GENWAL RESOURCES, INC
CRANDALL CANYON MINES
C/015/032

THIS SUBMITTAL IS IN RESPONSE TO:

DIVISION ORDER DO10A

REVISED RECLAMATION PLAN

WHICH ADDRESSES:

1) CRANDALL CANYON MEMORIAL
2) INDEFINITE MINE-WATER DISCHARGE
3) SEEP BACK-DRAIN AT "OLD LOADOUT AREA

SUBMITTED: JULY 25, 2011

COVER LETTER.....C1/C2 FORMS

C/015/032 Incoming
#3881
ok

GENWAL™ RESOURCES, INC.

P.O. Box 910, East Carbon, Utah 84520 794 North "C" Canyon Rd, East Carbon, Utah 84520
Telephone (435) 888-4000 Fax (435) 888-4002

Dana Dean, P.E.
Associate Director
Utah Division of Oil, Gas and Mining
P.O. Box 145801
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

July 25, 2011

Re: Crandall Canyon Mines, C/015/032
Revised Reclamation Plan
Division Order DO-10A

Dear Ms. Dean:

As per Division requirements under Division Order DO-10A, enclosed are six (6 ea) copies of a change to the Crandall Canyon Mine reclamation plan. This change addresses the following:

1) The plan assumes that water will continue to discharge indefinitely from the mine, but will not need perpetual treatment for iron. Therefore, the plan assumes the existing treatment facility will be removed during final reclamation and the "old loadout area" (a.k.a., the highwall area) where the current tretment facility is located, will be reclaimed by backfilling to approximate original contour. This is the assumption of the currently approved reclamation plan. However, the current plan now addresses the seep water which currently emanates from the highwall sandstone ledge and proposes a backdrain system to ensure slope stability of the reclaimed backfilled slope in this area.

2) The plan has been modified to show that the upper portion of the pad fill now associated with the Emery County Crandall Canyon Memorial will be left in place.

If you have any questions or comments regarding this change please contact me at 435 888-4017.

Sincerely,

David Shaver
Resident Agent

cc: Denise Dragoo, Esq.

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Date Folder 072811 C/015 0032

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JUL 28 2011
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Form DOGM - C1 (Last Revised July 8, 2011) File Folder # 3

APPLICATION FOR PERMIT PROCESSING

Permit Change ☐	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: 015/032
● Proposal Change to reclamation plan						Mine: Crandall Canyon Mines
						Permittee: **GENWAL Resources, Inc.**

Description, include reason for application and timing required to implement:.

Instructions: *If you answer yes to any of the first 8 questions (gray), submit the application to the Salt Lake Office. Otherwise, you may submit it to your reclamation specialist.*

☐ Yes	☑ No	1. Change in the size of the Permit Area? _____ acres Disturbed Area? ____ acres ☐ increase ☐ decrease.
☑ Yes	☐ No	2. Is the application submitted as a result of a Division Order? DO-10 A
☐ Yes	☑ No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes	☑ No	4. Does application include operations in hydrologic basins other than as currently approved?
☐ Yes	☑ No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes	☑ No	6. Does the application require or include public notice/publication?
☑ Yes	☐ No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☑ Yes	☐ No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes	☑ No	9. Is the application submitted as a result of a Violation?
☐ Yes	☑ No	10. Is the application submitted as a result of other laws or regulations or policies? Explain:
☑ Yes	☐ No	11. Does the application affect the surface landowner or change the post mining land use?
● Yes	☑ No	12. Does the application require or include underground design or mine sequence and timing?
☐ Yes	☑ No	13. Does the application require or include collection and reporting of any baseline information?
☐ Yes	☑ No	14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes	☑ No	15. Does application require or include soil removal, storage or placement?
☐ Yes	☑ No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	☑ No	17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes	☑ No	18. Does the application require or include water monitoring, sediment or drainage control measures?
☑ Yes	☐ No	19. Does the application require or include certified designs, maps, or calculations?
☐ Yes	☑ No	20. Does the application require or include subsidence control or monitoring?
☑ Yes	☐ No	21. Have reclamation costs for bonding been provided for?
☐ Yes	☑ No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes	☑ No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

☐ **Attach _3_ complete copies of the application.**

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations herein. (R645-301-123)

Signed - Name - Position - Date 7/8/11 agent

Subscribed and sworn to before me this 8th day of July 2011.

Notary Public Linda Kerns

My Commission Expires: 3.27.13

Attest: STATE OF Utah)
COUNTY OF Carbon)

LINDA KERNS
NOTARY PUBLIC • STATE of UTAH
COMMISSION # 578211
COMM. EXP. 03-27-2013

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ASSIGNED TRACKING NUMBER

Form DOGM - C2 (Last Revised 6/93)

File Folder # 3

Application for Permit Processing
Detailed Schedule of Changes to the MRP

Title of Application:	Permit Number: 015/032
Change to the reclamation plan	Mine: CRANDALL CANYON MINESA
	Permittee: GENWAL RESOURCES

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit application. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the existing mining and reclamation plan. Include page, section and drawing numbers as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☒ REPLACE	☐ REMOVE	Chapter 5: pages 5-vii, 5-iv
☐ ADD	☐ REPLACE	☐ REMOVE	
☒ ADD	☐ REPLACE	☐ REMOVE	Chapter 5: Figures 5-14
☐ ADD	☐ REPLACE	☐ REMOVE	
☒ ADD	☐ REPLACE	☐ REMOVE	Chapter 5: Figures 5-15
☐ ADD	☐ REPLACE	☐ REMOVE	
☒ ADD	☐ REPLACE	☐ REMOVE	Chapter 5; Appendix 5-20
☐ ADD	☐ REPLACE	☐ REMOVE	Addendum page
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☒ REPLACE	☐ REMOVE	Chapter 5: Appendix 5-22
☐ ADD	☐ REPLACE	☐ REMOVE	
☒ ADD	☐ REPLACE	☐ REMOVE	Chapter 5: Appendix 5-27
☐ ADD	☐ REPLACE	☐ REMOVE	Crandall Canyon Memorial
☐ ADD	☐ REPLACE	☐ REMOVE	
☒ ADD	☐ REPLACE	☐ REMOVE	Chapter 5: Appendix 5-28
☐ ADD	☐ REPLACE	☐ REMOVE	Slope Stability Analysis, RB&G Eng
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☒ REPLACE	☐ REMOVE	Chapter 7: page 7-47
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☒ REPLACE	☐ REMOVE	Chapter 7: Appendix 7-4
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☒ REPLACE	☐ REMOVE	Plates 5-3 5-16, 5-17, 5-17A, 5-17B
☐ ADD	☐ REPLACE	☐ REMOVE	5-17C

Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?

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CHAPTER 5.....REPLACEMENT PAGES

CHAPTER 5

LIST OF APPENDICES (continued)

APPENDIX NUMBER	DESCRIPTION
5-16	Storage Pad Stability Analysis
5-17	Road Expansion (within permit area) Safety Factor, Drawings
5-18	Fire Prevention Plan
5-19	Slope Stability Investigation Portal Pad
5-20	Bond Estimate (DOGM determination)
5-21	Reclamation Fill Stability Analysis At The Crandall Canyon Mine Emery County, Utah
5-22	Crandall Canyon Mine Site Reclamation Plan
5-22(A)	East Mountain Emergency Drillpads and Access Roads Reclamation Plan
5-23	Air Quality Permit Amendment, South Portals
5-23A	Blasting Plan
5-24	R2P2 (Resource Recovery and Protection Plan) Approval Letter (South Crandall Federal Lease UTU-78953)
5-24A	R2P2 (Resource Recovery and Protection Plan) Approval Letter (120 Acre Modification, Federal Lease UTU-68082)
5-25	Subsidence Survey Letters of Notification
5-26	Forest Service Trailhead Parking Arrangement
5-27	Crandall Canyon Mine Memorial, Emery County, Memorandum of Agreement
5-28	Slope Stability Analysis Report, RB&G Engineering

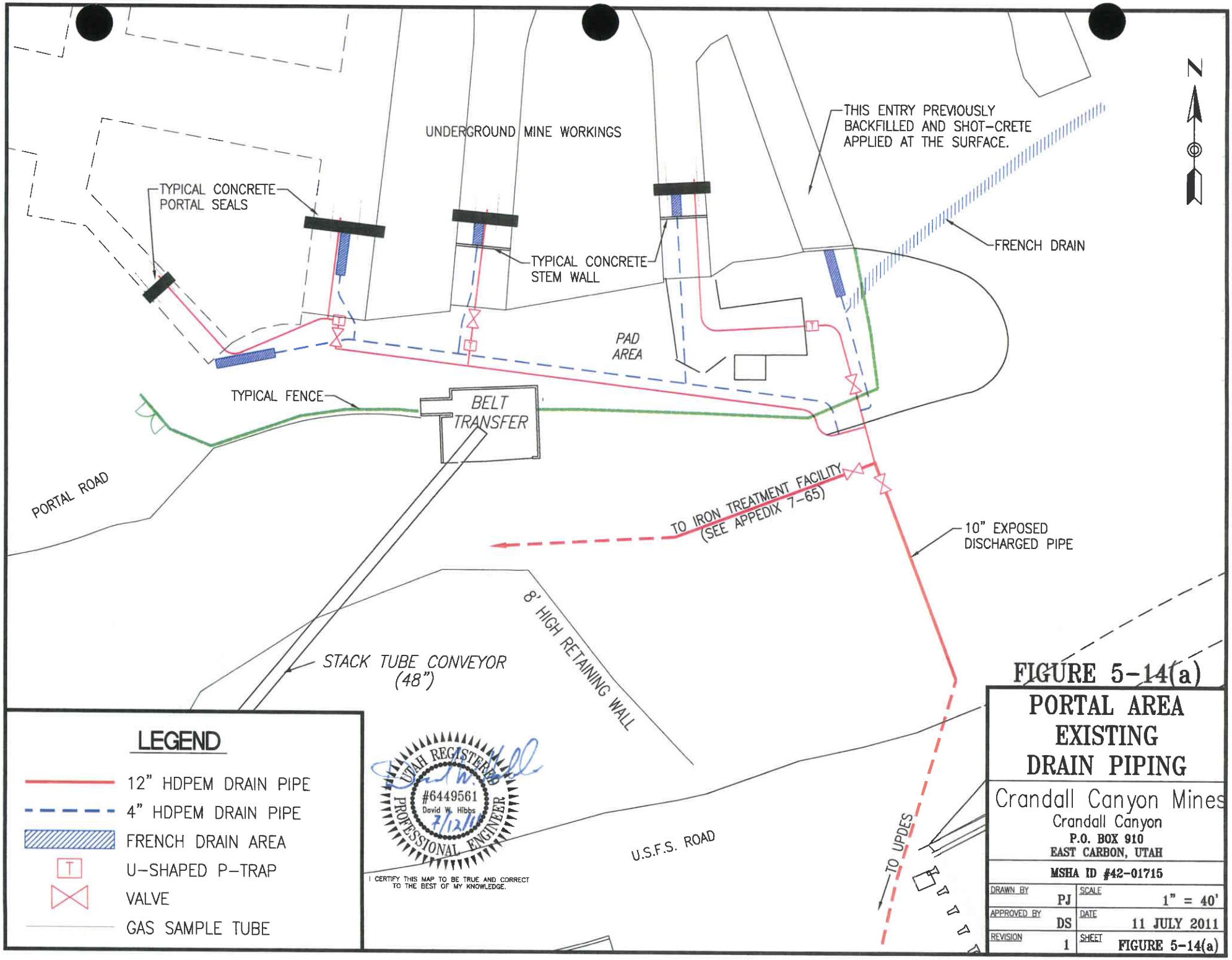
CHAPTER 5

FIGURES

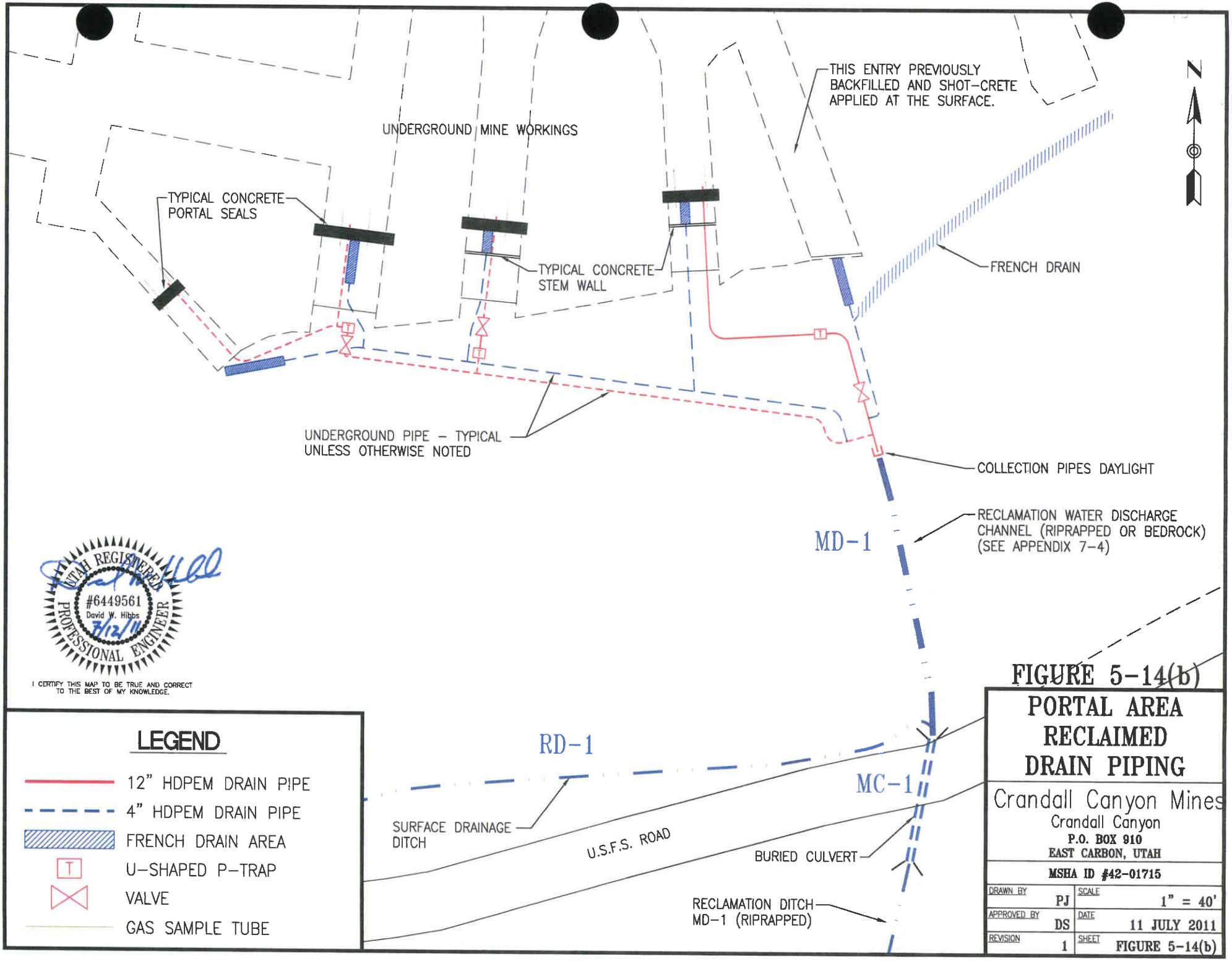
FIGURE	DESCRIPTION
5-1	Certification Report Sedimentation Pond
5-2	Sedimentation Pond Inspection Report
5-4	Maximum Subsidence Graph
5-5	Vertical Subsidence Distribution
5-8	Structure Map / Hiawatha Coal Seam
5-10	Typical Shotcrete Installation
5-11	Typical Profile, South Portal Pocket Cuts
5-12	Cross Section, South Portal Belt Conveyor
5-13a	Tunnel Construction Option (Plan)
5-13a	Tunnel Construction Option (Profile)
5-14	Portal Reclamation Drawings
5-15	"Old Loadout Area" Drawings

(Note: Unless otherwise noted, figures follow Chapter 5 text)

FIGURE 5-14.....PORTAL AREA RECLAMATION



G:\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamat ion\Portal Reclamation.dwg, Existing Piping, 7/11/2011 10:04:51 AM



G:\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamation\Portal Reclamation.dwg, Reclaimed Piping, 7/11/2011 9:44:48 AM

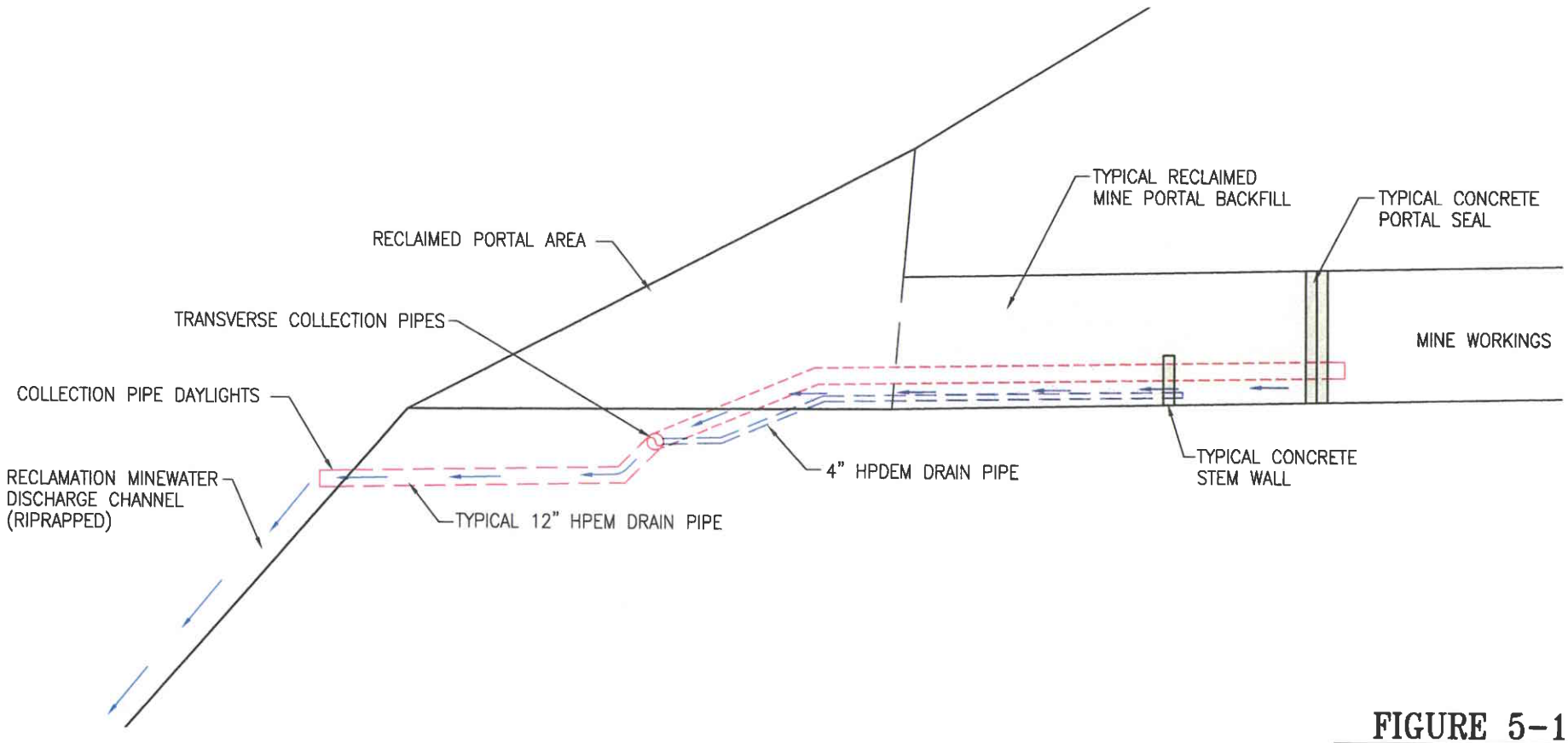


FIGURE 5-14(c)

PORTAL AREA TYPICAL RECLAIMED PORTAL SECTION

Crandall Canyon Mines
Crandall Canyon
P.O. BOX 910
EAST CARBON, UTAH

MSHA ID #42-01715

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 7/12/11

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

DRAWN BY	PJ	SCALE	1" = 10'
APPROVED BY	DS	DATE	11 JULY 2011
REVISION	1	SHEET	FIGURE 5-14(c)

G:\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamat ion\Portal Reclamation.dwg, Portal Section, 7/11/2011 9:12:01 AM

FIGURE 5-15....."OLD LOADOUT AREA" RECLAMATION

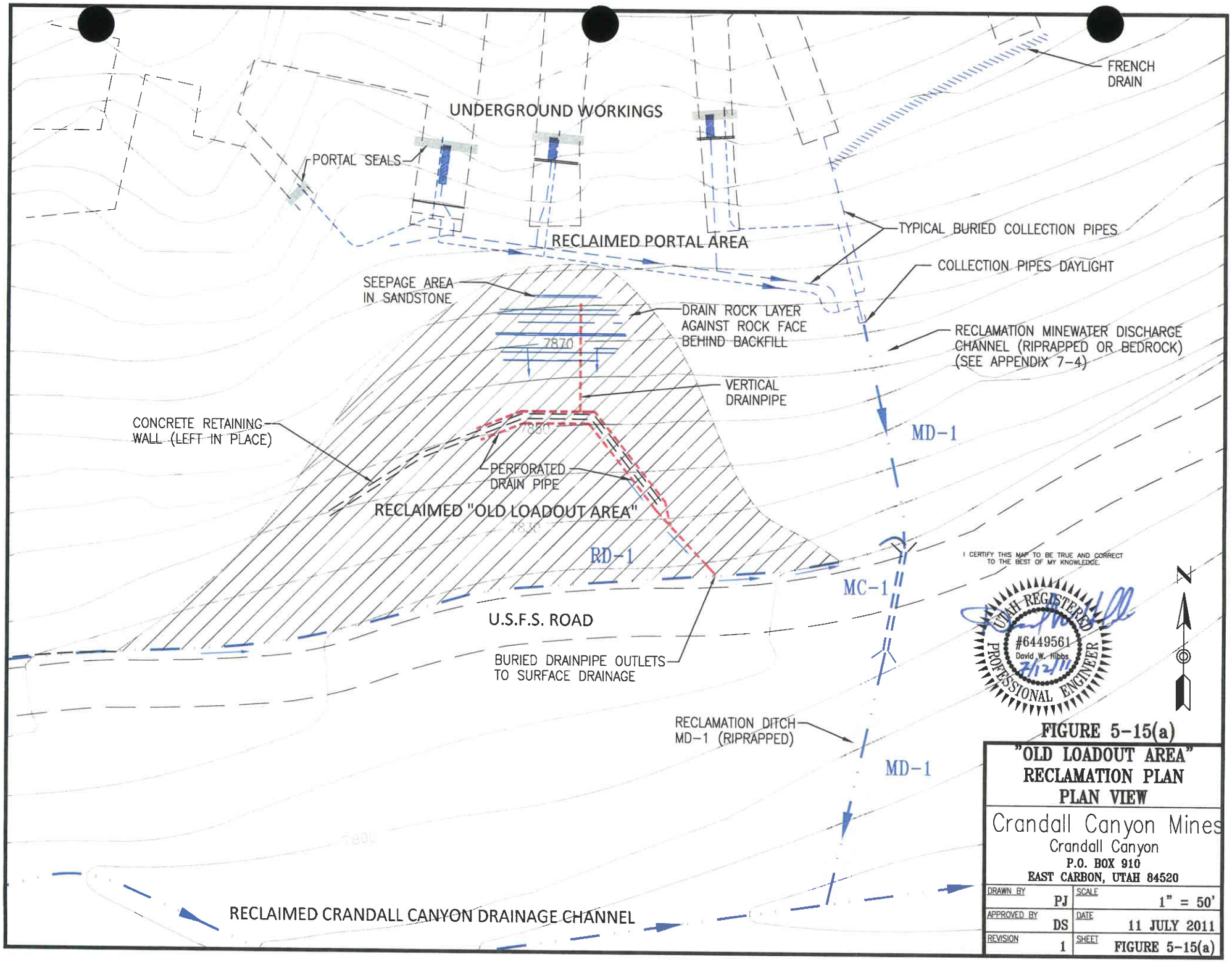
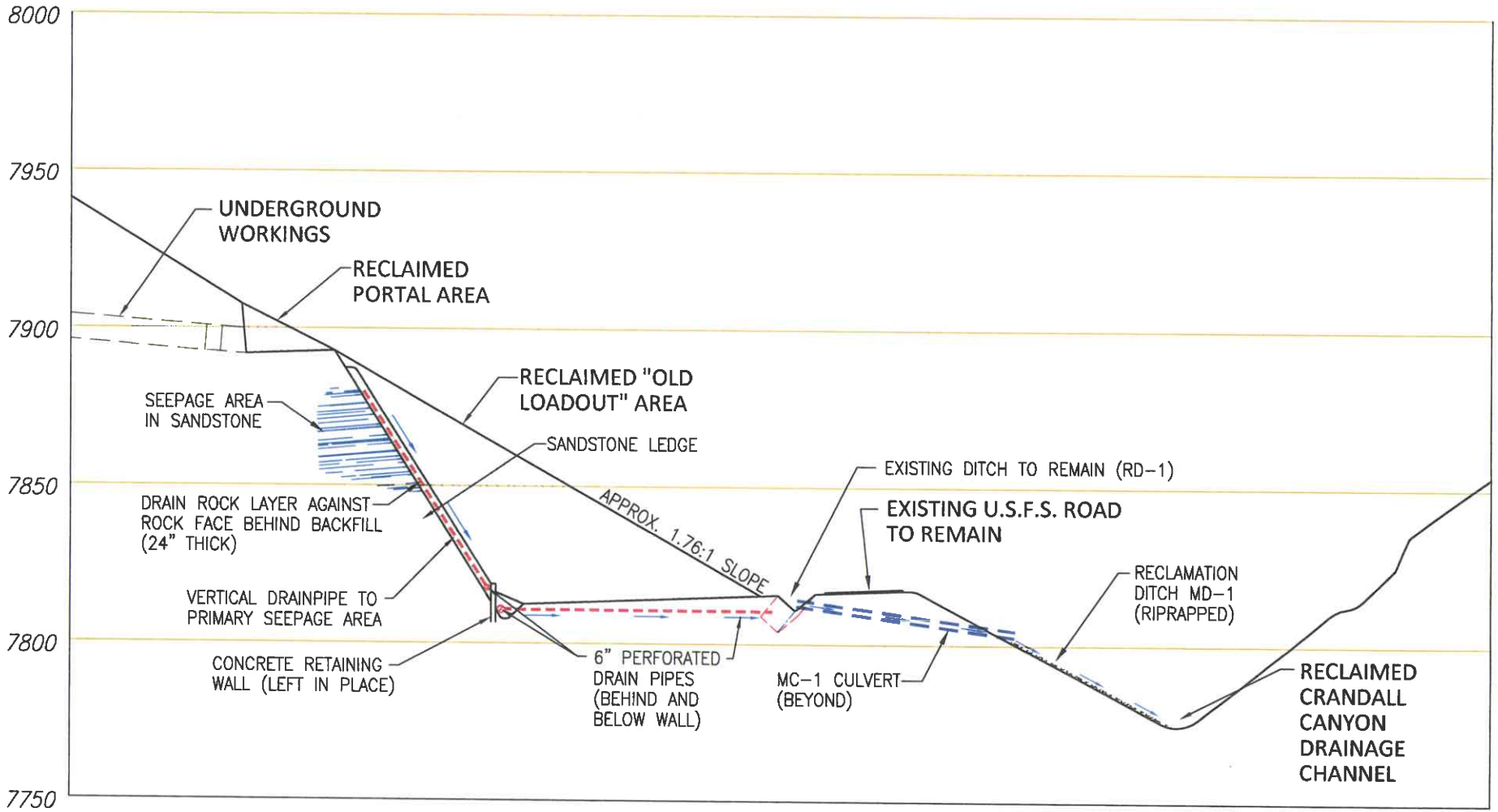


FIGURE 5-15(a)

"OLD LOADOUT AREA" RECLAMATION PLAN PLAN VIEW	
Crandall Canyon Mines Crandall Canyon P.O. BOX 910 EAST CARBON, UTAH 84520	
DRAWN BY PJ	SCALE 1" = 50'
APPROVED BY DS	DATE 11 JULY 2011
REVISION 1	SHEET FIGURE 5-15(a)

G:\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamation\High Wall Section Rev 1.dwg, Plan, 7/11/2011 9:34:23 AM



TYPICAL CROSS SECTION VIEW - LOOKING DOWNCANYON

FIGURE 5-15(b)

I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 7/12/11

"OLD LOADOUT AREA" RECLAMATION PLAN TYP. CROSS SECTION VIEW

Crandall Canyon Mines
Crandall Canyon
P.O. BOX 910
EAST CARBON, UTAH 84520

DRAWN BY	PJ	SCALE	1" = 50'
APPROVED BY	DS	DATE	11 JULY 2011
REVISION	1	SHEET	FIGURE 5-15(b)

G:\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamation\High Wall Section Rev 1.dwg, Section, 7/11/2011 9:14:36 AM

APPENDIX 5-20.....ADDENDUM

NOTE TO REVIEWERS:

ADD THIS PAGE AS AN ADDENDUM TO THE FRONT OF APPENDIX 5-20

APPENDIX 5-20
RECLAMATION COST ESTIMATE FOR BONDING
(ADDENDUM, JUNE 30, 2011)

HISTORICAL NOTE: The reclamation costs appearing in Appendix 5-20 were prepared in 1997 as part of the Crandall Canyon Mine Expansion Project. The plan was approved in July 30, 1997. Since that time the mine was expanded as proposed and worked continuously for the next 10 years. Mine operations were ceased in 2007 as the result of the Crandall Canyon Mine disaster of August 6, 2007. Following the disaster, the company deeded a 1.82 acre portion of the upper mineyard to Emery County to be used as a parking area and trailhead for a permanent memorial dedicated to the miners who lost their lives in the disaster. Therefore, this part of the mineyard will not be reclaimed as originally planned. The effects of this development on reclamation costs are as follows.

1) Demolition: By leaving the memorial area in place, the upper 248' of the 72" bypass culvert will remain in place as well. Therefore, the total length of bypass culvert to be removed will be reduced from 1400' down to 1152'. The present demolition cost to remove this culvert is $48,902/1400' = $34.93/ft. Also, the present cost to remove the bedding material is $145,670/1400' = $104.05/ft. Therefore, by leaving 248' of bypass culvert under the memorial area, the reclamation cost should be reduced by 248 feet x $138.98/ft = $34,467

2) Earthwork: Under the original plan a total of 66,096 loose yds of excess fill material would have to be hauled off-site for disposal in and approved landfill. According to computer generated volumes, by leaving the memorial area in place, the volume of excess material required to be hauled off will be reduced by 16,069 yds. Based on the currently approved Division bonding estimates (Feb 3, 2006) the unit cost of hauling and disposing of this material is $3.46 per yd. Therefore the amended plan should reduce the direct reclamation cost by 16,069 yds x $3.46/ yd = $55,598.

3) Revegetation: Presently, the revegetation cost for 6 acres is $50,524/6 acres = $8,421 per acre. By leaving the memorial area in place the total reclaimed area required to be revegetated is reduced by 1.82 acres. Therefore, the reclamation cost will be reduced by $8,421/ac x 1.82 acres = $15,326 .

Therefore the total direct reclamation costs resulting from the amendment should be reduced by ($34,467 + $55,598 + $15,326) = $105,391 as a result of leaving the upper fill material in place as part of the Emery County Crandall Canyon Memorial.

There may be some additional reclamation costs associated with the installation of the back-drain collection piping system for the ledge seepage, but this cost is expected to be substantially less than the $105,391 cost reduction which has resulted from leaving the Crandall Canyon Memorial facilities in place. Therefore the existing reclamation bond of $2,062,000 (posted June, 2008 and inflation-adjusted through 2011) should be sufficient to cover the incidental cost associated with the back-drain system.

APPENDIX 5-22

CRANDALL CANYON MINE SITE RECLAMATION PLAN

APPENDIX 5-22

CRANDALL CANYON MINE SITE RECLAMATION PLAN

(Revised: June 30, 2011)

CRANDALL CANYON MINE SITE RECLAMATION PLAN

HISTORICAL NOTE: Due to the tragic mine disaster of August 6, 2007, the Crandall Canyon Mine has been sealed up. Water has gradually backed up in the mine and is now discharging from behind the portal seals. The discharge is under the authority of an approved UPDES permit. However, as of February, 2009, the iron levels exceeded permit compliance limits. In December, 2009, a treatment facility designed to remove the iron was constructed in the "old loadout area" located directly below the mine portals. At the present time (July, 2011) it is uncertain whether or not long-term treatment of the mine discharge water will be required, because naturally-occurring chemical processes within the mine could potentially bring the iron content of the water to within compliance limits at some time in the future . This scenario is currently being addressed under Division Order DO-10 and is a matter of on-going legal discussion between the company and the Division. Until this issue is resolved, this present reclamation plan assumes that mine-water discharge will continue indefinitely but that no iron-removal treatment will be required at the time of reclamation.

Also, as a result of the Crandall Canyon Mine disaster, Genwal has deeded a portion of the upper mine yard (Expansion Area) to Emery County. This area is now included as part of a permanent memorial to the deceased miners, owned and maintained by Emery County. As a result, this area is no longer included in the final reclamation plan for the mine.

Phase 1

The reclamation of the disturbed areas of the Crandall Canyon mine site is described in outline and detail below. This description is based upon discussions in the text of Chapters 2, 3, 4, 5, 7 which address the regulations regarding reclamation requirements. In the interest of clarity, the following discussion describes the reclamation process in terms of several general areas within the mine yard. Refer to Figure 1 in this Appendix. Within each of these general areas, reclamation will follow a general sequence of 1) demolition, 2) backfilling, grading and topsoil application, 3) reclamation and revegetation. However, in practice, reclamation will be performed in several of these areas simultaneously. The final step, reclamation and revegetation, for all the areas will not be done until the fall.

Following Phase 1 reclamation, the only structures to remain will be the sedimentation pond and associated spillway and discharge structure as well as the conveyance ditches, berms and culverts necessary to route drainage to the pond. Refer to Plates 5-16 and 7-5 for location of these structures.

Genwal recognizes that development of a feasible reclamation plan for final reclamation of the expansion area containing the best available reclamation methodology is an essential part of this permitting process. Therefore, Genwal has contacted consultants with revegetation and reclamation experience to gather together the best reclamation techniques for reclamation of the

steep-slope area. JBR Environmental Consultants, who has had prior experience with reclamation in difficult areas, has provided a letter detailing reclamation methodology that they believe will contribute to the successful reclamation of this area. This letter, included as Attachment 1, was written in response to Genwal's discussions held with JBR as the reclamation plan was being revised. Genwal feels that incorporation of the various reclamation techniques that JBR has identified as being successful in past situations will greatly enhance the success of this reclamation effort. Genwal also recognizes that in the time between now and when final reclamation is actually done, technology may evolve new and better reclamation ideas. Genwal commits to modifying the reclamation plan prior to final reclamation should better reclamation products and methodology become available. This reclamation plan will be reviewed prior to implementation to incorporate applicable methodology and techniques which are considered best technology currently available (BTCA) at the time of reclamation.

Area Descriptions

The reclamation plan has been divided into several general areas for the purpose of explanation. It is likely that reclamation efforts will occur in multiple areas during the same time interval. These areas are depicted on Figure 1 and described in summary below.

Portal Area: The Portal Area consists of an inclined access road, the mine portals leading into the underground mine, and structures in this area.

Expansion Area: In 1997, the surface facilities expanded to the area south of the Forest Service road by culverting approximately 1,500' of Crandall Canyon through a 72" bypass culvert. Earthen fill material will have been trucked in to construct the Expansion Area. The truck loadout facilities was relocated to the Expansion Area along with the Overhead Conveyor, Stacking tube, Reclaim Tunnel and Conveyor, Crusher Building, MCC Building, Substation, and other associated structures. The fill from the Expansion Area will be utilized during final reclamation to restore approximate original contour in areas of cuts and highwalls. This fill ~~will~~ consists of 8" x 0" earth and rock material obtained from an approved off-site borrow area.

The Expansion Area has been divided into a North Slope Expansion Area and South Slope Expansion Area for the purposes of the reclamation discussion. The North Slope Expansion Area is that area north of the existing Crandall Creek and south of the existing Forest Service road. The South Slope Expansion Area includes the steeper hillside located south of the existing Crandall Creek. Due to the steep slopes encountered on the South Slope, special reclamation procedures have been prescribed for this area. Much of the reclamation plan designed for the South Slope is based on input from reclamation specialists who have experience in steep-slope reclamation situations.

As a result of the 2007 mine disaster, the upper end (westernmost end) of the Expansion Area has been deeded to Emery County as part of the Crandall Canyon Memorial. This area is contiguous with the existing Forest Service trailhead, and will not be disturbed as part of the final minesite reclamation.

Old Substation Area: The Old Substation Area the pad that was originally constructed in the northern part of the mine yard above the shop for a substation. However, the substation was never constructed at this location. Other than an existing powerline, there are no facilities on this site to be removed and the area has had interim revegetation.

Old Loadout Area: The Old Loadout Area is located adjacent to and just north of the Forest Service road and the new loadout. This is the area where coal was previously stockpiled and loaded into trucks prior to construction of the 1997 expansion area. The area has subsequently been utilized as the site of the operational mine-water iron treatment facility. This current reclamation plan assumes that at the time of final reclamation the mine discharge water will not require treatment, and that the "old loadout area" will be reclaimed as per the originally approved reclamation plan.

Forest Service Road: The Forest Service Road runs east-west through the mine site. As a result of construction of the Crandall Canyon Memorial in the summer of 2008, part of this road was deeded to Emery County. The road is to be kept in place following reclamation activities but will undergo a change in width.

Shop Area: The Shop Area is located west of the mine portal area and north of the Forest Service Road. Facilities to be removed from the Shop area include: Shop/Warehouse building, Substation, Rock Dust Bin, Oil Shed and parking lot asphalt.

RECLAMATION PLAN OUTLINE

1. Demolition and Removal of Surface Facilities - Portal Area
2. Removal and Disposal of Expansion Area Fill Material
3. Seal and Backfill Portals
4. Backfill, Grade and Topsoil - Portal Area
5. Revegetation - Portal Area
6. Demolition - Old Substation Area
7. Backfill, Grade and Topsoil - Old Substation Area
8. Revegetation - Old Substation Area
9. Demolition and Removal of Surface Facilities - Shop Area
10. Backfill, Grade and Topsoil - Shop Area
11. Revegetation - Shop Area
12. Demolition and Removal of Surface Facilities - Old Loadout Area
13. Backfill, Grade and Topsoil - Old Loadout Area
14. Revegetate - Old Loadout Area
15. Reclaim Forest Service Road North of Expansion Area
16. Demolition and Removal of Surface Facilities - Expansion Area
17. Removal of Fill Material and Recontouring - Expansion Area
18. Restoration of South and North Hillside Slopes - Expansion Area
19. Revegetation - South Slope of Expansion Area
20. Removal and Disposal of 72" Culvert
21. Topsoiling - North Slope of the Expansion Area
22. Revegetation - North Slope of the Expansion Area
23. Restoration of the Stream Channel
24. Revegetation of the Stream Channel
25. Sediment Control and Treatment
26. Topsoil Stockpile Reclamation
27. Phase 2 Reclamation

Note: A Reclamation Timetable has been provided at the end of this discussion.

RECLAMATION PLAN DETAIL

1. Demolition and Removal of Surface Facilities - Portal Area

When mining operations have been permanently ceased and the portals and surface facilities are no longer needed to support the mine, all buildings and other structures will be dismantled and hauled off site to an approved landfill. Reusable materials will be salvaged and recycled to the extent possible.

At the Portal Area, facilities to be removed are: ~~underground bath house,~~ mine fan housing structure~~, fan transformer (portable),~~ belt transfer station, guard rail at top and along access road, ~~water pipelines~~, and the diversion culvert above portals. The existing mine-water discharge collection and discharge pipelines will be routed so that the mine water discharges out from the east end of the portal bench.

The existing shotcrete above the portal road, above the portals and above the old coal loadout area, along with wire mesh, clips and other similar materials will be removed and disposed of in an appropriate state approved landfill. .

All combustible materials will be removed from the underground bathhouse and hauled to an approved solid waste landfill. Any structures that would interfere with sealing of the portals, such as beltline structure, would also be removed.

Equipment used in the demolition and disposal of the facilities include: a front end loader, a backhoe, highway end dump trucks, a trackhoe, a crane, truck with flat bed trailer, oxy-acetylene torches, air compressor and power tools, etc.

2. Removal and Disposal of Expansion Area Fill Material

At the same time the structures in the portal area are being demolished and removed, the other surface facility structures located on the Expansion Area (truck loadout, conveyors, crusher building, etc.) will also be removed. ~~After the removal of these structures from the Expansion Area, excess fill material from this area will be taken inside the mine entries for permanent placement~~ [note: reclamation of the Expansion Area is described in greater detail later in this plan]. Fill material, in excess of that needed for backfilling the Portal Area, Shop Area and Old Loadout Area ~~(an estimated 20,410 loose cubic yards, Table 5-20-10 in Appendix 5-20)~~ will be loaded, hauled and disposed of at an approved landfill. ~~underground in the mine workings (see Figure 1 in Appendix 5-20 for the disposal area in the mine workings.)~~ As shown on Table 5-20-10 of Appendix 5-20, this excess volume of fill material was originally determined to be 61,532 cubic yards. However, after these calculations were initially prepared, the upper end of the mine yard was deeded over to Emery County as part of the Crandall Canyon Memorial. As a result of this situation, the fill material in this area will now remain in place permanently as part of the memorial facility. Therefore, the total amount of fill material to be removed and hauled away

during final reclamation has now been reduced (according to computer generated volumes) by 16,069 cubic yards, from 61,532 cubic yards down to 45,463 cubic yards.

The equipment used in the performance of this step would be a l-h-d unit (scoop), dozer w/ripper, and a front end loader.

3. Seal and Backfill Portals

~~Upon the completion of the disposal of the excess Expansion Area fill material in the mine workings, the portals will be sealed and backfilled.~~ The four portals on the north side are: bath house entrance, intake air entry, belt entry and fan (return air) entry. The three portals on the south side are the intake, belt and fan entries. The seals will be constructed approximately 25-35 feet inby from the portal openings and will be built according to MSHA regulations. Equipment necessary for sealing would be a cement mixer and hand tools. After finishing the construction of the seals, the 25 to 35 feet of entry from the portals to the seals will be backfilled with additional fill material from the Expansion Area.

4. Backfill, Grade and Topsoil - Portal Area

As a result of the Crandall Canyon Mine disaster of August 6, 2007, the portals of the mine were sealed. A system of collection pipes was also installed at the portals to collect and handle the mine discharge water which began to build up behind the seals. The minewater is presently discharging at an average rate of about 500 gallons per minute, and this volume of discharge is expected to continue in the future. Figure 5-14 shows the details of the portal drain collection system. Presently, water from the four portals is collected into a common pipe which is directed down the hillside and ultimately discharges into the main bypass culvert at an approved UPDES outfall point. There is also a small amount of seepage water collected in a French drain outside one of the old portals from the old part of the mine (which is sealed off underground), which also reports to the main discharge pipe. All of the collection system is installed either within the portals inside the steel canopies, or else buried along and within the portal bench. This discharge piping daylights from the buried installation and continues overland down the hillside in an exposed 12" diameter pipe to the UPDES outfall where it enters the natural flow of Crandall Creek.

There is also a small amount of water which seems to be infiltrating into the Star Point Sandstone behind the mine portal seals and is seeping out to the surface through the underlying porous sandstone ledge located directly above the Old Loadout Area, at a rate of about 3 gpm.

This reclamation plan acknowledges that the water will continue to discharge from the mine (i.e., from the portal collection pipes, the old works French drain, and the saturated sandstone ledge) at current flow rates indefinitely into the future. The company proposes to address the long-term discharge of mine-water in the following manner: 1) backfill the portals, leaving the existing collection piping system in place, 2) replace the existing exposed overland

drainpipe (running down the hillside to the UPDES outfall) with an approved armored (rip-rapped) open channel, and 3) collect the seepage from the sandstone ledge with a drainrock/drainpipe system as part of backfilling the sandstone ledge area below the portals. These elements are discussed individually as follows:

1) The existing collection system utilizes 10" heavy-wall PVC pipe extending back through the seals in all four portals. Additional 4" pipes also collect seepage water outside the seals which is contained behind low check dams constructed within the portals. All piping is buried and was installed with plans to be part of a permanent post-reclamation discharge system. Upon reclamation, after the steel portal canopies have been removed, the portals will be completely backfilled as described below, leaving only the stub of pipe exiting to the re-contoured surface at its present location. Figure 5-14 shows details of the existing pipe collection system.

2) Presently, the discharge water is conveyed down from the portals over the hillside through a 12" PVC pipeline. This line then empties into an existing CMP culvert located under the roadway which then leads to the main bypass culvert at an approved UPDES monitoring point. Upon final reclamation, the PVC pipe will be replaced with an overland open channel. In this area the sandstone bedrock lies very close to the surface, and forms natural outcrop ledges in much of the immediate and surrounding vicinity. With a minor amount of work, debris and weathered material can be removed to expose the competent bedrock below and thereby create a permanent non-erosive channel for the discharge water course. In those areas where the weathered material is thicker, such as below the Forest Service Road, the channel would be lined with a suitable rip-rap armor. Details of this channel can be found in Appendix 7-4, and also in Plates 5-16 and 5-17. There would be no other flow in this channel other than the continuous 450 gpm (average) mine discharge flow.

3) Upon final reclamation, the sandstone ledge below the portals (a.k.a. Old Loadout Area) will be backfilled to approximate original contour as described in Item 13 below. As explained above, due to the porous nature of this sandstone, it is now conveying a small but constant amount of mine water (approx.3 gpm) from behind the seals to the ledge outcrop below the portals. The seepage conduit appears to be localized and can easily be contained during final reclamation. This will be done by installing a drain system between the ledge-rock and the back-filled slope which will collect the seepage water into a single discharge pipe. This will then be directed to join the main stream of discharge water, so that all discharge enters into the Crandall Creek at a common point. The details of this backdrain collection system are explained in greater detail in Item 13 (Old Loadout Area) below, as well as Figure 5-15 and Appendix 5-28.

Once the portals have been sealed and backfilled (see Figure 5-14), reclamation work can then commence on the Portal Area. This work consists of backfilling the cuts to approximate original contour, placing topsoil on the backfilled area and seeding the topsoiled area. Since the Portal Area (and the associated access road) is on a slope, this work will be done in short

segments starting at the eastern-most (upper-most) portion of the area and working westward across the portal area. and thence down the access road to the Shop Area. Fill material from the Expansion Area will be utilized to backfill and reclaim the highwall area. The fill material will contain rock fragments of all sizes, including a significant amount of 6" to 8" rock fragments. These rocks will assist in providing slope stability and aid revegetation by helping to retain moisture. The fill material will be topped with 12" of topsoil material to promote plant growth.

Mobile heavy equipment will be utilized to move and place fill in highwall and yard areas and the south portal pocket cuts. A front end loader and end dumps will be used to remove fill material from the Expansion Area and haul the material up to the Portal Area. The lifts will be built up horizontally with a slight slope on each lift toward the highwall. Material will be spread into lifts of 18 to 24 inches deep. The loader will compact each lift as the next lift is put in. A backhoe will be used to place and compact the final lift. Before placing topsoil on the final backfilled surface, that surface will be roughened with the backhoe bucket. This will help prevent slippage of the topsoil layer and promote root penetration.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on topsoil samples taken before topsoil redistribution and during final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile include: taking two soil samples per stockpile and collecting samples with a soil auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site will also be taken for a baseline chemical reference. Fertilizer will be added to the redistributed topsoil, prior to seeding, if a need is indicated by laboratory results. The fertilizer will be spread on the redistributed topsoil and either disked or hand-raked into the soil (depending on the steepness of the slope).

Areas to receive topsoil will be marked with stakes indicating the depth of application. A reclamation supervisor will oversee the topsoil redistribution operation. Topsoil will be left in a roughened condition prior to seeding to minimize compaction and erosion as well as promote infiltration of precipitation.

5. Revegetation - Portal Area

Revegetation procedures for the Portal Area and the south portal pocket cuts involves a four step program: 1) application of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3) hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation. Revegetation work will not be done until fall (September-October).

6. Demolition - Old Substation Area

The only structures existing at the Old Substation Area is the termination structure for the mine powerline. This powerline will be dismantled and removed from the site prior to completion of final reclamation.

7. Backfill, Grade and Topsoil - Old Substation Area

~~As excess~~ Fill from the Expansion Area ~~is placed in the underground mine workings, additional fill from the Expansion Area~~ will be hauled to the Old Substation Area for backfilling. The cut slope above the pad will be backfilled to the approximate original contour. The area will then be topsoiled and revegetated.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on topsoil samples taken before topsoil redistribution and during final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile include: taking two soil samples per stockpile and collecting samples with a soil auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site will also be taken for a baseline chemical reference. Fertilizer will be added to the redistributed topsoil as indicated by laboratory results of the most needful increment.

The areas to be topsoiled will be marked with stakes indicating the depth of application. A reclamation supervisor will oversee the topsoil redistribution operation. Topsoil will be left in a roughened condition prior to seeding to minimize compaction and erosion as well as promote infiltration of precipitation.

8. Revegetation - Old Substation Area

Revegetation procedures for the Old Substation Area involves a four step program: 1) application of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3) hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation. Revegetation work will not be done until fall (September-October).

9. Demolition and Removal of Surface Facilities - Shop Area

Facilities to be removed from the Shop area include: Shop/Warehouse building,

Substation, Rock Dust Bin, Oil Shed and parking lot asphalt. All structures will be removed from the site. Some components will be salvaged and recycled. Non-salvageable material will be disposed of in an approved solid waste landfill. All asphalt removed from the site will be disposed on in an approved RCRA disposal site.

A portion of the retaining wall which separates the Shop Area from the Forest Service Road will be removed, loaded onto trucks and hauled to an approved landfill. That portion not removed will be buried under a minimum of four feet of backfill material

Equipment used in the demolition and disposal of the facilities include: a front end loader, a backhoe, highway end dump trucks, a trackhoe, crane, truck with flat bed trailer, oxy-acetylene torches, air compressor and power tools, etc.

10. Backfill, Grade and Topsoil - Shop Area

With the Portal Area and Old Substation Area reclamation completed, and the retaining wall removed, the reclamation activities can continue at the Shop Area. Although this area is not as steep as the previous areas, the same reclamation procedures will be used. The cut slope behind the shop will be backfilled to approximate original contour using fill material from the Expansion Area. The lifts will be built up horizontally with a slight incline on each lift toward the existing cut slope. The dozer/loader will spread the material in lifts of 18 to 24 inches deep. The mobile equipment will compact each lift as the next lift is put in. Near the top of the slope, a backhoe will be used to place and compact the final lift. Before placing topsoil on the final backfilled surface, the surface will be roughened with the backhoe bucket to prevent slippage of the topsoil layer and promote root penetration.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on topsoil samples taken before topsoil redistribution and during final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile include: taking two soil samples per stockpile and collecting samples with a soil auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site will also be taken for a baseline chemical reference. Fertilizer will be added to the redistributed topsoil as indicated by laboratory results of the most needful increment.

The areas to be topsoiled will be marked with stakes indicating the depth of application. A reclamation supervisor will oversee the topsoil redistribution operation. Topsoil will be left in a roughened condition prior to seeding to minimize compaction and erosion as well as promote infiltration of precipitation.

11. Revegetation - Shop Area

Revegetation procedures for the Shop Area involves a four step program: 1) application

of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3) hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation. Revegetation work will not be done until fall (September-October).

12. Demolition and Removal of Surface Facilities - Old Loadout Area

~~At the time of final reclamation, the facilities at the Old Loadout Area will have already been removed and disposed of as part of the 1997 Surface Expansion Project.~~ The Old Loadout area is now the site of the operational iron treatment facility. This reclamation plan assumes that the treatment facility will no longer be required at the time of final reclamation and all components of the system will have been removed at that time. All asphalt removed from the site will be disposed on in an approved RCRA disposal site. A portion of the existing coal pile retaining wall will be removed, loaded onto trucks and hauled to an approved landfill. That portion not removed will be buried under a minimum of four feet of backfill material.

Equipment used in the demolition and disposal of the facilities include: a front end loader, a backhoe, highway end dump trucks, a trackhoe, crane, and truck with flat bed trailer.

13. Backfill, Grade and Topsoil - Old Loadout Area

With portions of the retaining wall removed, reclamation activities can continue at the Old Loadout Area. The same reclamation procedures will be used as described previously. The cut slope behind the retaining wall will be backfilled to approximate original contour using fill material from the Expansion Area. The lifts will be built up horizontally with a slight incline on each lift toward the existing cut slope. The dozer/loader will spread the material in lifts of 18 to 24 inches deep. The mobile equipment will compact each lift as the next lift is put in. Near the top of the slope, a backhoe will be used to place and compact the final lift. Before placing topsoil on the final backfilled surface, the surface will be roughened with the backhoe bucket to prevent slippage of the topsoil layer and promote root penetration.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on topsoil samples taken before topsoil redistribution and during final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile include: taking two soil samples per stockpile and collecting samples with a soil auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site will also be taken for a baseline chemical reference. Fertilizer will be added to the

redistributed topsoil as indicated by laboratory results of the most needful increment.

The areas to be topsoiled will be marked with stakes indicating the depth of application. A reclamation supervisor will oversee the topsoil redistribution operation. Topsoil will be left in a roughened condition prior to seeding to minimize compaction and erosion as well as promote infiltration of precipitation.

Because of the mine-water which is now occurring behind the seals in the portals, there are several seeps which issue from the porous sandstone ledge located between the portal bench and the old loadout area below. Much of this seepwater now appears to be coming from under the existing belt transfer (a.k.a., crusher) building, although other areas along the face of the ledge contribute seep flow as well. In order to properly handle this seepage on a permanent basis, a back-drain system will be installed at the interface of the sandstone ledge and the earthen reclamation backfill material. This back-drain system is described in greater detail in the geotechnical stability analysis prepared by RB&G Engineering, which appears in Appendix 5-28.

The back-drain would consist of a 2' thick layer of drain-rock placed against the entire height and width of the ledge, between the rock ledge and the backfill material. Historical measurements of the seep (collected at the base of the ledge at the retaining wall, show an average flow rate of 3 gpm, with a maximum flow of about 5 gpm. Engineering analysis indicates that only a couple of inches of drain-rock is needed to adequately carry this small flow, but a 24" contact layer has been specified in order to facilitate ease of placement and containment during construction, as the backfill is constructed layer-by-layer from the base to the top of the ledge. In addition to the drain-rock layer the back-drain will also include a number of perforated drainpipes installed within the drain-rock layer. Two 6" diameter pipelines will be installed horizontally at the base of the ledge; one at the base of the existing retaining wall, and the other along the top of the retaining wall. The retaining wall is a massive reinforced concrete structure, measuring 12" thick and about 8' high in this area. This wall will be left in place at the toe of the ledge to add increased structural stability to the backfilled slope and drain system. A third perforated drain pipe will extend vertically from the horizontal drainpipes up to the location of the base of the existing (but to be removed during reclamation) crusher/transfer building. As mentioned earlier, it is from this area from whence much of the seepage water emanates. Therefore, a vertical pipe extending up to this location will provide added assurance that the seep-water can be adequately collected and routed to discharge. This vertical pipe will connect to the upper horizontal pipe atop the retaining wall. The two horizontal collection pipes will then join together and exit from behind the backfilled area and discharge the collected seep water directly into the mine-water discharge channel MD-1 (see Item 4) near the inlet to the culvert MC-1 under the road. Refer to Figure 5-15 and Appendix 5-28 for details of the under-drain system. See Appendix 7-4 for details of the mine-water discharge channel MD-1.

14. Revegetation - Old Loadout Area

Revegetation procedures for the Old Loadout Area involves a four step program: 1)

application of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3) hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation. Revegetation work will not be done until fall (September-October).

15. Reclaim Forest Service Road North of Expansion Area

The Forest Service/Emery County road from the trailhead/turnaround will be reclaimed according to the Special Use Permit. As stipulated in the existing Forest Service special use permit (8/26/89) covering the road, during final reclamation the width of the asphalt road surface within the permit area will be reduced from a 27 foot subgrade and 22 foot running surface to a 20 foot subgrade and 14 foot running surface. Asphalt removed from the permit area as part of this road narrowing will be taken to a approved RCRA disposal site. The reclaimed area will be topsoiled and revegetated as described above.

Based on recent correspondence, the Forest Service now indicates that it prefers to have the asphalt totally removed from the road surface upon final reclamation. This position differs from the stipulations of the existing Forest Service Special Use Permit that requires that a 14' asphalt running surface be left in place upon final reclamation. Genwal commits to reclaiming the road through the minesite to any standard desired by the Forest Service/Emery County at the time of final reclamation. At the present time, however, it is difficult for Genwal to commit to a reclamation standard for the road that is contrary to the existing Forest Service Special Use Permit. Since the road now provides permanent access to the Crandall Canyon Memorial, which is owned by Emery County, the final disposition of the reclamation requirements regarding pavement removal may be determined in the future depending on discussions between the agencies involved.

16. Demolition and Removal of Surface Facilities - Expansion Area

The facilities to be removed from the Expansion Area are: the overhead conveyor, stacking tube, reclaim vault and tunnel/escapeway tube, crusher building, MCC building, loadout conveyor, truck loadout and loading platform. Removal of these facilities will take place simultaneously with removal of facilities from the aforementioned areas. After these surface facilities are removed, the only structures that will remain will be the sedimentation pond and associated spillway and discharge structure as well as the conveyance ditches, berms and culverts necessary to route drainage to the pond. Refer to Plates 5-16 and 7-5 for location of these structures.

Equipment used in the demolition and disposal of the facilities include: a front end loader, a backhoe, highway end dump trucks, a trackhoe, a crane, truck with flat bed trailer, oxy-acetylene torches, air compressor and power tools, etc.

17. Removal of Fill Material and Recontouring - Expansion Area

Reclamation of the Expansion Area ~~(which includes the south portal access ramp~~) is different from the other reclaimed areas because restoration of the approximate original contour involves removal of fill material rather than placement of backfill material. As described in the preceding sections, fill material removed from the Expansion Area will be used to regrade and restore approximate original contour at the Portal Area, Old Substation Area, Shop Area, and the Old Loadout Area. Therefore, these reclamation operations will be accomplished simultaneously. Expansion Area fill that is not slated for use as backfill for the aforementioned areas (i.e., excess fill) will be disposed of in an approved off-site land fill.

Reclamation of the Expansion Area involves three separate procedures involving three separate areas: the North Slope of the Expansion Area, the Crandall Creek Channel Area, and the South Slope of the Expansion Area. As described previously, the North Slope Expansion Area is that area north of the existing Crandall Creek and south of the existing Forest Service road. The South Slope Expansion Area includes the steeper hillside located south of the existing Crandall Creek and the south portal area. The Crandall Creek Channel Area is the area within and immediately on either side of the existing creek channel.

Reclamation of the North Slope Expansion Area will follow the normal reclamation procedures described above for the other general areas (i.e. regrading, topsoiling and revegetation). Reclamation on the steeper than normal slopes of the South Slope Expansion Area will involve a different reclamation technique which is designed to revitalize the existing left-in-place topsoil. Reclamation of the Crandall Creek Channel Area is also designed to revitalize the existing left-in-place topsoil and restore the previous channel morphology.

As a result of the Crandall Canyon Mine disaster of August 6, 2007, Genwal deeded a portion of the upper mine yard (upper end of the Expansion Area) to Emery County to be used as part of a permanent memorial to the deceased miners. (Refer to Appendix 5-27 for details of the deed agreement.) This deeded area measures approximately 240' x 330' (1.82 acres) and now serves as the parking area for the memorial, as well as the beginning portion of the trail that leads to the memorial headstones, as shown on Plate 5-3. As well as deeding this area to the County, the company also conveyed to the County a permanent easement for a road through the privately-owned part of the minesite. This road is a continuation of the existing Forest Service road, and will provide permanent public access to the memorial, even after final reclamation of the minesite. Since the parking area is now owned by Emery County as part of the memorial, the upper end of the Expansion Area, including the initial (upper) 248' segment of bypass culvert running underneath it, will be left in place permanently. Other than leaving this upper area in place, all other elements of reclamation of the Expansion Area, as described herein remain the

same. Refer to Appendix 5-27 for the Crandall Canyon Mine Memorial, Emery County Memorandum of Understanding and Quit-Claim Deed.

18. Restoration of South and North Hillside Slopes - Expansion Area

Five years prior to beginning reclamation operations, Genwal will consult with the Division to re-evaluate the techniques and practices being proposed for the Expansion Area. This consultation will include forming a task force of members with various areas of reclamation expertise to review the reclamation plan and recommend the best and most suitable reclamation techniques and products available at that time. The review and consultation will re-assess and revise, where needed, the existing reclamation plan to provide the best and most appropriate reclamation measures for the site.

At the time of final reclamation, all surface facilities located on the Expansion Area pad will be dissassembled and removed from the site. In the area of the (then removed) coal stockpile, all coal will be removed from the small adjacent slope area where the south flank of the coal pile had previously rested. Prior to reclaiming this area, all coal fines will be vacuumed from the surface. Using the existing pad as a work surface, a 12" layer of topsoil will then be reapplied to the disturbed area. Areas to receive topsoil will be marked with stakes indicating the depth of application. A reclamation supervisor will oversee the topsoil redistribution operation. Topsoil will be left in a roughened condition prior to seeding to minimize compaction and erosion as well as promote infiltration of precipitation.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on topsoil samples taken before topsoil redistribution and during final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile include: taking two soil samples per stockpile and collecting samples with a soil auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site will also be taken for a baseline chemical reference. Fertilizer will be added to the redistributed topsoil, prior to seeding, if a need is indicated by laboratory results. The fertilizer will be spread on the redistributed topsoil and hand-raked into the soil.

Revegetation procedures for this area will involve a four step program: 1) application of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3) hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation.

Following the surface facility demolition activities, fill material will be removed from the

Expansion Area in approximately 5'-10' lifts. During the fill removal process, the culvert inlet structure will be left in place on the west end of the yard to continue the diversion of water through the 72" culvert. A 40 foot wide berm will be left intact at the culvert inlet to continue to serve as the culvert headwall and to continue to divert water into the 72" culvert.

The sequence for removing the fill material, culvert, and underdrain system from the Expansion Area will be essentially the same as during the 1997 construction process but in reverse order. (See construction details in Appendix 7-50).

Fill will be removed from the Expansion Area in 5'-10' lifts starting from the west end of the yard and proceeding to the east end. At the intersection of the South Slope and the pad fill the marker soil/geotextile fabric will be located. The marker soil will be carefully removed from on top of the geotextile fabric on the South Slope as the yard fill is being removed. This will allow reclamation to be done on vertical increments of the hillside that will be easy to access from the adjacent yard level. Removal of fill material adjacent to the South Slope will be done very carefully in order not to disturb the in-place soil resources. Fill removal in this area will be done with small earth-moving equipment (Bobcats, backhoes, etc.) and/or by hand if necessary in order to minimize disturbance of the topsoil. Once the geotextile fabric has been exposed, the fabric will be carefully peeled away from the soil and the condition of the underlying soil materials observed at this time. The soil will be reclaimed and revegetated in 5-10 foot horizontal zones that can be easily accessed and worked by hand from the adjacent pad fill level. After each level has been reclaimed as described below, another lift (5-10 feet of fill) will be removed from the fill. Revegetation work will continue on the next increment of hillside below the previously reclaimed level. This work will be done in continued successive lifts, involving fill removal, peeling away the geotextile, revitalization of the in-place topsoil, and revegetation of the newly exposed increment.

It should be noted that approximate original contour of the North Slope of the Expansion Area will also be re-established as the Expansion Area fill is being removed in lifts as described previously. As the fill is being removed in vertical lifts, the adjacent North Slope surface will be regraded and prepared for subsequent topsoil application.

Sediment control during fill excavation will be met by continued use of the sediment pond east and downstream from the yard area. The main 72" culvert inlet and an adequate amount of fill to maintain the existing headwall will be left intact during this phase of the fill retrieval process.

19. Revegetation - South Slope of the Expansion Area

Reclamation of the South Slope will take place in vertical increments (lifts) simultaneously with the removal of the fill material in corresponding lifts. As fill lifts are being removed, the adjacent newly exposed hillside will be reclaimed and revegetated.

It is anticipated that after the Expansion Area fill is removed in lifts and the geotextile fabric is peeled away in vertical increments, the underlying soil material could be somewhat compacted. To enhance the ability of the soil to absorb moisture, a mixture of PAM (Polyacrylamide) or best technology currently available at the time of reclamation, will be applied to the soil surface. PAM is designed to relieve compaction of the soil and open up channels for air and water penetration. This treatment will be applied in successive 5-10' lifts as the fill is removed and the hillside is exposed.

The re-exposed soil structure will most likely be undamaged but lacking in microbes and nutrients. In order to regenerate naturally existing soil organisms and assist in reactivating soil activity, an inoculum will be applied to the soil to reestablish soil bacteria, microhorizia and mycelium. To enhance soil microbial establishment and promote more rapid stabilization of the soil the non-riparian seed mixture (as listed in Appendix 3-6) will be hand broadcast over the area and raked into the soil surface. A wood fiber mulch will be applied over the seed bed then the surface will be sprayed with a bonded fiber matrix tackifier. This type of tackifier has appeared to have a much greater ability than regular tackifier to hold and stabilize the soil surface. The bonded fiber matrix tackifier will be applied at a rate of 3,500 pounds per acre (or manufacturer's recommended application if greater).

By removing the fill in 5'-10' lifts and simultaneously reclaiming the adjacent South Slope in corresponding lifts, the pad area can then serve as convenient operating platform for the machinery and supplies used during the reclamation effort. In this manner heavy machinery will not be required to maneuver on the steep slopes. All reclamation work performed directly on the steep slopes will be done with hand labor and tools. The reclamation process will be supported by heavy equipment staged on the adjacent pad level.

20. Removal and Disposal of 72" Culvert

During the 1997 construction of the expanded surface facilities, the creek channel configuration was left intact throughout the entire length of the Expansion Area. This was accomplished by covered the channel in situ with a geotextile fabric during initial construction period. The geotextile was placed over the channel to preserve the indigenous soil and morphology of the existing creek bed. The fabric was placed along the bottom and 5 feet above the channel embankment. A colored marker material was placed on top of the geotextile to serve as a visual marker horizon during reclamation operations.

Fill removal (and South Slope reclamation) will proceed vertical lifts until the 72" culvert has been exposed. Prior to removing the culvert, the stream flow will be diverted into the 18" underdrain system by removing the cap from the drain pipe located at the upstream end of the culvert. This will be done during a low flow period of the year, such as July or August. Once the streamflow has been successfully diverted into the underdrain system, removal of the 72" culvert can begin. Removal of the culvert will be done in 20' segments starting from the upstream end and working downstream. All culvert material will be removed from the site and disposed of in

an approved landfill. The remaining culvert bedding material (2" x 0" gravel), which is located on top of the underdrain system, will be left in place at this time to provide a stable work area for heavy equipment involved in subsequent reclamation of the North Slope as described later in this discussion.

Starting at a point immediately below Emery County's Crandall Canyon Memorial parking facility, the 72" culvert will be removed downstream to an elevation just above the existing sediment pond. At this time, a new culvert inlet and headwall will be re-established for the remaining 72" culvert segment. The headwall will be rebuilt at this location according to original headwall design and will be rip rapped in a similar manner. At this stage of the reclamation process, approximately 1005' of 72" culvert will have been removed and approximately 293' still remains inplace below and around the left-in-place sediment pond. However, stream flow will still continue to flow temporarily through the underdrain system at this time until the North Slope reclamation has been completed.

21. Topsoiling - North Slope of the Expansion Area

After the Expansion Area fill and the 72" culvert have been removed, the underdrain system will still remain intact. Because this phase of work will be done during low flow, the stream will be adequately carried through the underdrain system. Mobile earthmoving equipment will still be able to operate on top of the 2" x 0" bedding material located over the underdrain system. Reclamation of the North Slope, which is not as steep as the south slope, will be done with the standard protocol for reclamation involving topsoiling and revegetation.

Topsoil will be reapplied to the North Slope in the conventional manner. Topsoil will be hauled in by truck and spread with a front end loader and/or backhoe. Areas to receive topsoil will be marked with stakes indicating the depth of application. A reclamation supervisor will oversee the topsoil redistribution operation. Topsoil will be left in a roughened condition prior to seeding to minimize compaction and erosion as well as promote infiltration of precipitation.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on topsoil samples taken before topsoil redistribution and during final reclamation. The method used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile include: taking two soil samples per stockpile and collecting samples with a soil auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site will also be taken for a baseline chemical reference. Fertilizer will be added to the redistributed topsoil as indicated by laboratory results.

22. Revegetation - North Slope of the Expansion Area

Revegetation procedures for the North Slope of the Expansion Area involves a four step program: 1) application of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3)

hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation. Revegetation work will not be done until fall (September-October).

23. Restoration of the Stream Channel

After the north slope has been topsoiled, the underdrain system will then be removed and the stream channel morphology restored. Prior to removal of the underdrain, silt fences will be established in Crandall Creek downstream from the existing 72" culvert outlet. These silt fences will be located in an area convenient for maintenance and cleanout.

Removal of the underdrain system will be done during low flow conditions and will be completed in reverse order from the way it was originally installed. Using small mobile equipment, such as a backhoe, the remaining culvert bedding material, drain rock and 18" drain pipe will be removed in 20' segments starting from the upper end and working downstream. After the drain rock and drain pipe are removed, the lower layer of geotextile can be carefully peeled back, re-establishing the "natural" streambed in the process. All drain rock, drain pipe and geotextile material removed during this process will be disposed of at an approved landfill. As each 20' segment of the underdrain system is removed, silt fencing will be installed on either side of the newly restored stream channel. The purpose of this silt fencing is to treat drainage from the adjacent recently reclaimed areas.

After the underdrain system has been removed and the stream channel re-established downstream past UD-1, a rip rapped ditchway will be installed to carry drainage from the side culvert outlet down the North Slope to the restored stream channel. Refer to Plate 5-16.

The underdrain system will be removed downstream to an elevation just above the sediment pond at the location of the new 72" culvert inlet and headwall. At this time, the remaining 18" drain pipe will be recapped and the stream flow rediverted back into the 72" culvert. [Note: this new sediment pond/culvert/underdrain configuration will remain in place until Phase 2 reclamation, as described later]. At this stage of the reclamation process, approximately 1005' of 72" culvert and underdrain system will have been removed and approximately 282' will still remain in-place to divert channel flow below and around the left-in-place sediment pond.

24. Revegetation of the Stream Channel

It is anticipated that after the underdrain system is removed and the geotextile fabric is peeled away, the underlying soil material along the stream banks will be somewhat compacted. To enhance the ability of the soil to absorb moisture, a mixture of PAM (Polyacrylamide) or best technology currently available at the time of reclamation, will be applied to the soil surface. PAM is designed to relieve compaction of the soil and open up channels for air and water penetration.

The re-exposed soil structure will most likely be undamaged but lacking in microbes and nutrients. In order to regenerate naturally existing soil organisms and assist in reactivating soil activity, an inoculum will be applied to the soil to reestablish soil bacteria, microhorizia and mycelium. To enhance soil microbial establishment and promote more rapid stabilization of the soil, the riparian seed mixture (as listed in Appendix 3-6) will be hand broadcast over the area and raked into the soil surface. A wood fiber mulch will be applied over the seed bed then the surface will be sprayed with a bonded fiber matrix tackifier. This type of tackifier has appeared to have a much greater ability than regular tackifier to hold and stabilize the soil surface. The bonded fiber matrix tackifier will be applied at a rate of 3,500 pounds per acre (or manufacturer's recommended application if greater).

25. Sediment Control and Treatment

In practice, many of the reclamation procedures outlined above will be conducted simultaneously. However, the sediment pond will provide complete sediment control during all phases of the reclamation process until such time as the upper 1005' segment of 72" culvert (below the Memorial facility) has been removed and removal of the underdrain system begins. Sediment control during removal of the underdrain will consist of silt fences constructed on either side of the newly restored stream channel and silt fences constructed within Crandall Creek below the outlet of the 72" culvert.

26. Topsoil Stockpile Location Reclamation

Following the removal of the topsoil stockpiles from the storage sites (during final reclamation retopsoiling activities), the topsoil pile locations will be reclaimed. (Enough topsoil will remain stockpiled for Phase 2 reclamation. Refer to the Phase 2 reclamation discussion in item #27 below.) The topsoil stockpile locations will not require soil redistribution since the native topsoil is still in place. At these locations, the ground will be lightly scarified and then reclaimed according to the standard reclamation protocol.

Revegetation procedures for the stockpile locations will involve a four step program: 1) application of fertilizer (if laboratory testing indicates a need), 2) hydroseed, 3) hydromulch the entire area with a wood fiber mulch to stabilize soil during vegetative growth and control runoff, 4) plant containerized stock to further stabilize the soil and provide vegetative diversity. Hydroseeding will combine the tackifier and small amount of mulch with the seed mix (to mark

the area of coverage) during application to the redistributed topsoil. All seed utilized on the site will be certified pure live seed. After the seeding step, the mulch (wood fiber and hay/straw) and tackifier will be applied to the seedbed surface. The plant containerized stock will be planted in the second year of reclamation. Revegetation work will not be done until fall (September-October).

Phase 2

27. Phase 2 Reclamation - Removal of Sedimentation Pond

During Phase 2 reclamation, prior to any earthwork activity, silt fences will be installed across the entire length of the downstream at the east end of the sediment pond embankment to filter any sediment resulting from removal of the pond. Additional silt fences will be installed in Crandall Creek below the culvert outlet to provide additional sediment control.

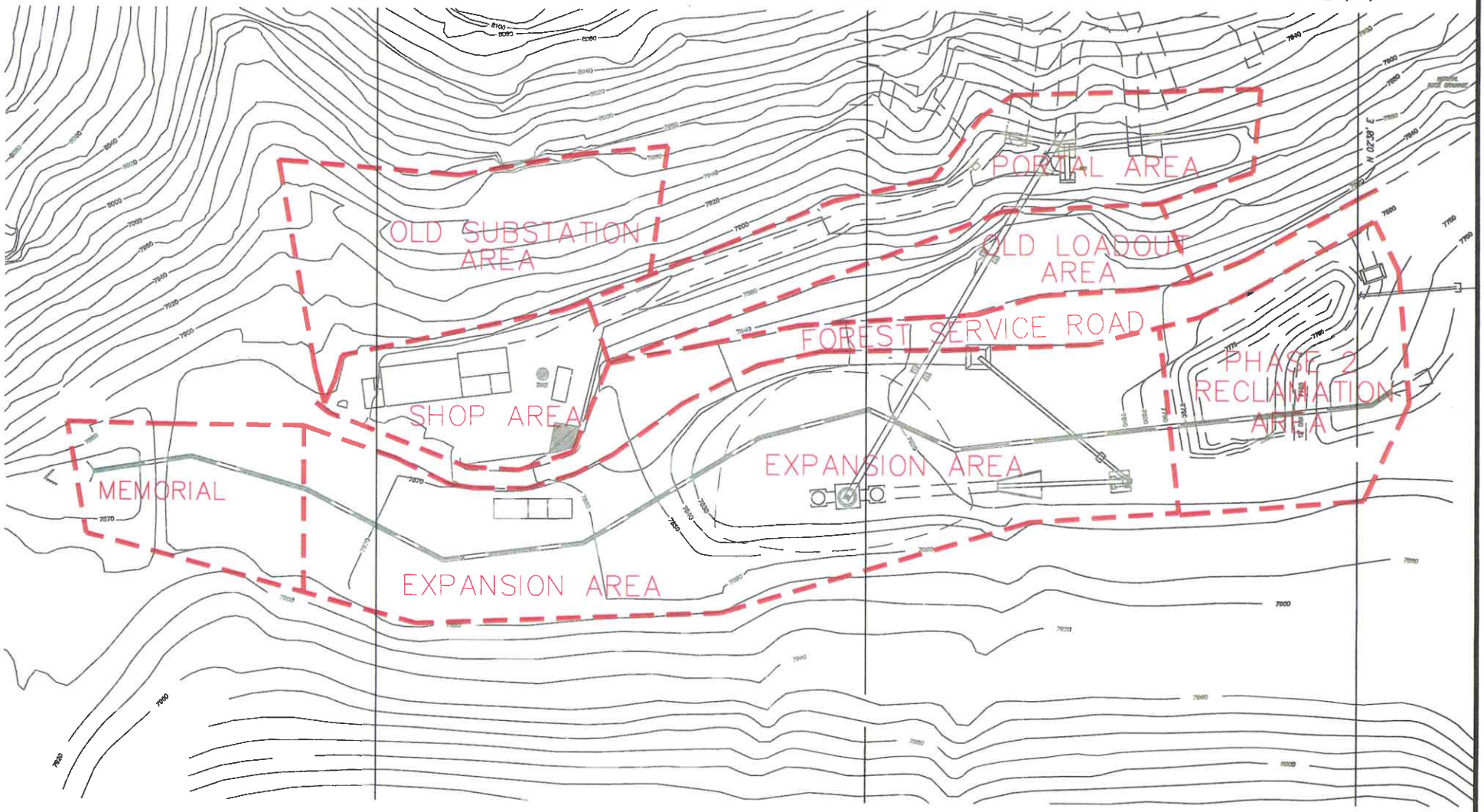
Removal of the sediment pond and the remaining 72" culvert/underdrain system will follow the same procedures described previously for the removal of the expansion area fill. The pond embankment will be removed in lifts down to the 72" pipe. Reclamation (grading, topsoiling and revegetation) of the North and South Slopes will be done in the same manner as described for the Expansion Area in Phase 1 reclamation. After the 72" culvert has been exposed the end cap will be removed from the 18" drain pipe located in the underdrain system. Flow will then be diverted through the underdrain system in the drain rock below the 72" pipe. The 72" pipe will be completely removed at this time.

After the 72" pipe has been completely removed, the geotextile fabric will be removed from the top of the underdrain system. The drain rock and 18" drain pipe will be removed with a small backhoe and hauled off-site for disposal. The drain rock beneath the drain pipe will be shoveled out of the channel and the geotextile that was placed over the original channel will be removed by hand, restoring the original stream channel morphology. The disturbed area will be revegetated in the manner previously described for the previously reclaimed areas. In many ways Phase 2 reclamation of the sediment pond embankment will be nearly identical to the Expansion Area reclamation described previously for Phase 1. Both areas involve the steeper South Slope, the stream channel culvert/underdrain system, and the less steep North Slope. Therefore, all pertinent aspects of reclamation which apply to Phase 1 as described in this appendix will also apply to Phase 2. This includes the special steep-slope reclamation techniques for the South Slope, the left-in-place soil revitalization for the channel area, and the standard reclamation procedures for the North Slope.

RECLAMATION TIME TABLE
CRANDALL CANYON MINE

RECLAMATION OPERATION	MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER			
	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4	WK1	WK2	WK3	WK4
PORTAL AREA																								
Remove structures																								
Remove asphalt																								
Haul earthfill into mine workings																								
Seal portals																								
Backfill, regrade, recontour																								
Topsoil																								
Seeding/mulching																								
OLD SUBSTATION AREA																								
Remove structures																								
Backfill/regrade/recontour																								
Topsoil																								
Seeding/mulching																								
OLD SHOP																								
Remove structures																								
Remove asphalt																								
Backfill/regrade/recontour																								
Topsoil																								
Seeding/mulching																								
OLD LOADOUT AREA																								
Remove structures																								
Remove asphalt																								
Backfill/regrade/recontour																								
Topsoil																								
Seeding/mulching																								
FOREST SERVICE ROAD																								
Remove asphalt																								
Topsoil																								
Seeding/mulching																								
EXPANSION AREA - NORTH SIDE																								
Remove structures																								
Remove asphalt (if any)																								
Remove fill (haul to mine workings)																								
Re-establish drainage ditches and rip rap																								
Topsoil																								
Seeding/mulching																								
EXPANSION AREA - SOUTH SIDE																								
Remove structures																								
Remove asphalt (if any)																								
Remove fill (haul to mine workings)																								
Remove marker material, geotextile																								
Revitalize existing topsoil																								
Seeding/mulching																								
EXPANSION AREA - STREAM CHANNEL																								
Remove 72" CMP																								
Remove underdrain and geotextile																								
Revitalize existing topsoil																								
Re-establish culvert inlet/headwall																								
Seeding/mulching																								

INCORPORATED
EFFECTIVE
JUL 30 1997
UTAH DIVISION OF OIL, GAS AND MINING
FIELD OFFICE



75' 0 150' 300'

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RECLAMATION AREAS

Crandall Canyon Mines
Crandall Canyon Mine
P.O. BOX 910
EAST CARBON, UTAH 84520

DRAWN BY PJJ	DATE 28 JUNE 2011
SCALE AS SHOWN	REVISION 3
SHEET	FIGURE 1

G:\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamat ion\RECAREAS R2 6-29-11.dwg, Layout1, 6/29/2011 1:23:35 PM

APPENDIX 5-27

CRANDALL CANYON MINE MEMORIAL
EMERY COUNTY
MEMORANDUM OF UNDERSTANDING
QUITCLAIM DEED

MEMORANDUM OF AGREEMENT

by and between

INTERMOUNTAIN POWER AGENCY,

ANDALEX RESOURCES, INC. and

EMERY COUNTY, UTAH

THIS MEMORANDUM OF AGREEMENT ("**Agreement**") is entered into this 21 day of May, 2008 (the "**Effective Date**") by and between **INTERMOUNTAIN POWER AGENCY,** a political subdivision of the State of Utah ("**IPA**"); **ANDALEX RESOURCES, INC.,** a Delaware corporation ("**ANDALEX**"); and **EMERY COUNTY, UTAH,** a body corporate and politic, acting through the **COMMISSION OF EMERY COUNTY, UTAH** ("**Emery County**"). Concerning IPA's obligations under this Agreement, the Los Angeles Department of Water and Power, as Operating Agent for the IPA, shall administer this Agreement on behalf of IPA.

WHEREAS, IPA and ANDALEX jointly own certain properties for the production, mining, and loading of coal at or near the town of Huntington in Emery County, Utah known as the Crandall Canyon Mine;

WHEREAS, on or about August 6, 2007, an accident occurred at the Crandall Canyon Mine resulting in six miners being trapped in the Mine;

WHEREAS, the six trapped miners, Kerry Allred, Don Erickson, Luis Hernandez, Juan Carlos Payan, Brandon Phillips and Manuel Sanchez, are now deceased;

WHEREAS, the families of the six trapped miners have now expressed their desire to establish a monument at the site of the Crandall Canyon Mine as a permanent memorial;

WHEREAS, on February 19, 2008, Emery County unanimously voted to support and represent the families of the six trapped miners in their efforts to establish the permanent memorial;

WHEREAS, ANDALEX and IPA fully support the families' efforts to establish a permanent memorial to the six trapped miners; and

WHEREAS, ANDALEX, IPA and Emery County now desire to enter into this Memorandum of Agreement for the purpose of setting forth their agreement and understanding concerning the establishment of a permanent memorial to the six miners trapped in the Crandall Canyon Mine and will endeavor to complete the memorial by August 6, 2008.

NOW THEREFORE, for and in consideration of the above premises and in consideration of the mutual benefits to be derived, the parties agree as follows:

1. ANDALEX, IPA and Emery County mutually agree to cooperate for the purpose of establishing a monument at the site of the Crandall Canyon Mine as a permanent memorial to the six miners trapped in the Crandall Canyon Mine on August 6, 2007. The memorial shall be hereinafter referred to as the "**Crandall Canyon Memorial.**" The location map and site plan for the Crandall Canyon Memorial, including an associated trail and parking lot, to be established at the site of the Crandall Canyon Mine are attached hereto as Exhibit 1.

2. As shown on Exhibit 1, the Crandall Canyon Memorial shall be located on land owned by the United States Forest Service ("**USFS**"). The dedicated parking lot for the Crandall Canyon Memorial will be located on fee land jointly owned by ANDALEX and IPA. The trail leading from the parking lot to the site of the Crandall Canyon Memorial will be located partially on land owned by USFS, and partially on land owned by ANDALEX and IPA. It is the intent of the parties hereto that Emery County will own all permits, rights-of-way, and real property necessary for the establishment, construction, and maintenance of the Crandall Canyon Memorial and associated facilities, including the parking lot and trail.

3. Emery County shall prepare and submit an application to the USFS for a Special Use Permit for the Crandall Canyon Memorial site and trail. ANDALEX and IPA agree to assume joint responsibility for the costs associated with the preparation of the application for the Special Use Permit. In addition, if the USFS determines that analysis is required under the National Environmental Policy Act ("**NEPA**") for federal actions associated with the Crandall Canyon Monument, ANDALEX and IPA agree to assume joint responsibility for the costs associated with the preparation of any such analysis.

4. ANDALEX and IPA will convey by quit claim deed to Emery County the real property (located near the upper section of the mine material storage yard) to be dedicated to the memorial parking lot and the beginning section of the trail (**"Deeded Land"**), on land located in Emery County, Utah, and more particularly described as follows:

   Beginning at the Northwest Corner of the Southwest Corner of Section 5, Township 16 South, Range 7 East of the Salt Lake Baseline and Meridian; thence running N88°06'35"E for 235.13'; thence South for 152.75'; thence West for 235.00'; thence North along the west section line of Section 5 for 145.00' to the Point of Beginning, containing 0.803 acres, more or less.

5. ANDALEX and IPA will also grant to Emery County an easement ("**Road Easement**") for a public road through the minesite which will connect the Deeded Land to the existing Forest Service Road No. 50248 (a.k.a., Crandall Canyon Road), on land located in Emery County, Utah, and more particularly described as follows:

   Encompassing 22.0' on either side (44' total) of a center line

beginning at a point that is located N88°06'35"E 695.40' from the Northwest Corner of the Southwest Corner of Section 5, Township 16 South, Range 7 East of the Salt Lake Baseline and Meridian; thence running S59°33'11"W for 12.78'; thence S54°25'37"W for 50.0'; thence S56°02'53"W for 50.0'; thence S65°54'48" W for 50.0'; thence S80°43'13"W for 50.0'; thence N84°43'48" for 50.0'; thence N62°43'15"W for 50.0'; thence N70°56'20"W for 50.0'; thence N73°32'52"W for 48.36'; thence S88°06'35"W for 319.18' to the end point which is located 22.0' South of the Northwest Corner of the Southwest Corner of said Section 5.

This easement follows the alignment of the existing public access through the minesite to the Forest Service trailhead. The ANDALEX operator, Genwal Resources, Inc. (**"GRI"**) will continue to be responsible for all maintenance of this road until such time as the mine is reclaimed as provided in the MRP as that term is defined in paragraph 6 below and Phase 1 bond release is obtained. At the time of final reclamation GRI will reclaim this segment of road to the extent required by State and Federal regulations.

6. The parties acknowledge that the Deeded Land is currently included within the Crandall Canyon Mine Mining and Reclamation Plan, Permit No. C015/032 (**"MRP"**) filed with the Utah Division of Oil, Gas and Mining (**"DOGM"**). ANDALEX through GRI, as permittee, shall amend the MRP to acknowledge the memorial parking area and trailhead within the Deeded Land as permanent structures and will obtain a post-mining land use change in the MRP to reflect this change. GRI will remove those portions of the Deeded Land used in conjunction with the memorial from all MRP permitting and reclamation requirements.

7. Within the Deeded Land a fence and/or barrier shall be constructed by GRI to delineate and separate the boundary of the memorial parking area from the mine operational area, at the approximate location and configuration as shown on Exhibit 1 attached hereto. The parties acknowledge that the mine operation area outside the parking area delineation can continue to be used by GRI for mine-related operations and reclamation until the mine is reclaimed as provided in paragraphs 8, 9 and 10 herein, and is further subject to the terms of that certain Right-of-Way Easement effective as of January 1, 2004, by and between ANDALEX, IPA and PacifiCorp (**"PacifiCorp ROW"**). The quit claim deed conveying the Deeded Land to Emery County will expressly except and reserve these uses.

8. GRI shall continue to be responsible for all MRP permitting and reclamation obligations for the operational area of the Deeded Land located outside the delineated memorial area and for the road easement. Emery County will assume no permitting or reclamation liabilities under the MRP for the Deeded Land or the Road Easement and GRI agrees to indemnify and hold harmless Emery County from all costs, penalties and liabilities associated with its permitting and reclamation obligations under the MRP.

9. A 6-foot diameter undisturbed drainage culvert is presently located under the Deeded Land, and will not be removed as a result of post-mining reclamation. GRI will amend

the MRP permit to acknowledge that within the Deeded Land, the memorial parking area and trail and the underlying culvert will remain as permanent structures as a post-mining land use, as shown on Exhibit 2 attached hereto. GRI will be responsible for all maintenance and upkeep of this segment of culvert until such time as the mine site is reclaimed and Phase 1 bond release is achieved under the MRP. Prior to Phase 1 bond release, GRI will make any and all necessary repairs to the culvert so that it is deemed at that time by Emery County to be fully functional. Following Phase 1 bond release, Emery County will assume responsibility for maintenance of the culvert and will indemnify and hold GRI harmless from all costs and liabilities associated with the culvert.

10. Emery County acknowledges that a small area within the northeast corner of the Deeded Land (as shown on Exhibit 1) is now, and has been in the past, used as an integral part of the existing Forest Service trailhead and trailhead parking facility, open to the public, and agrees that this unrestricted usage will continue in the future, at the discretion of the Forest Service, both while the mine remains in operation and after reclamation is completed in accordance with the MRP and Forest Service Special Use Permit PRI42.

11. ANDALEX and IPA agree to assume joint responsibility for costs associated with the construction of the Crandall Canyon Memorial, trail, parking lot, and parking lot delineation. Further, ANDALEX and IPA agree to oversee the construction of the Crandall Canyon Memorial project and to secure all necessary construction contracts related thereto. The trail leading to the Crandall Canyon Memorial shall be designed and constructed to meet applicable Emery County and USFS standards, if any.

12. Following execution of this Memorandum of Agreement, ANDALEX and IPA will promptly initiate discussions with USFS to effect a land exchange with USFS whereby: (i) ANDALEX and IPA would acquire from USFS joint ownership of a yet to be defined parcel of USFS land surrounding the site of the Crandall Canyon Memorial and located adjacent to the Deeded Land, and (ii) in exchange, USFS would acquire ownership of a yet to be defined parcel of real property owned by ANDALEX and IPA and located in lower Huntington Canyon, as shown on Exhibit 3 attached hereto. It is anticipated that USFS will issue the Special Use Permit discussed in Paragraph 3 above to Emery County for renewable five (5) year terms with the understanding that the surface area situated around the site of the Crandall Canyon Memorial will ultimately be conveyed by USFS to ANDALEX and IPA in a land exchange. The parties hereto will use their best efforts to diligently pursue the exchange with the USFS. Once the land associated with the Crandall Canyon Memorial has been acquired by ANDALEX and IPA through the exchange from USFS, it will be conveyed to Emery County to ensure that Emery County can maintain full administrative control of the Crandall Canyon Memorial without the long-term involvement of USFS.

13. ANDALEX and IPA agree to assume joint responsibility for the costs associated with reasonably necessary title searches and abstracts for the property to be transferred to Emery County by the terms of this Agreement. However, ANDALEX and IPA will not warrant title to such property.

14. It is the intent of ANDALEX, IPA and Emery County that, subject to Paragraphs 8, 9 and 10 above, following the construction of the Crandall Canyon Memorial, issuance of the necessary permits and the transfer of real property as described herein, Emery County shall assume permanent responsibility for maintenance and upkeep of the Crandall Canyon Memorial, trail, parking lot and any other properties or structures associated therewith. Following such time, and subject to paragraphs 8, 9 and 10, Emery County shall indemnify and hold harmless ANDALEX, IPA and GRI from all costs and liabilities associated therewith.

15. This Memorandum of Agreement shall take effect on the Effective Date and shall terminate upon the first to occur of the following events:

    (a) ANDALEX, IPA and Emery County have satisfied their respective obligations hereunder; or
    (b) Ten (10) years following the Effective Date.

16. This Memorandum of Agreement may not be assigned by any party hereto, without the prior written consent of the other parties hereto. The provisions of this Memorandum of Agreement are binding on, and shall inure to the benefit of the parties hereto and their permitted successors and assigns.

17. All notices, requests, demands and other communications required or permitted under this Memorandum of Agreement shall be in writing and shall be deemed to have been given on the date of delivery in person or of deposit in the United States mail, postage prepaid, if sent by registered or certified mail, return receipt requested, addressed to the parties at the addresses set forth below, or at such other addresses as to which the parties give notice in accordance herewith.

If to IPA:	Intermountain Power Agency c/o Los Angeles Department of Water and Power 111 North Hope Street, Room 1263 Los Angeles, California 90012 Attention: William Engels Facsimile: (213) 367-0269
If to ANDALEX:	ANDALEX Resources, Inc. 6750 N Airport Rd P.O. Box 902 Price, UT 84501 Attention: David Shaver Facsimile: (435) 888- 4002
If to Emery County:	Emery County Commission Emery County Courthouse Castle Dale, UT 84513 Attention: Ray D. Petersen Facsimile: (435) 381-5644

18. No waiver of any of the provisions of this Memorandum of Agreement shall be deemed or shall constitute a waiver of any other provision hereof.

19. Nothing in this Memorandum of Agreement shall entitle any person or entity other than the parties hereto, their successors and assigns, to any claim, cause of action, remedy or right of any kind.

20. This Memorandum of Agreement may be executed in any number of counterparts and each such counterpart hereof shall be deemed to be an original instrument, but all such counterparts together shall constitute for all purposes one document.

21. This Memorandum of Agreement constitutes all of the promises and agreements between the parties hereto with respect to the subject matter of this Agreement and supersedes any and all prior understandings, inducements or conditions, either expressed or implied, oral or written

IN WITNESS WHEREOF, the parties have executed this Memorandum of Agreement as of the date first shown above.

INTERMOUNTAIN POWER AGENCY

By: James A. Hewlett
Name: James A. Hewlett
Title: General Manager

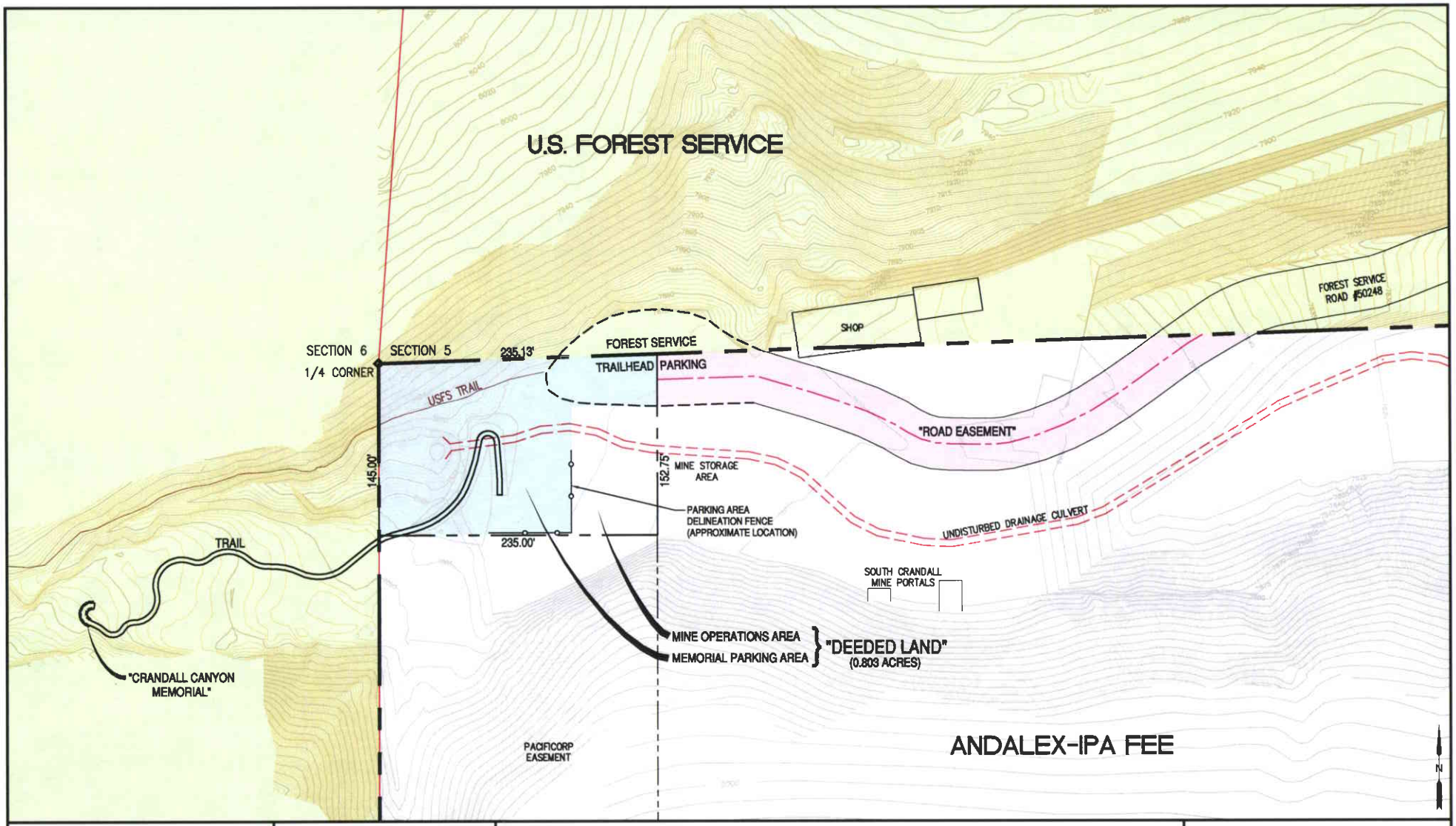
ANDALEX RESOURCES, INC.

By: P. Bruce Hill
Name: P. Bruce Hill
Title: President & CEO

EMERY COUNTY, UTAH, a body corporate and politic, acting through the **COMMISSION OF EMERY COUNTY, UTAH**

By: Drew Sitterud
Name: Drew Sitterud
Title: Commission, Chair

8762937.2



LINE TYPE LEGEND	COLOR LEGEND
SECTION LINE	MEMORIAL PARKING AREA WITHIN "DEEDED LAND"
LAND OWNERSHIP / CONTROL BOUNDARY	MINE OPERATIONS AREA WITHIN "DEEDED LAND"
EXISTING CONTOUR LINES AT 5' INTERVALS	"ROAD EASEMENT"
EXISTING CONTOUR LINES AT 1' INTERVALS	U.S. FOREST SERVICE LAND

50' 0 100' 200'

EXHIBIT 1

CRANDALL CANYON MEMORIAL SITE PLAN

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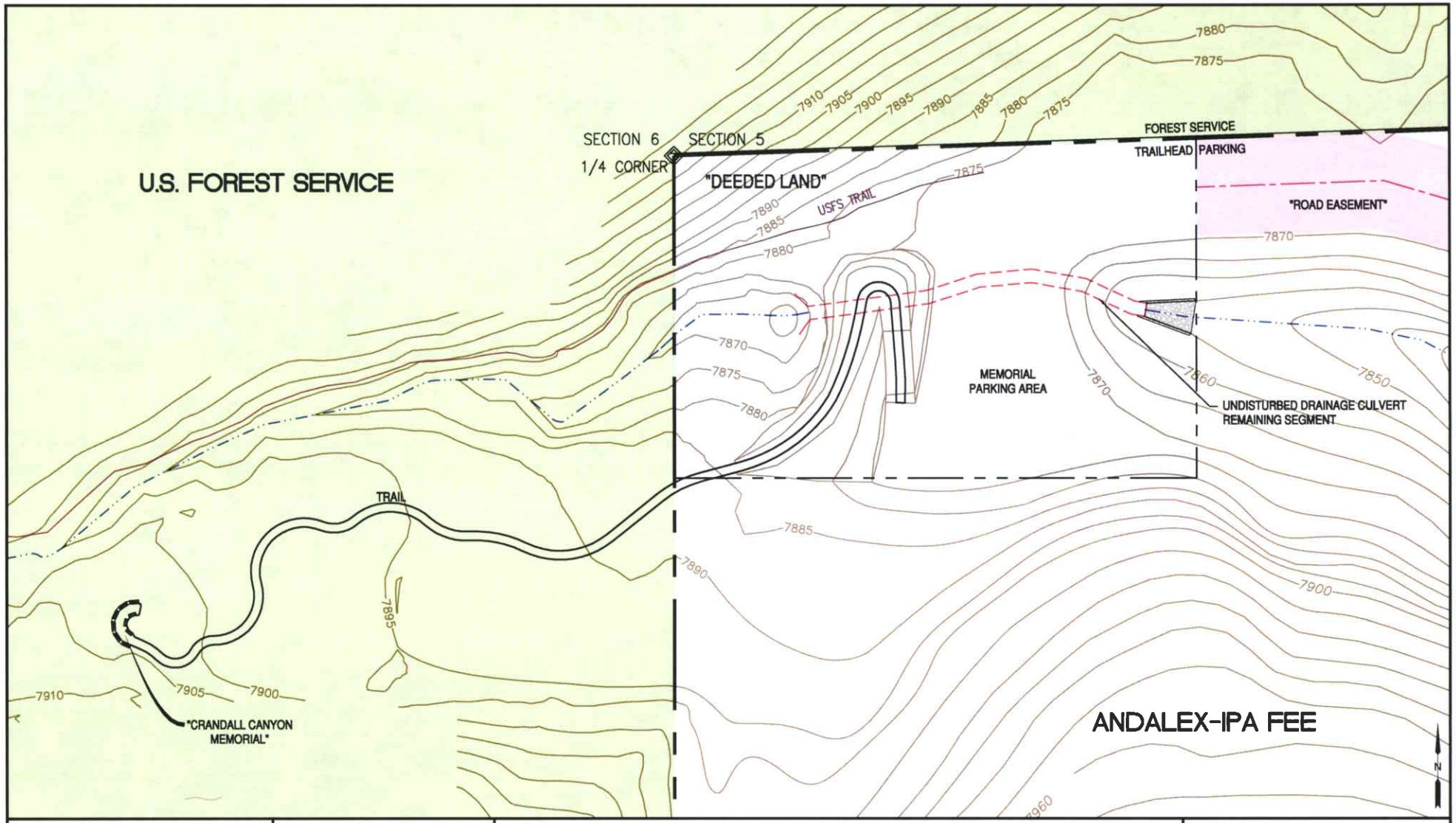

LINE TYPE LEGEND	COLOR LEGEND
SECTION LINE	"DEEDED LAND"
LAND OWNERSHIP / CONTROL BOUNDARY	"ROAD EASEMENT"
RECLAIMED CONTOUR LINES AT 5' INTERVALS	U.S. FOREST SERVICE LAND

20' 0 40' 80'

EXHIBIT 2

POST-MINING RECLAMATION

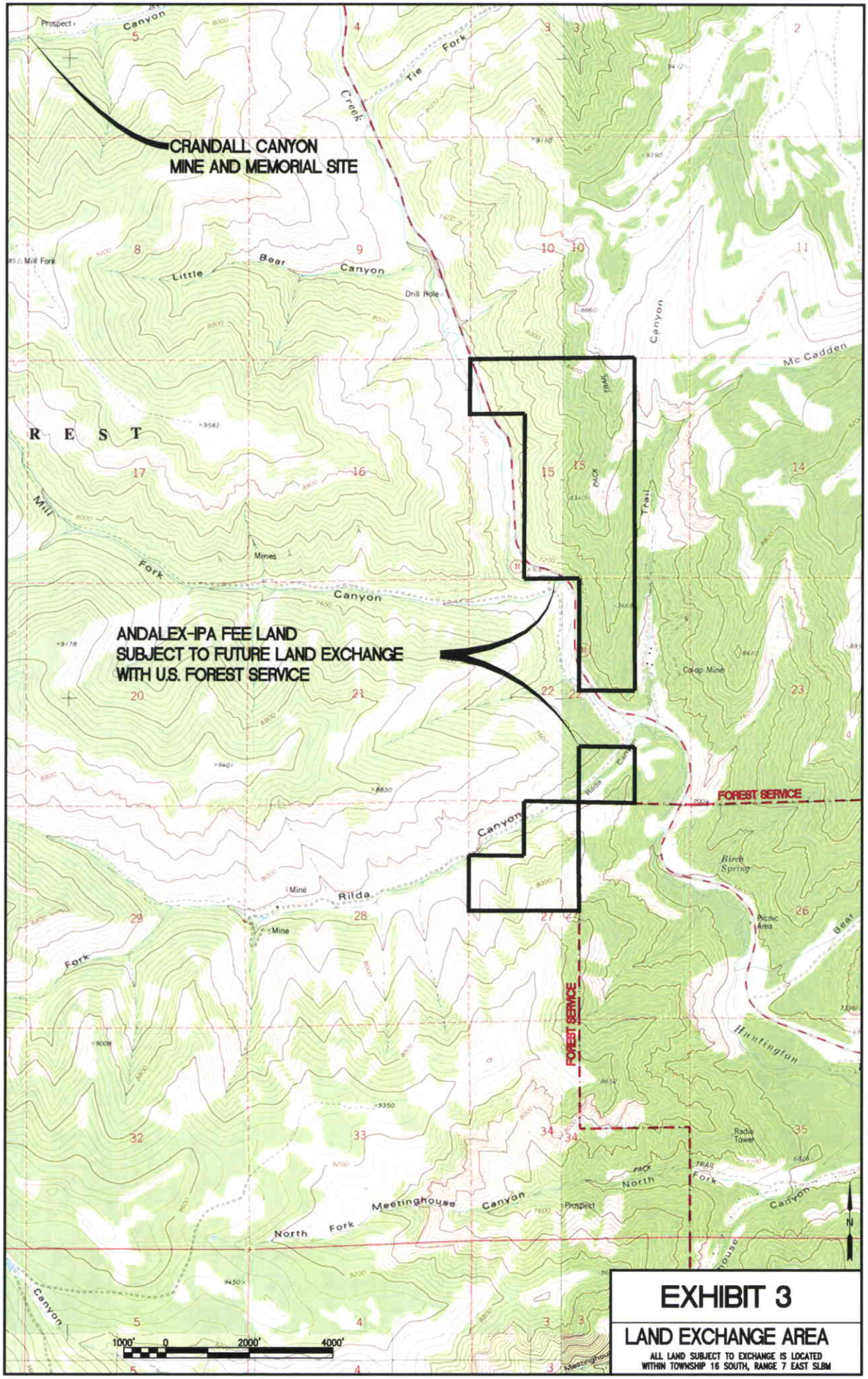

EXHIBIT 3

LAND EXCHANGE AREA

ALL LAND SUBJECT TO EXCHANGE IS LOCATED WITHIN TOWNSHIP 16 SOUTH, RANGE 7 EAST SLBM

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Date: 21-MAY-2010 12:29:41PM
Fee: None
Filed By: DS
DIXIE SWASEY, Recorder
EMERY COUNTY CORPORATION
For: EMERY COUNTY

WHEN RECORDED, RETURN TO:

David A. Blackwell, Esq.
Emery County Attorney
1850 North 500 West
P.O. Box 249
Castle Dale, Utah 84513

AMENDED QUITCLAIM DEED

INTERMOUNTAIN POWER AGENCY, a political subdivision of the State of Utah, having an address of 111 North Hope Street, Room 1263, Los Angeles, California 90012, and ANDALEX RESOURCES, INC., a Delaware corporation, having an address of 6750 North Airport Road, P.O. Box 902, Price, Utah 84501 (collectively "**Grantors**"), amend and replace the Corrected Quit-Claim Deed dated as of June 4, 2008 by and between Grantors and Emery County, Utah recorded at Entry No. 390768, official records of Emery County, Utah and hereby quit-claim to EMERY COUNTY, UTAH, a body corporate and politic, having an address of Emery County Courthouse, Castle Dale, Utah 84513, for the sum of Ten Dollars ($10.00), and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the following:

1. Deeded Land. A tract of land identified in Exhibit 1 attached hereto, as the "Deeded Land" located in Emery County, Utah, as follows:

> Beginning at the Northwest Corner of the Southwest Quarter of Section 5, Township 16 South, Range 7 East of the Salt Lake Base and Meridian; thence running N88°06'35"E for 330.18'; thence South for 245.89'; thence West for 330.00'; thence North along the west section line of Section 5 for 235.00' to the Point of Beginning, containing 1.82 acres, more or less.

EXCEPTING AND RESERVING UNTO GRANTORS and their agents, affiliates, successors and assigns unlimited access to the area at the approximate location and configuration identified in Exhibit 1 attached hereto as the "mine operations area" for mine-related operations and reclamation until Phase 1 bond release occurs pursuant to the terms of the Crandall Canyon Mine Mining and Reclamation Plan, Permit No. C/015/032, on file with the Utah Division of Oil, Gas and Mining;

AND FURTHER SUBJECT TO the terms of that certain Right-of-Way Easement, effective as of January 1, 2004, by and between Grantors and PacifiCorp, recorded at Entry 368298, Book 315, Page 235, official records of Emery County, Utah.

2. Nonexclusive Road Easement. A nonexclusive easement for a public road identified in Exhibit 1 attached hereto as the "Road Easement" which will connect the Deeded Land to the existing Forest Service Road No. 50248 (a.k.a. "Crandall Canyon Road"), on land located in Emery County, Utah, and more particularly described as follows:

Encompassing 22.0' on either side (44' total) of a center line beginning at a point that is located N88°06'35"E 695.40' from the Northwest Corner of the Southwest Corner of Section 5, Township 16 South, Range 7 East of the Salt Lake Base and Meridian; thence running S59°33'11"W for 12.78'; thence S54°25'37"W for 50.0'; thence S56°02'53"W for 50.0'; thence S65°54'48" W for 50.0'; thence S80°43'13"W for 50.0'; thence N84°43'48" for 50.0'; thence N62°43'15"W for 50.0'; thence N70°56'20"W for 50.0'; thence N73°32'52"W for 48.36'; thence S88°06'35"W for 319.18' to the end point which is located 22.0' South of the Northwest Corner of the Southwest Corner of said Section 5.

3. Land Exchange Area. A tract of land identified in Exhibit 2 attached hereto, referred to as the "Land Exchange Area", more particularly described as follows:

That portion of the Northwest Quarter of the Northwest Quarter of Section 15, Township 16 South, Range 7 East, Salt Lake Base and Meridian lying Westerly of State Route 31, containing 7.5 acres, more or less, as scaled.

PROVIDED THAT, consistent with Paragraph 12 of that certain unrecorded Memorandum of Agreement between Grantee and Emery County dated as of May 21, 2008, said Land Exchange Area will, at some time in the future, be conveyed by Emery County, Utah to the U.S. Forest Service in exchange for conveyance by the U.S. Forest Service to Emery County, Utah of certain property owned by the U.S. Forest Service surrounding the site of the Crandall Canyon Memorial, identified in Exhibit 1 attached hereto, referred to as the Memorial Area and generally described as follows:

Beginning at the Northeast Corner of the Southeast Quarter of Section 6, Township 16 South, Range 7 East of the Salt Lake Baseline and Meridian; thence running West for 330'; thence South for 330'; thence East for 330' thence North along the east section line of Section 6 for 330', containing 2.5 acres, more or less (or some other suitable parcel configuration encompassing the Memorial site as mutually agreed upon by Emery County and the Forest Service at the time of the exchange)

IN WITNESS WHEREOF, Grantors have caused their names to be hereunto affixed this 20th day of May, 2010.

Grantors:

ANDALEX RESOURCES, INC.,
a Delaware corporation

By: David W. Hibbs
Name: David W. Hibbs
Title: President

STATE OF Utah)
: ss.
COUNTY OF Carbon)

The foregoing instrument was acknowledged before me this 20th day of May, 2010, by David W. Hibbs the President of ANDALEX Resources, Inc.

MARY V. KAVA
NOTARY PUBLIC • STATE of UTAH
COMMISSION # 574260
COMM. EXP. 05-16-2012

Mary V. Kava
Notary Public

INTERMOUNTAIN POWER AGENCY,
a political subdivision of the State of Utah

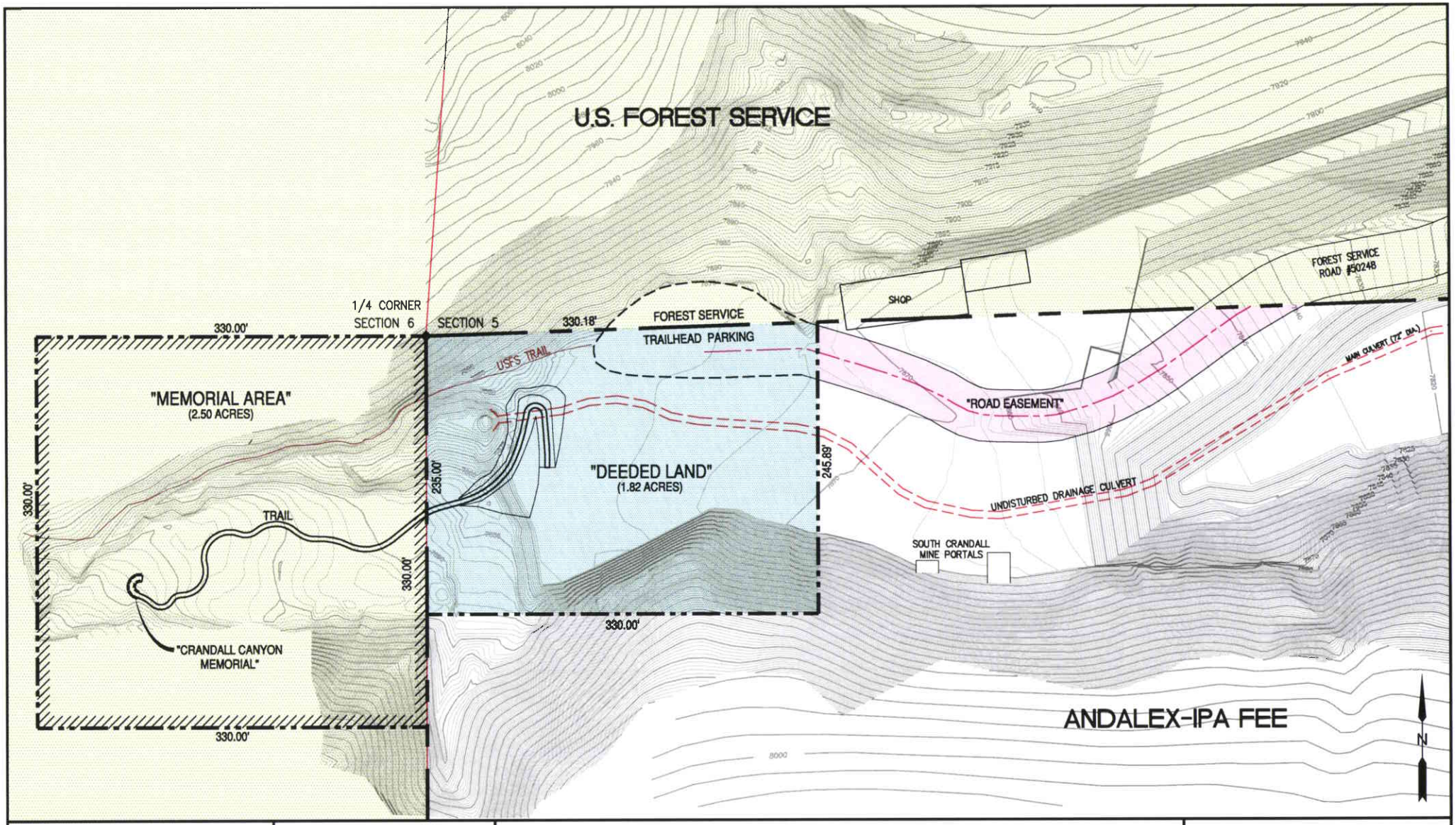
By: James A. Hewlett
Name: James A. Hewlett
Title: General Manager

STATE OF UTAH)
:ss.
COUNTY OF SALT LAKE)

The foregoing instrument was acknowledged before me this 18 day of MAY, 2010, by JAMES A. HEWLETT, the Gen Mgr. of Intermountain Power Agency.

KRISTA R. PAULL
NOTARY PUBLIC • STATE OF UTAH
10653 S. RIVER FRONT PKWY #120
SOUTH JORDAN, UT 84095
COMM. EXP. 09-01-2011

Krista R Paull
Notary Public



LINE TYPE LEGEND	COLOR LEGEND
SECTION LINE	"DEEDED LAND"
LAND OWNERSHIP / CONTROL BOUNDARY	"ROAD EASEMENT"
EXISTING CONTOUR LINES AT 5' INTERVALS	U.S. FOREST SERVICE LAND
EXISTING CONTOUR LINES AT 1' INTERVALS	"MEMORIAL AREA"

50' 0 100' 200'

EXHIBIT 1

(AMENDED QUITCLAIM DEED)

CRANDALL CANYON MEMORIAL SITE PLAN

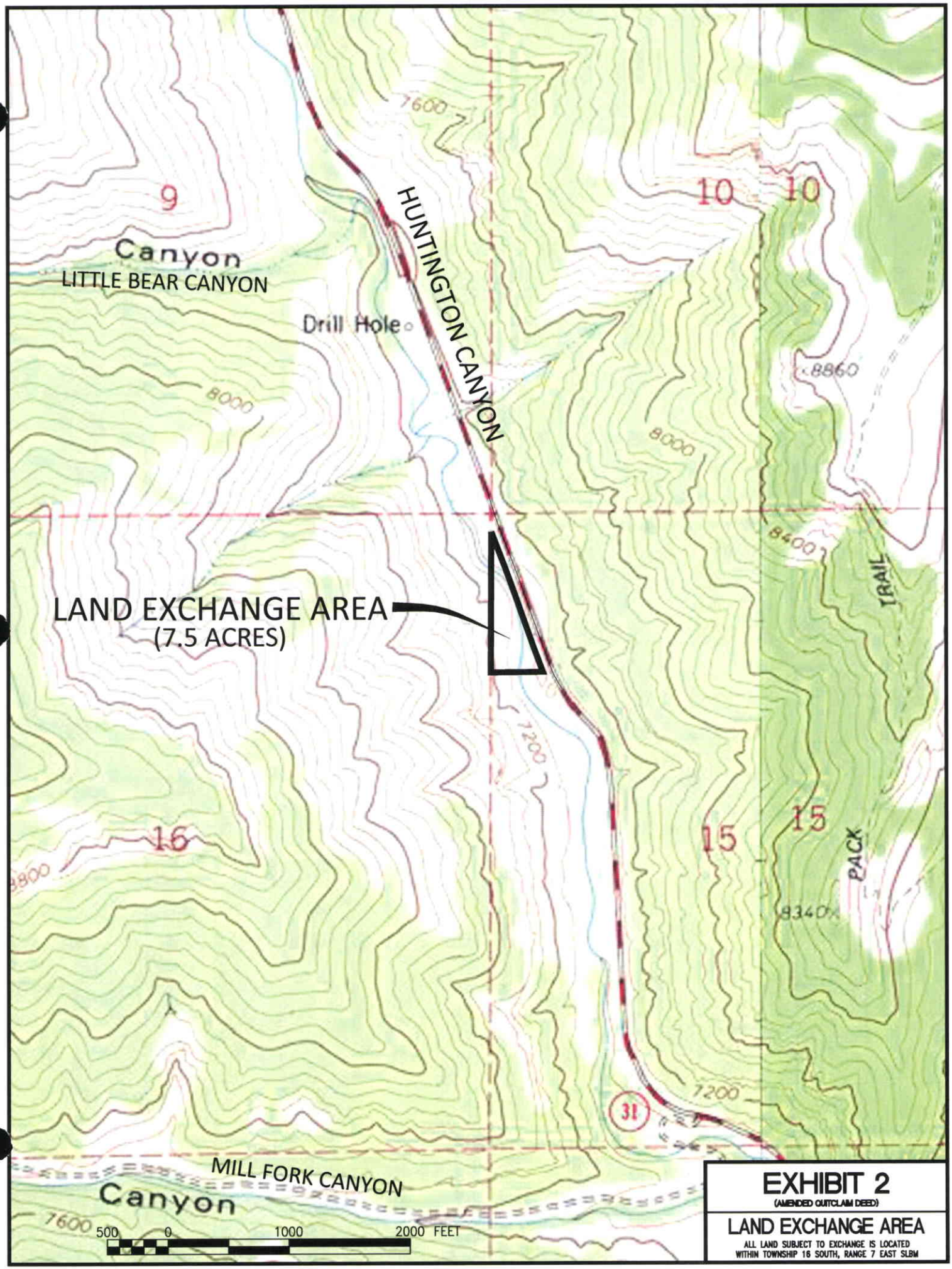


EXHIBIT 2

(AMENDED QUITCLAIM DEED)

LAND EXCHANGE AREA

ALL LAND SUBJECT TO EXCHANGE IS LOCATED WITHIN TOWNSHIP 16 SOUTH, RANGE 7 EAST SLBM

APPENDIX 5-28

SLOPE STABILITY ANALYSIS
("OLD LOADOUT AREA")
RB&G ENGINEERING

RB&G
ENGINEERING, INC.

July 11, 2011

Dave Shaver
West Ridge Resources, Inc.
P.O. Box 1077
Price, UT 84501

Re: Crandall Canyon Mine

Dear Mr. Shaver:

Slope Stability Analyses and Design Recommendations have been completed for the Crandall Canyon Mine near Huntington, Utah. The results of the study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

REGISTERED PROFESSIONAL ENGINEER
NO.162291
BRADFORD E. PRICE
STATE OF UTAH

Bradford E. Price, P.E.

bep/jal

1435 WEST 820 NORTH, PROVO, UTAH 84601-1343
PROVO 801-374-5771 SALT LAKE CITY 801-521-5771 FAX 801-374-5773

RB&G ENGINEERING, INC.

CRANDALL CANYON MINE

Near Huntington, Utah

Slope Stability Analyses and Design Recommendations

I. INTRODUCTION

1. PURPOSE AND SCOPE

A slope stability analysis has been performed for a fill to be constructed as part of the rehabilitation of the Crandall Canyon Mine. The purpose and scope of this analysis was to provide recommendations relative to design and construction. The scope of work was limited to site reconnaissance and design analyses and recommendations.

2. SITE LOCATION AND DESCRIPTION

The Crandall Canyon Mine is located about 14 miles northwest of Huntington, Utah. The mine portal is situated about 1 mile west of Highway 31 within a narrow canyon. The mine has been closed and it is our understanding that rehabilitation work is required. While the mine was in operation, the hillside in the vicinity of the mine portal was excavated. The cut surface of the hillside below the portal bench is about 80 feet high. The plan view base of the area excavated is trapezoidal in shape with average dimensions of about 80 feet by 120 feet.

The excavated materials consisted of overburden soils, weathered and competent bedrock. Rock bolts and shotcrete were installed in potentially unstable areas. At the time of our site visit (August 2009), the excavation appeared to be stable.

3. PROJECT DESCRIPTION

It is our understanding that rehabilitation of the mine requires that the exposed excavation in the vicinity of the portal be backfilled. The fill will generally restore the hillside to the slopes which existed prior to excavation.

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PROVO 801-374-5771 SALT LAKE CITY 801-521-5771 FAX 801-374-5773

II. DESIGN RECOMMENDATIONS

1. STABILITY ANALYSES

Subsurface investigations to determine the properties of the materials within the existing hillside were not performed. For purposes of this analysis, it has been assumed that the existing hillside is stable and that the critical failure surface will be contained within the added fill section. During the analyses, the bedrock materials within the existing hillside were assumed to have a unit weight of 150 pcf, an internal friction angle of 0 degrees and a cohesion value of 5000 psf.

It is our understanding that granular fill materials will be available to construct the fill. We have assumed that the fill material will have a total unit weight of about 135 pcf, internal friction angle of 36 degrees and 10 psf cohesion.

The 2002 USGS Seismic Hazard Deaggregation feature of the USGS web site was used to determine the mapped probabilistic peak ground acceleration (PGA) value for this site. The mapped PGA value is 0.16g for an event having a 10% probability of exeedance in 50 years. It is our opinion that the seismic event corresponding to this probability of exeedance is appropriate for this project. Stability analyses were performed using psedo-static methods with acceleration equal to ½ the mapped PGA value.

It is our understanding that the existing road through the bottom of the canyon will remain after rehabilitation is complete. In order to leave the road at the present alignment, a fill slope of about 1.76H: 1V (Horizontal: Vertical) will be required. Stability analyses indicate that this slope will have a factor of safety against failure of about 1.33 provided that the fill materials used have strength parameters at least as great as those assumed. Pseudo-static seismic stability analysis resulted in a factor of safety of 1.12.

Figures illustrating the slope stability analyses are attached to this report along with a drawing showing plan and cross section views. It is our understanding that plans to fill the area between the portal bench and the top of the portal wall is being submitted separately and it will be noted from the attached drawing that the fill section analyzed extends from the roadway to the portal bench level. Recommended gradation properties and Atterberg limits for fill materials are shown on the drawings.

2. OTHER CONSIDERATIONS

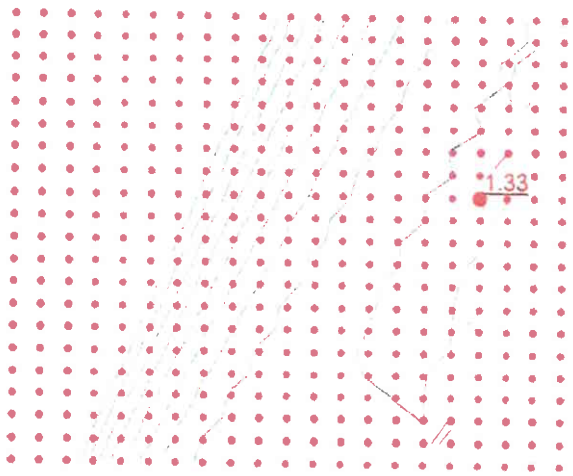
During the site visit, water was observed seeping from the existing slope. In order to prevent the fill materials from becoming saturated, it is recommended that a drainage layer be installed between the existing slope and the fill. The drainage layer should consist of clean well graded gravel and should be 2 feet thick measured perpendicular to the existing slope. The drain gravel layer should have at least 3 feet of cover to protect against frost and to inhibit infiltration of surface water. Slotted collection pipes should be placed within the drainage layer at the locations indicated on the plan sheet to collect the water and carry it outside the embankment. Details of the recommended drainage system are provided in the attached plan sheets.

It is our understanding that seepage from the hillside has been measured and recorded over the last 12 months. It has been reported to us that the measured seepage rates average about 3 gallons per minute and have not exceeded 5 gallons per minute. The drainage system shown on the drawings has been designed to carry at least 50 gallons per minute; however, the drainage system is intended to collect and channel only the water seeping from the existing hillside. If it is desired to place water collected from within the mine into the drainage system, larger pipes and thicker drainage layers will be required.

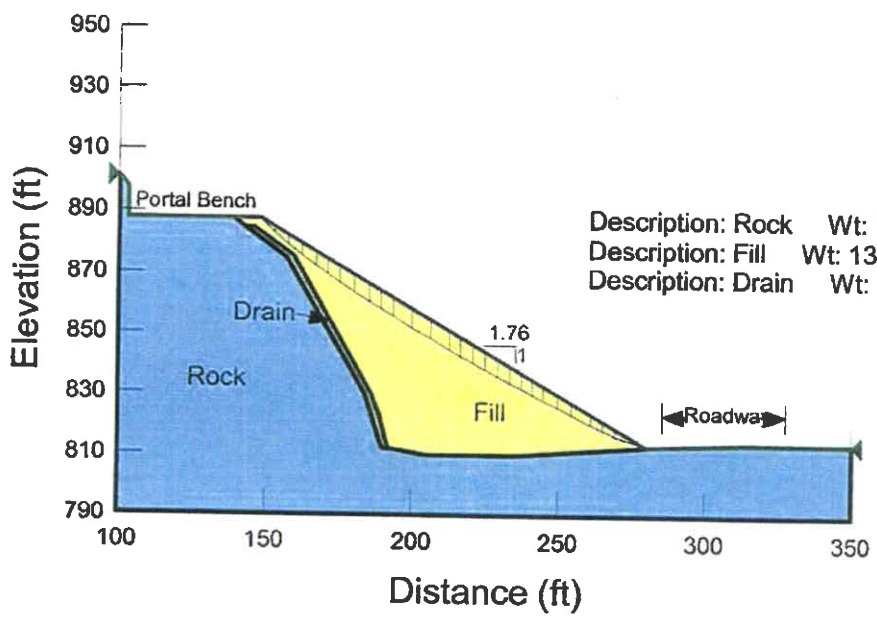
3. EMBANKMENT REQUIREMENTS

The soils used to construct the embankment should meet the gradation requirements and Atterberg limits shown on the attached plan sheet. The soils should be moisture conditioned to within 2 percent of the optimum moisture content and then spread in loose lifts not exceeding 12 inches thick. Each lift should be compacted to at least 95 percent of the maximum dry density. Optimum moisture content and dry density should be determined by the standard Proctor test (ASTM D 698). One to two density tests should be performed for each lift of fill to verify field compaction. If lifts are compacted with a smooth drum roller or otherwise become smooth or dry, the top 2 inches of the lifts should be scarified prior to placing the subsequent lift.

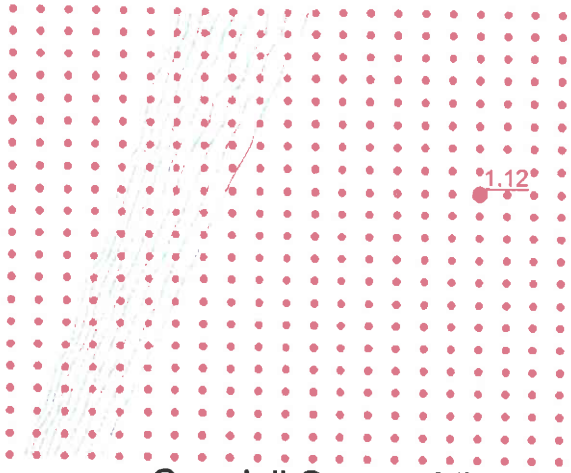
Gravel drain material used to construct the drainage system should be compacted. In order to compact against the existing slope, hand operated compaction equipment such as jumping jacks and/or walk behind rollers will likely be necessary. We recommend that gravel drain material to be compacted with hand equipment be placed in lifts not exceeding 8 inches in thickness. Each lift should be compacted with a minimum of 4 passes of the compaction equipment.



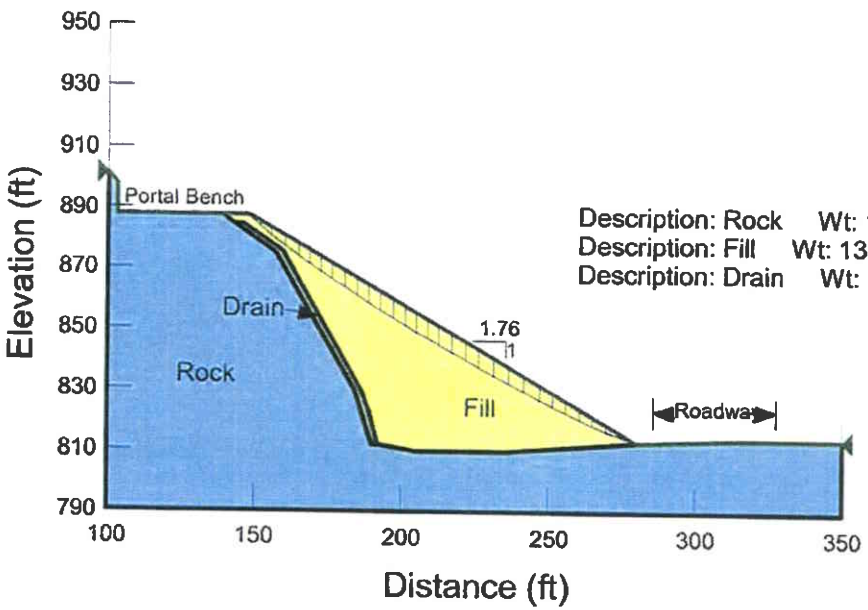
Crandall Canyon Mine Slope Stability
Static Condtions



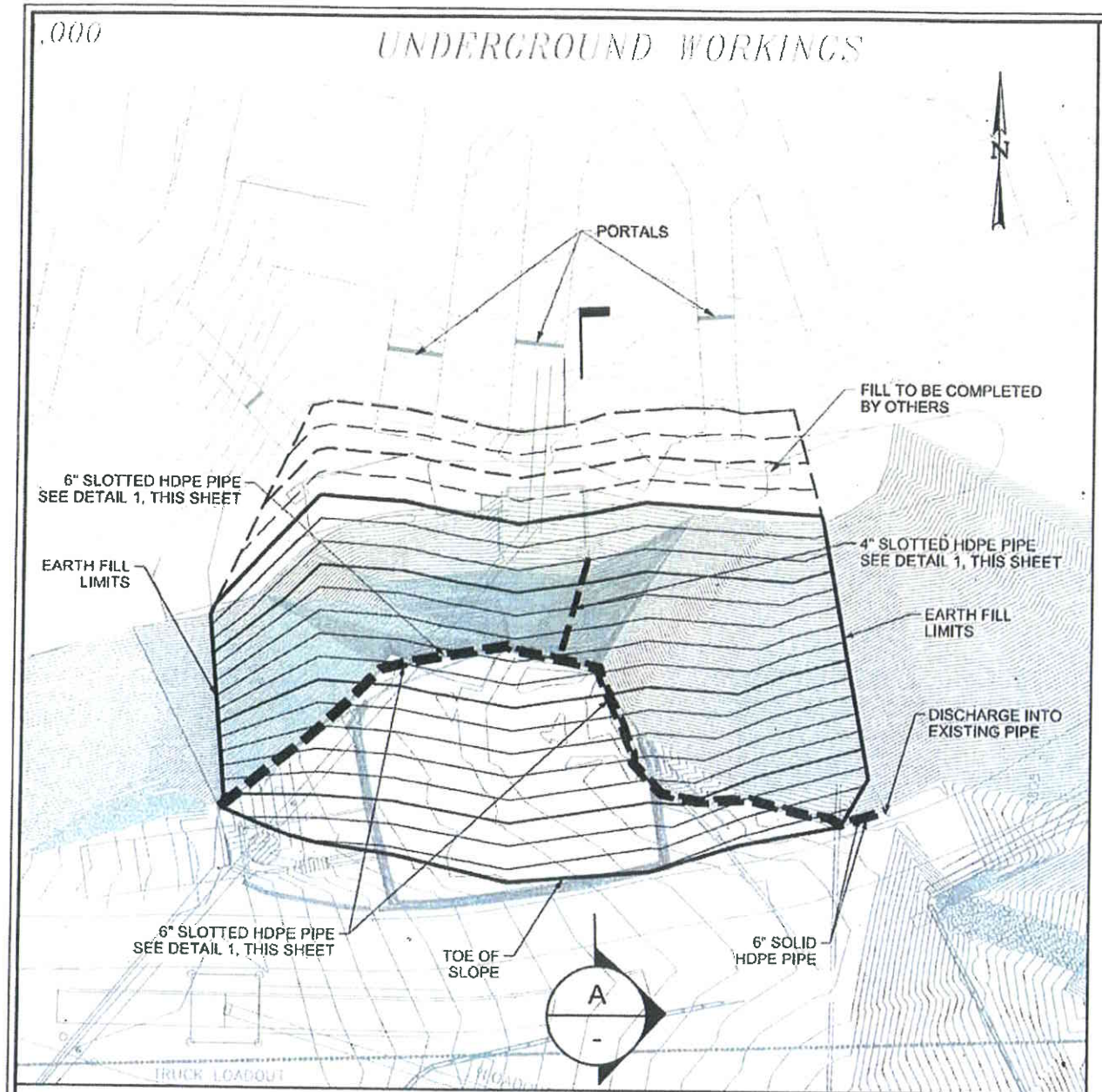
Description: Rock Wt: 150 Cohesion: 5000 Phi: 0
Description: Fill Wt: 135 Cohesion: 10 Phi: 36
Description: Drain Wt: 115 Cohesion: 0 Phi: 36



Crandall Canyon Mine Slope Stability
Seismic Condtion
Pseudo-static Coefficient = 0.08g

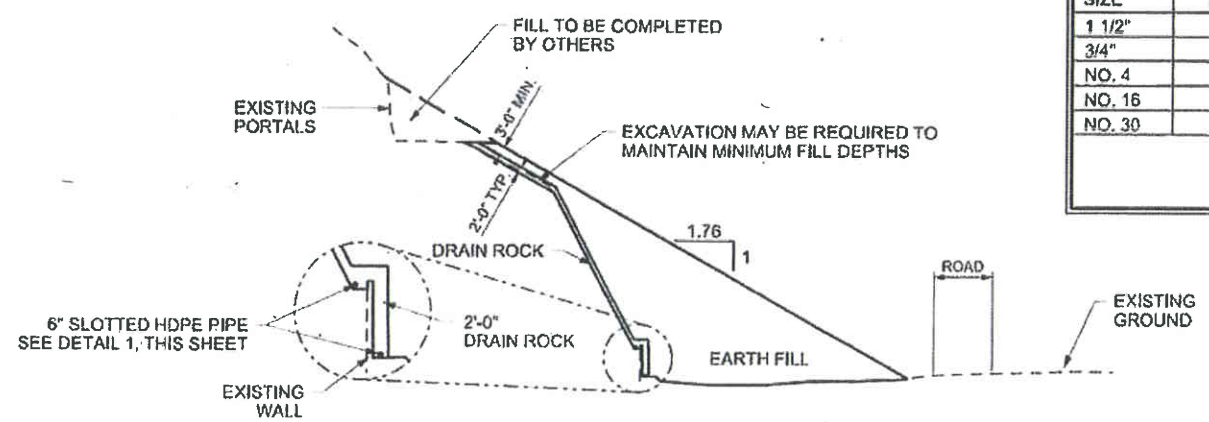


Description: Rock Wt: 150 Cohesion: 5000 Phi: 0
Description: Fill Wt: 135 Cohesion: 10 Phi: 36
Description: Drain Wt: 115 Cohesion: 0 Phi: 36



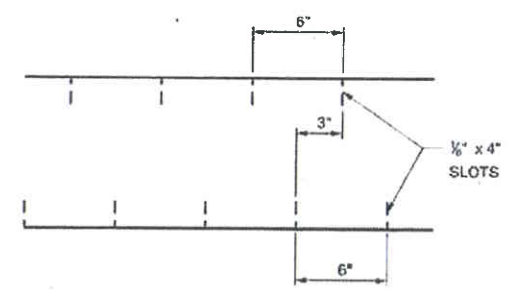
SITE PLAN OPTION 1

SCALE

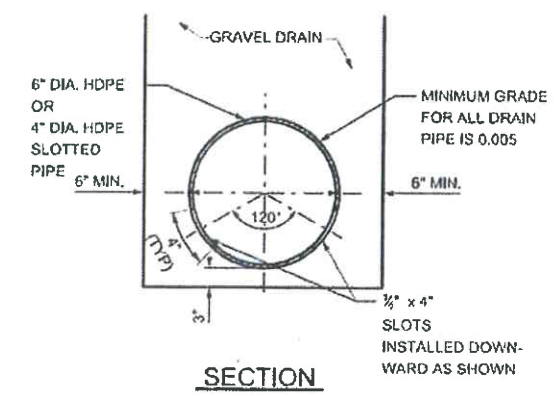


SECTION - TYPICAL (A / -)

GRADATION REQUIREMENTS			
GRAVEL DRAIN		EARTH FILL	
SIEVE SIZE	PERCENT PASSING	SIEVE SIZE	PERCENT PASSING
1 1/2"	100	6"	100
3/4"	70-100	3"	70-100
NO. 4	20-50	NO. 4	30-70
NO. 16	0-15	NO. 200	0-20
NO. 30	0-5		
		PLASTICITY INDEX≤6 FRICTION ANGLE ≥36°	



SLOT SPACING - PLAN



SECTION

6" HDPE OR 4" HDPE SLOTTED PIPE

SLOTTED PIPE	1
DRAIN DETAIL	-

NOTES:

1. GENERAL

A. THE CONTRACTOR IS RESPONSIBLE TO CONTROL ALL SURFACE AND SUBSURFACE WATER. INSURE THE SITE IS MAINTAINED IN COMPLIANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.

B. THE CONTRACTOR IS RESPONSIBLE TO VERIFY ALL EXISTING CONSTRUCTION MATERIAL TYPES, DIMENSIONS, ELEVATIONS AND CONDITIONS.

2. EARTHFILL

A. FOUNDATION SURFACES SHALL CONSIST OF ALL EXISTING SOIL OR ROCK MATERIALS TO BE WITHIN THE FOOTPRINT OF NEW CONSTRUCTION. VEGETATION, LOOSE OR OTHERWISE UNSUITABLE FOUNDATION MATERIALS SHALL BE STRIPPED BY THE CONTRACTOR PRIOR TO FILL PLACEMENT.

B. FILL SHALL NOT BE PLACED UPON A FROZEN SURFACE, NOR SHALL SNOW, ICE OR FROZEN MATERIAL BE INCORPORATED IN THE FILL

C. FILL SHALL BE PLACED IN APPROXIMATELY HORIZONTAL LAYERS. THE THICKNESS OF EACH LAYER BEFORE COMPACTION SHALL NOT EXCEED 12 INCHES. THE THICKNESS OF EACH LAYER OF HAND COMPACTED FILL, INCLUDING FILL COMPACTED BY MANUALLY DIRECTED POWER TAMPERS, SHALL NOT EXCEED 8 INCHES.

D. EARTH FILL SHALL BE MOISTURE CONDITIONED TO WITHIN 2 PERCENT OF OPTIMUM MOISTURE CONTENT AS DETERMINED BY ASTM D698.

E. EARTH FILL SHALL BE COMPACTED TO 95% OF THE MAXIMUM LABORATORY DENSITY AS DETERMINED BY ASTM D698. FIELD COMPACTION SHALL BE VERIFIED BY AT LEAST 1 DENSITY TEST PER LIFT OF FILL.

F. GRAVEL DRAIN MATERIAL SHALL BE COMPACTED TO THE SATISFACTION OF ENGINEER. DRAIN MATERIAL SHALL BE COMPACTED WITH AT LEAST 4 PASSES OF THE COMPACTION EQUIPMENT.

G. GRAVEL DRAIN MATERIAL SHALL BE MAINTAINED AT LEAST 6 INCHES ABOVE SURROUNDING EARTHFILL MATERIAL.

H. GRAVEL DRAIN MATERIAL MAY BE OBTAINED FROM APPROVED SOURCES OF AGGREGATE FOR CONCRETE OR MAY BE PRODUCED FROM APPROVED DEPOSITS.

3. DRAIN PIPE

A. JOINTS SHALL BE MADE BY BUTT FUSION WHEN POSSIBLE. THE PIPE MANUFACTURER'S FUSION PROCEDURES SHALL BE FOLLOWED AT ALL TIMES AS WELL AS THE RECOMMENDATIONS OF THE FUSION MACHINE MANUFACTURER.

B. IF MECHANICAL FITTINGS ARE UTILIZED, THE RECOMMENDATION OF THE MECHANICAL FITTING MANUFACTURER MUST BE FOLLOWED.

C. THE DIMENSION RATION (DR) OF THE SOLID AND SLOTTED DRAIN PIPES SHALL BE 11.

D. DRAIN PIPE SHALL HAVE SLOPE OF AT LEAST 0.5%. EARTH FILL MAY BE PLACED BENEATH GRVEL DRAIN AT WEST END OF PIPE TO PROVIDE POSITIVE DRAINAGE.

4. ESTIMATED QUANTITIES

DRAIN ROCK.....2,260 CU YDS.
EARTH FILL.....12,783 CU YDS.
6" SLOTTED HDPE PIPE.....574 LIN. FT.
6" SOLID HDPE PIPE.....40 LIN. FT.
4" SLOTTED HDPE PIPE.....46 LIN. FT.

REGISTERED PROFESSIONAL ENGINEER
NO.162291
BRADFORD E. PRICE
STATE OF UTAH

7/11/2011
1:\2010-006_CrandallCnyMineSlopeStabil\CadSheet_Files\SH-01.dgn

RB&G ENGINEERING, INC.
1435 WEST 820 NORTH
PROVO, UTAH 84601-1343
801 374-5771 PROVO
801 531-5771 SALT LAKE CITY

NO.	AUTHORIZED BY	REVISION	MADE BY	DATE
5				
4				
3				
2				
1				

DESIGNED BY S. HORROCKS
DRAWN BY J. SUSI
CHECKED BY B. PRICE
SCALE HORZ. VERT.
DATE FEB 2011

EMERY COUNTY, UTAH

CRANDALL CANYON MINE
SLOPE STABILITY

EARTHFILL

PROJECT NO. 2010-006
FILE DRAWING NO. SEE FILE
SHEET 1 OF ___ SHEETS

CHAPTER 7.....REPLACEMENT PAGE

the treated water ends up reporting to the Crandall Canyon drainage (by way of the main bypass culvert) at the existing approved UPDES outfall point.

There is every reason to believe that water will permanently discharge from the Crandall Mine portals. The iron level of the mine water historically was very low, and began rising only after the water began to build up and impound within the mine workings following the mine collapse of 2007. ~~It is now the consensus that the elevated iron concentration will be a permanent situation, and that the reclamation plan must provide for a permanent means of treating the discharge water so as to meet UPDES requirements, even subsequent to final reclamation. To address this situation, the company commits to revising the reclamation plan, in the near future. Additional baseline data will be incorporated into this revised reclamation plan.~~ At the present time (July, 2011) it is uncertain whether or not long-term treatment of the mine discharge water will be required, because naturally-occurring chemical processes within the mine could potentially bring the iron content of the water to within compliance limits at some time in the future . This scenario is currently being addressed under Division Order DO-10 and is a matter of on-going legal discussion between the company and the Division. Until this issue is resolved, the company commits to collecting additional hydrologic baseline data. This data includes:

a) flow quantities from the seep in the sandstone ledge above the treatment facility,.

b) measurement of the discharge rate from the sealed portals; either continuously (e.g., using a data logger) or at a minimum, daily

c). monthly whole water chemical analysis and field measurements of the untreated mine discharge as specified on Table 7-4(A).

7.42.22 Sedimentation Pond

Design

The sedimentation pond located in Crandall Canyon has been redesigned to control the additional storm runoff from the pad extension and from the designated undisturbed drainage areas above the pad extension associated with the proposed culvert expansion. The topography and watershed boundaries are shown on Plate 7-5 and 7-5C. Cross sections of the pond design are shown on Plate 7-3.

APPENDIX 7-4

SEDIMENTATION AND DRAINAGE CONTROL PLAN

REPLACEMENT PAGES

APPENDIX 7-4

CRANDALL CANYON MINE
SEDIMENTATION AND DRAINAGE CONTROL PLAN

PREPARED BY: *DAN W. GUY, P.E.*
BLACKHAWK ENGINEERING, INC.
1056 WEST 2060 NORTH
HELPER, UT. 84526

REVISED: *JULY 2011*

CRANDALL CANYON MINE
SEDIMENTATION AND DRAINAGE CONTROL PLAN

TABLE OF CONTENTS

SECTION		PAGE NUMBER
1-	Introduction:	1
2-	Design of Drainage Control Structures:	3
2.1	Precipitation	4
2.2	Flow	5
2.3	Velocity	6
2.4	Drainage Areas	6
2.5	Slope/Lengths	6
2.6	Runoff	7
2.7	Runoff Curve Numbers	7
2.8	Culvert Sizing	9
2.9	Culverts	9
2.10	Ditches	12
2.11	Main Canyon Culvert	14
2.12	Main Canyon Culvert Inlet Structure	16
2.13	Main Canyon Culvert Outlet Structure	16
3-	Design of Sediment Control Structures:	29
3.1	Design Specification for Expanded Sediment Pond	30
3.2	Sediment Yield	31
3.3	Sediment Pond Volume	33
3.4	Sediment Pond Summary	37
3.5	Alternate Sediment Control Area (ASCA's)	38

4- Design of Drainage Control Structures for Reclamation: 39

4.1 General (Phase I) 40

4.2 General (Phase II) 42

4.3 Reclamation - Disturbed Drainage Control 43

4.4 Restored Channels 44

4.5 Sediment Pond 44

4.6 Calculations 45

Tables:

Table 1 Watershed Summary

Table 2 Watershed Parameters

Table 3 Runoff Summary - Undisturbed Diversions

Table 4 Runoff Summary - Drainage to Sediment Pond

Table 5 Runoff Control Structure Watershed Summary

Table 6 Runoff Control Structure Flow Summary

Table 7 Disturbed Ditch Design Summary

Table 8 Undisturbed Ditch Design Summary

Table 9 Disturbed Culvert Design Summary

Table 10 Undisturbed Culvert Design Summary

Table 11 Sediment Pond Design

Table 12 Sediment Pond Stage Volume Data

Table 13 Sediment Pond Stage Discharge Data

Table 14 Reclamation - Phase I
Runoff Summary Drainage to Sediment Pond

Table 15 Reclamation - Phase I
Runoff Control Structure / Watershed Summary

Table 16 Reclamation - Phase I
Runoff Control Structure / Flow Summary

Table 17 Reclamation - Phase I
Reclaimed Ditch/Culvert Design Summary

Figures:

Figure 1	*Culvert Nomograph*
Figure 2	*Rip Rap Chart*
Figure 3	*Undisturbed and Disturbed Ditch Typical Section*
Figure 4	*Soil Erodibility Chart - Disturbed Areas*
Figure 5	*Soil Erodibility Chart - Undisturbed/Reclaimed Areas*
Figure 6	*Sediment Pond Stage-Volume Curve*
Figure 7	*Sediment Pond Stage-Discharge Curve*
Figure 8	*Reclamation Ditch RD-1 Typical Section*
Figure 9	*Runoff Curve Numbers for Forest Range*
Figure 10	*Main Canyon Culvert Inlet / Trash Barriers*
Figure 11	*Main Canyon Culvert Outlet*
Figure 12	*Typical Underdrain Construction*
Figure 13A	*Installation of Re-Routed Culvert UD-3 (Front View)*
Figure 13B	*Installation of Re-Routed Culvert UD-3 (Side View)*
Figure 14	*Reclamation Ditch MD-1 (Mine Water Discharge)*

1. Introduction

The Sedimentation and Drainage Control Plan for the Crandall Canyon Mine has been designed according to the State of Utah R645- Coal Mining Rules, November 1, 1996. All design criteria and construction will be certified by a Utah Registered Professional Engineer.

This plan has been divided into the following three sections:

1) Design of Drainage Control Structures for the Proposed Construction
2) Design of Sediment Control Structures
3) Design of Drainage Control Structures for Reclamation

The general surface water control plan for this project will consist of the following:

(a) The proposed pad expansion will necessitate modifications of a number of existing hydrologic structures on the site. In an effort to clarify the new plan, the entire sedimentation and drainage control plan has been re-evaluated for the site and presented in this Appendix.

(b) The general plan for the pad expansion is to divert undisturbed drainage from Crandall Canyon above the minesite through a 6' diameter CMP culvert beneath the expansion area and discharge below the disturbed area. As a result of the expansion, existing culverts C-2, C-8, C-10 and Ditch DD-9 will be removed. 2 new ditches (DD-12 & DD-13) and 3 new culverts (Main Canyon, C-11 and C-11A) will be added to provide for drainage control for the expanded facility. The existing sediment pond will also be expanded to contain additional runoff from the expansion area. All other existing drainage controls will remain unchanged. All minesite drainage controls are shown on Plate 7-5 "Drainage Map".

(c) *The main canyon culvert is sized to safely pass the runoff from a 100 year - 6 hour precipitation event. All other undisturbed diversions, disturbed ditches and culverts are sized to safely convey runoff from a 10 year - 24 hour precipitation event. The sediment pond is sized to contain runoff from a 10 year - 24 hour precipitation event, as required.*

(d) *The cresent-shaped area below the portals will be utilized as a water treatment facility for the mine water discharging from the mine and seeping from the slope below the portals. The plan is to divert all mine water into this area, where it will be treated with an aeration system and settling pond to reduce the iron content. Once treated, the mine water will flow into the main canyon culvert at the UPDES #002 discharge location. Calculations show a minimum 12" pipeline at a minimum grade of 3 % is more than adequate to carry the expected maximum discharge of 800 gpm or 1.78 cfs. A larger pipeline may be used. This system will be isolated from the rest of the minesite drainage by topography and jersey-barriers, and will no longer flow to the sediment pond. The location and drainage plans are shown on Plate 7-5. As a result of constructing this facility, the volume of runoff reporting to the sediment pond actually decreases by a small amount, estimated at about 0.05 ac/ft. However, since the facility may not be permanent and could be removed in the future, the runoff calculations for the affected ditches, culverts and sediment pond have not been changed to reflect any resulting decrease.*

(e) *When the Crandall Canyon Mine Portals were sealed as a result of the 2007 disaster, culvert system UD-3 which diverts undisturbed drainage area WSUD-3, was damaged beyond repair. Therefore it was decided to re-route UD-3 as shown on Figures 13A and 13B. Culvert UD-3 now reports to Disturbed Ditch DD-8, Culvert C-1, Disturbed Ditch DD-5, Culvert C-12 and ultimately into the Sediment Pond. Calculations show that all affected ditches, culverts and the Sediment Pond are adequately sized to handle the increased flow from WSUD-3 (See Tables 3, 5, 6, 7 and 11).*

DESIGN OF DRAINAGE CONTROL STRUCTURES

Design Parameters:

2.1 Precipitation
2.2 Flow
2.3 Velocity
2.4 Drainage Areas
2.5 Slopes, Lengths
2.6 Runoff
2.7 Runoff Curve Numbers
2.8 Culvert Sizing
2.9 Culverts
2.10 Ditches

Tables:

Table 1 Watershed Summary
Table 2 Watershed Parameters
Table 3 Runoff Summary - Undisturbed Diversions
Table 4 Runoff Summary - Drainage to Sediment Pond
Table 5 Runoff Control Structure Watershed Summary
Table 6 Runoff Control Structure Flow Summary
Table 7 Disturbed Ditch Design Summary
Table 8 Undisturbed Ditch Design Summary
Table 9 Disturbed Culvert Design Summary
Table 10 Undisturbed Culvert Design Summary

Design Parameters:

2.1 Precipitation

The precipitation-frequency values for the area were taken from the existing plan which lists Miller, et.al. (1973) as the sources.

Frequency - Duration	*Precipitation*
10 year-6 hour	*1.55"*
10 year-24 hour	*2.50"*
25 year-6 hour	*1.90"*
100 year-6 hour	*2.40"*
100 year-24 hour	*3.70"*

2.2 Flow

Peak flows, flow depths, areas and velocities were calculated using the computer program "Office of Surface Mining Watershed Model", Storm Version 6.21 by Gary E. McIntosh. All flow is based on the SCS - TR55 Method for Type II storms.

Time of concentration of storm events was calculated for each drainage area using the following formula:

$$t_L = \frac{L^{0.8}\,(S+1)^{0.7}}{1900\,Y^{0.5}}$$

where:

t_C	=	*Time of Concentration (hrs.)*
t_L	=	*Lag Time (hrs.)* $= 0.6\,t_C$
L	=	*Hydraulic Length of Watershed (ft.)*
Y	=	*Average Land Slope (%)*
S	=	$\frac{1000}{CN} - 10$

2.3 Velocity

Flow velocities for each ditch structure were calculated using the Storm computer program with Manning's Formula:

$$V = \frac{1.49}{n} R^{2/3} S^{1/3}$$

where:	V	=	*Velocity (fps)*
	R	=	*Hydraulic Radius (ft.)*
	S	=	*Slope (ft. per ft.)*
	n	=	*Manning's n; Table 3.1, p. 159,*

"Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner & Haan, 1983.

Note: The following Manning's n were used in the calculations:

Structure	*Manning's n*
Culverts (cmp)	*0.020*
Unlined Disturbed Area Ditches	*0.035*

2.4 Drainage Areas

All drainage areas were planimetered directly from Plate 7-5, Drainage Map, and Plate 7-5C, Watershed Boundaries.

2.5 Slopes, Lengths

All slopes and lengths were measured directly from the topography on Plate 7-5, Drainage Map, and Plate 7-5C, Watershed Boundaries.

2.6 Runoff

Runoff was calculated using the SCS Formula for Type II Storms; using the Storm Version 6.21 computer program:

$$Q = \frac{(P - 0.2\,S)^2}{P + 0.8\,S}$$

where:	CN	=	*Runoff Curve Number*
	Q	=	*Runoff in inches*
	P	=	*Precipitation in inches*
	S	=	$\frac{1000}{CN} - 10$

2.7 Runoff Curve Numbers

Two curve numbers were utilized for the undisturbed areas. Average curve numbers for the north facing and south facing slopes were determined from curves presented in Figure 7-3 (Chapter 7), using measured cover densities as reported in Chapter 3 and the northern half of lease area SL 062648, assuming a hydrologic soil group of C. Curve numbers of 60 and 69 were obtained for the north facing and south facing undisturbed areas, respectively, using Chart A for Oak-Aspen and ground cover densities of 45 and 26 for north facing and south facing areas, respectively. The above referenced Figure 7-3 (Chapter 7) is included in this Appendix as Figure 9.

Runoff curve numbers for reclaimed, disturbed and paved areas were selected based on comparison with Table 2.20 (p. 82, Barfield, et al, 1983) and numbers previously approved in the M.R.P. A conservative number of 75 was used for reclaimed areas within the disturbed boundary. Curve numbers of 90 and 95 were used for all disturbed areas and paved areas, respectively. See Plates 7-5 and 7-5C for referenced areas.

The following is a summary of runoff curve numbers used in these calculations:

Watershed	*Runoff CN*
Undisturbed (North Facing):	*60*
Undisturbed (South Facing):	*69*
Reclaimed:	*75*
Disturbed:	*90*
Paved:	*95*

2.8 Culvert Sizing

Minimum culvert sizing is based on the following Manning's Equation; using the Haestad Methods, Flowmaster I, Version 3.42 computer program:

$$D = \left(\frac{2.16\ Q\ n}{\sqrt{S}} \right)^{0.35}$$

where: D	=	*Required Diameter (feet)*
Q	=	*QP = Peak Discharge (cfs)*
n	=	*Roughness Factor (0.020 for cmp)*
S	=	*Slope (ft. Per ft.)*

Using the above formula, minimum required culvert sizes were calculated for each applicable area. Culverts were then selected above the required minimum, and these sizes were checked for adequacy against the Culvert Nomograph included as Figure 1 of this report.

2.9 Culverts

As indicated in Section 1, the proposed pad expansion will necessitate modifications of a number of existing hydrologic structures on the site, including culverts. As a result of the expansion, existing culverts C-2, C-8 and C-10 will be removed. Two new culverts (Main Canyon, C-11) were added to provide drainage control for the expanded facility during phase I of the surface expansion. One more (C-11A) will be added during the phase II south portal construction. All other existing culverts on the site will remain unchanged.

Culverts have been sized according to the calculations previously described, and are summarized on the following tables. The culverts are shown on Plate 7-5, Drainage Map.

All undisturbed diversions are labeled with a UD number (i.e. UD-1). One of these diversions is a culvert (UD-1), and is clearly marked on Plate 7-5. Contributing watersheds for undisturbed diversions are labeled with a WSUD number, (i.e. WSUD-1) as shown on Plates 7-5 and 7-5C. All undisturbed diversion culverts will be fitted with trash racks to minimize plugging by rocks or other debris.

The proposed Main Canyon culvert is sized to carry runoff from a 100 year - 6 hour precipitation event for the Crandall Canyon area above the minesite. A 6' diameter C.M.P. culvert is proposed to carry the Crandall Canyon runoff beneath the expanded pad area and discharge below the minesite. Calculations in Table 10 show the proposed 6' diameter culvert to be more than adequate to carry the expected peak flow. The culvert will be equipped with an inlet headwall and trash rack and a properly sized outlet apron and energy dissipator for erosion protection. Runoff characteristics, flow and culvert design are presented in this Appendix.

The remaining undisturbed culverts on the site (UD-1 and UD-3) are existing. These culverts are adequate for the required 10 year - 6 hour precipitation event, as shown on Table 10 of this Appendix.

Culverts carrying disturbed drainage are designed with a C number (i.e. C-1). Contributing watersheds for disturbed area culverts (and ditches) are designated with a WSDD number (i.e. WSDD-1) shown on Plate 7-5. All disturbed area drainage culverts have been designed to carry the runoff from a 10 year - 24 hour precipitation event. All calculations and design criteria are included in this Appendix.

Existing culverts C-2, C-8 and C-10 will be removed during the pad extension, and therefore are not included in this Appendix. These culverts are shown on Plate 7-5C, dated 03/21/91.

All culverts will be inspected regularly, and cleaned as necessary to provide for passage of design flows. Inlets and outlets shall also be maintained to prevent plugging, undue restriction of water flow and erosion. Culvert outlets will be rip-rapped where necessary to protect from erosion.

One culvert, UD-1, is considered a permanent diversion, and will remain in place after reclamation. This culvert is sized to carry runoff in-excess of a 100 year - 6 hour storm. Justification for leaving it in place is provided in the Reclamation Hydrology Section 4.1, of this Appendix.

All other culverts are considered temporary, and will be removed upon final reclamation, with the exception of the lower 300' of the Main Canyon Culvert. This portion of the culvert will be left in place until the sediment pond is removed during Phase II Reclamation. The remaining portion of the culvert will be removed at that time.

2.10 Ditches

The proposed pad expansion will necessitate modifications to hydrologic structures, including ditches. As a result of the expansion, existing ditch DD-9 will be eliminated. Two new ditches (DD-12 and DD-13) will be added to provide drainage control for the expanded facility. All other existing ditches on the site will remain unchanged.

Undisturbed diversions are designated with a UD number (i.e. UD-2). There is only one undisturbed diversion ditch - (UD-2). This ditch is existing. Contributing watersheds for the undisturbed diversion are labelled with a WSUD number (i.e. WSUD-2), and are shown on Plate 7-5C.

Disturbed diversions (ditches) are designated with a DD number (i.e. DD-1). Contributing watersheds for disturbed diversions are labelled with a WSDD number (i.e. WSDD-1) as shown on Plates 7-5 and 7-5C. All disturbed diversions carry runoff which ultimately goes to the sediment pond.

All ditches are designed to carry the expected runoff from respective watersheds from a 10 year - 6 hour precipitation event, with a minimum freeboard of 0.3'. Ditches were assumed to be unlined with a Manning's No. of 0.035. All ditches have been conservatively evaluated for size using the computer program "Office of Surface Mining Watershed Model," Storm, Version 6.21, by Gary E. McIntosh, to calculate peak flows, which were then routed into triangular shaped channels with 1:1 side slopes. This evaluation shows conditions which are not uncommon at minesites and which tend to maximize required flow depths. All ditches are designed with the steeper (1:1) side slopes to allow for maintenance by road grading or other equipment. Actual side slopes may vary in the field; however, as long as the ditch has the required depth and cross-sectional area to carry the flow with required

freeboard, the ditch is adequate.

Ditches with flow velocities of 5 fps or greater will be lined with properly sized rip-rap or other controls to protect from erosion.

All ditch slopes and lengths were taken from Plate 7-5, "Drainage Map".

A typical ditch section, as well as a summary of flow depths and sizes is provided in Figure 3 of this Appendix.

All ditches will be inspected regularly, constructed and maintained to the minimum dimensions to provide adequate capacity for the design flow. All ditches are temporary and will be removed during final reclamation.

Note: Ditches were also evaluated for adequacy to carry runoff from the 10 year - 24 hour precipitation event.

2.11 Main Canyon Culvert

The proposed main canyon culvert will be placed to closely approximate the existing stream alignment. In an effort to protect the natural channel, the area will be covered with a filter fabric (geotextile material). An underdrain will then be installed on the fabric, consisting of an 18" perforated drain pipe surrounded by a bed of clean 2" drain drainrock. The underdrain will be covered by a second layer of fabric which in turn will be covered with a layer of marker material used to facilitate visibility during final reclamation. A layer of bedding material will then be placed over the marker material. The proposed 72" cmp culvert will then be installed on the bedding material and backfilled and compacted throughout the length of the mine site - approximately 1500'.

The culvert has been sized to safely carry the runoff from a 100 year - 6 hour precipitation event for all of Crandall Canyon above the minesite. The 100 year - 6 hour flow has been calculated at 222.79 cfs, as shown on Table 3. This flow can be carried by a 3.75' minimum diameter culvert, as calculated by the Manning's Equation and shown in Table 10; therefore, the proposed 6' diameter culvert is more than adequate.

There have been some questions raised as to previous main canyon flow calculations which showed the expected runoff from the 100 year - 6 hour storm to be as high as 431 cfs. It appears this number was generated by using a computer program called "Peak", using slightly different parameters than those used in this report.

The runoff numbers in this Appendix were calculated using the "Office of Surface Mining Watershed Model", Storm Version 6.21, by Gary E. McIntosh. All flows were based on the SCS-TR55 Method for Type II storms. This program has been supplied to the operators by the Division, and results have been consistently accepted

by the agencies.

In an effort to make the runoff values more conservative, yet realistic, for design purposes, some parameters, such as concentration time and SCS Upland Curve numbers were placed on the conservative side in the program. Based on these numbers, a very conservative flow of 222.79 cfs was obtained. It should be noted that this flow agrees closely with a previous calculation using the equation of Thomas and Lindskov (1983), which estimates the 100 year - 6 hour flow for the main canyon at 272 cfs.

Summary: It is obvious that the final number on the main channel flow is entirely dependent upon which computer program or method is used. Since the OSM Storm program has been used throughout calculations for this plan, and since it is a widely accepted method, the more conservative figure of 222.79 cfs has been used in design calculations for this plan.

2.12 Main Canyon Culvert Inlet Structure

The culvert inlet will be protected by an inlet section and trash rack, along with a rip-rapped headwall. An additional trash rack will be installed upstream of the inlet at a location convenient for maintenance and cleanout, as shown on Figure 10. Based on the Culvert Nomograph, Figure 1, the expected flow will enter the culvert at slightly over 1 diameter of head; therefore, additional headwall protection will be provided for a minimum of 5' above and around the inlet structure. Headwall protection will be of 18" D_{50} rip-rap, as shown on Figure 10.

A small side drainage enters Crandall Creek just west of the bypass culvert inlet. As the drainage calculations took into consideration the runoff from this side canyon, the bypass culvert and inlet riprap are adequately sized to handle drainage from this side canyon. The riprap has been extended up this drainage for a short distance (see Map 5-3) in order to protect the culvert inlet.

2.13 Main Canyon Culvert - Outlet Structure

The outlet of the 6' diameter main canyon culvert has been designed to flow into a rip-rap apron to protect against scouring and for energy dissipation. The rip-rap apron is designed to fit the natural channel configuration as closely as possible, and will allow runoff to re-enter the natural channel at a reduced velocity which is no greater than natural flow conditions. Runoff from the 100 year - 6 hour precipitation event in the canyon above the minesite has been calculated at 222.79 cfs.

The rip-rap apron design is 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 apron should be a minimum of 22' in length, widening from 6' to 15', with a 0% slope. The proposed length has been increased to 30', with an 18' width, to ensure adequate time for velocity reduction. The slope is kept at 0%. Rip-rap size is conservatively placed at 30" D_{50}. Rip-rap will be placed to a depth of 1.5 D_{50} and will be embedded in a 12" layer of 2" drain rock filter. Rip-rap will also be placed on 1:1 side slopes to the height of the culvert (6') at the culvert outlet tapering to 3' at the outlet of the apron. This rip rap apron has been sized and designed to adequately dissipate energy from flow velocities of a 100 year, 24 hour precipitation event and resist dislodgement. The drain rock filter bed will also serve to secure the rip rap boulders firmly in place, to add an additional element of stability, and prevent scouring underneath the boulder bed.

The natural channel below the proposed outlet has been measured from field surveys to have a bottom width of approximately 17' at the proposed apron outlet, with side slopes approximately 1:1. When the flow is routed from the culvert across the apron to the natural channel, the velocity is reduced from 21.70 fps at the culvert outlet to 10.83 fps at the outlet of the apron. Refer to 72" Culvert Outlet Rip-Rap Apron Flow Velocity Calculations in Section 4.6. Based on actual field measurements, the natural channel flow velocity would be approximately 11.02 fps at this location with the same flow of 222.79 cfs. Therefore, the velocity of the stream flow exiting the rip rap apron will be less than the velocity in the naturally existing stream bed, at that location, under similar conditions.

TABLE 1
WATERSHED SUMMARY

Watershed	*Type*	*CN*	*Acres*	*Drains To*		*Final*
Crandall	*Undisturbed*	*69*	*3480.00*	*Main Culvert*	-	*Crandall Creek*
WSUD-1	*Undisturbed*	*69*	*84.88*	*Culvert UD-1*	-	*Crandall Creek*
WSUD-2	*Undisturbed*	*69*	*1.39*	*Ditch UD-2*	-	*Culvert UD-1*
WSUD-3	*Undisturbed*	*69*	*8.66*	*Culvert UD-3*	-	*Sediment Pond*
WSDD-1	*Undisturbed*	*69*	*0.14*	*Ditch DD-1*	-	*Sediment Pond*
WSDD-1	*Reclaimed*	*75*	*0.08*	*Ditch DD-1*	-	*Sediment Pond*
WSDD-2	*Reclaimed*	*75*	*0.15*	*Ditch DD-1*	-	*Sediment Pond*
WSDD-3	*Undisturbed*	*69*	*0.13*	*Ditch DD-3*	-	*Sediment Pond*
WSDD-3	*Reclaimed*	*75*	*0.15*	*Ditch DD-3*	-	*Sediment Pond*
WSDD-3	*Disturbed*	*90*	*0.26*	*Ditch DD-3*	-	*Sediment Pond*
WSDD-3	*Paved*	*95*	*0.33*	*Ditch DD-3*	-	*Sediment Pond*
WSDD-4	*Paved Road*	*95*	*0.11*	*Ditch DD-4*	-	*Sediment Pond*
WSDD-4	*Disturbed*	*90*	*0.08*	*Ditch DD-4*	-	*Sediment Pond*
WSDD-5	*Undisturbed*	*69*	*0.12*	*Ditch DD-5*	-	*Sediment Pond*
WSDD-5	*Reclaimed*	*75*	*0.33*	*Ditch DD-5*	-	*Sediment Pond*
WSDD-5	*Paved Road*	*95*	*0.33*	*Ditch DD-5*	-	*Sediment Pond*
WSDD-7	*Undisturbed*	*69*	*0.18*	*Ditch DD-7*	-	*Sediment Pond*
WSDD-7	*Disturbed*	*90*	*0.17*	*Ditch DD-7*	-	*Sediment Pond*
WSDD-7	*Paved Road*	*95*	*0.09*	*Ditch DD-7*	-	*Sediment Pond*
WSDD-8	*Undisturbed*	*69*	*3.59*	*Ditch DD-8*	-	*Sediment Pond*
WSDD-8	*Reclaimed*	*75*	*0.15*	*Ditch DD-8*	-	*Sediment Pond*
WSDD-8	*Disturbed*	*90*	*0.37*	*Ditch DD-8*	-	*Sediment Pond*
WSDD-8	*Paved Road*	*95*	*0.25*	*Ditch DD-8*	-	*Sediment Pond*
WSDD-10	*Undisturbed*	*69*	*0.07*	*Ditch DD-10*	-	*Sediment Pond*
WSDD-10	*Reclaimed*	*75*	*0.12*	*Ditch DD-10*	-	*Sediment Pond*
WSDD-10	*Disturbed*	*90*	*0.61*	*Ditch DD-10*	-	*Sediment Pond*
WSDD-10	*Paved Road*	*95*	*0.27*	*Ditch DD-10*	-	*Sediment Pond*
WSDD-11	*Undisturbed*	*69*	*2.09*	*Ditch DD-11*	-	*Sediment Pond*
WSDD-11	*Reclaimed*	*75*	*0.15*	*Ditch DD-11*	-	*Sediment Pond*
WSDD-11	*Disturbed*	*90*	*0.04*	*Ditch DD-11*	-	*Sediment Pond*
WSDD-12	*Undisturbed*	*60*	*8.82*	*Ditch DD-12*	-	*Sediment Pond*
WSDD-12	*Disturbed*	*90*	*2.29*	*Ditch DD-12*	-	*Sediment Pond*
WSDD-13	*Undisturbed*	*60*	*17.72*	*Ditch DD-13*	-	*Sediment Pond*
WSDD-13	*Disturbed*	*90*	*3.70*	*Ditch DD-13*	-	*Sediment Pond*
WSDD-13	*Paved*	*95*	*0.27*	*Ditch DD-13*	-	*Sediment Pond*
WSDD-14	*Disturbed*	*90*	*0.89*	*Sediment Pond*	-	*Sediment Pond*
WSDD-14	*Undisturbed*	*60*	*0.78*	*Sediment Pond*	-	*Sediment Pond*
WSDD-14	*Paved*	*95*	*0.02*	*Sediment Pond*	-	*Sediment Pond*
WSDD-15	*Paved*	*95*	*0.09*	*Ditch DD-7*	-	*Sediment Pond*

TABLE 2
WATERSHED PARAMETERS

Watershed	Type	CN	Acres	Hyd. Length(ft.)	Land Slope(%)	Elev.Change(ft.)
Crandall	Und.	69	3480.00	16,500	17.58	2900
WSUD-1	Und.	69	84.88	3,100	53.55	1660
WSUD-2	Und.	69	1.39	320	78.13	250
WSUD-3	Und.	69	8.66	1300	70.77	920
WSDD-1	Und.	69	0.14	100	40.00	40
WSDD-1	Recl.	75	0.08	120	25.00	30
WSDD-2	Recl.	75	0.15	200	25.00	50
WSDD-3	Und.	69	0.13	80	50.00	40
WSDD-3	Recl.	75	0.15	100	48.00	48
WSDD-3	Dist.	90	0.26	125	56.00	70
WSDD-3	Paved	95	0.33	100	3.00	3
WSDD-4	Paved	95	0.11	250	8.33	20
WSDD-4	Dist.	90	0.08	100	10.00	10
WSDD-5	Und.	69	0.12	60	50.00	30
WSDD-5	Recl.	75	0.33	80	50.00	40
WSDD-5	Paved	95	0.33	300	8.33	25
WSDD-7	Und.	69	0.18	100	78.00	78
WSDD-7	Dist.	90	0.17	120	66.67	80
WSDD-8	Und.	69	3.59	700	65.71	460
WSDD-8	Recl.	75	0.15	80	62.50	50
WSDD-8	Dist.	90	0.37	60	65.71	39
WSDD-8	Paved	95	0.25	560	5.36	30
WSDD-10	Und.	69	0.07	45	62.22	28
WSDD-10	Recl.	75	0.12	50	72.00	36
WSDD-10	Dist.	90	0.61	120	62.50	75
WSDD-10	Paved	95	0.27	335	5.37	18
WSDD-11	Und.	69	2.09	570	64.91	370
WSDD-11	Recl.	75	0.15	30	66.67	20
WSDD-11	Dist.	90	0.04	35	66.67	23
WSDD-12	Und.	60	8.82	1600	42.50	680
WSDD-12	Dist.	90	2.29	80	72.73	58
WSDD-13	Und.	60	17.72	2100	53.81	1130
WSDD-13	Dist.	90	3.70	650	9.09	59
WSDD-13	Paved	95	0.27	40	4.00	2
WSDD-14	Dist.	90	0.89	140	16.11	23
WSDD-14	Und.	60	0.78	380	64.41	245
WSDD-14	Paved	95	0.02	30	3.00	1
WSDD-15	Paved	95	0.09	150	3.33	5

TABLE 3
RUNOFF SUMMARY
UNDISTURBED DIVERSIONS

Diversion	*Main Culvert*	*UD-1*	*UD-2*	*UD-3*
Watershed	*Crandall Canyon*	*WSUD-1*	*WSUD-2*	*WSUD-3*
Area (Acres)	*3480.0*	*84.88*	*1.39*	*8.66*
Runoff CN	*69*	*69*	*69*	*69*
10 year/6 hour Rainfall (in.)	*1.55*	*1.55*	*1.55*	*1.55*
Peak Flow 10/6 (cfs)	*N/A*	*1.91*	*0.04*	*0.23*
25 year/6 hour Rainfall (in.)	*1.90*	*1.90*	*1.90*	*1.90*
Peak Flow 25/6 (cfs)	*N/A*	*3.68*	*0.08*	*0.43*
100 year/6 hour Rainfall (in.)	*2.40*	*2.40*	*2.40*	*2.40*
Peak Flow 100/6 (cfs)	*222.79*	*6.81*	*0.21*	*0.89*
10 year/24 hour Rainfall (in.)	*N/A*	*2.50*	*2.50*	*2.50*
Runoff Volume 10/24 (ac.ft.)	*N/A*	*2.98*	*0.05*	*0.30*

TABLE 4
RUNOFF SUMMARY
DRAINAGE TO SEDIMENT POND

Watershed	Type	10 year/24 hour Volume-ac.ft.	10 year/24 hour Peak Flow-cfs	10 year/6 hour Peak Flow-cfs	25 year/6 hour Peak Flow-cfs
WSDD-1	Undisturbed	0.02	0.10	0.04	0.06
WSDD-1	Reclaimed	0.01	0.04	0.01	0.01
WSDD-2	Reclaimed	0.01	0.06	0.01	0.03
WSDD-3	Undisturbed	0.00	0.03	0.00	0.01
WSDD-3	Reclaimed	0.01	0.05	0.01	0.02
WSDD-3	Disturbed	0.03	0.18	0.08	0.12
WSDD-3	Paved	0.05	0.32	0.17	0.22
WSDD-4	Paved	0.02	0.12	0.07	0.09
WSDD-4	Disturbed	0.01	0.08	0.04	0.05
WSDD-5	Undisturbed	0.00	0.03	0.00	0.01
WSDD-5	Reclaimed	0.02	0.10	0.02	0.04
WSDD-5	Paved	0.05	0.39	0.21	0.27
WSDD-7	Undisturbed	0.01	0.05	0.00	0.01
WSDD-7	Disturbed	0.02	0.12	0.05	0.07
WSUD-3	Undisturbed	0.30	1.40	0.23	0.43
WSDD-8	Undisturbed	0.13	0.75	0.10	0.20
WSDD-8	Reclaimed	0.01	0.05	0.01	0.02
WSDD-8	Disturbed	0.05	0.23	0.10	0.14
WSDD-8	Paved	0.04	0.37	0.20	0.26
WSDD-10	Undisturbed	0.00	0.03	0.00	0.01
WSDD-10	Reclaimed	0.01	0.03	0.01	0.01
WSDD-10	Disturbed	0.08	0.42	0.19	0.27
WSDD-10	Paved	0.04	0.35	0.19	0.24
WSDD-11	Undisturbed	0.07	0.47	0.06	0.12
WSDD-11	Reclaimed	0.01	0.04	0.01	0.02
WSDD-11	Disturbed	0.01	0.06	0.03	0.04
WSDD-12	Undisturbed	0.13	0.25	0.04	0.16
WSDD-12	Disturbed	0.29	3.33	1.51	2.10
WSDD-13	Undisturbed	0.26	0.49	0.07	0.30
WSDD-13	Disturbed	0.47	5.39	2.44	3.39
WSDD-13	Paved	0.04	0.20	0.11	0.14
WSDD-14	Disturbed	0.11	0.78	0.35	0.49
WSDD-14	Undisturbed	0.01	0.03	0.00	0.02
WSDD-14	Paved	0.02	0.07	0.04	0.05
WSDD-15	Paved	0.02	0.11	0.06	0.08
Totals		2.36	16.53	6.46	9.50

TABLE 5
RUNOFF CONTROL STRUCTURE WATERSHED SUMMARY

Structure	*Type*	*Contributing Watersheds*
Main Culvert	*Culvert*	*Crandall Canyon Above Mine*
UD-1	*Culvert*	*WSUD-1*
UD-2	*Culvert*	*WSUD-2*
UD-3	*Culvert*	*WSUD-3*
DD-1	*Ditch*	*WSDD-1, WSDD-2*
DD-3	*Ditch*	*WSDD-1, WSDD-2, WSDD-3*
DD-4	*Ditch*	*WSDD-1, WSDD-2, WSDD-3, WSDD-4, WSDD-8, WSDD-12*
DD-5	*Ditch*	*WSDD-1, WSDD-2, WSDD-3, WSDD-4, WSDD-5, WSDD-8, WSDD-12*
DD-7	*Ditch*	*WSDD-7, WSDD-11*
DD-8	*Ditch*	*WSDD-8, WSUD-3*
DD-10	*Ditch*	*WSDD-10 + Mine Water*
DD-10A	*Ditch*	*½ WSDD-10 (Disturbed)*
DD-11	*Ditch*	*WSDD-11*
DD-12	*Ditch*	*WSDD-12*
DD-13	*Ditch*	*WSDD-13*
DD-14	*Sheet Flow*	*WSDD-14*
C-1	*Culvert*	*WSDD-1, WSDD-2, WSDD-3, WSDD-8*
C-3	*Culvert*	*WSDD-7, WSDD-11, WSDD-15*
C-4	*Culvert*	*WSDD-10 + Mine Water*
C-5	*Culvert*	*WSDD-11*
C-6	*Culvert*	*WSUD-2*
C-7	*Culvert*	*WSDD-1, WSDD-2, WSDD-3*
C-9	*Culvert*	*WSDD-4, WSDD-12*
C-11	*Culvert*	*WSDD-12*
C-11A	*Culvert*	*WSDD-12*
C-12	*Culvert*	*WSDD-1, 2, 3, 4, 5, 8, 12*
C-13	*Culvert*	*WSDD-13*
C-14	*Slot Culvert*	*WSDD-4*
C-15	*Slot Culvert*	*WSDD-15*
C-16	*Culvert*	*WSDD-13*
C-17	*Culvert*	*WSDD-13*
Sediment Pond	*Pond*	*WSDD-1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, WSUD-3*

TABLE 6
RUNOFF CONTROL STRUCTURE FLOW SUMMARY

Structure	*Type*	*10 year/6 hour Peak Flow-cfs*	*10 year/24 hour Peak Flow-cfs*	*25 year/6 hour Peak Flow-cfs*	*100 year/6 hour Peak Flow-cfs*
Main Culvert	*Culvert*	-	-	-	*222.79*
UD-1	*Culvert*	*1.91*	-	*3.68*	*6.81*
UD-2	*Ditch*	*0.04*	-	*0.08*	*0.21*
UD-3	*Culvert*	*0.23*	-	*0.43*	*0.89*
DD-1	*Ditch*	*0.06*	*0.20*	*0.10*	-
DD-3	*Ditch*	*0.32*	*0.78*	*0.47*	-
DD-4	*Ditch*	*2.39*	*5.96*	*3.49*	-
DD-5	*Ditch*	*2.85*	*7.88*	*4.24*	-
DD-7	*Ditch*	*0.21*	*0.85*	*0.34*	-
DD-8	*Ditch*	*0.64*	*2.80*	*1.05*	-
DD-10A	*Ditch*	*0.10*	*0.21*	*0.14*	-
DD-10	*Ditch*	*2.62*	*3.06*	*2.76*	-
DD-11	*Ditch*	*0.10*	*0.57*	*0.18*	-
DD-12	*Ditch*	*1.55*	*3.58*	*2.26*	-
DD-13	*Ditch*	*2.62*	*6.08*	*3.83*	-
DD-14	*Sht Flw*	*0.39*	*0.88*	*0.56*	-
C-1	*Culvert*	*0.96*	*3.58*	*1.52*	-
C-3	*Culvert*	*0.21*	*0.85*	*0.34*	-
C-4	*Culvert*	*2.62*	*3.06*	*2.76*	-
C-5	*Culvert*	*0.10*	*0.57*	*0.18*	-
C-6	*Culvert*	*0.04*	-	*0.08*	-
C-7	*Culvert*	*0.32*	*0.78*	*0.47*	-
C-9	*Culvert*	*0.11*	*0.20*	*0.14*	-
C-11	*Culvert*	*1.55*	*3.58*	*2.26*	-
C-11A	*Culvert*	*1.55*	*3.58*	*2.26*	-
C-12	*Culvert*	*2.85*	*7.36*	*3.92*	-
C-13	*Culvert*	*2.62*	*6.08*	*3.83*	-
C-14	*Slot Cul.*	*0.11*	*0.20*	*0.14*	-
C-15	*Slot Cul.*	*0.06*	*0.11*	*0.08*	-
C-16	*Culvert*	*2.62*	*6.08*	*3.83*	-
C-17	*Culvert*	*2.62*	*6.08*	*3.83*	-
Sediment Pond	*Pond*	*6.46*	*16.53*	*9.50*	-

TABLE 7
DISTURBED DITCH DESIGN SUMMARY

Ditch	*DD-1*	*DD-3*	*DD-4*	*DD-5*	*DD-7*	*DD-8*	*DD-10A*
Slope (%)	*30.77*	*3.00*	*11.91*	*4.50*	*3.33*	*3.59*	*5.00*
Length (ft.)	*130*	*75*	*168*	*628*	*142*	*557*	*50*
Manning's No.	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*
Side Slope (H:V)	*1:1*	*1:1*	*1:1*	*1:1*	*1:1*	*1:1*	*1:1*
**Bottom Width (ft.)*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Peak Flow 10/6 (cfs)	*0.06*	*0.32*	*2.39*	*2.85*	*0.21*	*0.64*	*0.10*
Peak Flow 10/24 (cfs)	*0.20*	*0.78*	*5.96*	*7.88*	*0.85*	*2.80*	*0.21*
Flow Depth (ft.) 10/6	*0.14*	*0.40*	*0.66*	*0.84*	*0.33*	*0.50*	*0.23*
Flow Depth (ft.) 10/24	*0.22*	*0.56*	*0.92*	*1.23*	*0.57*	*0.87*	*0.31*
Flow Area (ft^2)10/6	*0.02*	*0.16*	*0.43*	*0.71*	*0.11*	*0.25*	*0.06*
Flow Area (ft^2)10/24	*0.05*	*0.31*	*0.85*	*1.52*	*0.32*	*0.76*	*0.10*
Velocity (fps)10/6	*3.15*	*2.00*	*5.55*	*4.02*	*1.87*	*2.55*	*1.81*
Velocity (fps) 10/24	*4.26*	*2.50*	*6.97*	*5.19*	*2.66*	*3.68*	*2.18*
Rip-Rap Req'd (Y/N)	*N*	*N*	*Y*	*N*	*N*	*N*	*N*
Rip-Rap D_{50}	-	-	*6"*	-	-	-	-

** All ditches are triangular.*
*** Flows include 1000 gpm (2.23 cfs) Mine Water Flow.*
Note: Slope/Lengths from Plate 7-5.

TABLE 7 (Continued)
DISTURBED DITCH DESIGN SUMMARY

Ditch	*DD-10*	*DD-11*	*DD-12*	*DD-13*	*DD-13 (MIN.)*	*(MAX.)*
Slope (%)	*3.33*	*3.00*	*3.29*	*1.79*	*50.00*	
Length (ft.)	*70*	*173*	*50*	*280*	*80*	
Manning's No.	*0.035*	*0.035*	*0.035*	*0.035*	*0.035*	
Side Slope (H:V)	*1:1*	*1:1*	*1:1*	*1:1*	*2:1*	
Bottom Width (ft.)	*0*	*0*	*0*	*0*	*2*	
Peak Flow 10/6 (cfs)	*2.62***	*0.10*	*1.55*	*2.62*	*2.62*	
Peak Flow 10/24 (cfs)	*3.06***	*0.57*	*3.58*	*6.08*	*6.08*	
Flow Depth (ft.) 10/6	*0.86*	*0.26*	*0.71*	*0.97*	*0.15*	
Flow Depth (ft.) 10/24	*0.92*	*0.50*	*0.97*	*1.33*	*0.24*	
Flow Area (ft^2) 10/6	*0.75*	*0.07*	*0.50*	*0.94*	*0.34*	
Flow Area (ft^2) 10/24	*0.84*	*0.25*	*0.94*	*1.77*	*0.60*	
Velocity (fps) 10/6	*3.51*	*1.50*	*3.07*	*2.79*	*7.66*	
Velocity (fps) 10/24	*3.65*	*2.31*	*3.79*	*3.44*	*10.12*	
Rip-Rap Req'd (Y/N)	*N*	*N*	*N*	*N*	*Y*	
Rip-Rap D_{50}	-	-	-	-	*9"*	

**All ditches are triangular.*
Note: Slope/Lengths from Plate 7-5.
Note: DD-12 is shortened due to construction of the south portal access ramp/fan pad.

TABLE 8
UNDISTURBED DITCH DESIGN SUMMARY

Ditch	*UD-2*
Slope (%)	*12.5*
Length (ft.)	*400*
Manning's No.	*0.035*
Side Slope (H:V)	*1:1*
Bottom Width (ft.)	*0*
Peak Flow-10/6 (cfs)	*0.04*
Flow Depth (ft.)	*0.14*
Flow Area (ft^2)	*0.02*
Velocity (fps)	*2.03*
Lined (Y/N)	*N*
Rip-Rap Req'd (Y/N)	*N*

Note: Slope/Lengths from Plate 7-5.

TABLE 9
DISTURBED CULVERT DESIGN SUMMARY

Culvert	C-1	C-3	C-4	C-5	C-6	C-7	C-9	C-11	C-11A	C-12	C-13	C-14	C-15	C-16	C-17
Slope (%)	16.67	8.00	25.07	57.14	17.20	3.00	3.50	3.50	1.50	4.50	3.00	1.00	1.00	25.00	20.00
Length (ft.)	60	360	69	120	12	80	18	30	60	330	100	40	30	40	60
Manning's No.	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Peak Flow 10/6 (cfs)	0.96	0.21	2.62*	0.10	0.04	0.32	0.11	1.55	1.55	2.85	2.62	0.11	0.06	2.62	2.62
Peak Flow 10/24 (cfs)	3.58	0.85	3.06*	0.57	N/A	0.78	0.20	3.58	3.58	7.36	6.08	0.20	0.11	6.08	6.08
Min. Diam. Req'd (ft.) 10/6	0.42	0.28	0.57	0.14	0.13	0.39	0.25	0.68	0.80	0.82	0.85	0.32	0.25	0.57	0.60
Min. Diam. Req'd (ft.) 10/24	0.69	0.46	0.61	0.28	N/A	0.54	0.32	0.93	1.09	1.16	1.17	0.40	0.32	0.79	0.82
Diam. Installed (ft.)	1.50	2.00	2.00	1.00	1.00	1.00	1.00	1.50	1.50	2.00	2.00	1.00	1.00	1.67	1.50
Velocity (fps) 10/6	6.80	3.53	10.18	6.13	3.11	2.71	2.20	4.27	3.10	5.46	4.59	1.38	1.18	10.17	9.35
Velocity (fps) 10/24	9.44	5.01	10.58	9.47	N/A	3.39	2.56	5.26	3.83	6.92	5.67	1.60	1.38	12.55	11.54
Rip-Rap D_{50}	12"	-	12"	6"	-	-	-	-	-	6"	-	-	-	12"	12"

* Includes 1000 gpm (2.23 cfs) Mine Water Flow.

Note: Slope/Lengths from Plate 7-5.

Source: (Haestad Methods, Flowmaster I, Version 3.42)

TABLE 10
UNDISTURBED CULVERT DESIGN SUMMARY

Culvert	**Main Canyon*	*UD-1*	*UD-3*
Slope (%)	*8.00*	*23.33*	*30.00*
Length (ft.)	*1500*	*270*	*50'*
Manning's No.	*0.02*	*0.02*	*0.02*
Peak Flow 100/6 (cfs)	*222.79*	-	-
Peak Flow 10/6 (cfs)	-	*1.91*	*0.23*
Min. Diam. Req'd (ft.)	*3.75*	*0.52*	*0.22*
Diam. Installed (ft.)	*6.00*	*3.50*	*1.00*
Velocity (fps)	*20.14*	*9.16*	*5.93*

** Culvert to be installed under expansion plan.*
All other undisturbed culverts are existing.

Note: Slope/Lengths from Plate 7-5.
Source: (Haestad Methods, Flowmaster I, Version 3.43)

DESIGN OF SEDIMENT CONTROL STRUCTURES

Design Specifications:

3.1 Design Specification for Expanded Sedimentation Pond
3.2 Sediment Yield
3.3 Sediment Pond Volume

Tables:

Table 11	*Sediment Pond Design*
Table 12	*Sediment Pond Stage Volume Data*
Table 13	*Sediment Pond Stage Discharge Data*

3.4 Sediment Pond Summary

Figures:

Figure 4	*Soil Erodibility Chart - Disturbed Areas*
Figure 5	*Soil Erodibility Chart - Undisturbed/Reclaimed Areas*
Figure 6	*Sediment Pond Stage-Volume Curve*
Figure 7	*Sediment Pond Stage-Discharge Curve*

3.1 Design Specification for Expanded Sediment Pond

The sedimentation pond located in Crandall Canyon has been redesigned and reconstructed to control the additional storm runoff from the pad extension and from the undisturbed drainage areas above the pad extension. The "As-Constructed" topography and cross sections of the pond design are shown on Plate 7-3.

The pond has been sized to meet the requirements of R645-301-742.221.33 (DOGM), which stipulates that sedimentation ponds be capable of containing or treating the 10-year 24-hour precipitation event. According to Miller, et al (1973), the 10-year, 24-hour design storm for Crandall Canyon is 2.5 inches. The design storm calculations for the sedimentation pond are presented in Table 4 of this Appendix. These calculations include the proposed pad extension, the additional watersheds above the pad extension, the existing pad and reclaimed areas, and the undisturbed watersheds above the existing pad.

As required by R645-301-742.223, the 25 year-6 hour precipitation event was routed through the sedimentation pond to determine the adequacy of the spillway. Overflow from the pond is discharged to Crandall Creek. Total precipitation from the 25 year-6 hour storm is 1.9 inches (Miller, et al, 1973). The 25 year-6 hour flow is calculated at 9.07 cfs. Based on the calculations, the primary spillway is more than adequate to carry the expected runoff from a 25 year-6 hour event.

3.2 Sediment Yield

The Universal Soil Equation (USLE) was used to estimate sediment yield from all drainage areas contributing to the pond. All soil loss from this area was assumed to be delivered to, and deposited in the sedimentation pond.

Erosion rate (A) in tons-per-acre-per-year is determined using the USLE as follows:

$$A = (R)\ (K)\ (LS)\ (CP)$$

Where the variables R, K, LS, and CP are defined as follows:

Variable "R" is the rainfall factor which can be estimated from $R = 27P^{2.2}$*; where P is the 2-year, 6-hour precipitation value. P for the Crandall Canyon area is estimated at 1.00" based on Figure 5.4, page 315, Barfield, et.al. 1983. Therefore, the estimated value of "R" for this area is 27.00.*

Variable "K" is the soil erodibility factor. For disturbed areas, the "K" value is taken as 0.06 as determined from soils samples and shown on the soil erodibility chart, Figure 4. K is estimated to be 0.15 for undisturbed and reclaimed areas, based on soils data and the soil erodibility chart, Figure 5.

Variable "LS" is the length-slope factor. This figure was determined by calculating a weighted average slope length and percentage for the undisturbed, reclaimed and disturbed areas, respectively. The slope length and percentage were then substituted into the following equation to determine the LS Factor:

$$LS = \left(\frac{\pi}{72.6}\right)^{m}\left(\frac{430\,x^2 + 30\,x + 0.43}{6.613}\right)$$

where:

π	=	*Field slope length in feet;*
m	=	*0.5 if S is 5% or greater;*
x	=	*sin* θ*;*
θ	=	*Angle of slope in degrees.*

Variable "CP" is the control practice factor, which can be divided into a cover and practice factor. Values were determined from Appendix 5A, Barfield, et.al., 1983.

Site	*CP Factor*
Disturbed Areas	*1.20*
Reclaimed Areas	*0.100*
Undisturbed Areas	*0.003*

The sediment volume is based on a density of 100 pounds per cubic foot of sediment.

SEDIMENT YIELD CALCULATIONS - USLE

Drainage	*R*	*K*	*Acres*	*Slope Length Feet*	*%*	*LS*	*CP*	*A**	*Yield***
Undisturbed	*27.00*	*0.15*	*42.25*	*1700*	*53*	*79.60*	*0.003*	*00.967*	*0.019*
Reclaimed	*27.00*	*0.15*	*1.22*	*90*	*52*	*17.81*	*0.10*	*07.213*	*0.004*
Disturbed	*27.00*	*0.06*	*8.92*	*350*	*26*	*11.69*	*1.200*	*22.725*	*0.093*

Total Sediment 1 year (ac.ft.) *0.116*

Total Sediment 3 years (ac. ft.). *0.348*

* *A = tons/acre-year*
** *Yield = acre-ft/year*

3.3 Sediment Pond Volume

The volumes shown in Table 11 are from the volumes calculated from the precipitation, runoff and sediment yield for a 10 year-24 hour precipitation event. The volumes were calculated based on the disturbed areas (and contributing undisturbed areas) runoff values, developed using the design parameters described in this section.

The sediment pond has been reconstructed, and the sediment pond volumes on Table 11, Table 12 and Figure 6 all represent the "As-Constructed" pond.

Mine Water

There may be times that the mine water oxidizer must be shut down for repair or cleaning, at which time the mine discharge water will need to bypass the treatment system. In such a case, the water will be directed to temporarily run down the road around the outside of the basin, and into the sediment pond through ditch DD-10 and existing culvert C-4 located below the treatment facility. Assuming the sediment level in the pond is below the approved clean-out level (7769'), and assuming the pond has been previously decanted under approved UPDES discharge criteria, the remaining capacity in the sediment pond is 3.22 ac. ft., as described in Table 12. The required freeboard for a 10 year -24 hour event is 2.452 ac. ft. (2.36 ac. ft. runoff + 0.092 ac. ft. direct precipitation) leaving a usable volume of 0.771 ac. ft. for the purpose of the above bypass. This equates to approximately 251,000 gallons. At an average flow rate of 500 gpm from the mine, the sediment pond could theoretically contain 8.37 hours worth of by-passed mine water in addition to the required 10 year - 24 hour storm event. The maximum amount of by-passed mine water storage would occur at a volume of 1.061 ac. ft. (0.290 acre-feet sediment level plus 0.771 acre-feet of mine water). As shown on Table 12, this volume would occur at elevation of 7773.2.

Expanded Area Pond Requirement

3 Year Sediment Storage

TABLE 11
SEDIMENT POND DESIGN

1. *Use 2.50" for 10 year-24 hour event.*

2. *Runoff Volume (from Table 4, 10 yr/24 hr) =* *2.360 ac. ft.*

3. *Sediment Storage Volume*

   USLE 0.116 ac.ft./yr. x 3 yrs. = *0.348 ac. ft.*

4. *Direct Precipitation into Pond*

   0.441 acres x 2.50" / 12 in./ft. = *0.092 ac. ft.*

5. *Total Required Pond Volume*

   2.360 + 0.348 + 0.092 = *2.800 ac. ft.*

6. ** Peak Flow (25 yr. - 6 hr. event) =* *9.500 cfs*

7. *Pond Design Volume @ Principle Spillway =*
   (See Table 12) *3.513 ac. ft.*

* *Peak Flow values from Table 4.*

TABLE 12
SEDIMENT POND
STAGE / VOLUME DATA

Elev.	Area	Volume	Acc. Volume (ac.ft.)	Remarks
7766	1756.67	.0000	.0000	Bottom of Pond
7767	3706.92	2731.80	0.063	
7768	5119.14	4413.03	0.164	
7769	5857.00	5488.07	0.290	Sediment Cleanout Level
7770	6949.54	6403.32	0.437	Maximum Sediment Level
7771	7806.54	7378.14	0.606	
7772	8894.51	8350.53	0.798	
7773	9905.02	9399.77	1.014	
7773.2	-	-	1.061	Max. Elev. of Mine Water
7774	11055.91	10480.47	1.254	
7775	12153.06	11604.49	1.520	
7776	13120.22	12636.64	1.810	
7777	14084.05	13602.14	2.123	
7778	15043.33	14563.69	2.457	
7779	15984.66	15514.00	2.813	
7780	16934.94	16459.15	3.191	
7780.81	17669.26	14014.70	3.513	Principal Spillway
7781	17868.13	3376.05	3.591	
7781.81	18661.53	15028.20	3.936	Emergency Spillway
7782	18848.42	3430.08	4.012	
7783	19886.14	19367.28	4.457	
7784	21113.55	20499.85	4.927	
7785	22110.39	21611.97	5.423	Top of Embankment

TABLE 13
SEDIMENT POND
STAGE / DISCHARGE DATA

Head (ft.)	Q (cfs) Weir Controlled	Q (cfs) Orfice Controlled	Q (cfs) Pipe Flow Controlled
0.0	-	-	-
0.2	1.69	6.77	17.14
0.4	4.77	9.57	17.32
0.6	8.76	11.72	17.50
0.8	13.49	13.53	17.68
1.0	18.85	15.13	17.86

Note: 1- *25 year-6 hour flow = 9.500 cfs.*

2- *Flow will be weir controlled at a head of 0.64' over riser inlet.*

Weir Controlled

$Q = CLH^{1.5}$; *where :* $C = 3.0$, L = *Circumference of Riser = 6.2832'*

Orifice Controlled

$Q = C'a\,(2gH)^{0.5}$; *where :* $C = 0.6$, a = *Area of Riser = 3.1416 ft²*, $g = 32.2$ *ft/sec²*

Pipe Flow Controlled

$$Q = \frac{a\,(2gH')0.5}{(1+Ke+Kb+KcL)^{0.5}}$$; *where*

a = *Area of Pipe = 1.77 ft²*

H' = *Head = H + 9.1 (At outlet of Riser)*

$Ke = 1.0$

$Kb = 0.5$

$Kc = 0.043$

$L = 90'$

3.4 Sediment Pond Summary

a) The sedimentation pond has been designed to contain the disturbed area (and contributing undisturbed area) runoff from a 10 year-24 hour precipitation event, along with 3 years of sediment storage capacity. Runoff to the pond will be directed by various ditches and culverts as described in the plan.

b) The required volume for the sediment pond is calculated at 2.800 acre feet, including 3 years of sediment storage. The existing sediment pond size is 3.513 acre feet (at the principle spillway), which is more than adequate.

c) The pond will meet a theoretical detention time of 24 hours. It is equipped with a decant, a culvert principle spillway and an open-channel emergency spillway. Any discharge from the pond will be in accordance with the approved UPDES Permit.

d) The pond inlets will be protected from erosion, and the spillway will discharge into the main Crandall Canyon drainage.

e) The pond is temporary, and will be removed upon final reclamation of the property.

f) The pond expansion will be constructed according to the regulations and under supervision of a Registered, Professional Engineer.

g) The pond volume has been increased at the request of the Forest Service to provide a greater level of protection for forest resources located down stream from the minesite. The enlarged pond capacity (3.513 acre ft.) is over-designed by nearly 25% to contain the 10 year-24 hour design evert.

Storm Event	*Pond Volume Required*	*Pond Capacity Provided*
10 yr./24 hr.	*2.800 acre ft.*	*125%*

3.5 Alternate Sediment Control Areas (ASCA's)

ASCA-2 (consisting of 0.34 acre) exists at the northwest corner of the site. This area was initially constructed as a substation pad but was never utilized as such. A 12-inch CMP culvert was installed to act as a discharge into UD-1. A silt fence and strawbale dike have been placed to trap the sediment and prevent erosion. (Refer to Plates 7-5)

ASCA-5, ASCA-6, ASCA-7 and ASCA-11 consist of the topsoil stockpiles #1, #2, #3, and #4 respectfully. These stockpiles are located on the north and south side of the access road as shown on Plate 2-3. Disturbed areas associated with the topsoil stockpiles are 0.20 acres, 0.22 acres, 0.62 acres and 0.65 acres for ASCA-5, ASCA-6, ASCA-7, and ASCA-11, respectively. All topsoil stockpiles have been protected from erosion by a combination of dikes, silt-fencing, berms, and a vegetative cover. (Refer to Plate 2-3)

ASCA-9 (0.15 acres) is the outslope of the sediment pond; ASCA-10 (0.02 acres) is the headwall of the inlet of the main by-pass culvert. The drainage from these areas can not be directed to the sediment pond and are too close to the creek to construct separate sediment ponds. Therefore GENWAL has used alternate sediment control methods such as silt fences, straw bale dikes and vegetation. (Refer to Plate 7-5)

Note: ASCA's 1, 3, 4 and 8 have been eliminated through previous permitting actions.

A 0.30 acre water treatment facility is located within WSDD-10. This facility contains a settling basin for treating mine discharge water. The treated water is then piped directly to a UPDES outfall into Crandall Creek. Therefore, surface runoff from this facility does not report to the sediment pond.

DESIGN OF DRAINAGE CONTROL STRUCTURES FOR RECLAMATION

Reclamation Hydrology:

4.1 General (PhaseI)

4.2 General (Phase II)

4.3 Reclamation - Disturbed Drainage Control

4.4 Restored Channels

4.5 Sediment Pond

4.6 Calculations

Tables:

Table 14 Reclamation - Phase I Runoff Summary Drainage to Sediment Pond

Table 15 Reclamation - Phase I Runoff Control Structure / Watershed Summary

Table 16 Reclamation - Phase I Runoff Control Structure / Flow Summary

Table 17 Reclamation - Phase I Reclaimed Ditch Design Summary

Figures:

Figure 8 Reclamation Channel RD-1 Typical Section

Reclamation Hydrology

4.1 General (Phase I)

During Phase I of reclamation, all disturbed area culverts and ditches will be removed except as shown on Plate 5-16. Undisturbed diversion UD-2 will also be removed, and the drainage from that area will be directed to the sediment pond. Undisturbed diversion UD-1 will remain in place as a permanent structure for the following reasons:

(1) The diversion is necessary to continue to divert runoff from the reclaimed site, the U.S. Forest Service turnaround area and beneath the U.S. Forest Service Road;

(2) The 10 year-24 hour storm runoff from WSUD-1 is approximately 2.98 acre feet, which combined with runoff from the reclaimed site, exceeds the holding capacity of the sediment pond;

(3) The existing diversion is a 42" full-round C.M.P. pipe, which is well in excess of the size required to carry runoff from a 100 year-6 hour storm event for the area (See Table 10).

The main canyon 72" culvert will also be removed during Phase I reclamation, except for the lower approximately 300', which will be left in place to divert undisturbed and treated runoff beneath the sediment pond and the upper 250' which will be left in place for the Emery County's Crandall Canyon Memorial. Once the main canyon culvert is removed, Crandall Creek will be directed back to the original drainage channel through the area. Silt fences will be installed on both sides of the restored channel to treat runoff from the reclaimed pad areas, as shown on Plate 5-16.

The U.S. Forest Service Road will be left as a permanent feature. A berm and ditch (RD-1) will be established along the road. This ditch will direct all runoff from areas above the road to the sediment pond. The sediment pond will remain in place until Phase II of reclamation.

During Phase I reclamation, provisions will also be made to permanently handle the approximate 500 -700 gallon per minute flow of mine water from the sealed north side portals. The flow is presently carried by a buried pipe from the portal area, beneath the road and dumped directly into a riser pipe to the main canyon culvert. Upon Phase I reclamation, the existing pipe will be replaced with a rip-rapped ditch down the steep slope, into an 18" diameter cmp culvert beneath the U.S. Forest Service Road, and again into a rip-rapped ditch to the reclaimed main channel. The ditch has been designated MD-1, and the culvert is designated MC-1, as shown on Plate 5-16 and 5-17. As indicated on Plate 5-16, culvert MC-1 will be extended beyond reclaimed ditch RD-1, allowing RD-1 to flow over the culvert without mixing the 2 flows at least until Phase II reclamation. At that time both flows will go directly to the reclaimed main channel as shown on Plate 5-17.

Ditch MD-1 and culvert MC-1 are therefore considered permanent features of the reclaimed mine site. These structures are sized to safely convey the maximum expected mine water discharge of 700 gpm (1.56 cfs), although the present discharge is considerably less (approx. 500 gpm). The proposed rip-rap size of 12" D_{50} will also provide more than adequate protection against erosion for the maximum expected flow. Rip-rap will be installed at a minimum depth of 1.5 D_{50} (18"), and placed on a bedding layer of -2" gravel to a depth of 0.75 D_{50} (9"), as shown on Figure 13.

Watersheds are shown on Plates 7-5 and 7-5C. Reclamation drainage details are shown on Plates 5-16 and 5-17.

4.2 General (Phase II)

Once the criteria for Phase II Bond Release are met, the sediment pond will be removed and, the area recontoured and reseeded according to the plan. The lower 300' of the main canyon 72" culvert will also be removed at this time. At the discretion of the U.S. Forest Service, the berm along the road can also be removed at this time, or left in place. If the berm if left in place, reclaimed ditch RD-1 will be extended through the reclaimed pond area to the main channel. . As indicated above, ditch MD-1 and culvert MC-1 will also remain, and flow to the reclaimed main channel.

4.3 Reclamation - Disturbed Drainage Control

Drainage from all contributing watersheds above the U.S. Forest Service Road, except WSUD-1, will be collected in a reclamation ditch (RD-1) and diverted into the sediment pond during Phase I reclamation. Drainage from the reclaimed areas and contributing watersheds below the road, will be treated through silt fences along the restored natural main channel, during Phase I reclamation.

Approximately 300' of the main canyon culvert will remain in place beneath the sediment pond area during Phase I.

Upon Phase II reclamation, the sediment pond will be removed and the area restored. The remaining portion of the main canyon culvert will also be removed at this time. Silt fences along the previously reclaimed channel section may also be removed during Phase II; however, additional silt fences will be installed along the 300' section of culvert removal channel restoration.

Undisturbed diversion UD-1, ditch MD-1 and culvert MC-1 will remain in place as permanent features, as mentioned previously.

4.4 Restored Channels

Upon final reclamation, the main canyon drainage will be returned to the natural channel. During construction, this channel is to be covered by filter fabric and an underdrain system. The culvert will then be placed over the protected channel. Upon removal of the culvert, filter fabric will also be removed, exposing the natural channel. Construction in this manner will have a temporary effect on the riparian vegetation; however, this can readily be restored upon reclamation. Flow characteristics, bedding and other natural features of the natural channel will not be changed appreciably; therefore, no actual channel reconstruction or reclamation (beyond revegetation) is proposed.

No other channels are proposed to be restored within the reclaimed minesite.

4.5 Sediment Pond

The sediment pond will remain in place during Phase I reclamation. The pond will be removed during Phase II and all drainage will be returned to the Main Crandall Canyon channel at that time.

Calculations show the sediment pond to be adequately sized to contain the runoff from contributing watersheds from a 10 year-24 hour precipitation event, along with a minimum of 3 years of sediment storage. The principle and emergency spillways are each capable of passing the runoff from a 25 year-6 hour event, as required.

4.6 Calculations

For ease of calculation and to ensure a conservative runoff requirement for sediment pond adequacy, no curve numbers for contributing watersheds were changed for reclamation purposes. Contributing watershed characteristics and flows were taken from Tables 1 through 4 of this report. Watersheds and pre-reclamation drainage control are shown on Plates 7-5 and 7-5C. Phase I and Phase II drainage control are shown on Plates 5-16 and 5-17, respectively.

TABLE 14

RECLAMATION - PHASE I
RUNOFF SUMMARY
DRAINAGE TO SEDIMENT POND

Watershed	*10 year/24 hour Volume-ac.ft.*	*10 year/ 6 hour Peak Flow-cfs*	*25 year/6 hour Peak Flow-cfs*
WSUD-2	*0.05*	*0.04*	*0.08*
WSUD-3	*0.30*	*0.23*	*0.43*
WSDD-1	*0.03*	*0.05*	*0.07*
WSDD-2	*0.01*	*0.01*	*0.03*
WSDD-3	*0.09*	*0.26*	*0.37*
WSDD-4	*0.03*	*0.11*	*0.14*
WSDD-5	*0.07*	*0.23*	*0.32*
WSDD-7	*0.05*	*0.11*	*0.16*
WSDD-8	*0.23*	*0.41*	*0.62*
WSDD-10	*0.13*	*0.39*	*0.53*
WSDD-11	*0.09*	*0.10*	*0.18*
WSDD-14	*0.13*	*0.39*	*0.56*
Totals	*1.21*	*2.33*	*3.49*

Note: *Volumes and flows are totals from respective watersheds on Tables 3 and 4 of this report.*

TABLE 15

RECLAMATION - PHASE I
RUNOFF CONTROL STRUCTURE
WATERSHED SUMMARY

Structure	*Type*	*Contributing Watersheds*
Main Channel	*Silt Fence*	*WSDD-12, WSDD-13*
UD-1	*Culvert*	*WSUD-1*
RD-1	*Ditch*	*WSUD-2, WSUD-3, WSDD-1 thru WSDD-11*
Sediment Pond	*Pond*	*WSUD-2, WSUD-3, WSDD-1 thru WSDD-11 and WSDD-14 WSDD-14*
MD-1	*Ditch*	*Mine Water Discharge*
MC-1	*Culvert*	*Mine Water Discharge*

TABLE 16

RECLAMATION - PHASE I
RUNOFF CONTROL STRUCTURE
FLOW SUMMARY

Structure	Type	10 year/6 hour Peak Flow (cfs)	25 year/6 hour Peak Flow (cfs)	100 year/6 hour Peak Flow (cfs)
Main Channel	Silt Fence	3.73	5.44	-
UD-1	Culvert	1.91	3.68	6.81
RD-1	Ditch	1.94	2.93	-
Sediment Pond	Pond	2.33	3.49	-
*MD-1	Ditch	1.56	-	-
*MC-1	Culvert	1.56	-	-

* Continuous Mine Water Discharge

TABLE 17

RECLAMATION - PHASE 1
RECLAIMED DITCH/CULVERT DESIGN SUMMARY

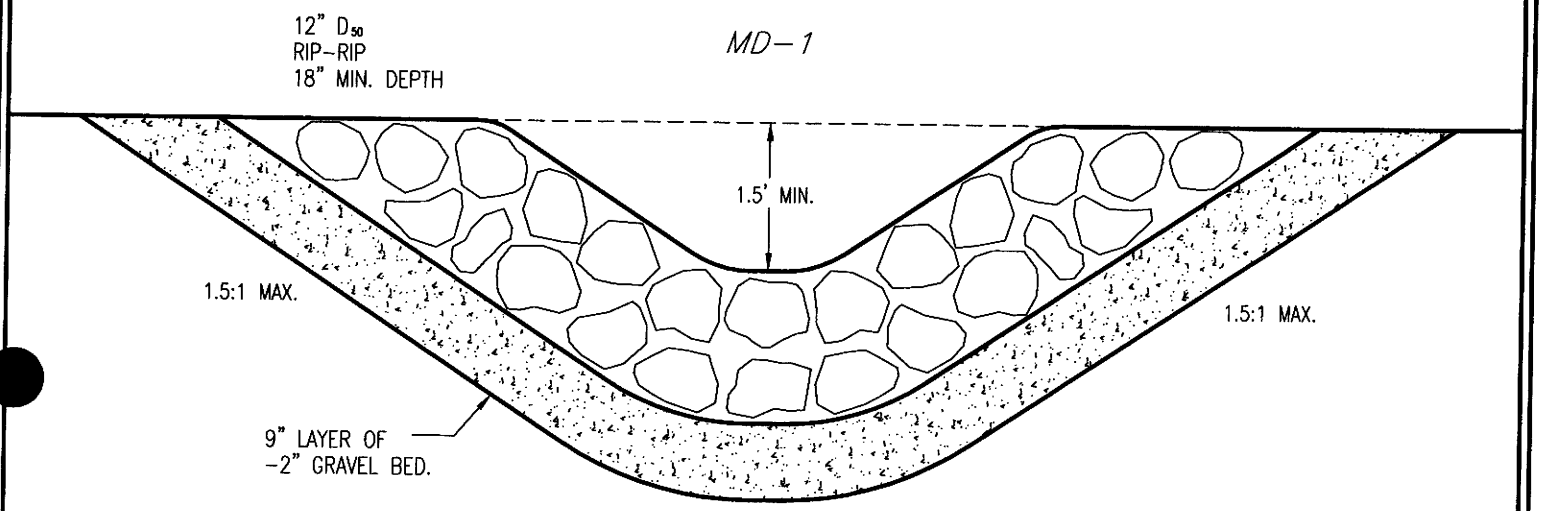
Ditch	*RD-1*	**MD-1*	***MC-1*
Slope (%)	*10.10*	*75.00*	*3.00*
Length (ft.)	*990*	*210*	*60*
Manning's No.	*0.035*	*0.035*	*0.020*
Side Slope (H:V)	*1.5:1*	*1.5:1*	*-*
Bottom Width (ft.)	*0*	*0*	*1.50 Diam.*
Peak Flow 10/6 (cfs)	*1.94*	*1.56*	*1.56*
Flow Depth (ft.)	*0.52*	*0.33*	*0.70*
Flow Area (ft^2)	*0.40*	*0.16*	*0.39*
Velocity (fps)	*4.85*	*9.75*	*4.03*
Lined (Y/N)	*N*	*N*	*-*
Rip Rap Req'd (Y/N)	*N*	*Y*	*N*
Rip Rap D_{50}	*-*	*12"*	*-*

Note: Slope / Length from Plate 5-16

* *Mine Water Ditch to Reclaimed Main Channel.*

** *Mine Water Culver beneath U.S. Forest Service Road.*

MINE WATER DISCHARGE
RECLAMATION DITCH MD-1
TYPICAL SECTION



DITCH SIZING		
DITCH	FLOW DEPTH	FLOW AREA
MD-1	0.33	0.16

NOTE:

DITCH CONFIGURATIONS MAY VARY IN FIELD; HOWEVER, MINIMUM FLOW DEPTHS AND AREAS WILL BE MAINTAINED.

FIGURE 14

CULVERT FLOW CALCULATIONS

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: GENWAL MINE

Comment: MINE WATER CULVERT MC-1

Solve For Full Flow Diameter

Given Input Data:

Slope.....	0.0300 ft/ft
Manning's n.....	0.020
Discharge.....	1.56 cfs

Computed Results:

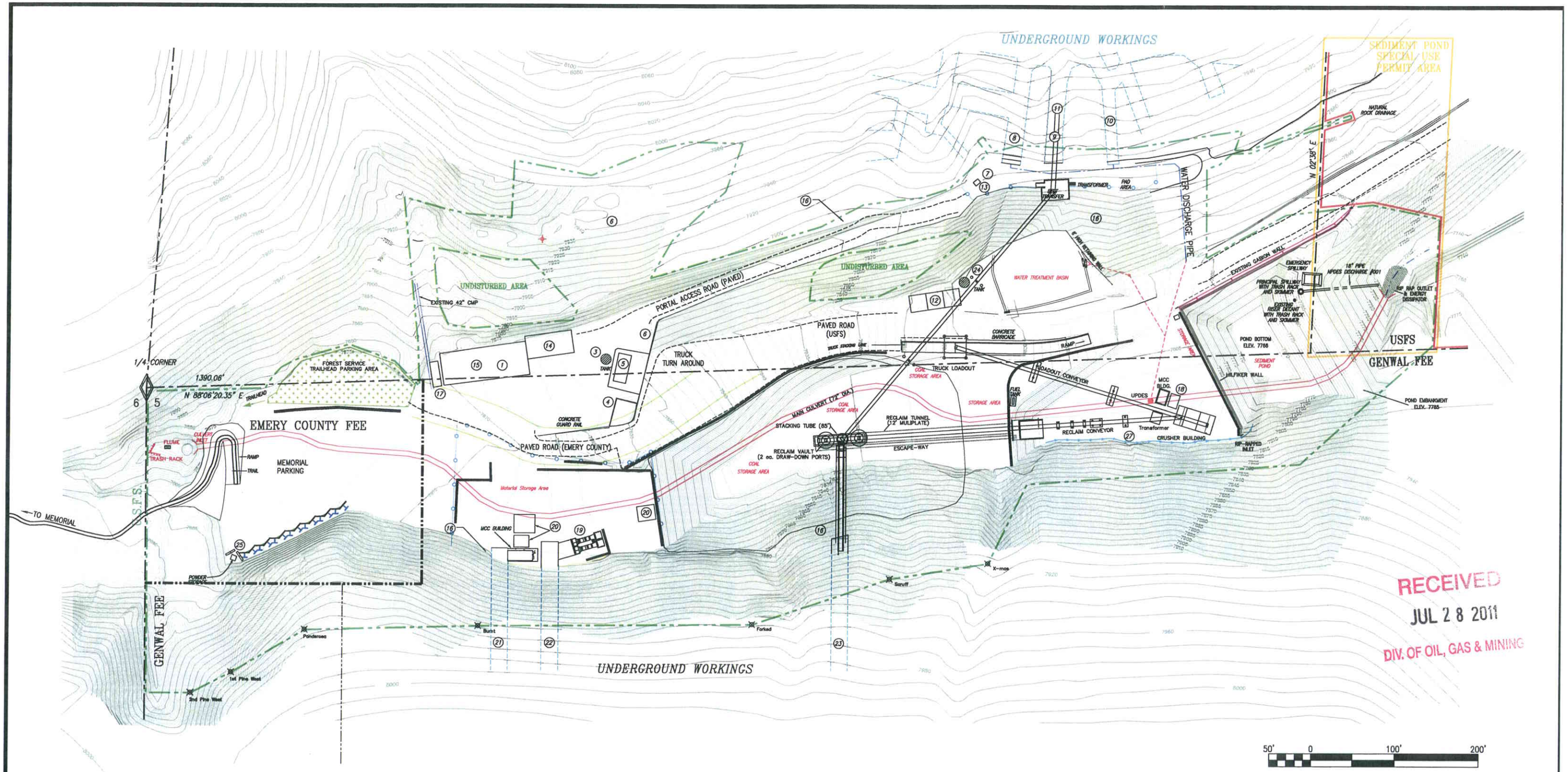
Full Flow Diameter.....	0.70 ft
Full Flow Depth.....	0.70 ft
Velocity.....	4.03 fps
Flow Area.....	0.39 sf
Critical Depth....	0.58 ft
Critical Slope....	0.0295 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	1.56 cfs
QMAX @.94D.....	1.68 cfs
Froude Number.....	FULL

Open Channel Flow Module, Version 3.43 (c) 1991
Haestad Methods, Inc. * 37 Brookside Rd * Waterbury, Ct 06708

DITCH FLOW CALCULATIONS

```
Title of run: MD-1
   Solving for................= Depth Normal
Triangle
   Flow depth (ft)............=    0.33
   First Side slope...........=     1.5
   Second Side slope..........=     1.5
   Slope of diversion.........=  0.7500
   Manning"s n................=   0.035
   CFS........................=    1.56
   Cross section area (sqft)..=    0.16
   Hydrualic radius...........=    0.14
   fps........................=    9.75
   Froude number..............=    4.66
```

PLATES



RECEIVED
JUL 28 2011
DIV. OF OIL, GAS & MINING

LEGEND:

- SEDIMENT POND (SPECIAL USE PERMIT AREA)
- EXTENT OF DISTURBANCE
- 10' CONTOUR
- JERSEY BARRIERS
- RE-ESTABLISHED USFS ROAD (DOUBLE-LANE)
- SAFETY BARRIERS
- FENCING

FACILITY LEGEND:

1. Shop
2. Ventilation Fan
3. Rockdust Silo
4. Concrete Dumpster Pad
5. Power Center
6. Power Pole
7. Offices & Bathhouse (u'grd)
8. Intake Portal
9. Belt Portal
10. Fan Portal
11. Mine Belt
12. Iron Treatment Shed
13. Visual Disconnect
14. New Warehouse and Office Building
15. 4500 Gallon Cullinary Water Tank
16. Shotcrete
17. Parts Shed
18. Portable Shed
19. Ventilation Fan
20. Material Storage Sheds
21. Intake Portal
22. Return Portal
23. Belt Portal
24. Mag Tank
25. Powder Storage
26. Cap Storage
27. Concrete Ditch

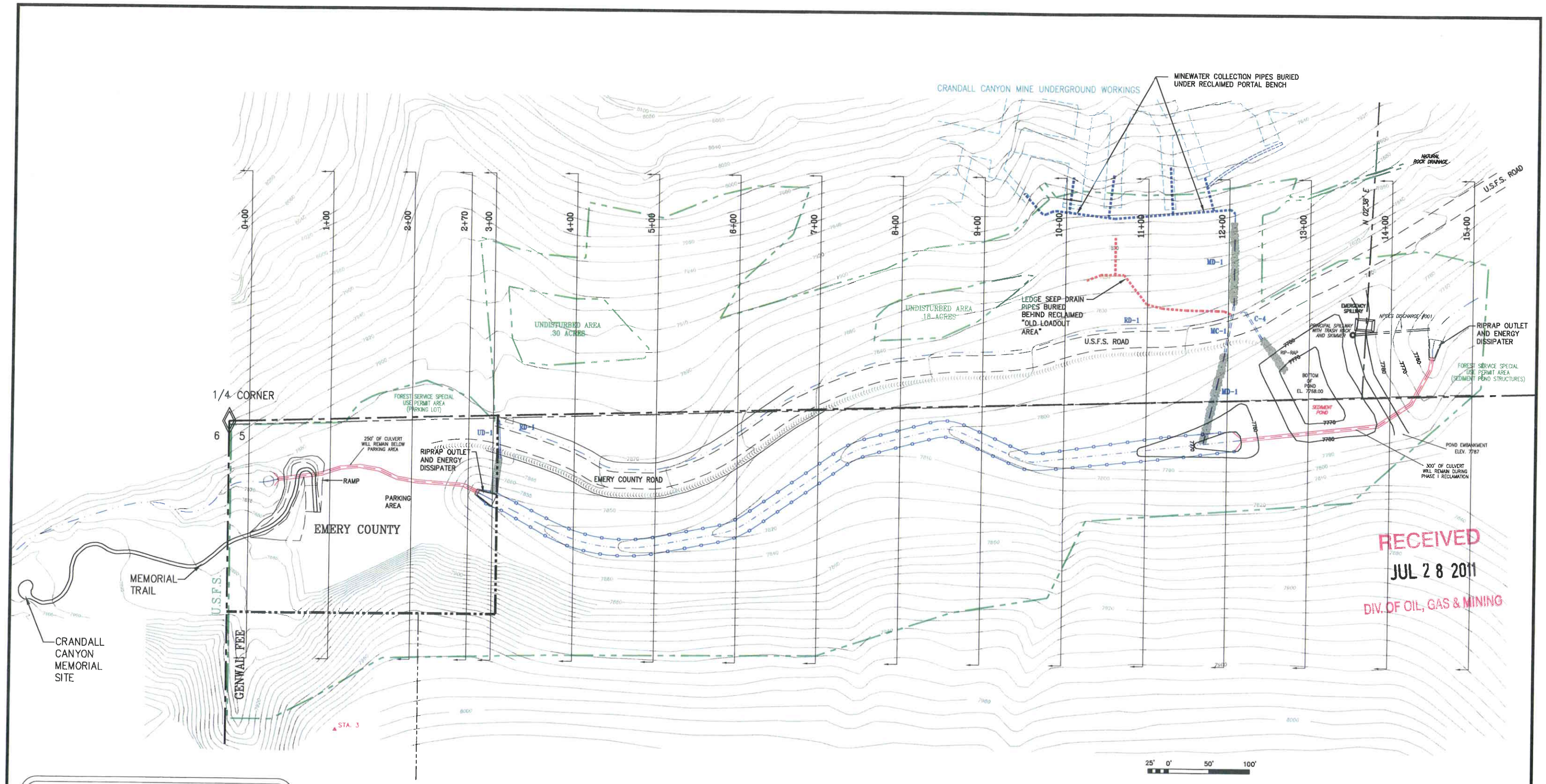
UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 6/30/11

T. 16 S., R. 7 E., SLBM

GENWAL™ RESOURCES, INC.
P.O. Box 1077, 794 North "C" Canyon Rd, Price Utah
Telephone: (435) 888-4000

CRANDALL CANYON MINE
SURFACE FACILITIES

REV: 17	ACAD: 5-3 REV17
DATE: 6/21/11	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5-3



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LEGEND:

- *EXTENT OF DISTURBANCE*
- *10' CONTOUR*
- *CROSS-SECTION*
- *RECLAMATION DIVERSION DITCH* — RD-1
- *BERM*
- *ALTERNATE SEDIMENT CONTROL*
- *6' Ø CULVERT*

CONTOUR INTERVAL = 10'
PHOTOGRAPHY DATE = OCTOBER 25, 1989

NOTE:

1) SEDIMENT POND WILL STAY IN PLACE DURING PHASE I RECLAMATION.

2) STREAM BED WILL BE RETURNED AS IT PRESENTLY EXISTS BELOW MEMORIAL PARKING AREA.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 6/30/11

T. 16 S., R. 7 E., SLBM

GENWAL RESOURCES, INC.
P.O. Box 1420 195 North 100 West Huntington, Utah
Telephone (801) 687-9813

CRANDALL CANYON MINE RECLAMATION (PHASE I)

DRAWN BY:	PJJ	REVISION NUMBER:	9
DATE:	6/21/11	PLATE #:	5-16
SCALE:	AS SHOWN		

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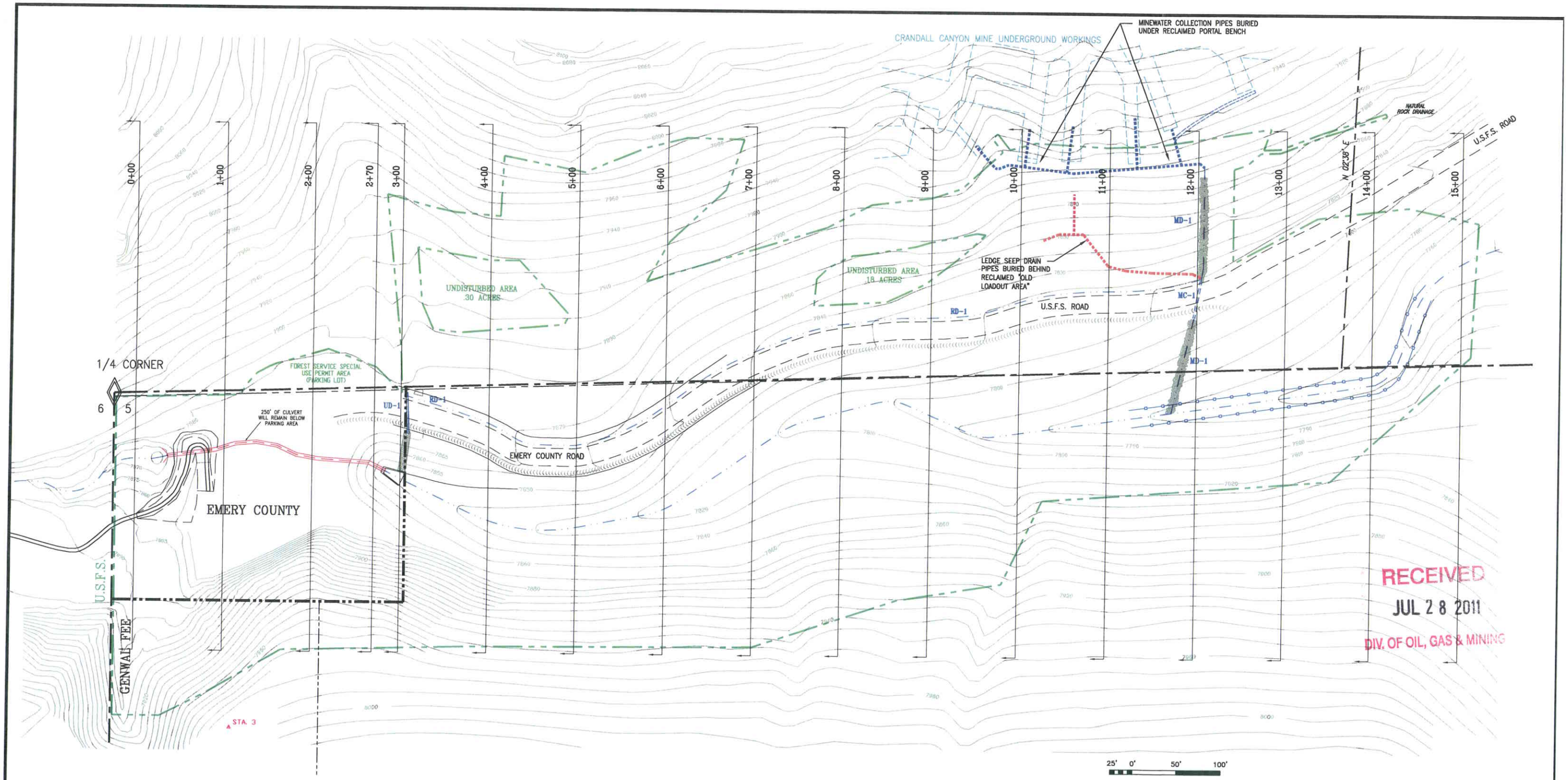

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LEGEND:

- EXTENT OF DISTURBANCE
- 10' CONTOUR
- CROSS-SECTION
- RECLAMATION DIVERSION DITCH — RD-1
- BERM
- ALTERNATE SEDIMENT CONTROL
- 6' ø CULVERT

CONTOUR INTERVAL = 10'
PHOTOGRAPHY DATE = OCTOBER 25, 1989

NOTE:

1) STREAM BED WILL BE RETURNED AS IT PRESENTLY EXISTS BELOW MEMORIAL PARKING AREA.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 6/30/11

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CRANDALL CANYON MINE RECLAMATION (PHASE II)

DRAWN BY:	PJJ	REVISION NUMBER:	9
DATE:	6/21/11	PLATE #:	5-17
SCALE:	AS SHOWN		

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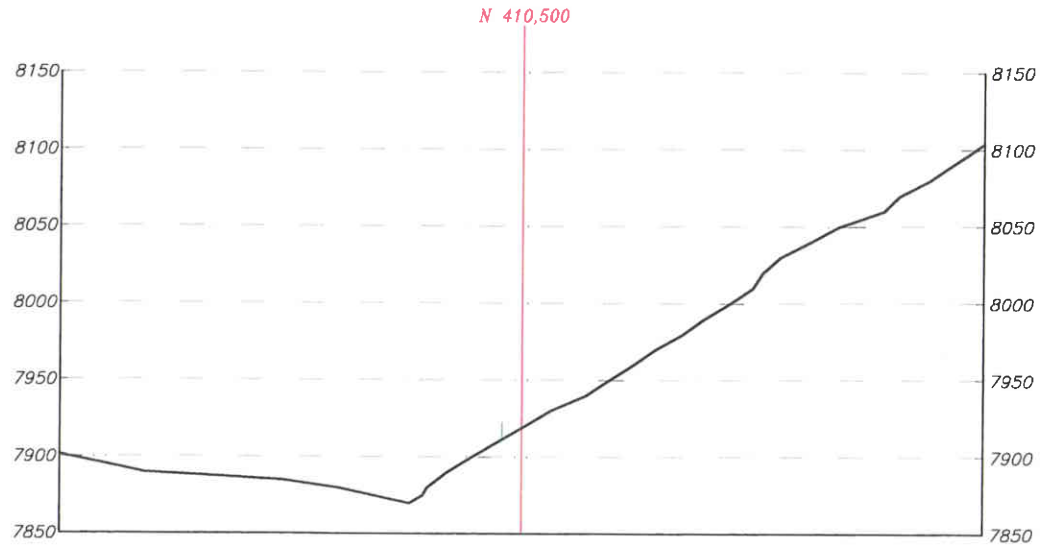

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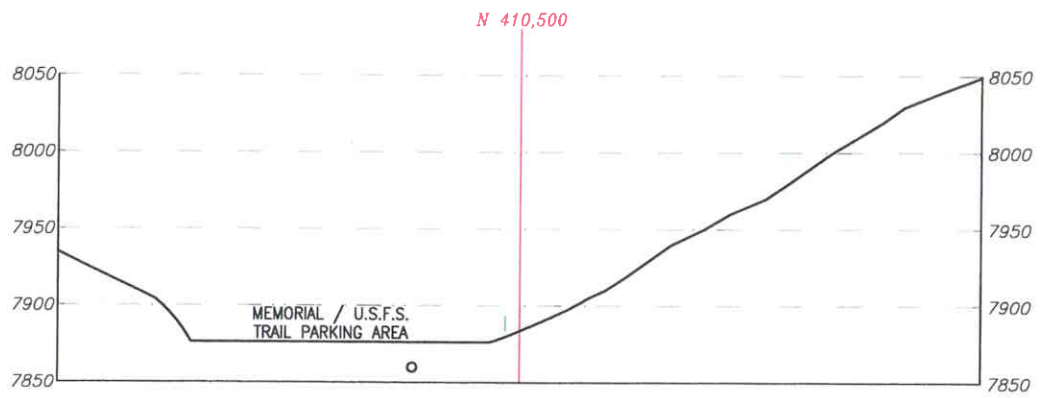

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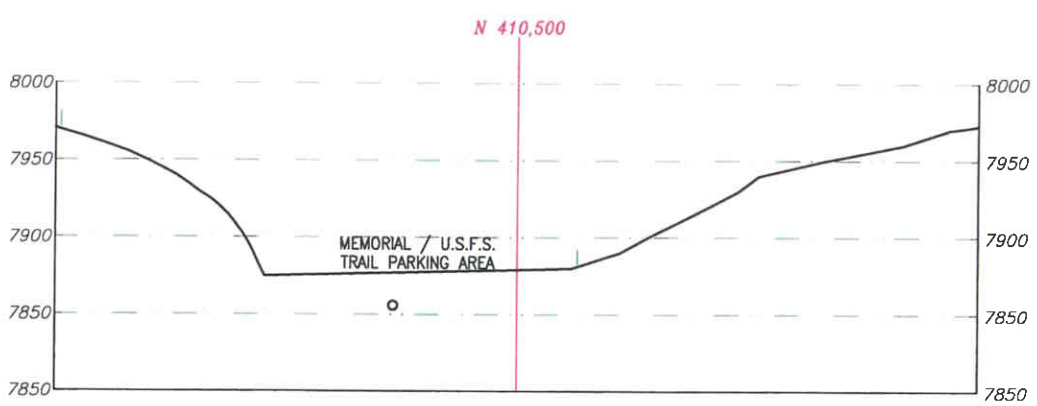

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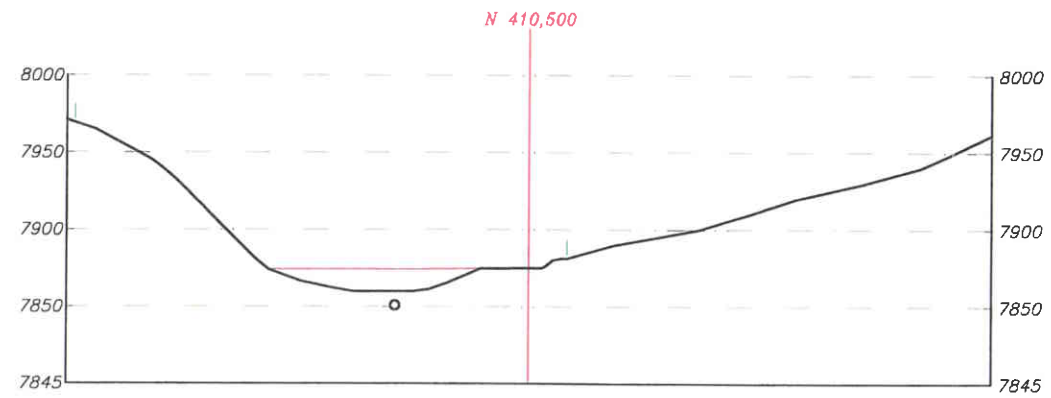

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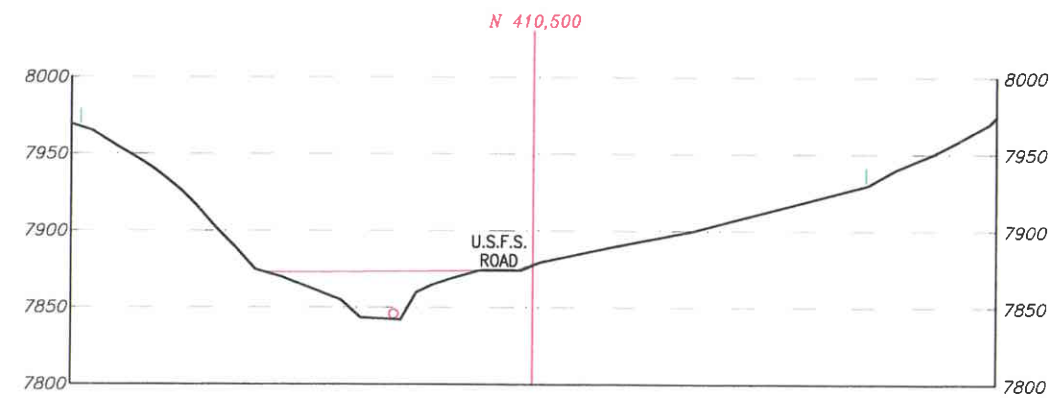

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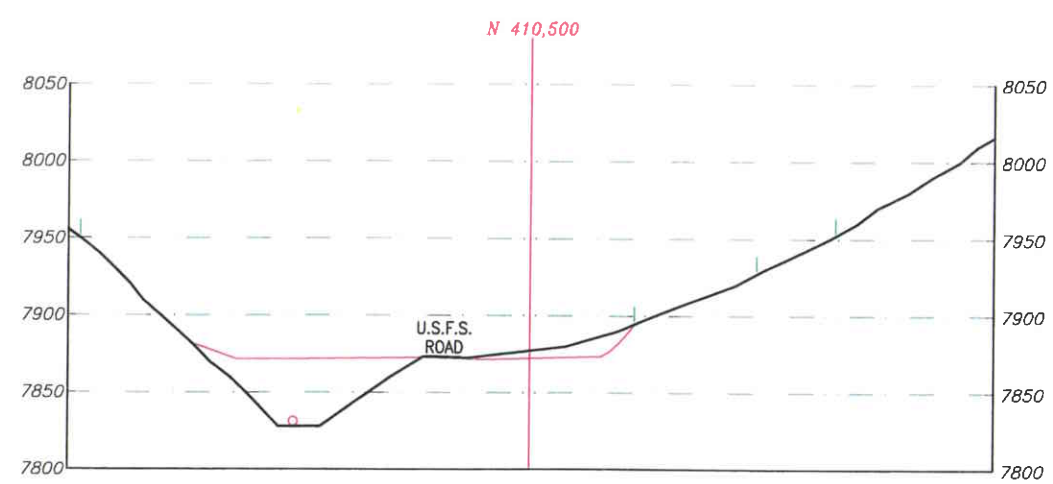

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LEGEND:

- EXTENT OF DISTURBANCE
- EXISTING GRADE LINE (REMOVED IN PHASE I RECLAMATION)
- GRADE LINE (REMOVED IN PHASE II RECLAMATION)
- COMPLETE RECLAIMED GRADE LINE
- MAIN CULVERT (REMOVED IN PHASE I RECLAMATION)
- MAIN CULVERT (REMOVED IN PHASE II RECLAMATION)
- MAIN CULVERT (TO REMAIN AFTER RECLAMATION IS COMPLETE)

NOTES:

1) CROSS-SECTION LOCATIONS ARE SHOWN ON PLATES 5-16 AND 5-17.
2) STREAM BED IS BASED UPON ACTUAL SURVEY.
3) SEDIMENT POND WILL REMAIN IN PLACE THROUGH PHASE I RECLAMATION.

25' 0' 50' 100'

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UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 7/20/11

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Telephone (801) 687-9813

CRANDALL CANYON MINE
RECLAMATION CROSS-SECTIONS

DRAWN BY:	PJJ	REVISION NUMBER:	5
DATE:	6/16/11	PLATE #:	5-17A
SCALE:	AS SHOWN		

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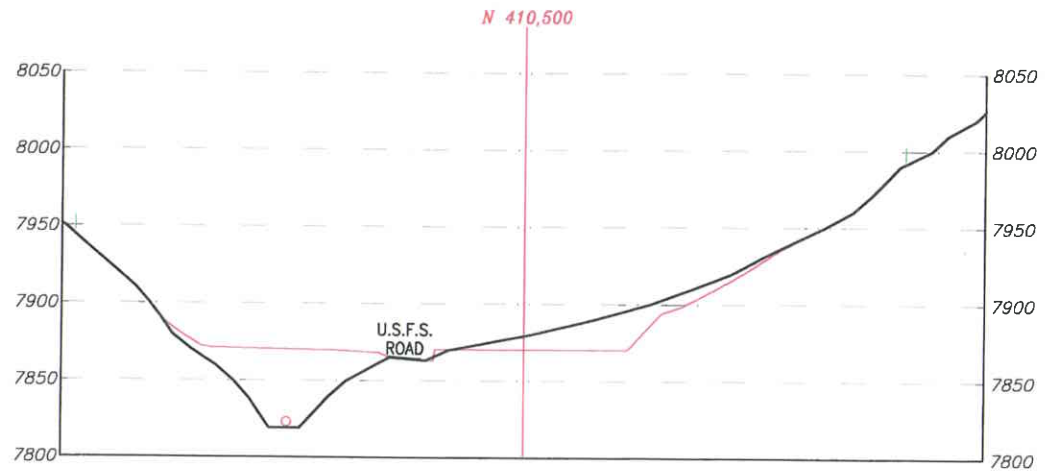

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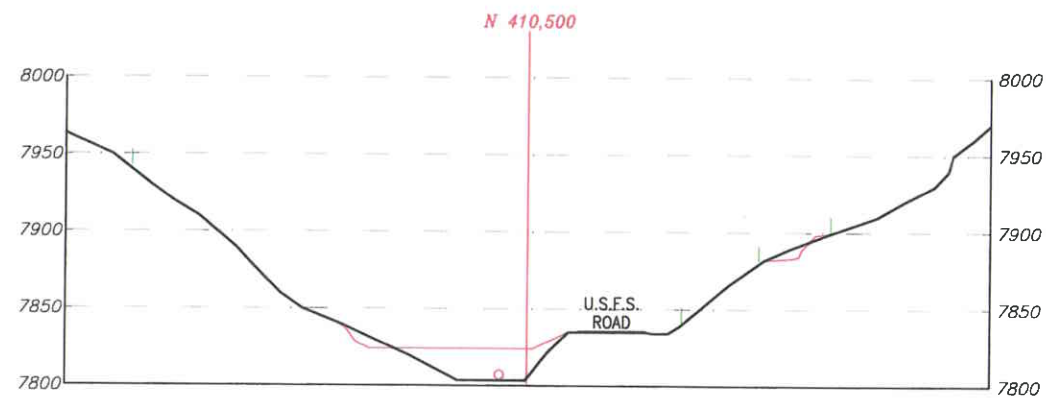

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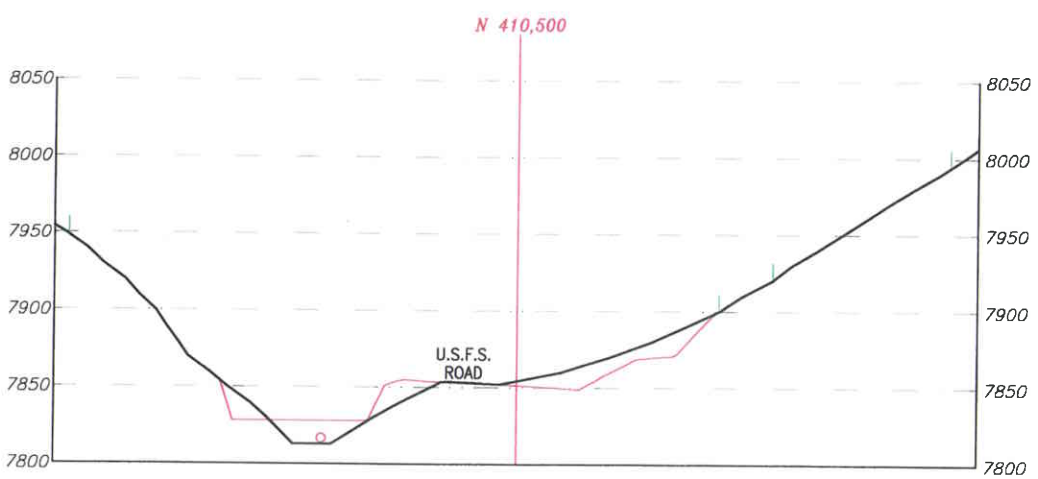

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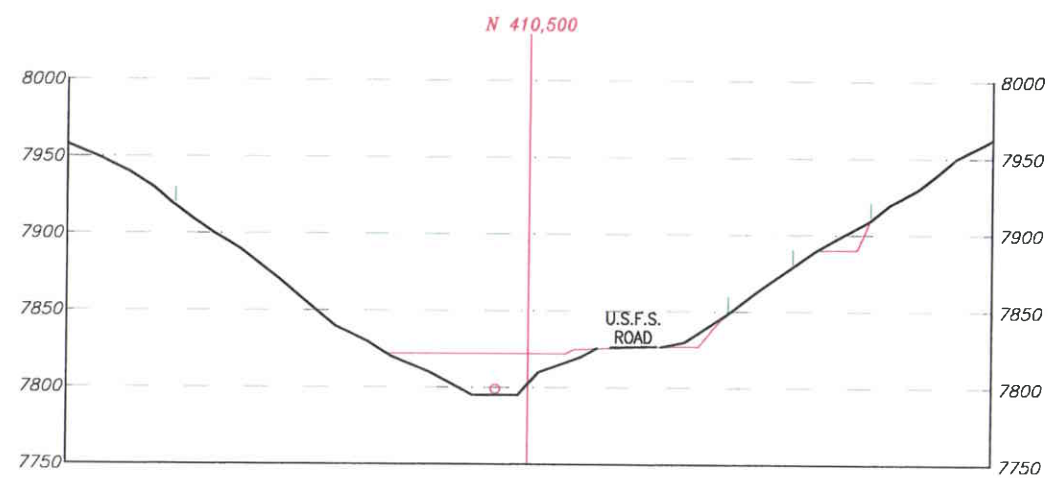

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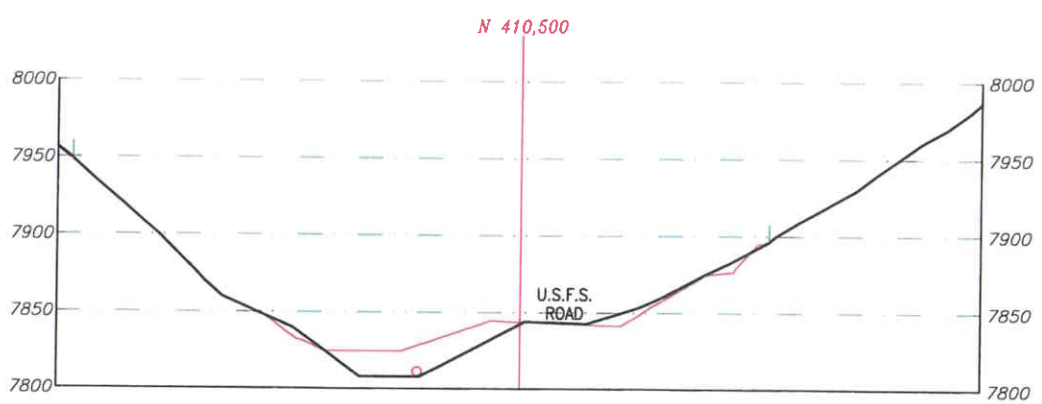

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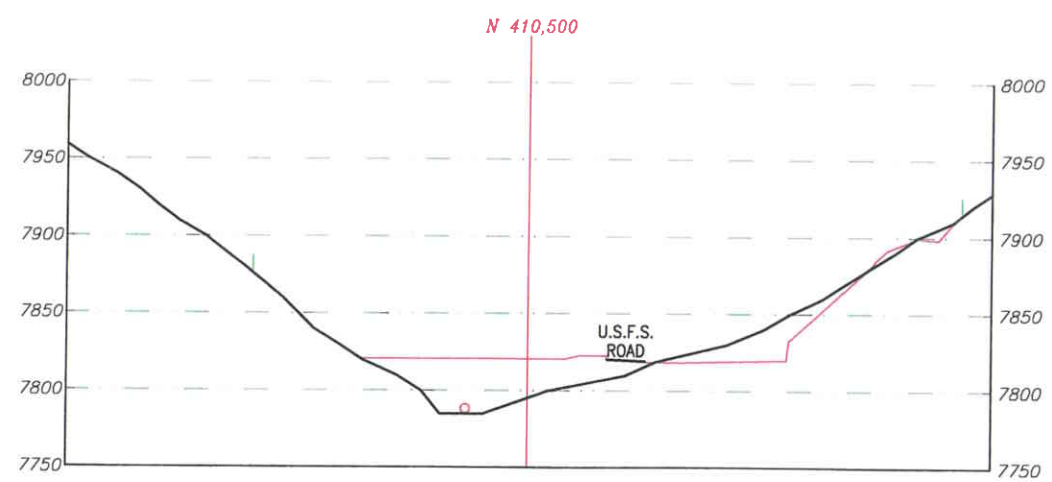


10+00

LEGEND:

- EXTENT OF DISTURBANCE
- EXISTING GRADE LINE (REMOVED IN PHASE I RECLAMATION)
- GRADE LINE (REMOVED IN PHASE II RECLAMATION)
- COMPLETE RECLAIMED GRADE LINE
- MAIN CULVERT (REMOVED IN PHASE I RECLAMATION)
- MAIN CULVERT (REMOVED IN PHASE II RECLAMATION)
- MAIN CULVERT (TO REMAIN AFTER RECLAMATION IS COMPLETE)

NOTES:

1) CROSS-SECTION LOCATIONS ARE SHOWN ON PLATES 5-16 AND 5-17.
2) STREAM BED IS BASED UPON ACTUAL SURVEY.
3) SEDIMENT POND WILL REMAIN IN PLACE THROUGH PHASE I RECLAMATION.

25' 0' 50' 100'

RECEIVED
JUL 28 2011
DIV. OF OIL, GAS & MINING

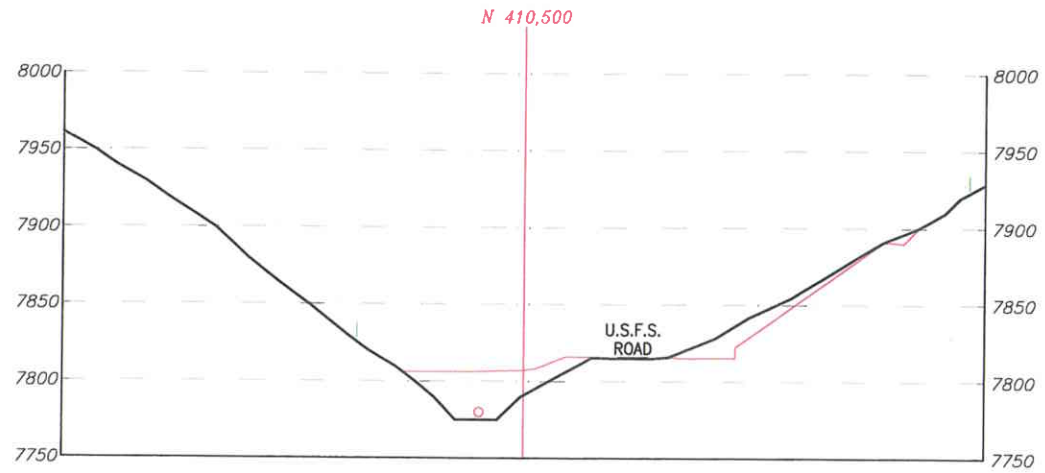
UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs 6/30/11

GENWAL RESOURCES, INC.
P.O. Box 1420 195 North 100 West Huntington, Utah
Telephone (801) 687-9813

CRANDALL CANYON MINE
RECLAMATION CROSS-SECTIONS

DRAWN BY:	PJJ	REVISION NUMBER:	5
DATE:	6/16/11	PLATE #:	5-17B
SCALE:	AS SHOWN		

\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamation\ACAD-PLATE 5-17A-C REV 5.dwg, 5-17B, 6/21/2011 8:50:48 AM



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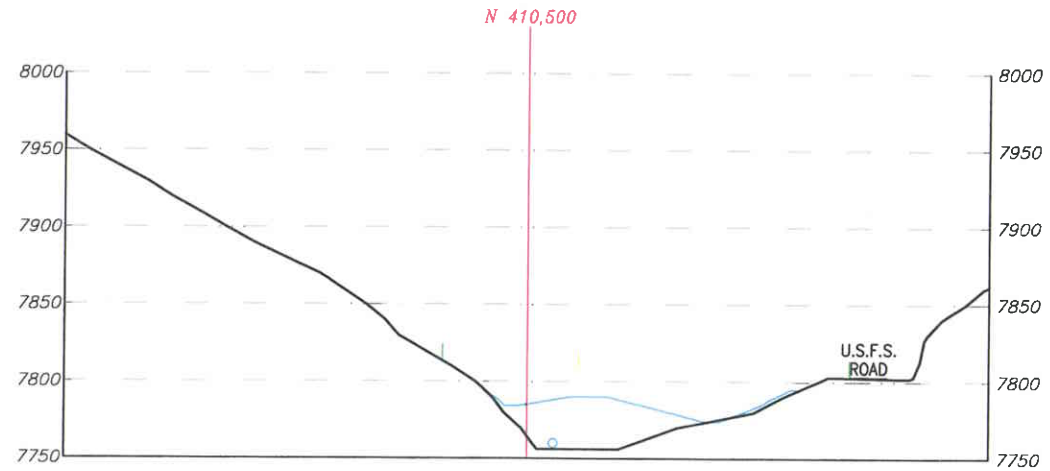

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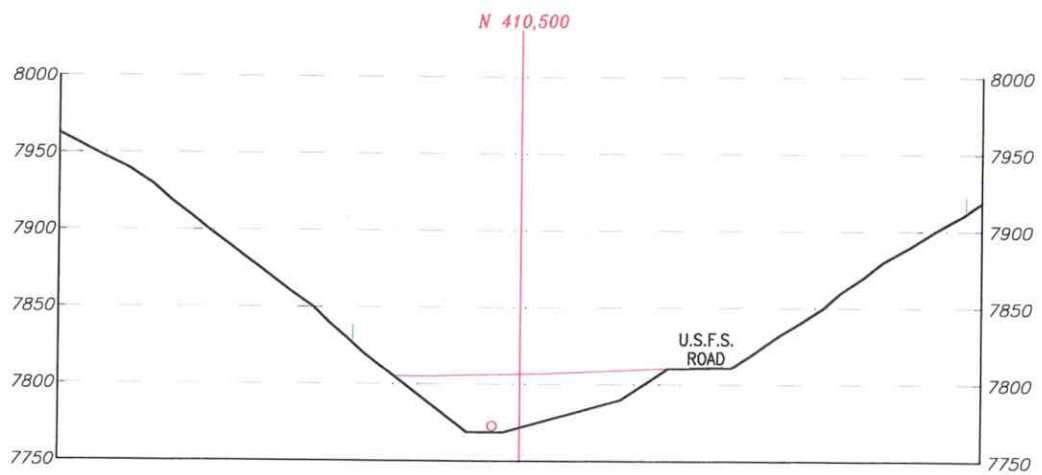

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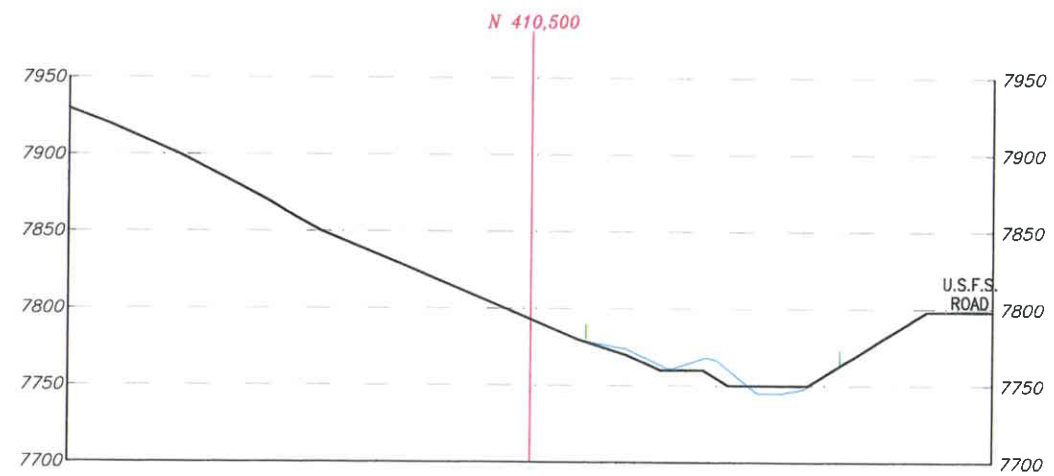

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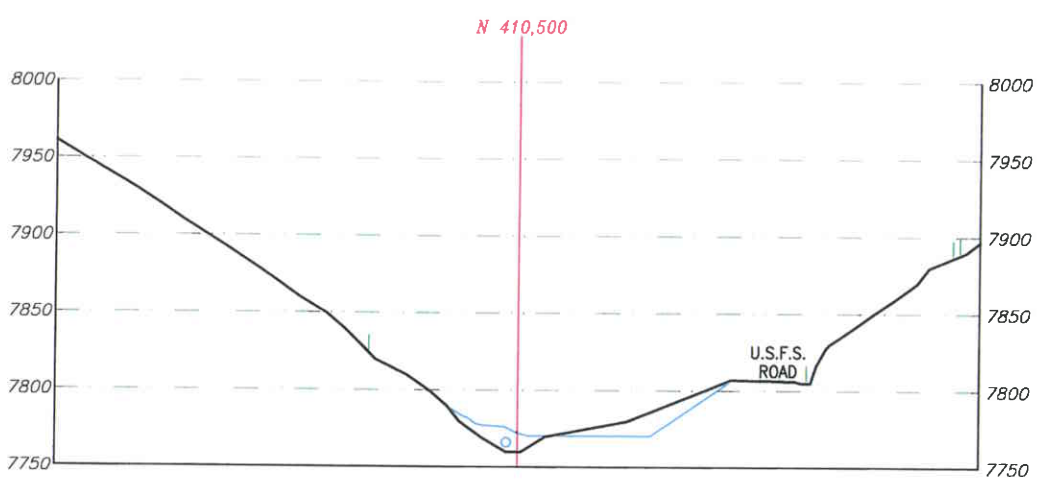

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LEGEND:

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CRANDALL CANYON MINE
RECLAMATION CROSS-SECTIONS

DRAWN BY:	PJJ	REVISION NUMBER:	5
DATE:	6/16/11	PLATE #:	5-17C
SCALE:	AS SHOWN		

\Current Drawings\MRP Maps\Crandall Canyon\Current\CranDall Portal Reclamation\ACAD-PLATE 5-17A-C REV 5.dwg, 5-17C, 6/21/2011 8:50:54 AM