program regulations such as reclamation sediment pond design (E-PM), water monitoring, channel reclamation, and existing site drainage plans and structures.

## TECHNICAL ANALYSIS:

### UMC 817.43 Hydrologic Balance: Diversions

The applicant proposes four diversions for the Aberdeen mine facilities area. These diversions are depicted on Plate 8 of the MRP and are identified as DD-4, UD-2, UD-4, and UD-5. An additional diversion is not identified in the design calculations and text but is depicted on Plate 8. This diversion is located from the office facilities area to culvert CD-6 along the office access road. This diversion should have a label and design and sizing information should be submitted.

The following comments refer to Plate 8 and the depiction of diversions and watershed boundaries:

Diversion UD-4 ends approximately 300 ft. upstream from sediment pond E. This diversion should be extended to the watershed boundary at the inlet to culvert C-14 or the watershed boundary should be revised to depict this area drainage reporting to sediment pond E.

The direction of drainage immediately up the main access road from culvert CD-5 should be depicted. If the drainage from the depicted road crossing for DD-3 at the upper end of sediment pond C reports to culvert CD-5, the watershed boundary for the undisturbed drainage reporting to pond E should be revised to include this area.

The watershed labeled as "undisturbed drainage to sediment pond E" located up canyon from culvert C-14 appears to be incorrect. A large portion (northern) appears to report to sediment pond C. The boundary should be revised or a diversion should be depicted that directs this drainage to sediment pond E.

The watershed located between culvert CD-6 and C-12 should be depicted and included in the design of sediment pond E.

The watershed areas presented in Table IV-3 and 3A, pages 165-167, for UD-4, UD-5 and DD-4 appear to be in error. Exact values were not digitized by the Division, but using an engineer's scale and assuming an approximate triangular shape (Plate 8), the following values were found: UD-4 is approximately 5 acres (600 ft. x 650 ft./2); UD-5 is approximately 16 acres (1150 ft. x 1140 ft./2). The values presented in that Table are 3.21 acres and 9.0 acres for UD-4 and UD-5 respectively.

Similarly, the hydraulic lengths appear to be in error. Scaled values for UD-4 and UD-5 are approximately 600 ft. and 1800 feet versus 250 ft. and 800 ft. as presented in Table IV-3. The hydraulic length for DD-4 was given as 200 ft. which is clearly underestimated (reference to Plate 8). The watershed area for diversion UD-2 is given as 74.2 acres whereas Appendix 0 and Division calculations result in approximately 55 acres. The disturbed area for DD-4 is given as 6.02 acres (Table IV-3A, p. 167) which results in a peak flow of 21.9 cfs. In contrast, page 150, section 2.8, gives the disturbed acreage for the primary spillway design as 11.82 acres with the same peak flow (21.9 cfs). Clearly, discrepancies exist. That table also gives an undisturbed area of 36.0 acres for DD-4 design. The Division estimates this area to be on the order of 15 acres.

The orifice flow rating tables in Appendix O appear to be based partially upon an incorrect formula. The first formula is correct, however the formula given at the bottom of the page(s) is incorrect. The value given as D should be the circumference of the pipe for weir controlled flow calculations. Checking the calculations shows that the diameter of the pipe was used as D for the calculations. For example, at one ft. of head the weir flow control will be 25.9 cfs and the orifice control flow will be 23.64 cfs. The Table presents the flow as 7.5 cfs.

Appendix O contains design information for the undisturbed culvert system. The application previously used a curve number of 70 for these designs. This submittal utilizes a curve number of 65 for the revised designs. The submittal states that the curve number was based upon site visit and literature. The submittal should include the specific assumptions used in the CN determination (i.e., watershed soil type and hydrologic group, vegetation type, and total vegetation cover values). Text narrative on page 156 discussing curve number selection should correspond with values used and presented in the design calculations and tables (including Appendix O). The vegetation information should be referenced to the vegetation survey data in the MRP.

#### UMC 817.44 Hydrologic Balance: Stream Channel Diversions

The applicant proposes to extend the existing bypass culvert beneath the mine facilities to a location below the anticipated disturbance associated with the Aberdeen mine facilities. Peak flow values were checked to validate the applicant's values. The Division values for 10 yr. - 24 hr. peak flow events for all watersheds were slightly less than those presented by the applicant (attached). The Division calculations were performed using a CN of 70 and a precipitation value of 1.82 inches. The applicant's flow were calculated using a CN of 65 and a precipitation value of 2.25 inches. To obtain the design flow value for culvert C15, peak flow values were routed for all upstream watersheds. The Division calculated a value of 46.1 cfs (SEDCAD software) and the applicant presented a value of 55.0 cfs for the design flow. This design will be acceptable when justification for the curve number selection (65) is submitted and approved. The calculation's using a CN of 70 in Appendix O should be removed from the application.

UMC 817.46 Hydrologic Balance: Sedimentation Ponds

A single sedimentation pond (pond E) is proposed to treat the drainage from the disturbance associated with the Aberdeen Mine facilities area. A manual decant structure has been proposed to decant treated runoff as necessary. The decant is to be located at an elevation of 6956 feet. The application contains discrepancies in watershed boundaries and does not give an accurate elevation for the maximum sediment storage, therefore, compliance with subsection (d) cannot be demonstrated.

Page 150, section 2.8, presents the required head (under orifice controlled flow) to pass the peak flow event as 2.53 feet. Plate 13 depicts a primary spillway elevation of 6960 ft., an emergency spillway elevation of 6961 ft., and the top of the embankment at 6963 feet. This indicates the 10 yr. - 24 hr. event will pass through the emergency spillway (6961 ft.). It also indicates the pond design will not meet the requirements of subsections (g) and (j). It appears as if the peak flow values used are conservative and that the required head value assuming orifice flow is in error. It appears as though the applicant used the value from the orifice flow stage-discharge relationships given in Appendix O. As noted under the discussion for UMC 817.43, this table appears to be incorrect.

The emergency spillway design is based upon Manning's equation. Accepted practice usually uses the formula  $Q = CL(H)^{1.5}$ . However, the emergency spillway design presented does not contain a Manning's n value for the grouted riprap. The design appears to be based upon the slope 3h:1v which is the outslope of the embankment. The design depth should be based upon the limiting slope across the spillway crest and the design velocity should be based upon the maximum slope (outslope). Even so, using the values presented on page 150 and Figure IV-6, the calculated depth of flow, required structure area, and velocity values are in error. The correct information is required to determine compliance with subsection (i) of this regulation. It was also noticed (section 2.8, p. 150) that with an increase in the peak flow from 28 cfs for pond E to 95 cfs for pond E-PM and using the same spillway structure, the velocity remains the same at 18.53 fps. This is impossible. It is suggested that a design be submitted using the weir flow formula presented at the beginning of this paragraph.

Division calculations show that at an elevation of 6954 ft. (the 60 percent sediment cleanout elevation, Plate 13), the available pond capacity is 0.57 ac-ft. This is less than the 0.709 ac-ft. value presented in section 2.6 on page 142. This value is approvable, but the operator should be aware that this value will require more frequent pond cleanout than regulations require. Plate 13 depicts an elevation of 6954 ft. for the sediment cleanout level while Figure IV-4A depicts that elevation as the maximum sediment level. Page 145 incorrectly states the maximum sediment design elevation is depicted on Plate 13. These discrepancies should be corrected and correct elevations for the 60 percent cleanout and maximum sediment storage should be submitted. The development of a stage-volume curve for the pond is considered to be the easiest means to determine these values and demonstrate compliance with this regulation.

Page 98, section 4.9, states the disturbed area of the Aberdeen minesite will be 6.4 acres. This conflicts with pages 142 and 145 (11.82 acres).

The watershed boundary to sediment pond E is unclear. Specific concerns have been previously discussed under UMC 817.43 of this review. Pond runoff volumes and design peak flow values have not been evaluated at this stage of the review due to these concerns. Additionally, as discussed in UMC 817.43, the undisturbed curve number used for the calculation of the diversions (65) differs from the undisturbed curve number for the pond design (70). The use of 70 will be acceptable if the 65 can be adequately justified as previously discussed.

The size of the antiseep collars is not specified in the plan.

The top width of the embankment is proposed to be 10.0 ft. (Plate 13) which exceeds 9.6 ft. as required by subsection (l). The combined sideslopes meet the requirements of subsection (m). The pond will be inspected quarterly (section 2.2-5) as required by subsection (t). Page 102 commits to monitoring the discharge into the pond and retaining the pond until the drainage meets state and federal water quality limitations and the revegetation requirements are met (complies with subsection (u)).