3.0 RESULTS AND DISCUSSION

3.1 Sedimentation Pond

3.1.1 Design. Results of analyses to determine the required size and hydraulics of the sedimentation pond are included in Appendix A. In sizing the pond, plans for future expansion of the surface facilities at the Crandall Canyon Mine were accounted for.

Insufficient space exists at the site to include runoff to the sedimentation pond from both the disturbed and upstream undisturbed areas. Hence, a diversion was designed above the disturbed area to divert runoff from undisturbed areas.

Runoff to the sedimentation pond from the 10-year, 24-hour storm was determined to be 0.73 acre-foot. Based on a disturbed drainage area to the pond of 5.7 acres (see Plate 1) and a required sediment storage volume of 0.1 acre-foot per acre of disturbed area (UMC 817.46(b)(1)), 0.57 acre-foot of sediment storage volume was provided in the pond. Hence, the pond was designed to accept a total storage of 1.30 acre-feet.

Plate 2 presents details of the design of the proposed sedimentation pond. Based on the topographic map of the pond, the stage-capacity curve provided in Figure 5 was developed. As noted in this figure, the new pond will provide sediment storage to an elevation of 7777.9 feet and total storage (sediment plus runoff) to an elevation of 7783.0 feet. Sediment will be cleaned out of the pond when it reaches an elevation of 7775.7 feet at the riser (the elevation correponding to a volume of 60 percent of the required sediment storage volume).

The existing riser in the sedimentation pond has an overflow elevation of 7779.4 feet and a decant elevation of 7776.4 feet. Based on data presented in Figure 5, it will be necessary to raise the elevation of the bottom of the decant pipe 1.5 feet to an elevation of 7777.9 feet (i.e., above the top of the sediment storage level). Furthermore, the outflow point on the riser should be raised 3.6 feet to an elevation of 7783.0 feet (the top of the total storage pool). This can be accomplished with a section of 24-inch CMP welded to the existing riser.

Results of inflow-outlflow analyses from the 25-year, 24-hour storm are also presented in Appendix A. Utilizing the combined hydraulics of the primary and proposed emergency spillways, the peak outflow stage during the 25-year, 24-hour storm was calculated by SEDIMOT II as 5.8 feet above the sediment storage level. Thus, the outflow elevation during the design flow event was determined to be 7783.7 feet.

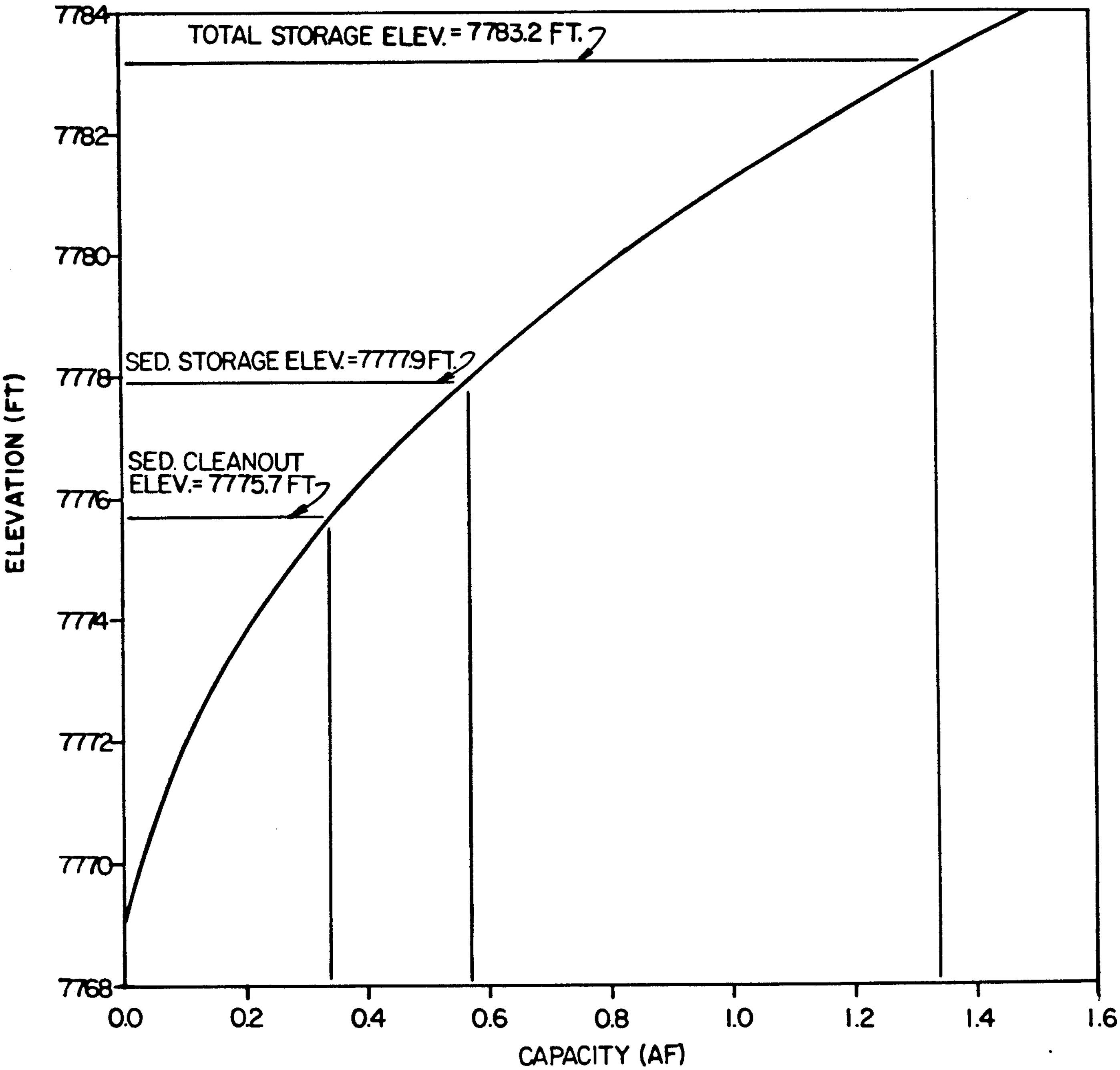

Figure 5. Stage-capacity curve for proposed sedimentation pond.

UMC 817.46(i) requires that the crest of the emergency spillway be located at least 1.0 foot above the crest of the principal spillway. Hence, the emergency spillway crest will be placed at an elevation of 7784.0. As a result, all water will be passed through the primary spillway during the design event (with a design elevation of 7783.7 feet). The emergency spillway will be retained in the design, however, due to requirements of the U.S. Forest Service. As designed, the emergency spillway has a bottom width of 4.0 feet and side slopes of 2h:1v.

Since the emergency spillway will not be flowing during the design event, UMC 817.46(j) requires only that the top of the settled embankment be 1.0 foot above the crest of the emergency spillway. This will result in an embankment crest elevation of 7785.0 feet. Since the crest of the existing embankment is at an elevation of 7783.0 feet, the proposed design will require the addition of 2.0 feet of settled embankment to the top of the existing embankment. UMC 817.46(k) requires that this height be increased five percent to account for settling. Thus, 2.1 feet of material will be added to the existing embankment.

With a crest elevation of 7785.0 feet and a base elevation of 7769.0 feet, the embankment will have a height of 16.0 feet. Using the equation provided in UMC 817.46(l), the required top width of the embankment is 10.2 feet.

The design presented herein assumes that the existing pond will be enlarged to meet the volume requirements of this plan by removing excess fill from the interior of the pond and placing it on the exterior slope. Prior to placing fill on the exterior slope, all large rock fragments will be removed. The fill will then be placed in 6-inch lifts down the side of the existing embankment to decrease its outslope to 2h:1v. This new fill will be compacted in place with a hand-operated vibrator prior to placing the next lift.

The emergency spillway will be lined with riprap and a filter blanket as noted in Appendix A to reduce erosion potential. Grading of the riprap, filter blanket, and embankment materials are shown in Figure 6.

Because of the location of the sedimentation pond (on a hillside between the access road and Crandall Creek), insufficient space is available to permit construction of side alopes with a combined upstream and downstream slope of 5h:1v and still provide the required storage capacity. Hence, the pond has been designed with 2h:1v sideslopes on both the upstream and downstream sides. As included in the original design, the interior of the pond will be lined with a local, compacted clay to reduce seepage from the pond and, thereby, increase the stability of the embankment.

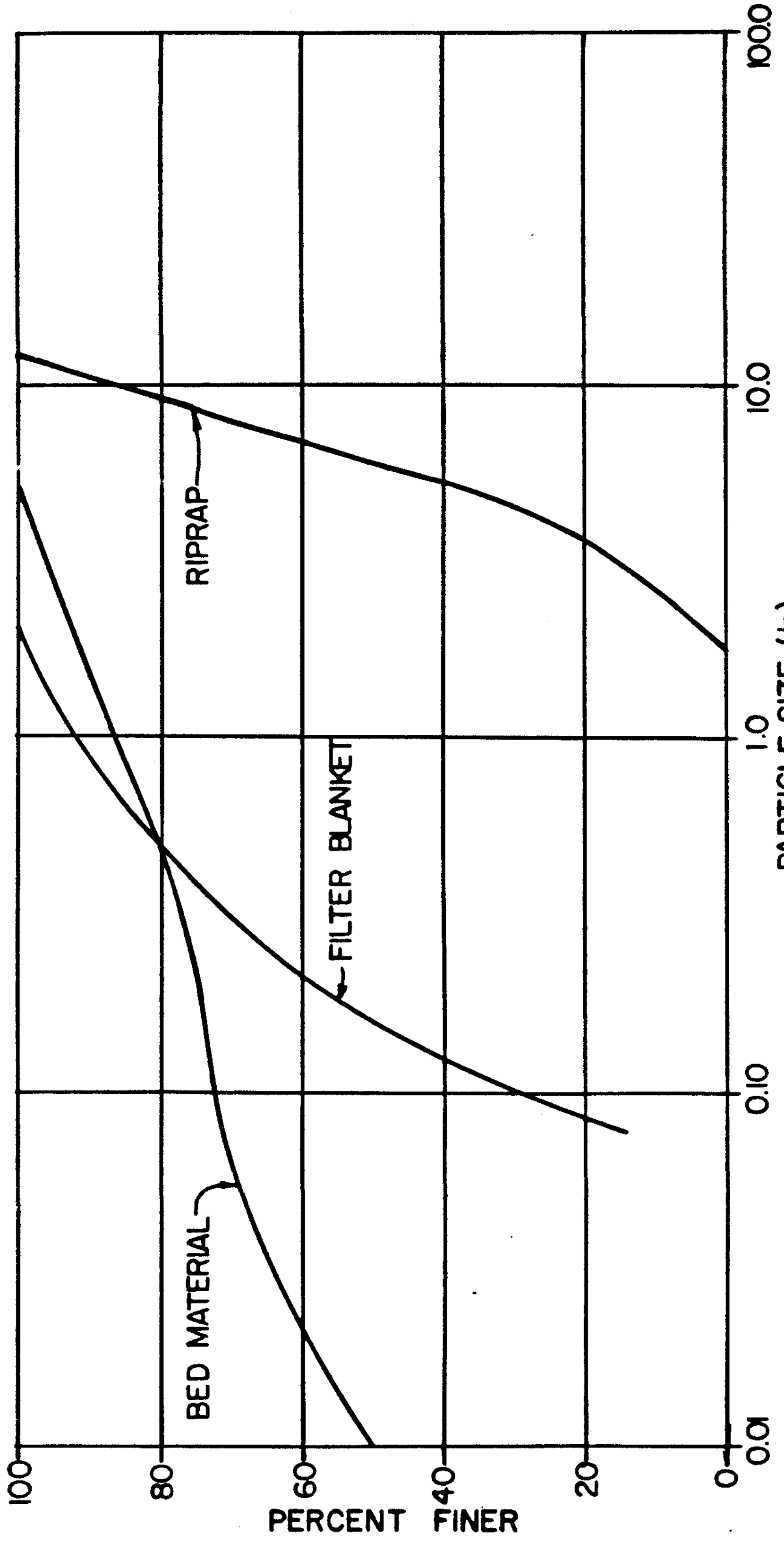

Figure 6. Gradation of embankment, filter, and riprap materials.

To further increase the stability of the embankment, the downstream toe of the embankment will be loaded with the large rock fragments that currently lie on and adjacent to the outer embankment slope. These fragments are angular, predominately sandstone, and originated in the highwall area during initial mine development. Fragments range from approximately 6 inches to at least 36 inches in size.

Results of the slope stability analyses are presented in Appendix B. As noted in this appendix, the static factor of safety for the design condition (liner functioning, both full and empty pond conditions) is 1.5 under static conditions. Under seismic conditions, the safety factor was determined to be 1.3.

If the liner fails, the embankment would become saturated and less stable. Information presented in Appendix B indicates that the safety factor under these circumstances reduces to 1.0 under static conditions and 0.9 under seismic conditions. Although these factors are significantly reduced below those for which the pond was designed, it should be noted that the potential for a failed liner and continually saturated embankment is remote. Hence, these safety factors are considered adequate.

3.1.2 Embankment Revegetation. UMC 817.46(s) requires that areas disturbed by pond construction (including the embankment) be stabilized with an effective vegetative cover as soon as possible after disturbance. As a result, the final lift placed on the downstream of the embankment will not be compacted above the upper elevation to which rock stabilization is added. This upper area will be planted with the grasses provided in Table 1 for temporary reclamation.

The mixture presented in Table 1 was developed in consultation with Lynn Kunzler of the Division and Walt Nowak of the U.S. Forest Service. This mixture provides rapid growth species, sod-forming species, and species that are compatible with other plants.

All disturbed areas associated with the pond will be seeded with the exception of the interior of the pond below the sediment storage level. Seeding will be done in the late fall, just prior to the first heavy snowfall of the year or in the early spring immediately following snowmelt (Plummer et al., 1968). Seeding will be accomplished by hydromulching or broadcasting with a cyclone seeder. Mulch will be placed after seeding. If the seed is broadcast, the mulch (two tons of straw or grass hay per acre of disturbed area) will be spread over the area to be planted and crimped into the soil with a roto tiller or shovel to aid in moisture retention (U.S. Soil Conservation Service, 1975).

Table 1. Proposed seed mix for embankment revegetation.

Species	Planting Rate (lb/ac PLS)
Smooth brome	4.0
Intermediate wheatgrass	3.0
Orchard grass	1.0
Fairway crested wheatgrass	2.0
Slender wheatgrass	2.0
Alfalfa rambler	1.0
Yellow sweatclover	1.5
Total	14.5

3.2 Diversions and Runoff Control

A diversion will be placed along the western edge of the site at the location shown in Plate 3 to divert water from a 95-acre undusturbed watershed around the yard area. Analyses and design information associated with this diversion are contained in Appendix C.

The diversion was designed to safely pass the peak flow from the 10-year, 24-hour precipitation event. The resulting peak flow from this event (as noted in Appendix C) was determined to be 8.70 cubic feet per second.

The cross section for diversion channel on the western edge of the mine yard was designed using the shallowest slope along the profile (2.5 percent). The riprap lining was designed using the steepest slope in the section. Results of these analyses are presented in Appendix C. The resulting cross section is provided in Figure 7.

The diversion channel on the western edge of the mine yard will empty into a 24-inch CMP culvert with a flared inlet at the edge of the Crandall Creek bank to convey water down the bank to the stream. Discharge from this culvert will flow onto a splash basin to prevent scour at the outlet.

A channel was also designed to divert water from the undisturbed watershed above the highwall (WS-3 of Plate 1) away from the mine yard. Details of this design are presented in Appendix C. This channel will discharge to an existing channel east of the disturbed area.

Existing culverts in the mine yard were examined to determine their adequacy with respect to passing the peak flow from the 10-year, 24-hour precipitation event. Data provided in Appendix C indicate that the downstream-most culvert at the yard need be only 18 inches in diameter. Since this and all other upstream existing culverts at the yard are 24 inches in diameter, these culverts are adequately sized. A proposed new culvert to be placed at the downstream end of the upper administratiion pad (see Plate 3) will be 18 inches in diameter.

A berm will be placed around the proposed substation to prevent runoff water that accumulates thereon from flowing across the remainder of the site. A small channel behind the berm will divert water from WS-4 (Plate 1) to the WS-1 channel.

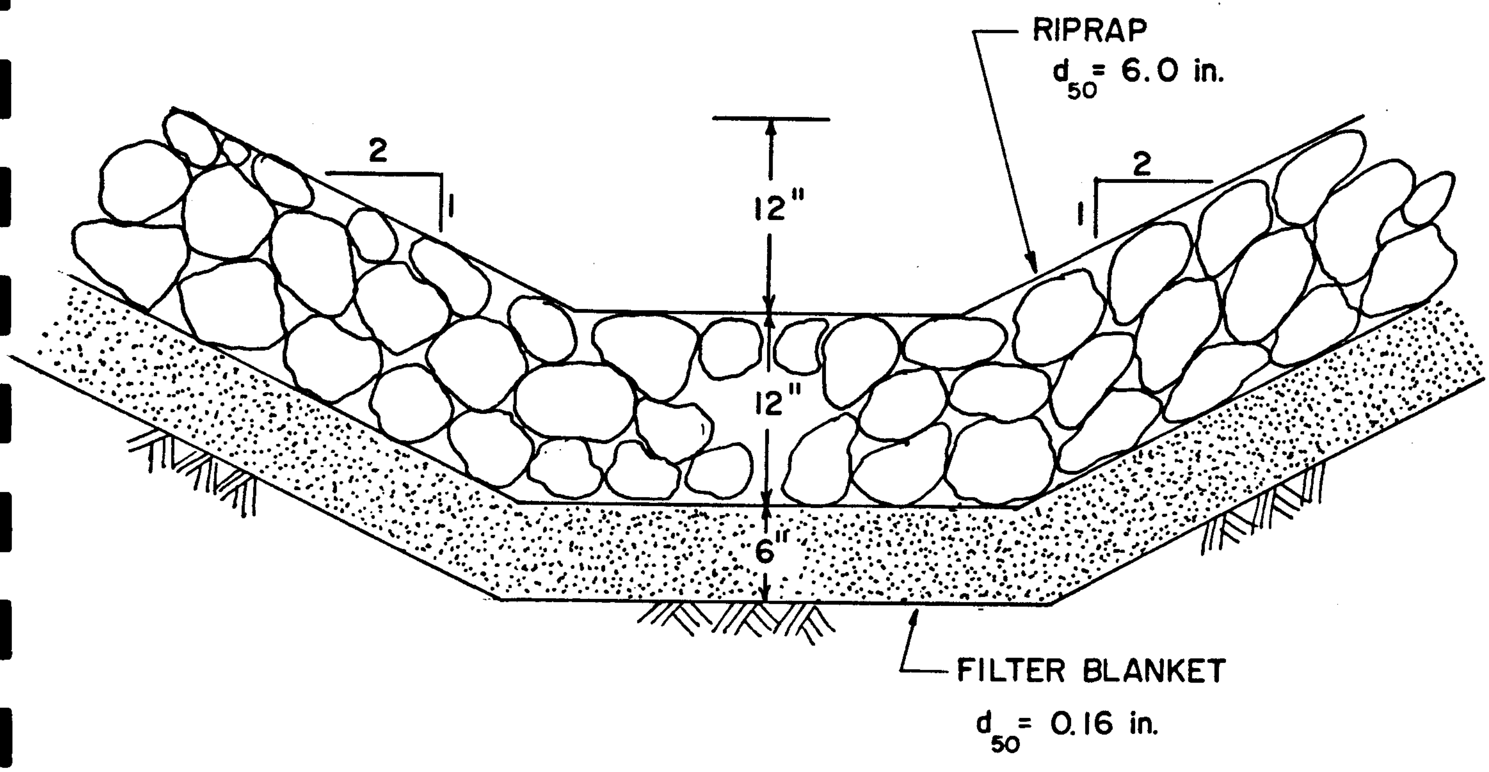

Figure 7. Typical diversion channel cross section.

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