GENWAL™ RESOURCES, INC.

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Utah Division of Oil, Gas & Mining
Utah Coal Program
1594 West North Temple, Suite 1210
Salt Lake City, UT 84114-5801

April 30, 2020

Attn: Steve Christensen
Permit Supervisor
Re: Genwal Resources, Inc. C/015/032
C20-002 Final Reclamation Plan (DO-19B), Deficiencies Task #6049 Response

Dear Mr. Christensen,

Please find attached the application to update the Crandall Canyon MRP to address DO 19-B, and deficiencies Task #6049. The updates include a revised reclamation plan, accounting for continued water discharge from the Crandall Canyon Mine portals. The update also includes a plan to move the UPDES Outfall #002 from its present location at the main bypass culvert for the surface facilities to the west bank of Huntington Creek.

Attached to this letter is a list of the deficiencies noted in a letter from the Division, dated January 30, 2020 that identifies Task #6049. With each individual deficiency, the action taken by Genwal Resources in response to each item in this submittal is listed.

If you have any questions regarding this submittal, please feel free to call me directly at: 435-888-4000.

Thank you for your time and attention.

PJ Jensen
Engineering Technician
Genwal Resources, Inc.

Responses to Individual Deficiencies, Task #6049

1. Right of Entry deficiencies by ADaniels

R645-301-114: The Forest Service Special Use Permit for the proposed mine-water pipeline must be submitted to the Division before approval can be given for the proposed application. This deficiency is repeated from Task 5968.

Genwal Resources has attained the special use permit for the proposed mine water pipeline. The permit is included in this submittal as Appendix 1-19 of the MRP.

2. Legal Description deficiencies by ADaniels

R645-300-141, -301-521: The legal description of the expanded permit area is too general to define its location and must be updated. The legal description must also include all areas disturbed due to coal mining and reclamation activities.

R645-301-521: The disturbed area boundary must include the USFS road from the surface facilities to Huntington Creek, as this road, during reclamation, will be "reduced from a 27 foot subgrade and 22 foot running surface to a 20 foot subgrade and 14 foot running surface" (MRP section 5.42.60).

The legal description for the entire permit area has been revised to include all of the surface facilities (including the pipeline and the USFS road), coal leases, and the rescue drill holes in Chapter 1 of the MRP. The description is now given in lots and section divisions down to 10-acre parcels (1/4 1/4 1/4 of a section). This has expanded the size of the permit area by over 500 acres, but the description has better defined the location of the parcels associated with the mine.

The disturbed area boundary has been expanded to include the pipeline and the USFS road. The new acreage is shown in Chapter 1. Please see Plate 5-3 for the new disturbed area boundary for the surface facilities, less the area for the rescue drill holes. Plate 5-17 details how the disturbed area for the USFS road and for the pipeline have been merged into a single width.

3. Historic and Archeological Resource Information deficiencies by TMiller

R645-301-411: The Permittee must demonstrate current clearances from Manti-La Sal National Forest and SHPO regarding the expanded project area and plan.

During the permitting process by the U.S. Forest Service for the special use permit for the pipeline, Sarah Herrera, with the Forest Service, conducted an archeological survey of the proposed pipeline alignment. The report shows a determination of “No Adverse Effect” pursuant to 36CFR800.5(b), and the project would not alter the characteristics of the cultural resources in the area. A copy of the archeological report and the letter of concurrence for the Utah State

Historic Preservation Office (SHPO) are included in Appendix 5-30, Attachment #7, of this submittal.

4. Fish and Wildlife Resource Information deficiencies by TMiller

R645-301-322: The Permittee must provide updated fish and wildlife resource information related to the proposed project. This information may be provided as part of securing a Special Use Permit from the USFS.

During the permitting process for the special use permit for the pipeline, the USFS prepared wildlife resource reports. The "Wildlife Resources Report" is included in Appendix 5-30 as Attachment #5. The "Biological Assessment and Biological Evaluation (BA/BE)" is included in Appendix 5-30 as Attachment #6. Both reports are public information.

5. Soils Resource Information deficiencies by PBurton

R645-301-222, Provide a soil survey investigation of the proposed pipeline disturbed area. This deficiency is repeated from Task 5968.

R645-301-121.200, Please clarify the discrepancy in proposed disturbed area between Chapter 1, Section 114, page 1-5, Permit Area Table (which states that the pipeline disturbance will affect 1.52 acres, of which 0.95 acres is new disturbance) and Appendix 5-30 pages 1-3 (which describe a disturbed area closer to 3.0 acres).

A Soil Survey was conducted by Environmental Industrial Service (EIS) of the pipeline alignment. A copy of the survey report is included in Appendix 5-30 as Attachment #4.

The discrepancy in the proposed disturbed areas has been resolved. The pipeline has a temporary USFS permit boundary of twenty (20) feet, centered on the pipeline, for construction purposes. The disturbed boundary line has been clarified as the outermost extension of the temporary USFS permit boundary and extends to the opposite side of the roadway for reclamation of the roadway. As the two individual disturbed boundaries (pipeline and roadway) overlap, they were combined to a single width. Please see Plate 5-17 for details of the disturbed boundary along the pipeline and roadway. The disturbed area tabulation in Chapter 1 shows the corrected disturbed area acreages.

6. Topsoil and Subsoil deficiencies by PBurton

R645-301-232, Based upon the soil survey, please describe the topsoil and subsoil removal.

R645-301-234, Please state whether pipeline soils will be promptly redistributed or whether soils will be stockpiled during construction.

R645-301-234.240, Please state whether topsoil stockpile #4 will be moved, since on Dwg 2-3 it appears to be in the path of the pipeline.

Based upon the soils survey conducted by EIS (Appendix 5-30, Attachment #4) and recommendations made by the US Forest Service, six (6) to twelve (12) inches of topsoil, more if

encountered, will be removed during construction of the pipeline. The subsoil will then be removed to the required depth for the pipeline or its components.

Once the pipeline is positioned within the trench, the trench will be backfilled and compacted as soon as possible. Topsoil will then be applied as soon as possible, and interim seeding applied (see Appendix 5-30). Most topsoil along the length of the pipeline will be applied as soon as is possible. Topsoil for larger, single elements of the pipeline (i.e. energy dissipater and manholes) will need to be stockpiled for a short time as concrete needs time to cure. An area at the surface facilities within the truck turn-around has been designated for any topsoil storage associated with the pipeline (see Plate 5-3a). Stockpiled topsoil will be applied to subsoils as soon as possible and interim seeding applied. Please see Appendix 5-30 for more information.

Topsoil Pile #4 is not anticipated to be moved or disturbed during the construction of the pipeline. However, in the event that it is disturbed, the topsoil will be segregated, stored, and reapplied to the stockpile as soon as possible according to the actions detailed in Appendix 5-30, including interim seeding.

7. Road System Plans and Drawings deficiencies by JEatchel

R645-301-527.200, R645-301-534.140: The Permittee must commit to a definite plan for the reclamation of Forest Service road 50248. Should asphalt be stripped from the current road surface, the Permittee must describe how this will be achieved (i.e. the labor and machinery required, and plans for stabilization post removal, etc.). Permittee must also ensure that asphalt removal along FR 0248 is accounted for within the reclamation bond.

Genwal Resources has committed to remove the asphalt paving from Forest Service Road #50248 as required by the Forest Service Road. The asphalt paving will be removed and the roadway will be narrowed. Please see Appendix 5-22 for more information. The asphalt removal and roadway reclamation are included within the revised bond calculations attached to this submittal.

8. Road Performance Standards deficiencies by JEatchel

R645-301-527.210 - 527.230: Permittee must provide a maintenance plan describing how the pipeline will be maintained throughout its use until such time that ownership of the pipeline is transferred to a third party.

The pipeline will require very little to no maintenance due to its chemical composition and construction. Also, the pipeline will not operate under pressure, and will act essentially as a closed ditch. However, maintenance information is included in Appendix 5-30.

Additionally, Genwal Resources has been discussing the pipeline with third parties regarding the transfer of ownership upon final reclamation of the mine site. Multiple parties have shown interest in the acquisition of the water and the pipeline. However, due to current uncertainties as to exactly when the pipeline will be constructed, nothing has been established in writing at this time. Once the details of the pipeline installation are confirmed and a contract is signed, a copy of that contract will be provided to the Division.

9. Hydro Surface Water Monitoring deficiencies by ADaniels

R645-301-731.220: The Permittee must provide an updated Surface Water Monitoring Plan, including update relevant maps, to include monitoring of Huntington Creek that would detect impacts from the proposed relocated mine-water discharge point. This would include monitoring points on Huntington Creek above and below the pipeline discharge point. This deficiency is carried over from Task 5968.

The Surface Water Monitoring Plan has been revised to accommodate the proposed pipeline (included Chapter 7 of the MRP). Two (2) new water monitoring locations have been added to Huntington Creek. One location is just above the proposed discharge location to sample water quality prior to the discharge water entering the stream. The second location has been added, which is several hundred feet below the proposed discharge location, in order to give the discharge water time to mix with the water in Huntington Creek to determine the impacts of the new discharged water on the water quality of Huntington Creek. The locations of the new monitoring points are shown on Plates 7-12 and 7-18 as HC-AP (Huntington Creek Above the Pipeline) and HC-BP (Huntington Creek Below the Pipeline).

10. Hydrologic Water Quality Standards

R645-301-751: The Permittee must provide the Division a revised UPDES permit for the proposed discharge location of the mine-water pipeline. This deficiency is carried over from Task 5968.

The revised UPDES permit is currently in the public comment period. A copy of the Public Notice Letter from the Department of Environmental Quality is attached to this submittal. A draft copy of the revised UPDES permit is also attached to this submittal, as the final permit is not yet available. Once the public comment period has passed and the permit finalized, a copy of the revised UPDES permit will be provided to the Division.

11. Hydrologic Diversion General deficiencies by ADaniels

R645-301-742.312: The Permittee must provide engineering justification for the removal and placement of vents along the length of the pipeline.

R645-301-742.312: The Permittee must justify the proposed section of pipeline being 3.5 feet deep in sections with bedrock to ensure there won't be problems with freezing temperatures causing damage.

R645-301-742.312: The site specific design of the discharge structures for the pipeline (i.e. riprap sizing and placement) must be submitted to the Division for review and approval.

High spots within the pipeline will not be accepted; and since the pipeline will not be operating full or under pressure, it will essentially act as a closed ditch. The pipe within the manholes will not be contiguous to allow for inspection of the water flow and to admit air to enter the pipeline as needed. Thus, the vented manhole covers will provide adequate venting of the pipeline. The removal of the vents along the length of the pipeline is discussed in Appendix 5-30, Attachment #1.

The pipeline is intended to be placed a minimum of 5.0 feet below grade along the length of the pipeline in order to lie below the frost depth at this elevation, except near the outfall location on the bank of Huntington Creek. References to a depth of 3.5 feet have been removed from Appendix 5-30.

The riprap sizing and placement at the pipe discharge location are discussed in Appendix 5-30, Attachment #1. The appropriate drawings and details have been revised accordingly.

12. Hydrologic Stream Buffer Zones deficiencies by ADaniels

R645-301-731.600: A detailed plan, including design drawings, must be submitted that ensures that the quantity or quality of Huntington Creek waters will be protected during the installation of the discharge structure. This includes a drawing indicating the placement of specified sediment control features.This deficiency is carried over from Task 5968.

A new plate has been attached to Appendix 5-30 that shows the sediment control plan at the discharge location on the bank of Huntington Creek. Control measures include straw bale barriers, fiber roll check dams, silt fences, and a turbidity curtain to be installed within Huntington Creek to protect the water quality within Huntington Creek. Sediment control device plans along the Forest Service Road (Crandall Canyon Road) are also included on the plate. Please see Appendix 5-30 for further discussion.

13. Hydrologic Sediment Control Measures deficiencies by ADaniels

R645-301-732.100: Sediment control measures for the installation of the pipeline, its outfall structures, and all other reclamation work must be clearly defined in the MRP and be detailed on design drawings. This deficiency is carried over from Task 5968.

Sediment control measures for the installation of the pipeline and its outfall structures are discussed in Appendix 5-30. Plate 5-30-3c details sediment control measures at the outfall structures and along the Forest Service Road during and after the construction of the proposed pipeline. Other reclamation work is also discussed in Appendix 5-30.

14. Reclamation Plan – General Requirements deficiencies by JEatchel

R645-301-541.100,-541.400, -542.500, and -121.200: The Permittee must clarify the following inconsistencies within Appendix 5-22:

- *Add discussion of when or how a 40-foot headwall is removed at the head of Crandall Creek once the 72" culvert and underdrain system are removed in the later stages of reclamation as proposed on pages 18 and 19.*

- *Elaborate on where newly paved roads will be constructed, and include a map showing where new asphalt may be constructed and existing asphalt repaired. The reclamation bond must cover the costs associated with constructing new sections of asphalt road as well as repairs to sections of existing asphalt paving as claimed on page 29.*

- *The following items in Appendix 5-22 must be addressed in the reclamation bond: sediment structures such as Excelsior logs, check dams, etc. (PDF page 121), the use of fertilizers, inoculum, and polyacrylamide soil amendments (PDF page 132), and the use of excessive labor to hand rake amendments into the newly laid topsoil (PDF pages 132, 133).*

The 40-foot headwall discussion has been removed from Appendix 5-22. However, the existing inlet structure and approximately 150 feet of the 72" diameter culvert will remain after final reclamation is complete. The Memorandum of Understanding (MOU) between Emery County and Genwal Resources requires a section of the culvert and a portion of the existing material storage area to remain as access to the memorial to the fallen miners that lies westward and up-canyon from the surface facilities. Please see Appendix 5-27 for the MOU. The remaining culvert and pad area are shown on Plate 5-17.

The alignment of the proposed pipeline discussed in Appendix 5-30 has been realigned so it will no longer disturb any existing asphalt paving. Therefore, no new asphalt paving will be installed in relation to the pipeline. However, the existing asphalt paving within the Forest Service Road #50248 (Crandall Canyon Road) will be removed during final reclamation (see Appendix 5-22). Bonding for the removal of the asphalt paving and reclamation of the road is included within the new bond calculations included in this submittal.

The reclamation bond calculations have been revised, and are included in this submittal, to cover sediment control structures, fertilizers, soil amendments, and hand labor for final reclamation.

15. Wildlife Protection deficiencies by TMiller

R645-301-342: The amendment must include the placement of a fish barrier in Crandall Creek. The barrier must be at least 6 feet tall and designed in order to prevent pooling at its base.

A fish barrier is included within the reclamation plan (Appendix 5-22). The proposed location of the barrier is shown on Plate 5-17. Details of the construction of the barrier are shown on Plate 5-21. The barrier is proposed to consist of a rock retaining wall with a minimum six (6) feet in height, with a concrete slab at its base to prevent water pooling.

16. Backfill and Grading General deficiencies by JEatchel

R645-301-553 and R645-301-121.200: The Permittee must provide a cut/fill table that explains the earthwork volumes for all reclamation surfaces within the permit. Table 5-20-10 that is continually cited within the narrative is not found anywhere in this submittal. Additionally, the Permittee must elaborate on where the excess 20,410 yds.^{3} will be disposed of.

The reclamation contours on Plate 5-17 have been reworked. New profile sections were added so profiles are now drawn at fifty (50) foot intervals, in lieu of the previous 100-foot distances. Based upon the new profiles, a cut and fill table has been generated, and is shown on Plate 5-17a. Appendix 5-22 explains in detail how the cut and fill volumes were determined. Also, references to Table 5-20-10 have been removed from the text.

According to the cut/fill table, the estimated excess material is approximately 57,991 cubic yards of material. Excess material will be removed and taken off-site. This excess material will be removed from the site and hauled to another property owned by the Permittee. The attached bonding calculations have been adjusted to accommodate the haulage of this material.

17. Mine Openings deficiencies by JEatchel

R645-301-529: The Permittee must provide design drawings to accompany the narrative provided on page 5-47 and Appendix 5-22 that describes permanent closure of all portals within the permit area.

Portal closure details are provided on Plate 5-17 included in this submittal. The portals will be sealed in accordance with the Mine Safety and Health Administration's (MSHA) requirements. The outside face of each seal will be located approximately thirty (30) feet within each portal. The portal will then be backfilled and compacted to create an earthen plug that does not comprise the integrity of the portal seal. The backfill will receive topsoil and vegetation per the reclamation plan in Appendix 5-22.

18. Topsoil and Subsoil deficiencies by PBurton

R645-301-240, (1) All topsoil and non-topsoiled areas called out on the table in Chapter 2, Section 2.42 must be illustrated on Figure 1 of Appendix 5-22. (2) The boundary of the Forest Road on Figure 1 should match that described in Section 2 of Appendix 5-22, because there is no topsoil and no revegetation of the Forest Road. (3) The amendment must describe reclamation of the disturbed pipeline soils.

R645-301-121.200 and R645-301-122, Provide Figure 8C which is referenced in a footnote to the Genwal Disturbed Acreage table on page 1-10 of chapter 1 or if this reference is no longer valid, delete the reference. This deficiency is repeated from Task 5968.

1) Figure 1 of Appendix 5-22 has been revised to reflect the reference areas described in Chapter 2 of the MRP.

2) The disturbed area boundary has been revised to include the proposed pipeline and the Forest Service Road #50248 (Crandall Canyon Road). Plate 5-3 depicts the entirety of the disturbed area boundary. The tables within Chapter 2 of the MRP have been revised to reflect the new disturbed acreage. The Forest Service Road will receive topsoil along the side of the road that is reclaimed as described in Appendix 5-22, and depicted on Plate 5-17.

3) The reclamation of the disturbed pipeline is described in Appendix 5-30. In short, as the trench for the pipeline is dug, the pipeline installation will follow as quickly as possible. The trench will then be filled as soon as is possible behind the pipe installation. The removed topsoil will then be applied as soon as is possible afterward, and interim seeding applied as soon as possible. The plan is to reclaim the pipeline disturbed areas as quickly as can be accomplished.

Figure 8c, "Reclamation Topsoil Distribution Map," is attached to Chapter 2 within this submittal. This figure also includes the "Disturbed Area / Reclamation Topsoil Amounts

Tabulation,' which details the amount of topsoil to be applied to each reference area. The table also describes the total disturbed area for each reference area described in Chapter 2 of the MRP.

19. Hydrological Information Reclamation Plan deficiencies by ADaniels

R645-301-763.100: The Permittee must provide justification through soil loss modeling or similar analysis that the proposed reclamation work and timing of the removal of the sediment pond will prevent additional suspended solids from leaving the permit area throughout the reclamation work and until the disturbed area has been stabilized and revegetated. This deficiency is carried over from Task 5968.

Genwal Resources proposes the use of deep gouging (pocking) as a method to prevent additional suspended solid from leaving the permit area through the reclamation work. This method uses a series of small pits (pocks) that will be dug within the newly topsoiled grades to capture precipitation and sediment. These pocks will remain after final reclamation is complete to help stabilize the slopes, and capture precipitation to assist vegetation growth. Silt fences will also be installed as temporary sediment control structures to better prevent suspended solids from leaving the disturbed area. The full discussion regarding sediment control can be found in Appendix 5-22.

20. Revegetation General Requirements deficiencies by TMiller

R645-301-353: The Permittee must provide a plan for the revegetation of the disturbed area left behind from the reduction in width of the Forest Service Road.

The revegetation plan for the Forest Service Road is included in Appendix 5-22. The road will be narrowed per the requirements of the Forest Service at final reclamation. The relinquished area of the roadway that will remain unfinished after the narrowing of the road will receive topsoil and vegetation according to Appendix 5-22. Plate 5-17 depicts the typical reclamation of the roadway.

21. Revegetation Timing deficiencies by TMiller

R645-301-354: The Permittee must alter, or provide justification for, the timeline of revegetation of the South Slope of the Expansion Area

The revegetation time table of the South Slope of the Expansion Area has been modified. In lieu of receiving final vegetation along the South Slope as the Expansion Area fill is removed, the slope will now receive interim vegetation until final vegetation procedures are enacted in the fall. Please refer to Appendix 5-22 for further discussion.

22. Stabilization of Surface Areas deficiencies by PBurton

R645-301-244.200, (1) The Appendix 5-22 Reclamation Time Table shows the redistributed topsoil will not be seeded for a month or more after placement. Therefore, erosion control must be provided for all reclaimed areas as they are completed and measures must be taken to loosen the topsoiled surface before seeding. This deficiency is repeated from Task 5968. (2) The plan should

describe pocking for erosion control on recontoured and fill slopes, because it is recognized as the best technology currently available.

R645-301-121.200, The statement made on the first page of Appendix 5-22 Crandall Canyon Mine Site Reclamation Plan (Reclamation Plan) is not accurate, because it states, "The final step of reclamation, revegetation, for all the areas will not be done until the fall." However, Appendix 5-22 Reclamation time table shows that revegetation of the South slope expansion area will begin in June. Therefore, please remove or modify the global statement in Appendix 5-22 Final Reclamation (page 3) regarding timing of revegetation.

The Reclamation Time Table has been revised, as have the procedures for topsoil handling. Genwal Resources proposes to utilize pocking on recontoured and filled slopes as a method of erosion and sediment control. The practice will also provide moisture retainment for vegetation. Furthermore, areas that will see a longer time period between topsoil preparation and final vegetation, such as the South Slope of the Expansion Area, will receive hay mulch and interim seeding to protect the soil until final vegetation and mulch can be administered.

The global statement regarding vegetation for all areas occurring in the fall is now correct. The South Slope of the Expansion Area will receiving hydroseed and hydromulch in the fall, as will the remainder of the reclaimed areas. However, as the topsoil along the Expansion Area is exposed, interim seeding and hay mulch will be applied. Please see Appendix 5-22 for further discussion.

23. Bonding Determination Amount deficiencies by JEatchel

R645-301-830, R645-301-542.800: Permittee must provide an updated reclamation bond that addresses the costs associated with the following items outlined in the recently submitted reclamation plan:

- *The construction of the backfilled drainage system in the Old Loadout area.*
- *The construction of the pedestrian footbridge spanning Crandall Creek to access the Miner's Memorial.*
- *The haulage and disposal of excess expansion area fill off-site.*
- *The cleanup and disposal of accumulated iron sludge within the mine water treatment pond.*
- *The construction and long term operation and maintenance of the proposed pipeline redirecting mine drainage from the north portals to Huntington Creek.*
- *The demolition and disposal of asphalt from FR 0248 as per stipulations contained within the USFS Special Use Permit.*
- *Enhanced earthwork techniques (topsoil pocking) to address sediment control in the latter stages of reclamation.*
- *The installation of sediment structures such as Excelsior logs, check dams, etc. as stated on pages 18 and 19 of Appendix 5-22.*
- *The construction of new asphalt roads as well as repairs to the existing*

asphalt road as stated on pages 28 and 29 of Appendix 5-22.

- *The use of soil amendments (PAM, inoculum, and fertilizers) on page 19 of Appendix 5-22.*
- *The use of additional labor to hand rake amendments into the topsoil in the latter stages of reclamation as stated on pages 19 and 20 of Appendix 5-22.*

These items were addressed in the previous bonding deficiency (Task #5968) but not adequately resolved.

The bonding calculations have been revised and are included in this submittal. The above-referenced item have been addressed within the revised bond calculations.

APPLICATION FOR PERMIT PROCESSING

Permit Change X	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: ACT/015/032
Title of Proposal: C20-002 Crandall Canyon Final Reclamation Plan						Mine: Crandall Canyon Mine
						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*

☐ Yes	☐ No	1. Change in the size of the Permit Area? 592.14 acres Disturbed Area? 8.58 acres X increase ☐ decrease
☐ Yes	☐ No	2. Is the application submitted as a result of a Division Order? DO # DO19-B
☐ 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? (Modification of R2P2?)
☐ 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?

X Attach 1 complete digital copy of the application and maps.

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.

Signed / Karin Madsen / Environmental Permitting Engineer / Date
Name Position

Subscribed and sworn to before me this 29th day of April 20 20

Stacy M Headley
Notary Public

My Commission Expires: 1/9 20 23
Attest: STATE OF Utah
COUNTY OF Carbon

STACY M HEADLEY
NOTARY PUBLIC
STATE OF UTAH
COMMISSION # 703969
COMM. EXP. 01/09/2023

Received by Oil, Gas & Mining

ASSIGNED TRACKING NUMBER

Application for Permit Processing
Detailed Schedule of Changes to the MRP

C20-002 Crandall Canyon Final Reclamation Plan	Permit Number: ACT/015/032 Mine: Crandall Canyon Mine Permittee: Genwal Resources, Inc.

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.**

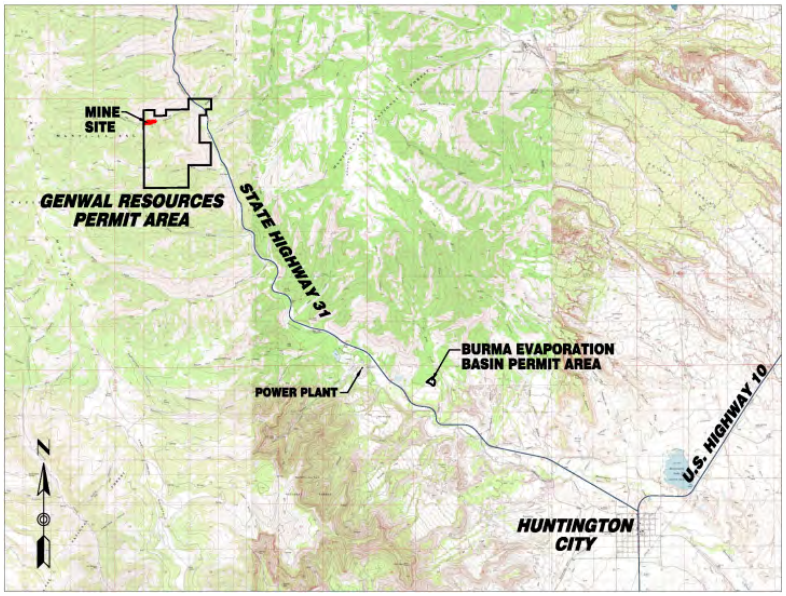
			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☐ REPLACE	☐ REMOVE	Plates: 1-1 Lease Map 1-1A Permit Areas 1-2 Disturbed Areas 2-3 Stockpile Locations 2-6 Regional Soils 3-1A Wildlife-Moose 3-1B Wildlife-Elk 3-1C Wildlife-Deer 3-2 Vegetation 4-1 Land Use 4-2 Land Use 4-3 Oil and Gas 4-4 Surface Ownership 5-5 Subsidence Monitoring 6-1 Geology 7-5 Drainage 7-12 Seep and Springs 7-14 Groundwater Rights 7-15 Surface Water Rights 7-18 Water Sites
☐ ADD	☐ REPLACE	☐ REMOVE	5-3 Overall Surface Facilities 5-3A Enlarged Surface Facilities 5-16 Sediment Control Details 5-17 Reclamation Contours 5-17A Reclamation Profiles 5-22 Fish Barrier Plan and Details
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 1-19 USFS Permit for Water Pipeline Appendix 5-21 Crandall Canyon Mine Site Reclamation Plan Appendix 5-30 Relocation of UPDES Outfall 002 to Huntington Creek
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 5 Pages: v, vi, ix, 3, 5, 6, 6a, 8, 11, 12, 13, 14, 16, 17, 19, 21, 22, 23, 24, 25, 26, 28, 29, 30d, 31, 32, 33, 34, 35, 39, 40, 42-47, and 50.
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 1 pages: i-iii, 5-12
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 2 pages: i-ii, v, 1, 5, 7, 8, 12-19, all figures
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 7 (all)
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 5-27 (all)
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 5-28(all)
☐ ADD	☐ REPLACE	☐ REMOVE	Bonding (complete)

PUBLIC NOTICE FOR REVISION TO FINAL RECLAMATION PLAN

PRINCESS/CRANDALL CANYON MINES

MILEPOST 33 HWY 31
HUNTINGTON, UT 84520
P. O. BOX 910
EAST CARBON, UT 84520

Notice is hereby given that Genwal Resources, Inc., has filed for revision of the final reclamation plan under R645-303-224 for permit number (C/015/032) for its Princess/Crandall Canyon Mines with the Utah Division of Oil, Gas and Mining. The lands involving activities are located in Emery County. The site is located in Huntington Canyon, in Huntington Utah. The Permit area encompasses approximately 1790 acres in the Crandall Permit. The permit area is shown on the area map below.



A copy of this revision to the final reclamation plan is available for examination at the Division of Oil, Gas and Mining at 1594 W North Temple, Suite 1210, Salt Lake City, Utah, and also at the City Hall building in Huntington, Utah. Written comments, objections, or requests for an informal conference should be addressed to the Salt Lake City address no later than thirty (30) days from the date of the last publication of this notice. This notice is being published to comply with the Surface Mining and Reclamation Act of 1977, and State and Federal regulations promulgated pursuant to said Act.

Published in ETV News January __, __, __, and __ 2020.

WordPerfect Document Compare Summary

Original document: K:\Crandall\2020\C19-002 Final Reclamation Plan\originals\Chapter 1 Original.wpd
Revised document: K:\Crandall\2020\C19-002 Final Reclamation Plan\January Deficiencies Task 6049\Text\Chapter 1 Edits Task 6049.wpd
Deletions are shown with the following attributes and color:
~~Strikeout~~, Blue RGB(0,0,255).
Deleted text is shown as full text.
Insertions are shown with the following attributes and color:
Double Underline, Redline, Red RGB(255,0,0).

The document was marked with 34 Deletions, 35 Insertions, 0 Moves.

CHAPTER 1

LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION (R645-301-100)

TABLE OF CONTENTS
CRANDALL CANYON MINE, MINE AND RECLAMATION PLAN
CHAPTER 1
LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION

SECTION	DESCRIPTION	PAGE
112	Identification of Interest	1-1
112.100	Business Entity	1-1
112.200	Applicant	1-1
112.300	Ownership and Control	1-2
112.410	List of Current & Previous Coal Mining Permits	1-2
112.500	Holders of Leasehold Interest	1-2
112.600	Owners of Contiguous Areas	1-3
112.700	Mine Identification: MSHA Numbers	1-4
112.800	Interest of Lands Contiguous to Permit Area	1-4
113	Violation Information	1-4
114	Right of Entry and Operation	1-5
	Special Use Permit Assignments	1-6
	Permit Legal Description	1-~~7~~8
	Disturbed Acreage	1-~~8~~10
115	Status of Unsuitability Claims	1-1~~0~~1
116	Permit Terms	1-1~~1~~2
117	Insurance, Proof of Publication	1-1~~2~~3

TABLE OF CONTENTS (Continued)
CRANDALL CANYON MINE, MINE AND RECLAMATION PLAN
CHAPTER 1
LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION

SECTION	DESCRIPTION	PAGE
118	Filing Fee	1-1~~2~~3
120	Application Format and Contents	1-1~~2~~3
123	Verification of Application	1-1~~3~~4

LIST OF PLATES

PLATE NUMBER	DESCRIPTION
PLATE 1-1	Lease Boundary Map
PLATE 1-1A	Permit Area Map, Burma Pond Included

LIST OF APPENDICES

APPENDIX NUMBER	DESCRIPTION
APPENDIX 1-1	Lease Assignment
APPENDIX 1-2	USFS Road Use Permit
APPENDIX 1-3	USFS Special Use Permit for Facilities
APPENDIX 1-4	USFS Special Use Permit for Potential Surface Effects
APPENDIX 1-5	Land Ownership (Surface Lease from A.R.C.O.)
APPENDIX 1-6	Mining Suitability Determination
APPENDIX 1-7	Negative Unsuitability Determination
APPENDIX 1-8	Newspaper Advertisement
APPENDIX 1-9	Ownership and Control
APPENDIX 1-10	Certificate of Insurance
APPENDIX 1-11	List of Previous Violations
APPENDIX 1-12	Current and Previous Coal Mining Permits
APPENDIX 1-13	South Crandall Federal Lease UTU-78953
APPENDIX 1-14	SITLA/PacifiCorp Sub-Lease (Now Federal Lease UTU-88990)
APPENDIX 1-15	Modification of Federal Lease UTU-68082
APPENDIX 1-15A	BLM/Forest Service Joint Decision (UTU-68082 Lease Mod)
APPENDIX 1-16	SITLA Special Use Lease, Burma Evaporation Pond
APPENDIX 1-17	Forest Service Special Use Permit for Surface Facilities ~~*(To be submitted upon approval)*~~
APPENDIX 1-18	Nielson Fee Coal Lease

APPENDIX 1-19 Forest Service Special Use Permit for Mine Water Discharge Pipeline

CHAPTER 1

LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION

R945-301-112 IDENTIFICATION OF INTERESTS

112.100 GENWAL Resources, Inc. is a corporation organized and existing under the laws of Utah and qualified to do business in Utah.

112.200 The applicant, GENWAL Resources, Inc. will also be the operator.

GENWAL Resources, Inc.
P.O. Box 910
East Carbon, Utah 84520
(435) 888-4000
Matt Efaw- President

112.220 The resident agent of the applicant, GENWAL Resources, Inc., is:

Karin Madsen
GENWAL Resources, Inc.
P.0. Box 910
East Carbon, Utah 84520
(435) 888-4000

112.230 GENWAL Resources, Inc. will pay the abandoned mine land reclamation fee.

112.300 thru 112.330 Ownership and Control - See Appendix 1-9.

GENWAL Resources, Inc. is the permittee and operator of the Crandall Canyon and the South Crandall Mines. GENWAL Resources, Inc. is a wholly owned subsidiary of ANDALEX Resources, Inc. GENWAL Resources, Inc. is a Utah corporation licensed to do business in the State of Utah. ANDALEX Resources, Inc, is a wholly owned subsidiary of UtahAmerican Energy Inc., which in turn is a wholly owned subsidiary of Murray Energy Corporation.

112.340 See Appendix 1-12

112.350 See Appendix 1-12

112.410 See Appendix 1-12

112.420 See Appendix 1-9

112.500 Surface Owners:

U.S. Forest Service
Manti-La Sal National Forest
599 West Price River Drive
Price, Utah 84501

School and Institutional Trust
Lands Administration
355 West North Temple, Suite 400
Salt Lake City, Utah 84180-1204

GENWAL Resources Inc.
P.O. Box 910
East Carbon, Utah 84520

Subsurface Owners:

Bureau of Land Management
Utah State Office
136 East South Temple
Salt Lake City, Utah 84111

School and Institutional Trust
Lands Administration
355 West North Temple, Suite 400
Salt Lake City, Utah 84180-1204

GENWAL Resources Inc.
P.O. Box 910
East Carbon, Utah 84520

112.600 Contiguous Surface Owners:

U.S. Forest Service
Manti-La Sal National Forest
599 West Price River Drive
Price, Utah 84501

School and Institutional Trust
Lands Administration
355 West North Temple, Suite 400
Salt Lake City, Utah 84180-1204

Dick Nielson
c/o Kris Ligon
4819 Mandell Street
Houston, Texas 77006

Contiguous Sub-Surface Owners:

Bureau of Land Management
Utah State Office
136 East South Temple
Salt Lake City, Utah 84111

School and Institutional Trust
Lands Administration
355 West North Temple, Suite 400
Salt Lake City, Utah 84180-1204
Dick Nielson
c/o Kris Ligon
4819 Mandell Street
Houston, Texas 77006

112.700 See Appendix 1-12

112.800 N/A

113 Violation Information:

113.100 The applicant or any subsidiary, affiliate or persons controlled by or under common control with the applicant has not had a federal or state permit to conduct coal mining and reclamation operations suspended or revoked in the five years preceding the date of submission of the application.

113.120 The applicant etc. has not forfeited any performance bond or similar security.

113.200 Not applicable

113.300 A listing of violations received by the applicant in connection with any coal mining and reclamation operation during the three year period preceding the application date is provided in Appendix 1-11. MSHA numbers for the operations can be found in Appendix 1-12. There have been no unabated violations or cessation orders issued to any affiliated companies during the previous three years.

113.400 N/A

114 RIGHT OF ENTRY INFORMATION

114.100 Applicant bases its legal right to enter and begin underground mining activities in the permit area upon the following:

UNDERGROUND COAL LEASES SUMMARY			
Lease Type	Lease Name / Number	Area (acres)	See Location
Federal Lease	UTU-78953	880.00	Appendix 1-13
Federal Lease	UTU-88990	40.00	Appendix 1-14
Private Fee Lease	Dellenback Fee Lease	160.00	Appendix 1-1
Private Fee Lease	Nielson Fee Lease	160.00	Appendix 1-18
Total Underground Lease Area		**1240.00**	

LEASE / USFS SPECIAL USE PERMIT ~~AREA~~ SUMMARY				
Lease Type	Lease Name/Number	Area (acres)	Surface or Underground	See Location
Federal Lease	UTU-78953	880.00	Underground	Appendix 1-13
Federal Lease	UTU-88990	40.00	Underground	Appendix 1-14
Private Fee Lease	Dellenback Fee Lease	160.00	Surface and Underground	Appendix 1-1
Private Fee Lease	Nielson Fee Lease	160.00	Underground	Appendix 1-18
FS SUP	Sediment Pond	1.5	Surface	Appendix 1-3
FS SUP	Topsoil Piles	1.4	Surface	Appendix 1-3
FS SUP	Surface Facilities~~*~~	7.53	Surface	Appendix 1-17
SITLA	Special Use Lease (Burma Pond)	7.32	Surface	Appendix 1-16
FS SUP	Crandall Canyon Road	5.42	Surface	Appendix 1-2
FS SUP	Mine Water Discharge Pipeline	1.13	Surface	Appendix 1-19
Total ~~Permit Area1257.75~~ ~~* Application for a Forest Service~~Lease / SUP Lease Area:		**1264.30**		

Note: Some United States Forest Service (USFS or FS) Special Use Permit ~~(FS SUP) was submitted April 27, 2016 for the surface facilities included in the relinquished Federal Lease #SL-062648.~~boundaries overlap.

- Federal coal lease UTU-78953 (also known as the South Crandall tract) was acquired in June 2003. (Refer to Appendix 1-13)

- A 40 acre parcel of the SITLA Millfork Lease was subleased from PacifiCorp in February, 2004. (Refer to Appendix 1-14). On July 11, 2011 the SITLA Millfork Lease (ML-48258) reverted to the United States Department of the Interior and became Federal Lease UTU-88554, still leased by Pacificorp. The same 40 acre parcel was subleased from Pacificorp. In September 2011, Andalex filed for an assignment of this parcel as a separate lease. Effective January 1, 2013 this 40 acre parcel was assigned Federal Lease number UTU-88990, with Andalex Resources holding 100% undivided interest.

- A 160 acre parcel was leased to Swisher Coal Co., known as the Dellenback Fee Lease, on March 24, 1976 from William and Julie Dellenback. The lease was acquired by Nevada Electric Investment Company and Intermountain Power Agency on September 9, 1993. Nevada Electric Investment Company sold its 50% share in the lease to Andalex Resources on January 11, 1995. Effective September 29, 2010, the Intermountain Power Agency conveyed all of its interest in Genwal Resources, including this lease, to Andalex Resources Inc. Andalex Resources currently holds 100% undivided interest in what is still titled the Dellenback Fee Lease.

The present Owner (Andalex) base their legal right to enter and continue underground mining activities in the permit area upon the following documents and the NEICO/Andalex sales contract:

Federal Coal Lease Assignments

Federal coal lease UTU-78953 (also known as the South Crandall tract) was acquired in June 2003. (Refer to Appendix 1-13)

Federal coal lease UTU-88990 that was formerly Federal Coal Lease UTU-88554.

Forest Service Special Use Permit Assignments

Special Use Permit, 1.5 acres, 150 x 400 ft adjacent to the eastern boundary of GENWAL's Federal Coal Lease SL-062648 for construction of the Sediment Pond. (See Appendix 1-3)

Special Use Permit, .10 acres located in Section 6, SW quarter NE quarter T16S R7E SLBM for the Trailhead parking and snow storage. (See Appendix 1-3).

Special Use Permit, 1.4 acres for stockpiles 1, 2, 3 and 4 dated 8/17/87 (See Appendix 1-3)~~-~~.

Special use Permit #PRI1608, 7.3 acres for the surface facilities when federal coal leases were relinquished, dated September 9, 2016. (See Appendix 1-17)

Road Use Permit Assignment for F.S. No. 50248 road issued May 21, 1981 by the United States Forest Service (Appendix 1-2).

An application was made to the Forest Service for a Special Use Permit ~~on April 27, 2016 to cover the portion of the surface facilities that was permitted under Federal Lease #SL-062648. It should be noted that when Genwal Resources relinquished Federal Lease #SL-06248, the intention was to keep the surface rights so Genwal Resources would maintain the right of entry for the existing surface facilities. Unfortunately, these surface rights were relinquished at the time of the lease relinquishment. Under the direction of the Bureau of Land Management and the Utah Department of Oil, Gas and Mining, Genwal Resources applied for a special use permit from the Forest Service for the area covered by the Federal Lease. The permit has yet to be issued. Genwal Resources will provide a copy of the special use permit when it is issued by the Forest Service. The permit will become Appendix 1-17 at that time~~in July 2019 to provide a new right-of-way for a mine water discharge pipeline to move UPDES Outfall #002 from the Crandall Creek to the Huntington Creek. During construction of the pipeline, the right-of-way will be 3.25 acres, with an area of 250 feet x 30 feet at the portals to the Crandall Canyon Mine; and area of approximately 95 feet x 20 feet on the western bank of Huntington Creek; and a temporary 20-foot wide area centered on the pipeline from the portals to Huntington Creek. After construction of the pipeline is complete, the areas at the portals and Huntington Creek will remain, but the temporary 20-foot wide area centered on the pipeline will be reduced to 6 feet, again centered on the pipeline. The final total right-of-way area after construction will be 1.13 acres. The permit is provided as Appendix 1-19.

It should be noted that throughout this Mining and Reclamation Plan the combined area of Federal Lease UTU-78953 and UTU-88990 are collectively referred to as the South Crandall lease area, the South Crandall tract, the South Crandall mining area, and similar such terms.

Private Lease

Andalex Resources acquired 100% undivided interest in the Dellenback Fee Lease in Septem~~e~~ber 2010.

Andalex Resources leased 160.00 acres known as the ~~Neilson~~Nielson Fee Lease on August 1, 2004. See Appendix 1-18.

Emergency Drillholes and Access Roads

On August 6, 2007, the active mine workings in Main West barrier pillar section collapsed trapping six miners underground. In an emergency attempt to rescue these men a number of boreholes were drilled from the surface of East Mountain down to the underground workings (see Plate 1-1). Due to the emergency nature of this rescue operation all surface construction for the drillpads and access roads was done under the emergency provisions of the various surface management regulations. The Forest Service, BLM, SITLA and the Division all granted verbal authority to proceed in a cooperative effort to not hinder the rescue attempts. Due to the emergency nature of the operation no formal rights-of-entry were granted for the areas of surface disturbance. On August 30, MSHA officially called off the rescue effort. Reclamation of drill pads and access roads began shortly thereafter. Refer to Appendix 5-22(A) for the addendum to the reclamation plan for the East Mountain drillpads and access roads. This plan includes a more complete description of activities and land management issues involving this rescue attempt.

SITLA Special Use Lease #1708, Burma Evaporation Basin

This Special Use Lease is located in lower Huntington Canyon, and is the site of the Burma evaporation pond. Refer to Plate 1-1A for location. Refer to Appendix 1-16 for right-of-entry information. Refer to Appendix 7-66 for details of the evaporation basin facility.

PERMIT LEGAL DESCRIPTION

The permit area is located and described as follows:

~~PARCEL~~	~~ACREAGE~~	~~LEGAL DESCRIPTION~~
~~FEDERAL LEASE U-78953~~	~~880.00~~	~~T 16 S, R 7 E~~
		~~Section 4: W½SW¼ S½SW¼NW¼~~
		~~Section 5: SE¼ S½SE¼NE¼~~
		~~Section 8: E½ NE¼NW¼ S½NW¼~~
		~~Section 9: NW¼~~
~~FEE SURFACE AND COAL (Dellenback)~~	~~160.00~~	~~T 16 S, R 7 E~~
		~~Section 5: SW¼~~

FEDERAL LEASE UTU-88990 40.0 T 16 S, R 7 E

Section 8: NW¼NW¼

FEE UNDERGROUND COAL 160.00 T 16 S, R 7 E
(Nielson)
Section 8: SW1/4

FOREST SERVICE SPECIAL USE AREAS:
(all in T 16 S, R 7 E)

SEDIMENT POND (7/28/83) 1.5 Section 5: located within SW¼SW¼SE¼NW¼,

TOPSOIL PILE #1 (8/17/87) 0.2 Section 5: located within SE¼SE¼SE¼NW¼,

TOPSOIL PILE #2 (8/17/87) 0.2 Section 5: located within SW¼NW¼SE¼NE¼,

TOPSOIL PILE #3 (8/17/87) 0.5 Section 4: located within NW¼NW¼SE¼NW¼,

TOPSOIL PILE #4 (8/17/87) 0.5 Section 4: located within SW¼SW¼NE¼NW¼

SECTION	DESCRIPTION	ACREAGE
MINE AND SURFACE FACILITIES	7.53	Section 5: located within Lot 6
(forthcoming)		

SITLA SPECIAL USE LEASE* 7.32 T 17 S, R 8 E
(Burma Evaporation Basin) Section 5: located within Lot 6

T. 16 S., R. 7 E.

Section 4:	Lot 3	37.35
	Lot 4	37.36
	SW1/4, NW1/4	40.00
	NW1/4, SE1/4, NW1/4	10.00

Section 5:	Lot 6	43.64
	Lot 9	21.70
	S1/2, NE1/4	80.00
	S1/2	320.00
Section 8:	All	640.00
Section 9:	NW1/4	160.00
MINE AND SURFACE FACILITIES SUBTOTAL:		1,390.05

RESCUE ROAD AND DRILL PADS (for location purposes)
T. 15 S., R. 6 E.

Section 35:	Lot 2	40.12
	Lot 3	40.28
	Lot 4	40.43

T. 16 S., R. 6 E.

Section 2:	Lot 4	11.40
	Lot 5	11.09
	Lot 6	9.20
	Lot 8	40.00
	Lot 9	40.00
	Lot 16	40.00
	Lot 21	40.00
	Lot 24	40.00
	Lot 25	40.00
RESCUE ROAD AND DRILL PADS SUBTOTAL:		392.52

BURMA EVAPORATION BASIN*
T. 17 S., R 8 E.

Section 5:	Within Lot 6	7.32

TOTAL PERMIT ~~AREA 1257.75~~
AREA: 1,789.89 Acres

* For complete legal description of Burma Pond, refer to Appendix 1-16

RESCUE ROAD AND DRILL PADS

The right of entry for reclamation of the rescue road and drill pads is through the permits attained to construct said road and drill pads (See Appendix 5-22(A)). Though the permit terms of five (5) years expired in 2012, Genwal Resources has the obligation, per the permits, to reclaim the disturbed areas per SM~~A~~CRA. Thus, Genwal Resources has the right of access to the area, per the permits in Appendix 5-22(A), for reclamation purposes only. Genwal Resources is nearly ready to apply for a Phase II bond release for the reclamation of the rescue road and drill pads.

For bonding and location purposes only, the rescue road and drill pads used in rescue operations in August 2007 are contained within a polygon containing:

Township 15 South, Range 6 East, SLBM
Section 35: Lots 2, 3 and 4

Township 16 South, Range 6 East, SLBM
Section 2: Lots 4, 5, 6, 8, 9, 16, 21, 24 and 25

The right to continue underground mining operations will apply to the property attached hereto as Appendices 1-1, 1-13, 1-14 and 1-18.

The surface facility area and permit area is not within 300 feet of any occupied dwelling and is not subject to the prohibitions or limitations of the State and/or Federal Regulations.

GENWAL DISTURBED ACREAGE

AREA	LOCATION	ACRES	PARCEL
Crandall Canyon Road and Mine Water Pipeline	Sections 4 and 5 (1)	6.55	FS Special Use Permits
Minesite	Lot 6 of Sec 5 (1)	7.53~~*~~	FS Special Use Permit ~~(forthcoming)~~
Minesite	SW1/4 of Sec 5 (1)	6.0~~86~~9	Dellenback Fee
Topsoil Pile #1	NW1/4 of Sec 5 (1)	0.20	FS Special Use Permit
Topsoil Pile #2	NE1/4 of Sec 5 (1)	0.20	FS Special Use Permit
Topsoil Pile #3	NW1/4 of Sec 4 (1)	0.50	FS Special Use Permit
Topsoil Pile #4	NE1/4 of Sec 4 (1)	0.50	FS Special Use Permit

Rescue Drillholes	SE1/4 of Sec 35 (2)	2.27	Federal Lease UTU-68082 *(relinquished)*
Rescue Drillholes	NE1/4 of Sec 2 (3)	5.64	State Lease ML-21568 *(relinquished)*
SITLA Rescue Road	E1/2 of Sec 2 (3)	3.98	State Lease ML-21568 *(relinquished)*
Burma Evaporation Basin	Lot 6 of Sec 5 (4)	7.32	SITLA Special Use Lease 1708
TOTAL DISTURBED AREA		**~~3~~40.~~23~~78 Acres**	

Notes: (1) T16S, R7E
(2) T15S, R6E
(3) T16S, R6E
(4) T17S, R8E

* Includes all areas within "permitted" disturbed area. Not all acreage is presently disturbed. ~~See Figure 8C.~~

Please note that the disturbed area of the Crandall Canyon Road and the mine water pipeline have been combined as their respective disturbed areas overlap. This disturbed area includes the 20-foot temporary permit area described above for the pipeline's construction, and the area required for the road's reclamation. See Plate 5-17 for the Typical Reclamation Detail of Crandall Canyon Road which shows the typical disturbed boundary for the road and pipeline.

115 STATUS OF UNSUITABILITY CLAIMS

All available information concludes that the proposed permit area is not within an area designated as unsuitable for underground mining activities (refer to Appendix 1-7). The map required to be maintained by the regulatory authority under 764.25(b), does not indicate this permit area as unsuitable for underground mining. The regulatory authority has also stated that this area is not under study for designation in an administrative proceeding. The permit area is located in the Wasatch Plateau as described in the following, "Known Recoverable Coal Resource Area", as indicated in the San Rafael Planning Area Management

Framework Plan, published in July 1979, by the United States Department of Interior, Bureau of Land Management. Pages 43 and 44 of that publication, copies of which are included with this application and found at the end of this chapter as Appendix 1-6, indicate that none of the acreage in the KRCRA was determined to be unsuitable for underground mining. In addition, the Land Management Plan, Ferron-Price Planning Unit, Manti-La Sal National Forest, published in May 1979, by the United States Department of Agriculture, Forest Service, Intermountain Region. The Forest Service has stated that this permit area, which is included in the Section A3 minable coal area of this publication, will not be considered unsuitable for leasing or mining. Page 149 of the document is included with this application as Appendix 1-7.

The applicant was notified of a public hearing scheduled for June 2, 1981, at 3:00 p.m. in Huntington, Utah, at the Senior Citizens Center. An officer of GENWAL was present at the hearing. The public hearing dealt with the proposed mining activities of the Crandall Canyon Mine within 100 feet of a public road (Forest Service Development). The USFS has issued a Special Use Permit for the Crandall Canyon Mine and accepts that the operation will occur within 100 feet of the Forest Service Development road.

The surface facility area and permit area is not within 300 feet from any occupied dwelling and is not subject to the prohibitions or limitations of State and/or Federal Regulations.

The area to be included in the Incidental Boundary Change (IBC) is immediately adjacent to the current permit area. Since mining in the IBC will be primarily first mining (longwall setup entries and barrier pillars), no surface impacts are expected to occur. Protection of the resources in this IBC are provided under the Mining and Reclamation Permit as well as state and federal.

116 PERMIT TERMS

The applicant requests a permit term of five years from the date of approval, however mining activities will continue longer than five years if the coal becomes available and feasible to mine. The starting and termination dates in one year increments is shown on Plate 5-2. The horizontal extent of the underground mine workings is also shown. GENWAL will commit to comply with all applicable standards during times of temporary and permanent cessation of operations. Further discussion may be found in Chapter 5, Engineering.

117 INSURANCE, PROOF OF PUBLICATION

117.100 Insurance

A Certificate of Liability Insurance is included in Appendix 1-10.

117.200 Proof of Publication

A copy of the newspaper advertisement of the application for a renewal of Crandall Canyon Mine permit was included in the permit package, as required under R645-300-121.100. Also, a copy of the newpaper advertisement for the permit amendment to install a culvert in Crandall Canyon has been included. See Appendix 1-8 for both copies.

118 FILING FEE

This permit application to conduct coal mining and reclamation operations pursuant to the State Program was accompanied by a fee of $5.00.

120 APPLICATION FORMAT AND CONTENTS

This application is structured based on the R645 regulations of the Division of Oil, Gas, and Mining. The chapter divisions in the application are based on the different sections of the R645 regulations. Each section of the application is based on the corresponding sections of the GENERAL CONTENTS of the R645 regulations.

123 VERIFICATION OF APPLICATION

I hereby certify that I am a responsible official (Resident Agent) of the applicant (Andalex for GENWAL Resources, Inc.) 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

_____ **Signed - Name - Position - Date**

Subscribed and sworn to before me this__ day of_____, 20__

_____

Notary Public

My commission Expires: _____, 20____)

Attest: STATE OF _____) ss:

COUNTY OF _____)

CHAPTER 2

SOILS

(R645-301-200)

TABLE OF CONTENTS

CRANDALL CANYON MINE, MINE AND RECLAMATION PLAN CHAPTER 2

SOILS

SECTION	DESCRIPTION	PAGE
2.10	Introduction ……	~~2-~~1
2.20	Environmental Description ……	~~2-~~1
2.21	Prime Farmland Investigation……	~~2-~~2
2.22	Soil Survey……	2-~~2~~
2.23	Soil Characterization……	~~2-~~4
2.24	Substitute Topsoil……	~~2-~~4
2.30	Operation ……	~~2-~~4
2.31	General Requirements……	~~2-~~4
2.32	Topsoil and Subsoil Removal……	~~2-8~~11
2.33	Topsoil Substitute and Supplements……	~~2-8~~11
2.34	Topsoil Storage……	~~2-8~~11
2.40	Reclamation Plan……	~~2-9~~11
2.41	General Requirements……	~~2-9~~11
2.42	Soil Redistribution……	~~2-10~~12
2.43	Soil Nutrients and Amendments……	~~2-13~~18

2.44 Soil Stabilization …… ~~2-~~

~~14~~18

2.50 Performance Standards……~~2-~~

~~14~~19

2.52 Stockpile Maintenance…….. ~~2-~~

~~14~~19

CHAPTER 2

LIST OF PLATES

PLATE NUMBER	DESCRIPTION
PLATE 2-1	Soils Types Study Map
PLATE 2-2	Topsoil Storage Piles
PLATE 2-2A	Topsoil Storage Pile #3
PLATE 2-3	Topsoil Stockpile Locations
PLATE 2-4	Proposed Culvert Disturbed Area Soil Pit Locations
PLATE 2-5	Plan and Profile Proposed Topsoil Storage Pile #4
PLATE 2-5A	Proposed Topsoil Storage Pile #4 Cross-Sections
PLATE 2-5B	Proposed Topsoil Storage Pile #4 Cross-Sections
PLATE 2-6	Regional Soil Map

CHAPTER 2

LIST OF APPENDICIES

APPENDIX NUMBER	DESCRIPTION
APPENDIX 2-1	Negative Determination, Prime Farmland
APPENDIX 2-2	Negative Determination, Alluvial Valley Floor
APPENDIX 2-3	Soils Study
APPENDIX 2-3A	Soils
APPENDIX 2-3B	Supplemental Soils Inventory Proposed Culvert Expansion
APPENDIX 2-4	Rational and Justification for Redistribution of 611 Top Soil (Growth Media) for Final Reclamation
APPENDIX 2-5	Surface Facility Expansion - Topsoil Removal Report
APPENDIX 2-6	Soil Survey Report - Proposed Phase Two Expansion Area (South Portals) - James Nyenhuis
APPENDIX 2-7	Geotextile Properties

APPENDIX 2-8 Laboratory Analysis, Native Fill and Imported Fill

APPENDIX 2-9 Letter Regarding Noxious Weeds in Fill

APPENDIX 2-10 Letter Regarding Prime Farmland

APPENDIX 2-11 Laboratory Analysis, South Crandall Portals Tunneling Material

CHAPTER 2

LIST OF TABLES

TABLE NUMBER	DESCRIPTION	PAGE

No tables included in this chapter.

CHAPTER 2

LIST OF FIGURES

FIGURE NUMBER	DESCRIPTION

FIGURE 8A Soil Depth of Interim Locations

FIGURE 8B Soil Salvage Areas

FIGURE 8C ~~Soil Redistribution Areas~~Reclamation Topsoil Distribution Map

FIGURE 8D Geotextile Areas

CHAPTER 2

SOILS

2.10 Introduction

This chapter presents soil resource data and soil mapping for the Crandall Canyon Mine. This information has been compiled from the previously approved Mine Reclamation Plan ACT/015/032 and newly gathered data associated with the approved culvert expansion. Additional soil information from the proposed south portals is also included. Soil studies were conducted in accordance with guidelines issued by the Utah Division of Oil, Gas, and Mining. All surveys fulfilled the requirements established by the Soil Conservation Service (SCS).

The permit area and coal leases are delineated on Plate 1-1. The disturbed area is presented on ~~Plate~~Plates 5-3 and 5-3a. There will be no surface disturbance within the Incidental Boundary Change area. The area is being added to facilitate the extension of underground main entries and will not affect the ground surface or vegetation. There ~~wi11~~will be no surface disturbance within the South Crandall Lease area ~~nor~~, or the U-68082 lease mod area as a result of mining within the lease.

This chapter presents a description of the pre-mining soil resources, feasible use of substitute soils, topsoil and subsoil to be saved, stockpiling of soils, and surveys of the soils.

2.20 Environmental Description

The mine and existing area of disturbance is at an elevation of approximately 7500-7800 feet on a southern exposure with slopes ranging from 5% to 70%. The disturbance associated with the culvert expansion includes the canyon floor and the associated toe-slopes. The mean annual soil temperature is 40 to 44 degrees F, and the average annual precipitation is 20 to 23 inches.

The soils are classified as Entisols and Mollisols. The Entisols are shallow, found on the steeper slopes and have a moderate to high erosion hazard. The Entisols are classified as poor for the recoverability of topsoil due to the steepness of slope (50-70 percent) and the high percent of large rocks on and in the surface layer (35-60 percent). Recovery of topsoil from these areas is difficult.

The Mollisols are found on more moderate slopes and are deep, well drained soils which have a moderate to low erosion hazard. The Mollisols generally have a deep, well-formed A horizon. These soils in general can produce large amounts of topsoil and subsoil that can be removed, stockpiled, and used as good growth medium for reclamation.

2.21 Prime Farmland Investigation

The land within the permit area has not been historically used as cropland nor is the area conducive to intensive agricultural uses. GENWAL contacted SCS in Salt Lake City and obtained a letter of negative determination enclosed as Appendix 2-1 from Mr. T.B. Hutchings Ph.D., SCS State Soil Scientist. There is no prime farmland within the South Crandall lease area nor the U- 68082 lease mod area. (Refer to Appendix 2-10)

Also, information from the field survey completed by Valley Engineering was sent to SCS and a Letter was received by GENWAL indicating a negative determination for the presence of an alluvial floor. The SCS letter is included with this application as Appendix 2-2. Both of these negative determinations are supported by the findings of Mr. Dean Larson, Soil Scientist with the Price Office of the U.S. Forest Service (Appendix 2-3A).

2.22 Soil Survey

The initial soil survey was conducted by Valley Engineering. Refer to Plate 2-1 for the existing surface disturbance. Accurate soil survey information and productivity data were obtained and are representative of the entire disturbed area (see Appendix 2-3 and Plate 2-1).

A supplemental soil survey was conducted by GENWAL personnel, Chris Hansen of Earthfax and David Steed of EIS in the summer of 1995 and 1996 to assess the undisturbed soils in the area of the culvert expansion project (Plate 2-4). These data have close correlation with and support the findings of the previous soil surveys.

2.22.2 Soil Identification

The "Soil Study" report prepared by Valley Engineering is included as Appendix 2-3 and the "Soil Types Study Map" is included as Plate 2-1. An additional soils study, prepared by the U.S. Forest Service, is included under Appendix 2-3A. The data collected for the approved culvert expansion project are contained in Appendix 2-3B. An additional soil study was prepared by James Nyenhuis for the south portal expansion (see Appendix 2-6). A map is included with this report.

2.22.3 Soil Description

Soil descriptions are found in the "Soil Study" report prepared by Valley Engineering included as Appendix 2-3 and on the "Soils Types Study Map" included as Plate 2-1. Refer to Plate 2-6 for the regional soil classification, including the soils within the South Crandall lease area.

Also, additional soil survey information can be found in Addendum to Appendix 3-2, Synopsis of Riparian Baseline Inventory of Crandall Creek and Review of Baseline Riparian Inventory of Crandall Creek Proposed Crandall Mine Expansion for a more thorough discussion on hydric soils.

2.22.4 Present and Potential Productivity of Existing Soils

The present and potential productivity of soil within the disturbed area and the approved culvert expansion have been assessed to determine the volume of suitable growth materials and the difference between topsoil and subsoil. The following data have been supplied in Appendix 2-3 and 2-3B: sodium absorption ratio (SAR); electrical conductivity (ECE); saturation percentage; soluble calcium; magnesium and sodium; organic matter content; and lime content. Appendix 2-6 defines the productivity of the soils in the proposed south portal area.

The larger rock fragments encountered during topsoil salvage operations that could damage equipment during loading and transportation operations will be sorted out during salvage operations. Moderate-size fragments will be salvaged with the topsoil and stockpiled. The ECE values are very low in all samples as shown on page 8 of Appendix 2-3 and in Appendix 2-3B. There are no problems with salinity. The SAR values are also very low in all samples, indicating there are no problems with sodium salts, the pH is slightly alkaline which is normal for the area. All samples have some presence of carbonate.

On June 2, 1992, Mr. Larry Johnson and personnel from Environmental Industrial Service inventoried three areas that have interim reclamation. The areas in question are shown on Figure 8a and are listed as Areas 1, 2, and 3 respectively. The purpose of the inventory was to determine the depth of in-place soil and the success of the revegetation. The inventory also indicated that none of the reclaimed areas were topsoil storage sites.

Soil depths were determined utilizing a six foot probe driven into the ground on approximately 5 foot centers. At each test point, the probe was driven in three times in an area approximately 12 inches in diameter at a 90 degree angle to the surface and the depth of soil noted. The maximum depth encountered was then recorded and plotted.

A small portion of Area 1 had soil material to a depth of 24 inches. However, this soil was determined to be in situ soil that had not been disturbed due to its close proximity to an island of undisturbed vegetation. In addition to the reclaimed areas, the soil depths at the two undisturbed areas were also inventoried. Both areas average 39 inches of soil, but included approximately 50% cobble size rock (4 inches to 6 inches in diameter). Thus, this soil would yield less than 18 inches of usable top and subsoil if salvaged.

Therefore, the net gain of soil to be utilized in other areas does not appear to justify the destruction of the existing established islands of mature vegetation.

2.23 Soil Characterization

The soil survey was conducted in accordance with the standards of the National Cooperative Soil Survey and with the procedures set forth in the U.S. Department of Agriculture Handbook 436 (Soil Taxonomy, 1975) and 18 (Soil Survey Manual, 1951). In 1992 in conjunction with the acquisition of Lease UTU 68082 a new soils inventory was incorporated into the permit (Appendix 2-3A). In addition, supplemental soil data were collected for the proposed culvert expansion.

2.24 Substitute Topsoil

Topsoil and subsoil were removed in separate layers from all areas subject to surface disturbance, except for map unit DPH2 (Plate 2-1). The removal of topsoil was restricted in areas with steep slopes of 30% and greater and in areas with a high percent of large rocks present in the soil profile. The subsoil from the IDE map unit (Plate 2-1) will be used as a topsoil substitute for reclamation of the steep rocky slopes associated with the DPH2 soils. The acreage of DPH2 soils to be reclaimed is 2.39 acres.

2.30 Operation

2.31 General Requirements

2.31.1 Methods for Removal and Storage

All topsoil and subsoil were removed during the construction season of 1982. Actual procedures are not known. Based on the data available, the following suppositions are provided.

The subsoil and topsoil were not stockpiled separately. Topsoil and subsoil were removed in one lift with the depth of topsoil determined by the operator who monitored the soil color. The lift depth varied as shown within the "soil study" report, Appendix 2-1. Topsoil and subsoil were removed and stored in the permanent stockpile location.as shown on Plate 2-2. (The four stockpiles located on Plate 2-2 are within the permit area and the disturbed boundary).

The topsoil was removed from the areas indicated on the soil survey map (Plate 2-1) as TCE and JDE, which included the Datino Variant, Jodero Variant and Twin Creek soils, after the vegetative cover was cleared from the areas. A front end loader and a D-6 size dozer were used to remove and load topsoil into haul trucks. A qualified supervisor monitored the topsoil removal and stockpiling operation to insure the protection and preservation of all topsoil material. Each topsoil stockpile was worked with a small Cat

D-6 ~~sizetrack~~size track dozer to minimize compaction to the stockpile while dressing the stockpile to final design configuration.

The topsoil stockpiles are adjacent to the public access road, as requested by the USFS. The annual and perennial plants that were used to stabilize the topsoil stockpiles for interim reclamation are contained in the seed mix described in section 3.30 of Chapter 3.

The topsoil piles were inventoried to attempt to determine the disposition of distribution of topsoil and subsoil. All three storage areas appeared to be made up of similar material with no distinct change in color and/or texture which might distinguish subsoil or topsoil placement. The inventory consisted of minor probing and ocular estimates of the surface only." Due to the well-established vegetation and the stability of the piles of soil, a more extensive inventory would serve no purpose other than to damage the integrity ~~f~~of the storage sites.

The pedogenic process will become somewhat restricted for the soils stored in the topsoil stockpiles. The physio-chemical changes that may occur include nitrogen loss, loss of micro biological life forms, the existence of anaerobic conditions within the deeper portions of the stockpiles, and structural breakdown of the soils. These changes will be minimized by avoiding compaction during stockpile construction and by segregating the individual soil units where practical.

Topsoil from the culvert expansion area was salvaged from the area south of the warehouse identified as the North Slope area (Map Unit A), the south slope bench area (Map Unit B), and the south slope of the hillside adjacent to the coal pile area (Map Unit C) as shown on Figure 8B. Two additional new areas, shown as Map Unit D and Map Unit E on Figure 8B, were identified for topsoil salvage, during pad construction, in the southwest comer of the mine yard expansion area. Immediately east and contiguous to Unit D is a rocky point that was re-contoured during the yard expansion. This area is identified as Map Unit E. Topsoil was removed from this point but because this work was done after most of the topsoil recovery was finished, this volume of material was not included in the soil report prepared by Pat Johnston, the soil consultant who supervised and monitored the topsoil recovery and stockpiling operations during the yard expansion operations. Nielson Construction Project Manager Mark Greenhaulgh oversaw the topsoil removal and stockpiling from this particular area. Approximately 108 cubic yards of topsoil was removed and stockpiled at stockpile #4 from this nose cut area.

Soil was also removed, during the surface expansion project, from two areas, designated as Map Unit G, during the construction project. This soil was collected from a narrow strip along the south side of the road and old loadout site and from the new area that was disturbed when the sediment pond was reconstructed. Approximately 160cubic yards of topsoil material was removed from these two areas and stockpiled.

No topsoil or substitute topsoil material was salvaged from the area associated with the stream or streambank or the area of steep slope area on the southern flank of the stream. To preserve the alluvial and residual soils and stream channel in this area, GENWAL covered the insitu stream area with a geotextile fabric prior to placing any backfill during construction. Similarly on the steep slope area to the south of the stream bank a geotextile fabric was placed on the surface before placing any backfill material. During the culvert expansion approximately 2.5 acres of in place topsoil were protected using the geotextile (see Figure 8D). A description of the geotextile used is given in Appendix 2-7. During the south portal construction an additional 0.08 acres of in place topsoil will be protected with geotextile.

After the lower pad of the Expansion Area was completed to finish grade, the permanent coal storage area was prepared. Topsoil material was removed from Map Unit C (Figure 8B) a small area of the adjacent slope near the location where the southern flank of the coal pile rests against the existing hillside. This topsoil was salvaged under the direction of Pat Johnston, soil scientist, to assure optimum recovery of the soil resource in this area. The soil was stockpiled at topsoil stockpile #4 for storage until it is utilized during final reclamation. Between all salvage areas, about 3,880 cubic yards of topsoil was collected and stockpiled at stockpile #4 for final reclamation. This amount exceeded the original projection of 3,480 cubic yards by 400 cubic yards.

During coal storage and stockpiling activities, coal was pushed up beyond area C onto an area where topsoil had not been stripped. In order to abate violations N98-45-I-I and N98-45-3-I, GENWAL has removed the coal from the area where topsoil had not been removed on the south slope. (The approximate area is identified as Map Unit F on Figure 8B.) The previously undisturbed topsoil area, which had been covered with coal, was cleaned thoroughly using the best technology available. The topsoil was then removed under the supervision of Pat Johnston. Reclamation specialist/soil scientist between August 5- August 18, 1998 and transported to topsoil stockpile #4. The topsoil was removed from the slope area that was and could potentially be affected by the coal stockpile in the future. Approximately 690 cubic yards (69 truckloads) was salvaged from the slope. The visible topsoil depth averaged 3-4 inches over this area but 8-9 inches was actually removed due to the steepness of the slope and the operational constraints of the equipment on the steep slope.

During phase 2 of the surface expansion, three portals will be established on the south slope of the mine yard. The new portals will be constructed along the south side of the upper pad of the existing mine-yard (refer to Plate 5-3). This area is presently serving as the parking lot and material storage yard. The new portals will consist of an intake portal, -a fan portal, and a belt portal. The intake portal will be used to accommodate fresh air intake into the mine, and also to provide primary travel access into the mine for employees and materials. The fan portal will support a ventilation fan which will suck

return ventilation air out of the mine. The belt entry will be located south of the existing coal pile and will contain the main conveyor belt hauling coal out of the mine.

Construction of the portals will be done within the existing permitted disturbed area boundary. The existing disturbed area boundary will not be increased. The existing sediment pond bas been sized to accommodate this new portal construction area, so no changes to the sediment pond will be required.

In the area of the new south portals, the base of the coal seam is located approximately 17' above (i.e., higher than) the level of the existing mine-yard.

Prior to starting the portal cuts, the existing topsoil at the portal sites will first be salvaged. Topsoil conditions along the south slope portal area are similar to the conditions at the adjacent coal pile area where topsoil was salvaged during August, 1998. This topsoil salvage effort is described in appendix 2-5, Part II, prepared by Pat Johnson, soil scientist. At that area, according to Ms. ~~Johnson' s~~Johnson's report, the depth of true topsoil was 3" but an average of 8" - 9" of material taken due to the operating nature of the backhoes which were employed in the salvage process. In addition, an intensive soil inventory and site investigation was performed on the south slope on August 18, 1998 and is included in Appendix 2-6.

In order to minimize the area of additional disturbance associated with the construction of the south portals these portals will be constructed by excavating individual pockets into the hillside for each portal rather than along a common highwall. By utilizing individual pocket cuts for the portals the total area of new disturbance isexpected to be less than 4500 sq. ft. (0.11 acres). Topsoil will be removed from the areas of the south portal pocket cuts prior to excavation as described in Section 2.31.1. According to the Nyenhuis survey, the upper 2 feet (24 inches) is suitable for salvage. Based on the Nyenhuis soil survey it is anticipated that approximately 9000 cu. ft. (333 yds.) of topsoil will be salvaged from the intake and fan portal cuts.

The salvaged topsoil will be stored on the existing topsoil pile #4 located off-site at the bottom of Crandall Canyon. This topsoil pile is constructed on Forest Service land under a Special Use Permit issued on 8/17/87. This pile #4 was originally constructed in 1997 curing Phase 1 of the surface facility expansion. At that time it was designed and constructed sufficiently large to accommodate the additional topsoil storage requirements for the Phase 2 south portal construction. The Forest Service has concurred with the addition of the south portal topsoil to this pile. All topsoil removal, salvage and storage will be over-seen, directed and monitored by an independent soils scientist or knowledgeable contractor approved by the Division.

After the portal sites have been faced up, construction of the portal canopies will begin. These canopies will be constructed from steel I-beams and plate according the MSHA guidelines. The canopies will be anchored to concrete footers. These canopies will provide a safe structure from which the miners can begin driving the entries back into

the coal seam. After the intake and fan entries have been driven into the hillside and connected together underground with a cross-cut, work can then be started on construction of the mine fan installation. While the fan is being installed, the miners will drive the belt entry from inside the mine out to the belt portal. During this phase of development, mined coal will be moved away from the surface with a front-end loader, a mobile radial stacker, or some other temporary means of conveyance. After the belt portal connection is completed, a new conveyor truss will be installed from a concrete landing at the belt portal out to the existing coal pile. AU coal from the mine will then be delivered directly to the existing coal pile and will be crushed and loaded on trucks through the existing coal handling facilities.

Power, water, communications, and other mine infrastructure will be supplied to the south portals as an extension of the pre-existing Crandall Canyon Mine facilities.

Figure 5-11 depicts a typical cross-section through the south portals, showing the pocket cut, access ramp, ~~lu~~in-situ soil geotextile protection, and the portal canopy construction.

Plate 5-~~3~~3a depicts that area of the south slope where the portals are proposed to be located during phase 2 expansion in mid-1999. Plate 5-~~3~~3a also shows the in the southwest portion of the mine yard. The topography for this portion of mine yard has been revised to reflect the as-built configuration. A side canyon drainage channel conveying undisturbed area runoff to the main Crandall Creek channel forms the western boundary of the mine yard in this area. Rip rap for the culvert inlet headwall was installed on both sides of the channel farther up the embankments than depicted on the proposed construction map. This additional rip rap was added to protect the main culvert inlet from erosion due to the side canyon drainage. Rip rap was added to the side channel to increase the integrity of the channel and to prevent the channel embankment from eroding thus allowing undisturbed drainage to enter the mine yard area. The same rip rap specifications used for the main undisturbed drainage inlet culvert and headwall were also used for armoring the side channel.

Short tunnels will be driven from the existing yard level up to the coal seam. The pocket cuts will be made into the hillside lower down at the same level as the existing pad. This level is approximately ~~15'below~~15' below the base of the coal seam. Since the coal seam sits directly on top of the Star Point Sandstone, this sandstone out-crops at the existing yard level. Tunneling will begin in the sandstone and ramp up underground to the coal seam.

If the tunnels are driven at an incline of 10% they will be about 160' long to where they intersect the base of the coal seam. At 8' high and 20' wide, excavation of the two tunnels (intake and fan) would generate approximately 1900 cubic yards of material during construction. This tunnel excavation material will consist of sandstone mixed with coal. This excess material will be disposed of by placing it in a 6' deep layer along the existing fill bank located between the upper material yard and the coal storage pad. This

embankment is part of the designated coal storage area and currently is covered with coal. Therefore, after the tunnel excavation material is layered onto the embankment, it too will be covered over by the active coal pile for the remaining life of the mine. Refer to Figure 13-A and 5-13B for more details of this tunneling construction option.

Upon final reclamation the tunnel excavation material will be hauled back into the mine tunnels where it would be sealed up prior to backfilling the portals. Backfilling and reclamation of the portal pocket cuts would be the same regardless of whether the ramp or tunnel option is selected.

GENWAL commits to ensuring the protection of the hydrologic balance for surface and groundwater systems as required by R645-301-731. The tunnel excavation material will be tested for acid- and toxic-forming material and the analytical results of this testing will be presented to the Division. (Appendix 2-11) The hydrologic balance will be protected in the following manner.

a) The excavation material will consist of fragmented Star Point sandstone. This sandstone outcrops naturally in the mine site area and is one of the major geological features which determine the character of Crandall Canyon and many other canyons in the Wasatch Plateau. This predominant sandstone is not known to be acid- or toxic- forming anywhere in the Utah coalfields. However, further site-specific testing of the sandstone will be conducted prior to any construction.

b) The proposed location of the material storage is on top of the existing pad fill. Any runoff from this area would report to the existing sediment pond.

c) The existing pad fill in the proposed storage area varies between 10' and 40' thick over the bypass culvert and is densely compacted. This thickness of compacted fill material is sufficient to preclude any leaching downward into the bypass culvert or groundwater.

2.31.2 Analysis of Topsoil Substitute

The soil survey and chemical analysis for the proposed topsoil substitute have been completed. A portion of the B horizon of the TCE soil was salvaged and stockpiled along with that from the IDE to insure that an adequate supply of plant growth medium will be available for reclamation of the steep slopes (50 to 70 percent).

2.31.3 Topsoil Evaluation

Testing plans for evaluating the results of topsoil handling are discussed within Section 2.42 of this chapter. Nutrient and soil amendments will be added based on the results of these tests. Sampling techniques are discussed in Section 2.41.

Five years prior to beginning reclamation operations, GENWAL will consult with the Division to re-evaluate the techniques and practices being proposed in the reclamation plan (Appendix 5-22). 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 plans to provide the best and most appropriate reclamation measures for the site.

2.31.4 Stockpiles

The volume of each stockpile is included on Plates 2-2, 2-2a and 2-5 as well as in Section 2.42 -of this application.— _See Appendix 2-4 for the justification and rationale for 6" topsoil redistribution.

The topsoil stockpiles are protected from erosion, compaction, and contamination. An earthen berm and asphalt berm in combination with straw bale dikes have been constructed to protect against topsoil loss and the stockpiles have been revegetated with an approved vegetative cover.

The cross sectional views of the topsoil and subsoil stockpiles are included on Plates 2-2, 2- 2A, 2-3, 2-5,2-5A and 2-58. Stockpile #4 will be used for the salvaged materials from the culvert expansion area, and the design is shown on Plates 2-5, 2-5A and 2-58. GENWAL has submitted Plate 2-3 showing the location of the topsoil stockpiles with respect to the surface facilities. Topsoil identification and protection markers are installed. The perimeter and topsoil markers conform to UDOGM regulations.

Stockpile #4 will be constructed with topsoil removed from the surface expansion project. The stockpile will be located across the road and north of stockpile #3. This location was previously surveyed for cultural resources by Forest Service archeologist, Barbara Blackshear. No cultural resources were located. Soil survey information for this area is presented in Appendix 2-3A.

The pile area will accommodate approximately 5,000 cubic yards of soil material with side-slopes on a 3:1 slope and a top elevation of 6,997'. Approximately 4,756 cubic yards of material were salvaged from the surface expansion area. Approximately333 cubic yards of additional material is expected to be salvaged from the south portals. Refer to Plates 2-5, 2-5A and 2-5B for design detail. These plates will be updated in the MRP to reflect the as-built configuration after construction of the south portals is complete. Refer to Plate 2-SC for the as-built drawing.

The topsoil and substitute topsoil materials are stored in Stockpile #4 and will be protected from erosion by a vegetative cover. Upon placement and configuration of the topsoil stockpile, two tons per acre of organic mulch and an approved seed mix was applied at the specified rate approved by the Division. The mulch and seed was applied to the topsoil stockpile in the early fall of 1997. Silt fence was placed around the perimeter of the pile.

2.32 Topsoil and Subsoil Removal

All topsoil and subsoil, associated with the initial disturbance, were removed during the construction season of 1982. The volumes of salvaged topsoil and subsoil, included in Section 2.42, is 9,219 bank cubic yards. The topsoil was stored in four locations as shown on Plates 2-2, 2-2a, 2-3, and 2-5. The topsoil associated with the proposed culvert expansion will be removed and stockpiled according to approved plans. Areas showing soil removal are shown on Plate 2-4 and Figure 8B; and the stockpile area is shown on Plates 2-3 and 2-5.

2.33 Topsoil Substitute and Supplements

Section 2.24 and 2.42 of this chapter address the substitute topsoil soils and their perspective locations.

2.34 Topsoil Storage

All topsoil and subsoil from the initial disturbed area were removed and stored during the construction season of 1982. The volumes of salvaged topsoil and subsoil are included in Section 2.42 of this chapter. The topsoil was stored in four locations as shown on Plates 2-2, 2-2a, 2-3, and 2-5. Sections 2.31 and 2.42 of this chapter address the topsoil storage and location of the topsoil piles.

2.40 Reclamation Plan

2.41 General Requirements

The permit application includes plans for redistribution of soils, use of soil nutrients and amendments and stabilization of the redistributed soils.

2.42 Soil Redistribution

The soil redistribution volumes are presented in the table below for the ~~13.6~~21.89 acre ~~surface facility site and~~disturbed boundary area, including the 1.40 acre topsoil stockpile areas. (Refer to Figure ~~SC~~8C.)

~~AREA IDENTIFICATION~~	~~ACREAGE~~	~~DEPTH~~	~~VOLUME~~
~~Original Surface Facilities Area~~			
~~Portal Area~~	~~0.90 acres~~	~~12"~~	~~1,452 CY~~
~~Shop Area~~	~~1.09 acres~~	~~12"~~	~~1,759 CY~~
~~Old Substation Area~~	~~0.40 acres~~	~~12"~~	~~645 CY~~

~~Old Loadout Area~~	~~2.11 acres~~	~~12"~~	~~3,404 CY~~
~~Subtotal~~	~~4.50 acres~~	~~12"~~	~~7,260 CY~~
~~Expansion Area~~			
~~North Slope Area~~	~~0.14 acres~~	~~16"~~	~~300 CY~~
~~S. Slope Bench Area~~	~~0.49 acres~~	~~16"~~	~~1,051 CY~~
~~Coal Pile Area~~	~~0.41 acres~~	~~12"~~	~~662 CY~~
~~SW corner of mine yard~~	~~0.28 acres~~	~~12"~~	~~452 CY~~
~~Nose cut area~~	~~0.11 acres~~	~~12"~~	~~178 CY~~
~~Upper coal pile area~~	~~0.15 acres~~	~~12"~~	~~242 CY~~
~~Loadout/pond area~~	~~0.22 acres~~	~~12"~~	~~355 CY~~
~~South Portals~~	~~0.11 acres~~	~~16"~~	~~236 CY~~
~~Subtotal~~	~~4.50 acres~~	~~12"~~	~~7,260 CY~~

REFERENCE AREA	TOPSOIL ACREAGE	TOPSOIL DEPTH	TOPSOIL VOLUME
Emery County Property	0.57 acres	15" (1.25')	1,144.74 CY
Portal Area	0.64 acres	15" (1.25')	1,295.89 CY
Expansion Area	0.82 acres	15" (1.25')	1,652.28 CY
Old Substation Area	0.50 acres	15" (1.25')	1,007.23 CY
Old Loadout Area	0.88 acres	15" (1.25')	1,774.02 CY
Forest Service Road (at the Mine Site)	0.70 acres	12" (1.00')	1,123.84 CY
Forest Service Road (below the Mine Site – includes topsoil stockpiles)	2.09 acres	12" (1.00')	3,376.88 CY
Shop Area	0.75 acres	15" (1.25')	1,502.92 CY
Totals:	**6.94 acres**		**12,877.80 CY**

Areas ~~Not~~NOT Topsoiled

~~Forest Service Road~~	~~0.53 acres~~
~~Forest Service Trail Head~~	~~0.30 acres~~
~~Topsoil Storage Areas~~	~~1.40 acres~~
~~Interim Reclamation Areas~~	~~0.78 acres~~
~~Undisturbed Areas – N. Side~~	~~0.48 acres~~
~~Unaffected Area Culvert Inlet~~	~~0.50 acres~~
~~South Slope Area~~	~~2.50 acres~~
~~Undisturbed Areas – S. Side~~	~~1.89 acres~~
~~Area East of Old Loadout~~	~~0.22 acres~~

~~Subtotal~~	~~8.60 acres~~
~~**TOTAL AREA**~~	~~**15.01 ACRES**~~

REFERENCE AREA	ACREAGE
Emery County Property	1.24 acres
Portal Area	0.25 acres
Expansion Area	6.15 acres
Old Substation Area	0.53 acres
Old Loadout Area	0.47 acres
Forest Service Road (at the Mine Site)	0.80 acres
Forest Service Road (below the Mine Site – includes topsoil stockpiles)	5.44 acres
Shop Area	0.05 acres
Total:	**14.95 acres**

Topsoiled Areas at Final Reclamation:	6.94 acres
Total Areas Receiving No Topsoil at Final Reclamation	14.95 acres
Total Disturbed Area	21.89 acres

Topsoil areas noted above are based upon Figure 8c (attached to this chapter); Plate 5-3, "Overall Surface Facilities;" and Plate 5-17, "Reclamation Contours." The drawing sheets are based upon the same surface facility maps that were drawn utilizing Autocad Map 3D 2017 by Autodesk, and Carlson Software's Civil 2017 module, which is an add-on program to Autocad that specializes in civil drafting and design. Each reference area is described in Appendix 5-22 of this MRP. The areas receiving topsoil and those areas not receiving topsoil for each reference area were individually drawn, and the respective square footage for each area was determined utilizing commands and abilities of the software.

The respective areas were then input into a Microsoft Excel spreadsheet and imported into Autocad. The spreadsheet can be seen on Figure 8c, attached to this chapter. The reference areas were divided into four (4) distinct categories for topsoil at final reclamation: 1) Total Undisturbed / Unaffected Area (requiring no topsoil application at final reclamation), 2) Total Interim Reclamation Area (requiring no topsoil application at final reclamation), 3) Total Restored Streambed Area (requiring not topsoil application at final reclamation), and 4) Total Reclaimed Area with Topsoil at final application.

The first category, Total Undisturbed / Unaffected Area, is described as those areas that were not initially disturbed and have not been disturbed by construction and mining activities. All care will be taken at final reclamation to protect these areas from any

disturbance during the final reclamation activities. The reclaimed Forest Service Road (Crandall Canyon Road) is also included in these area calculations as they will not receive any topsoil. Additionally, the topsoil stockpiles are included herein as these locations will not require topsoil application.

The second category, Total Interim Reclamation Area, is described as an area that was previously disturbed during the construction of the surface facilities for the mine. This area has since been reclaimed and received interim seeding for the area. Upon final reclamation, these areas will be scrutinized for success and may receive further seeding and planting similarly to reclaimed areas at final reclamation.

The third category, Total Restored Streambed Area, is described as that area that was buried during the expansion of the surface facilities. During final reclamation, these areas will be restored to their original contours that existed prior to the expansion of the surface facilities. Here, the topsoil was buried and will be revitalized during final reclamation of the site (see Appendix 5-22).

The fourth category, Total Reclaimed Area with Topsoil, is described as those areas that will be filled and contoured to approximate original contour (AOC) during final reclamation with subsoil removed from the expansion area. Once these areas are filled to the specified contours as shown on Plate 5-17, "Reclamation Contours," less the described topsoil depth, the surface of the newly placed subsoil will be roughened. The topsoil will then be harvested from the topsoil stockpiles and applied accordingly to the respective areas. The strip of land alongside the Forest Service Road (Crandall Canyon Road) from where the existing road base will be removed to reclaim the roadway, will also be roughened and receive topsoil as the native subsoil will be exposed. Most areas will be deeply gouged (pocked) that receive topsoil. In those areas that cannot be pocked due to their location (e.g. the side of the Forest Service Road), the topsoil will be left rough and pitted to limit rilling and to provide for water retention to enhance seed germination. No topsoil will be spread when the subsoil or topsoil is frozen, wet or powdery. Mulch will be applied over the newly applied topsoil. Please see Appendix 5-22 for more information.

The 1.40 acres comprising the four topsoil/subsoil locations will not require soil redistribution since the native topsoil is still in place. The USFS access road and trailhead area will be left intact removing an additional 1.47 acres from reclamation requirements. On the south slope of the Expansion Area, where the fill ~~will be~~was placed to create the coal stockpile yard, the topsoil has been left in place and protected by geotextile fabric. This area will not have any additional soil material placed on it during final reclamation. Topsoil material recovered from this area will instead be dedicated to reclaiming the original mine yard area and area adjacent to the road. On the south slope area, adjacent to the permanent coal storage area, topsoil will be removed from a small area of the adjacent slope near the location of the future stacking tube where the southern flank of the coal pile will rest against the existing hiJ1side. This topsoil will be salvaged under the direction of a soils scientist to assure optimum

recovery of the soil resource in this area. The soil will be stockpiled off-site at an approved storage location until it is re-used during final reclamation.

The topsoil requirements will be met from the following areas:

SOIL	ACREAGE	VOLUME	DEPTH
Stockpile 1 (JDE & TCE)	0.20	943 CY	NA
Stockpile 2 (JDE & TCE)	0.20	1,087 CY	NA
Stockpile 3 (JDE & TCE)	0.50	3,709 CY	NA
Stockpile 4 (Additional)	0.50	2,052 CY	NA
Stockpile 4			
From coal storage area - Summer 1997 (Areas A, B, C, D, E & G)		4,066 CY	
From coal storage area, August 1998 (Area F)		690 CY	
From South Portals		333 CY	
From Forest Service Trailhead		32 CY	
	TOTAL	12,912 CY	

(Previously 9,519)

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Any salvaged topsoil that is not utilized within the areas receiving fifteen (15) inches of topsoil per the soil distribution table above, will be spread within the areas noted to receive twelve (12) inches of topsoil.

The subsoil material has been chemically and physically analyzed, to allow for the suitability determination as a plant growing media (Appendix 2-3). The subsoil was removed from the IDE and TCE areas outlined on Plate 2-1 (see Plate 5-3 for surface facilities).

Topsoil and subsoil of the IDE soil type are stored at the above referenced four locations (Plates 2-2, 2-2a and 2-3). Topsoil stockpiles are a mixture of soil types JDE and TCE. The soil types were not segregated during placement in the existing topsoil stockpiles. Topsoil piles will be maintained in their present location and condition until approval is received from the Division for redistribution.

Topsoil will be redistributed with a small, tracked, front-end loader and a D-6 (or smaller) size dozer or a backhoe. The disturbed areas will be ripped prior to topsoil redistribution. A qualified supervisor will monitor the topsoil redistribution operation. The monitoring will ensure even distribution of the topsoil. To minimize compaction of the topsoil, after redistribution, the topsoil will be ~~disced~~disked and/or harrowed on the contour where slopes safely allow. Any reclaimed areas that exhibit rills and gullies in excess of six inches will be regraded and seeded.

In that area where the entire soil horizon has been covered with geotextile fabric, the fill material will be removed in 5-10 foot lifts exposing the marker soil and geotextile fabric on an increment of the south slope. After the marker soil has been carefully removed, the geotextile fabric will be peeled away from the surface of the slope. The soil will then be sampled randomly to determine what amendments might be needed. Soil amendments such as fertilizer or PAM (~~polyacrlimide~~polyacrylamide) would be applied. After the appropriate amendments have been added, the surface would be broadcast seeded. The seed would be hand raked into the soil surface. A wood fiber mulch would then be sprayed ~~ovr~~over the seeded soil surface. Bonded fiber tackifier will be sprayed over the mulch to hold it in place. Reclaiming the south slope in 5-1O' vertical increments, as the yard fill is being removed, will allow better access to the slope for hand work such as seeding, raking and mulching and also minimize soil disturbance and exposure to erosion.

If possible, the topsoil will be redistributed in the late fall (late September or early October) just prior to the seeding time which will provide a seedbed free of weeds and annual grasses. Any weeds and annual grasses which become established before seeding, will be removed before seeding is attempted. Seeding will be done as soon as possible after the seedbed is prepared, but not prior to October 1st. If seeding cannot be done within 30 days of topsoil redistribution, the Division will be notified.

No borrow areas will be required to supplement the volume of topsoil or substitute topsoil for redistribution. Due to the limited space within the disturbed area, the subsoil, which will serve as a topsoil substitute, has been stored in topsoil stockpiles as shown on Plate 2-3.

No terracing will be done. All final grading and preparation of overburden before replacement of topsoil will be done along the contour to minimize erosion and instability. See Chapter 5, Section 5.40 for further information.

Initial data indicated that the coal may have had an acid forming potential. However, more recent data (overburden and underburden samples from three in-mine locations and coal channel samples from three in-mine locations) indicate that the material is neither acid-forming nor toxic. The chemical analysis of the coal and overburden may be found in Appendix 6-2. The applicant has provided the results of chemical analysis for overburden (soils) on pages 8 and 10 in Appendix 2-3. Accumulated waste from the sediment pond will be analyzed for the acid and toxic forming constituents as defined in Section 5.28.30, prior to either onsite or offsite disposal.

All coal will be removed from the site as saleable product prior to reclamation. The toxicity of the material below the coal stockpile will be tested prior to soil redistribution and treated as necessary. No underground waste will be stored on the surface which would require a plan to be submitted for treating an acid and/or toxic material.

Post-mining topographic views of the disturbed area are shown on ~~Plates 5-16 and~~Plate 5-17. The contour map shows the final surface configuration of the permit area which can be used in conjunction with the pre-mining surface configuration map.

As an alternative (and a present day industry standard for sediment and erosion control) to constructing contour and collection ditches, PacifiCorp and others have had excellent success utilizing deep gouging techniques (pocking) for sediment control. Using this technique for controlling sediment, models have shown that the disturbed or reclaimed areas produce a reduced sediment load than that of the undisturbed or background areas. Modeling data utilizing RUSLE for the areas of the Cottonwood/Wilberg Mine shows that sedimentation within the disturbed area is controlled through deep gouging (pocking), mulching, and tackifying practices and produces similar or less amounts of sediment as the undisturbed areas.

The existing sediment ponds at the Cottonwood/Wilberg Mine are situated in the narrow canyon of the Grimes Wash at the lower portions of the disturbance. The ponds take up nearly the entire width of the canyon. Because of the failure concerns, PacifiCorp proposed to remove the sediment ponds as part of the final reclamation activity, but prior to the two (2) years after the last augmented as dictated by R645-301-763.100.

Justification for removing the ponds prior to the two (2) year requirement is detailed in the following section.

Sediment Control Measures Utilizing Best Technology Currently Available (BTCA)
Sediment transport will be controlled as required by R645-301-552.100 and R645-301-742 of the Utah Coal Regulations. Best Technology Currently Available (BTCA) measures will utilize deep gouging (pocking) techniques that encourage water retention and enhances plant growth. These protective measures to prevent additional contributions of sediment to the streamflow or runoff outside the permit area will be used as a permanent control measure, in lieu of siltation structures throughout the responsibility period.

Backfilling and grading shall be conducted starting in the upper reaches of the disturbed areas and then working down canyon. After each section is backfilled and graded, the area will be covered with a hay mulch at a rate of 2000 lbs/acre. Once the mulch is evenly spread over the surface, deep gouging (pocking) techniques for sediment control will be used. These techniques require a track-hoe, or similar machine, to roughen the disturbed area in a random and discontinuous fashion using its bucket. Pockmarks created are approximately 3.0' feet in diameter and 1.5' feet deep. The pockmarks are designed to capture and trap precipitation, influencing infiltration. Gouging serves to control erosion through water retention, thus enhancing vegetation growth.

Because of the water retaining capabilities of deep gouging techniques, contributions of sediment beyond background levels are not expected to contribute suspended solids and sediment to receiving streams.

Due to the success rates in other reclamation projects utilizing the deep gouging, or pocking, Genwal proposes to utilize these techniques during final reclamation at the Crandall Canyon Mine site. Pocking will be utilized in those areas of the restored stream channel (see Plate 5-17) that are of a slope less than 2 horizontal units to 1 vertical unit, working from the lower contours and working upwards toward the reclaimed roadway.

During final reclamation, any drainage that occurs in the disturbed area from a storm event will be treated. At new and existing culverts, stone check dams will be constructed to route runoff towards the culvert inlet. A sediment trap will be placed in front of the culvert inlet so that runoff will be treated before entering the culvert inlet. This treatment will keep most of the soil from unprotected slopes out of the stream. As reclamation of the slopes and channels reach the location of the pond, the sediment pond will be removed. Once the pond is removed, sediment control shall be maintained by the deep gouging, mulching and tackifying techniques. Temporary silt fences will be installed beyond the existing toe of the sediment pond slope prior to the removal of the sediment pond. These fences will remain until the pocking has been accomplished and final seeding is established enough to prevent erosion of the topsoil.

Re-contouring

All areas affected by surface operations will be graded and restored to a contour that is compatible with the natural surroundings and post mining land use. For approximate contours prior to surface disturbance refer to the maps presented as Plates 3-7, 3-8, and 3-9.

Removal or Reduction of Highwall

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See Chapter 5, Engineering, Section 5.40, Reclamation Plan.

2.43 Soil Nutrients and Amendments

GENWAL has committed to adding nutrients as determined by lab analysis conducted on topsoil samples after redistribution and during final reclamation. The methods used to ensure adequate and representative samples from different locations and depths within the topsoil stockpile used for lab analysis are presented below. Amendments will be added to the soil according to "Soil Survey" recommendations (See Appendix 2-3).

Two soil samples per acre of redistributed topsoil will be submitted to the lab for assessment of nutrient requirements. All lab work will be conducted by a qualified laboratory using methods approved by the Division. The samples will be collected by auger with each auger sample taken on the correct angle to the slope. Results of the samples, along with consultation from the regulatory authority, will determine the necessary nutrients and amendments to the topsoil.

Nutrients and soil amendments, if shown to be required by soil tests shall be applied to the redistributed topsoil layer by broadcast methods and tilled into the topsoil (if required). One ton per acre of alfalfa or straw mulch will be incorporated into the redistributed topsoil and substitute topsoil for increased fertility and physical structure enhancement (separate and distinct from the wood fiber mulch used as a surface mulch described in Section 2.44). No other mitigation plans are proposed for the soil resources except for the addition of nutrients to the topsoil and subsoil after redistribution during the reclamation process.

2.44 Soil Stabilization

Before the topsoil is redistributed, the area to receive topsoil will be regraded and ripped to ensure positive contact and minimize slippage between the existing surface and the redistributed topsoil. The regraded area will be disced on slopes of less than 20% and scarified with a track-hoe on slopes greater than 20% until the grade becomes impractical for the equipment to operate. Topsoil will be redistributed in a manner that achieves an approximate, uniform stable thickness on a surface that will prevent excess compaction of the topsoil. The topsoil will be protected from wind and water erosion before and after it is reseeded. It is proposed that the topsoil will be redistributed with a front end loader and D-6 size dozer. Surface roughening techniques, such as gouging or deep pocking, will be used on the soil surface to minimize compaction and promote water harvest and conservation.

On slopes of 30% and less a wood fiber mulch of 1.5 tons per acre will be used which will be bonded with the soil using a tackifying agent. However, the steeper slopes south of Crandall Creek will treated with a PAM chemical soil treatment to enhance moisture retention and relieve compaction. Then, the seed would be broadcast and hand raked into the soil surface. A soil inoculation treatment may also be incorporated into the soil to aid the re-establishment of soil bacteria, microhorizia and mycelium. Wood fiber mulch will be sprayed over the seed bed and then a bonded fiber matrix tackifier will be applied.

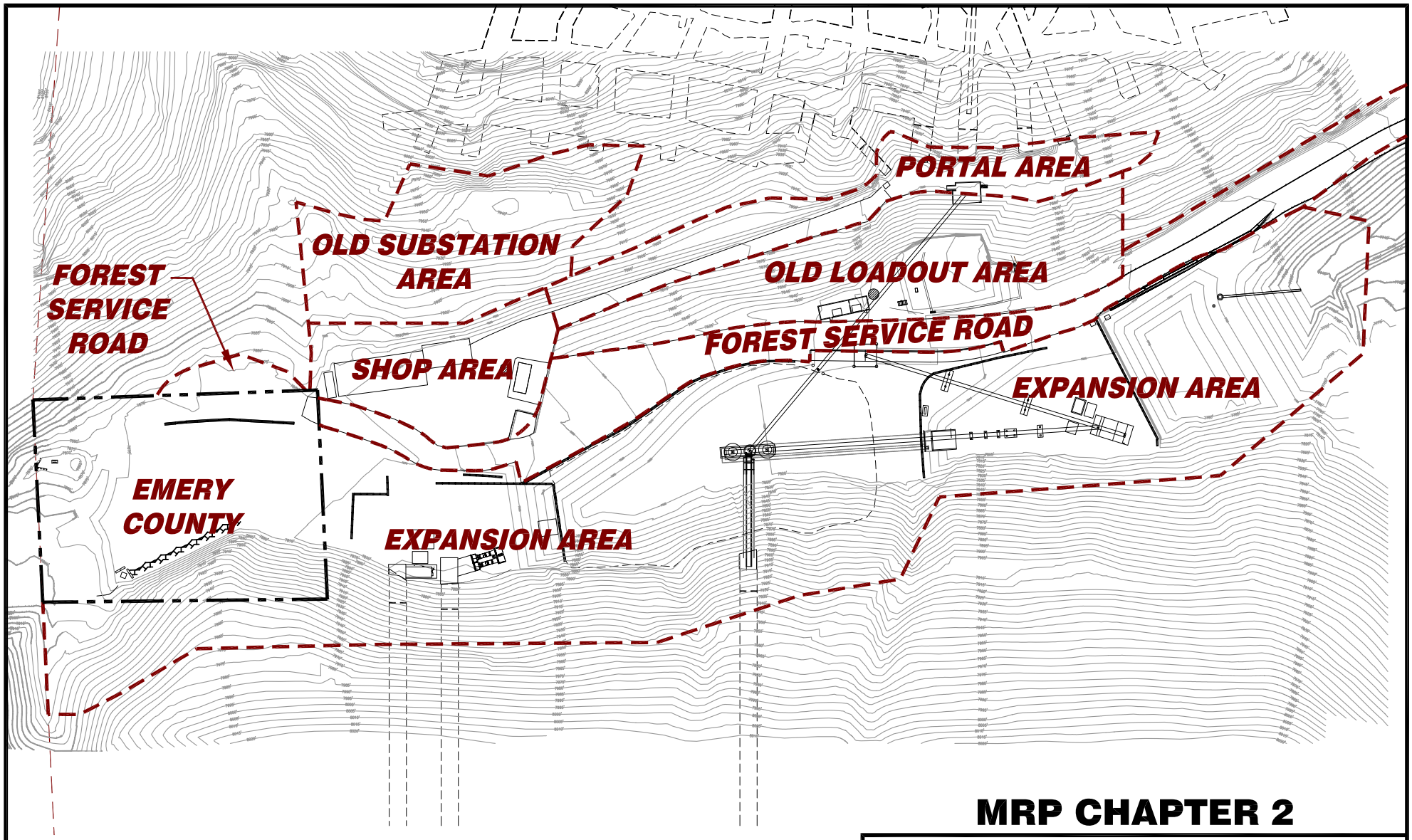
2.50 Performance Standards

All topsoil, subsoil and topsoil substitutes or supplements will be removed, maintained and redistributed according to the plan given under R645-301-230 and R645-301 -240.

2.52 Stockpile Maintenance

All stockpiled topsoil, subsoil and topsoil substitutes or supplements will be located, maintained and redistributed according to plans given under R645-301-230 and R645-301-240. Stockpiled topsoil will be protected through a combination of berms, vegetative cover, straw-bale dikes and/or silt fences. In addition, those piles adjacent to the main

access road that could be impacted by salt used in ice removal will be closely monitored to determine if the vegetation is adversely impacted. In the event damage is in evidence, salt use will be suspended in those areas adjacent to topsoil piles. *(Note: after two decades of salting the road, no adverse effects on the vegetation on the topsoil pile have been observed, as noted in the annual reports. The amount of salt used on the road varies from year to year depending on the amount of snowfall. The salt (NaCl) used on this road is identical to the salt used by UDOT on Highway 31 running through Huntington Canyon.)*



MRP CHAPTER 2

RECLAMATION AREAS

SURFACE FACILITIES RECLAMATION PLAN

GENWAL™ RESOURCES, INC.
794 NORTH "C" CANYON ROAD, EAST CARBON, UTAH 84520
P.O. BOX 910, PRICE, UTAH 84520
PHONE: (435) 888-4000 FAX: (435) 888-4002

CRANDALL CANYON MINES

PERMIT NUMBER C015/032

DRAWN BY	PJ	SCALE	NO SCALE
APPROVED BY	ME	DATE	30 APRIL 2020
REVISION:	3	PLATE	FIGURE 1

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CHAPTER 2

FIGURES

4/97 Revised 5/97

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UTAH DIVISION OIL, GAS AND MINING
PRICE FIELD OFFICE

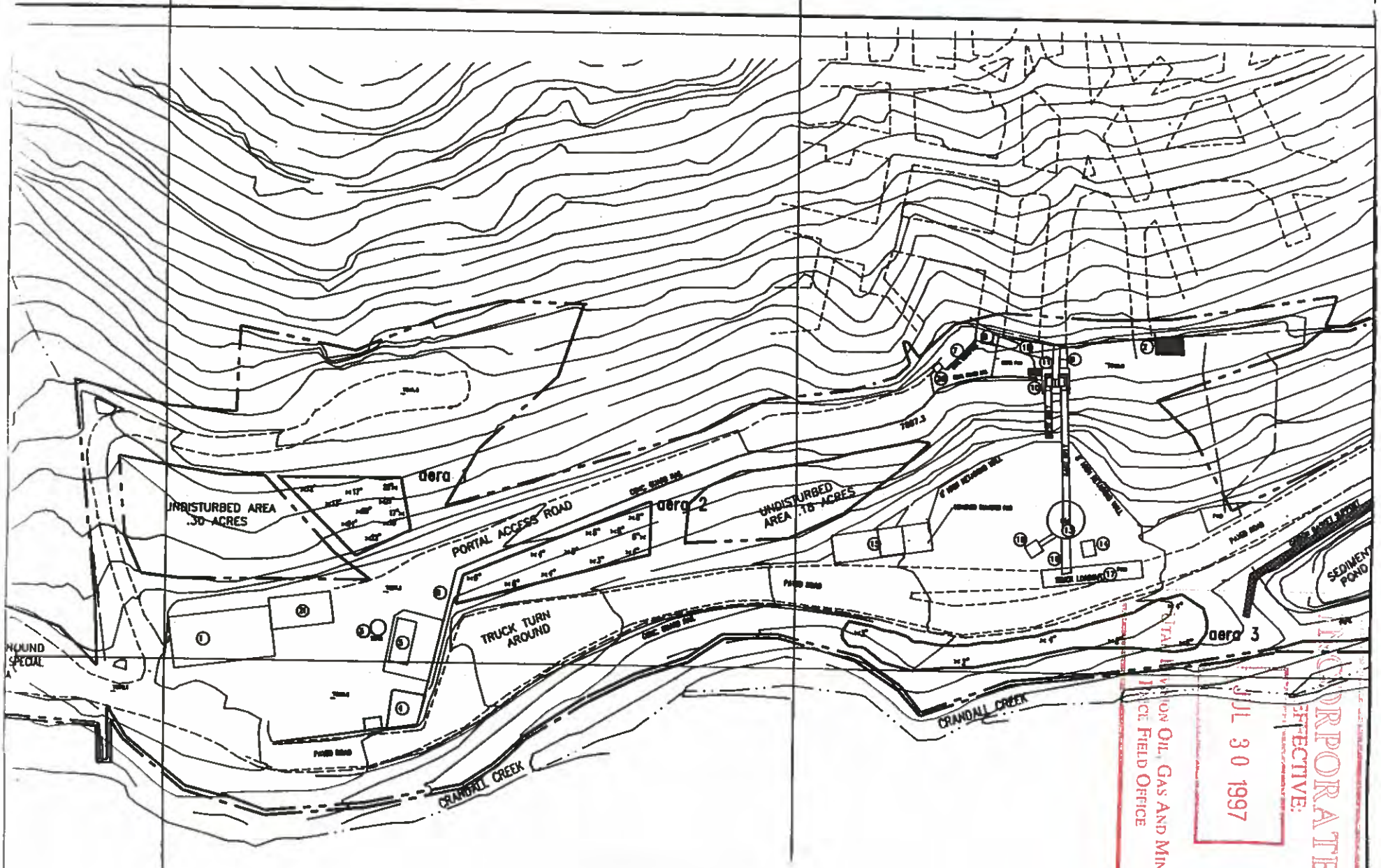

FIG. 8A SOIL DEPTH FROM INTERIM RECLAMATION LOCATIONS

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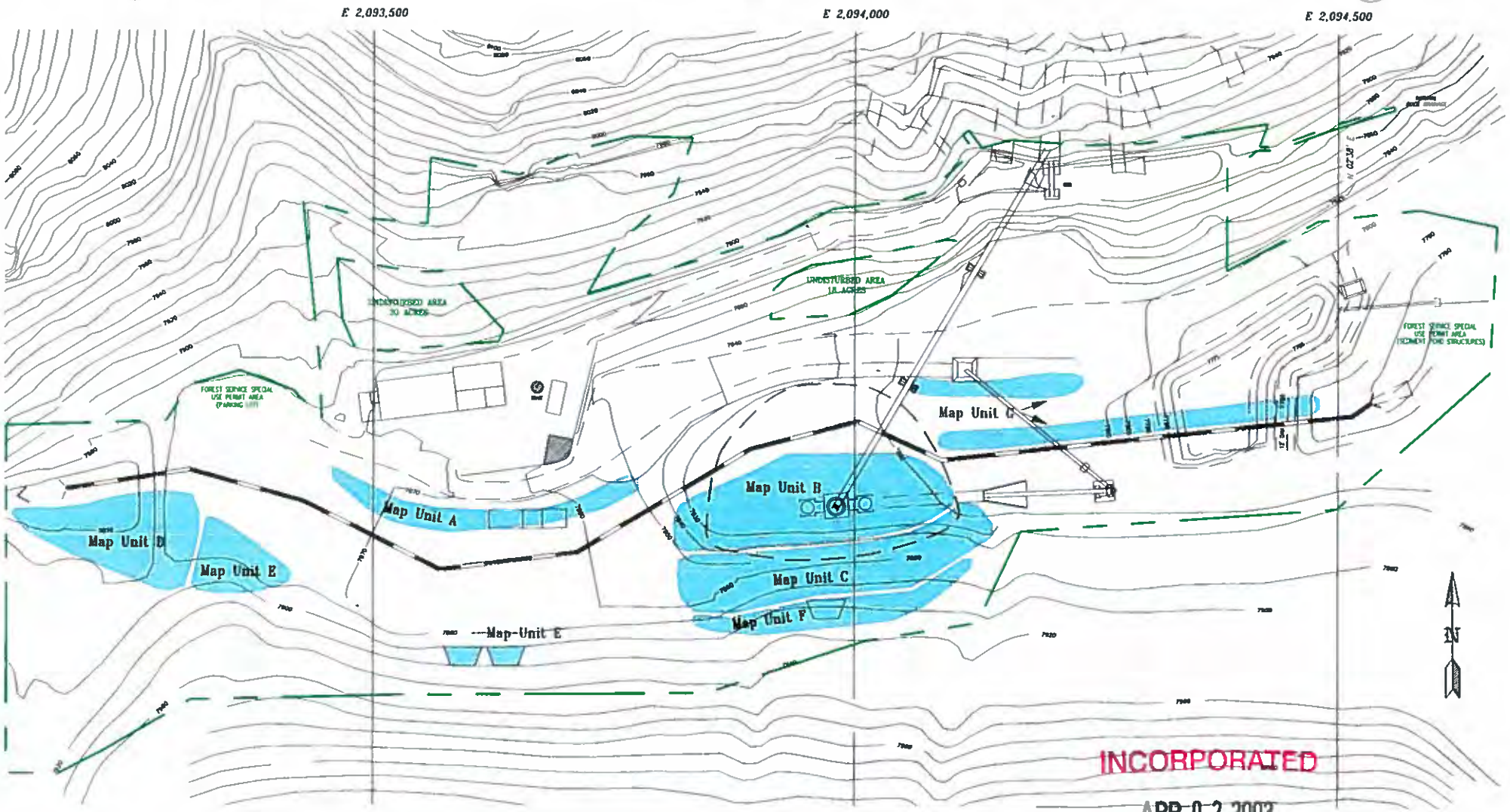
EFFECTIVE:



INCORPORATED

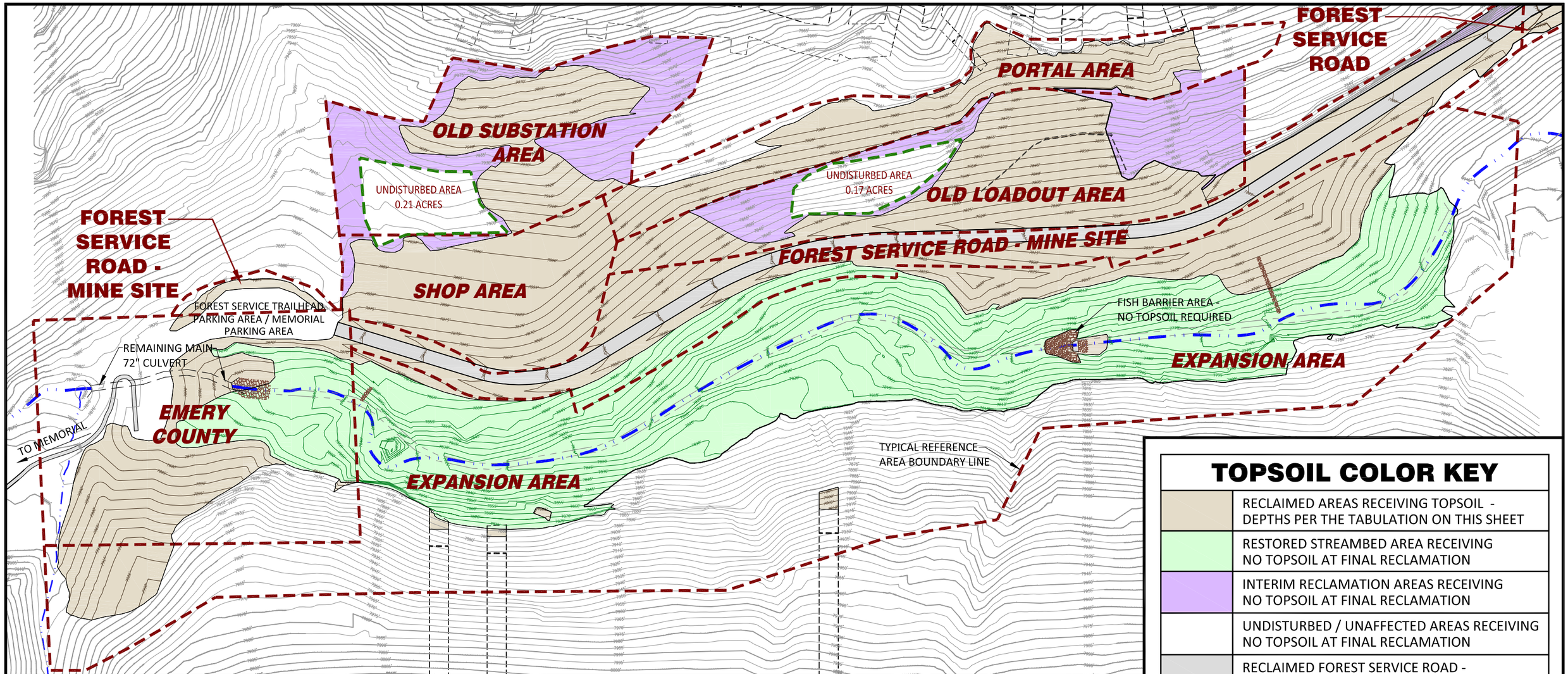
APR 0 2 2003

DIV OF OIL GAS & MINING

SOIL SALVAGE AREAS

		Acreage	Volume
Map Unit A	(N. Slope Area)	0.14 ac	180 yd.3
Map Unit B	(S. Slope Bench Area)	0.49 ac	1,728 yd.3
Map Unit C	(Coal Pile Area)	0.41 ac	
Map Unit D	(SW corner of mine yard)	0.28 ac	1,672 yd.3
Map Unit E	(Nose cut area/south portals)	0.22 ac	441 yd.3
Map Unit F	(coal pile area)	0.15 ac	690 yd.3
Map Unit G	(loadout/pond area)	0.22 ac	178 yd.3

02/20/03 FIGURE 8B SOIL SALVAGE AREAS



TOPSOIL COLOR KEY

	RECLAIMED AREAS RECEIVING TOPSOIL - DEPTHS PER THE TABULATION ON THIS SHEET
	RESTORED STREAMBED AREA RECEIVING NO TOPSOIL AT FINAL RECLAMATION
	INTERIM RECLAMATION AREAS RECEIVING NO TOPSOIL AT FINAL RECLAMATION
	UNDISTURBED / UNAFFECTED AREAS RECEIVING NO TOPSOIL AT FINAL RECLAMATION
	RECLAIMED FOREST SERVICE ROAD - FINAL CONFIGURATION

DISTURBED AREA / RECLAMATION TOPSOIL AMOUNTS TABULATION

Reference Area	Total Undisturbed / Unaffected Area (Requiring No Topsoil Application)	Total Interim Reclamation Area (Requiring No Topsoil Application)	Total Restored Streambed Area (Requiring No Topsoil Application)	Total Reclaimed Area with Topsoil	Total Depth of Applied Topsoil (feet)	Total Amount of Applied Topsoil (cubic feet)	Total Amount of Applied Topsoil (cubid yards)	Total Disturbed Area (square feet)	Total Disturbed Area (acres)
Emery County	37,863.66	0.00	16,237.61	24,726.41	1.25	30,908.01	**1,144.74**	78,827.68	**1.81**
Portal Area	10,130.25	879.47	0.00	27,991.25	1.25	34,989.06	**1,295.89**	39,000.97	**0.90**
Expansion Area	135,341.51	0.00	132,746.88	35,689.31	1.25	44,611.64	**1,652.28**	303,777.70	**6.97**
Old Substation Area	0.00	23,105.95	0.00	21,756.20	1.25	27,195.25	**1,007.23**	44,862.15	**1.03**
Old Loadout Area	12,687.29	7,980.90	0.00	38,318.75	1.25	47,898.43	**1,774.02**	58,986.94	**1.35**
Forest Service Road Mine Site	18,790.58	9,013.56	7,204.38	30,343.67	1.00	30,343.67	**1,123.84**	65,352.19	**1.50**
Forest Service Road	130,612.39	106,494.07	0.00	91,175.73	1.00	91,175.73	**3,376.88**	328,282.19	**7.54**
Shop Area	0.00	1,951.62	141.31	32,462.98	1.25	40,578.73	**1,502.92**	34,555.91	**0.79**
Totals	345,425.68	149,425.57	156,330.18	302,464.29		347,700.51	**12,877.80**	953,645.72	**21.89**

MRP CHAPTER 2

GENWAL™ RESOURCES, INC.
P.O. Box 910, 794 North "C" Canyon Rd, East Carbon, Utah
Telephone: (435) 888-4000

CRANDALL CANYON MINES SITE
RECLAMATION TOPSOIL DISTRIBUTION MAP

REV: 3	ACAD: RECLAMATION PLAN R10
DATE: 4-30-20	BY: PJJ
SCALE: 1"=100'	FIGURE 8c

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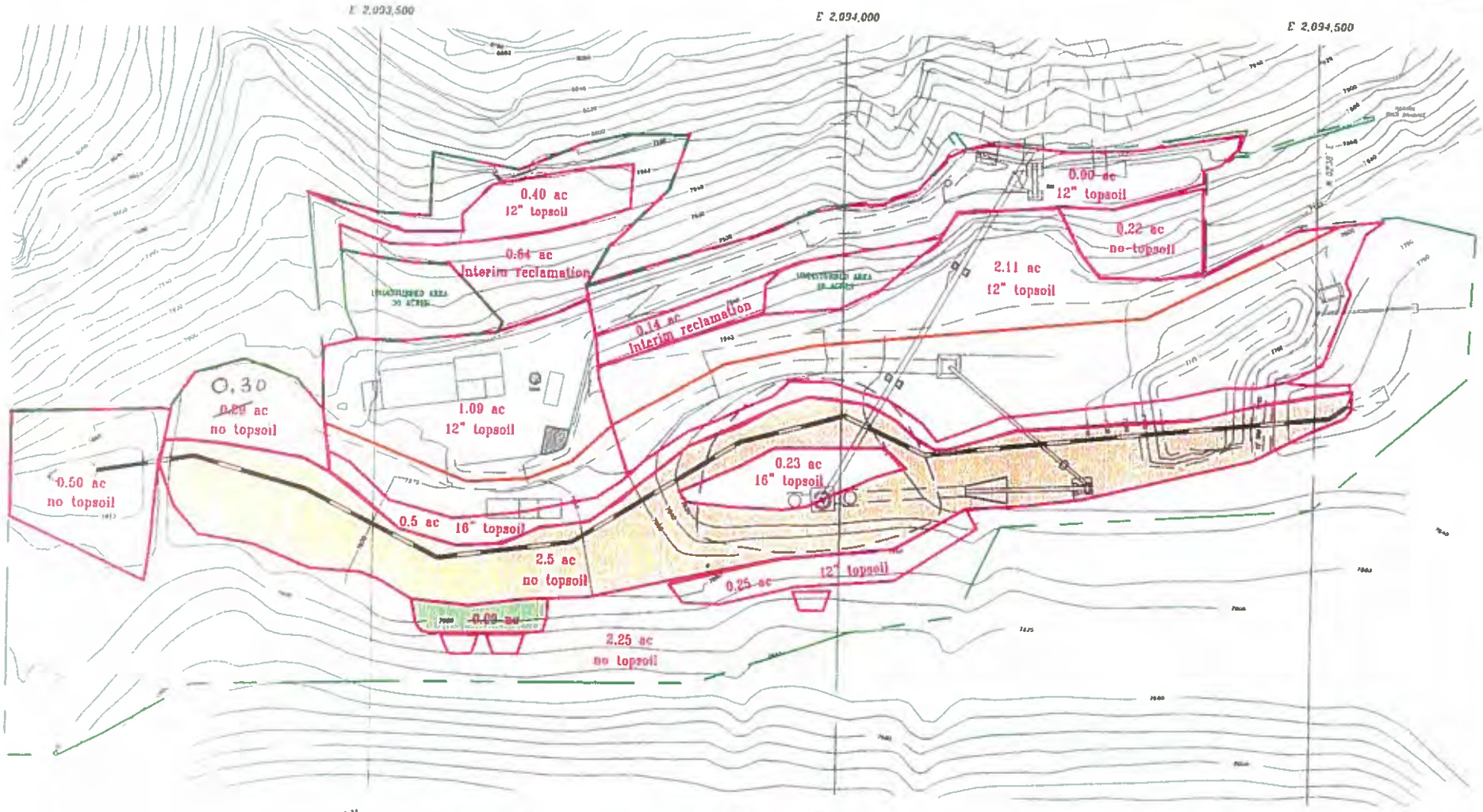

12" Topsoil

16" Topsoil

No Topsoil

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APR 02 2003

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FIGURE 8D
SOIL AREAS PROTECTED BY GEOTEXTILE

Proposed South Portals

Culvert Expansion

Acad Ref: Fig 8D.Dwg

WordPerfect Document Compare Summary

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CHAPTER 5

ENGINEERING
(R645-301-500)

TABLE OF CONTENTS
CRANDALL CANYON MINE, MINE AND RECLAMATION PLAN
CHAPTER 5
ENGINEERING

SECTION	DESCRIPTION	PAGE
5.10	Introduction	5-1
5.11	General Requirements	5-1
5.12	Certification	5-1
5.13	Compliance with MSHA	5-1
5.14	Inspections	5-1
5.15	Reporting and Emergency Procedures	5-4
5.15.10	Reporting a Slope failure	5-4
5.15.20	Impoundment Hazards	5-4
5.15.30	Temporary Cessation	5-4
5.20	Operation Plan	5-4
5.21	General	5-5
5.21.11	Previously Mined and Presently Mined Areas	5-5
5.21.12	Existing Surface and Subsurface Facilities	5-5
5.21.13	Landowners, Right of Entry & Public Interest Maps	5-5
5.21.14	Mine Maps and Permit Area Maps	5-7
5.21.15	Land Surface Configuration Maps	5-7
5.21.16	Maps & Cross-sections	5-7
5.21.17	Transportation Facilities Maps	5-7
5.21.18	Support Facilities	5-7
5.21.20	Signs and Markers	5-7
5.21.24	Mine & Permit Identification Signs	5-7
5.21.25	Perimeter Markers	5-8
5.21.26	Buffer Zone Markers	5-8
5.21.27	Topsoil Markers	5-8
5.22	Coal Recovery	5-8
5.23	Mining Methods	5-10
	Mining Operation	5-10
	Mining History	5-11
	Underground Equipment	5-14
	Geotechnical	5-14
	Revised Pillar Design	5-16
	Barrier Perimeters	5-16
	Annual Production of Coal	5-17
	Access to Future Reserves	5-17
	Projected Mining for Planned Mine Life	5-17

TABLE OF CONTENTS (Continued)

CHAPTER 5

SECTION	DESCRIPTION	PAGE
	Operating Schedule and Employment	5-17
	Safety Training	5-17
	Fire Protection	5-18
	Water & Electrical Systems	5-18
5.24	Blasting	5-19
5.25	Subsidence	5-20
5.25.10	Subsidence Control Plan	5-21
	Surface Features Subject to Subsidence	5-22
5.25.11	Methods of Coal Removal	5-23
5.25.12	Description of Physical Conditions	5-23
5.25.13	Measures to Prevent Subsidence	5-23
5.25.14	Subsidence Monitoring	5-25
5.25.15	Anticipated Effects of Planned Subsidence	5-26
5.25.16	Mitigation of Damages	5-26
5.25.20	Subsidence Control	5-27
5.25.30	Public Notice of Proposed Mining	5-27
5.26	Mine Facilities	5-27
	Coal Handling	5-31
	Power Systems & Transmission Lines	5-31
	Surface Equipment	5-32
	Culinary Water System	5-32
	Sewage System	5-32
	Sediment Control Structures & Water Treatment	5-32
5.26.3	Water Pollution Control	5-33
5.26.4	Air Pollution Control	5-33
5.27	Transportation Facilities	5-33
5.28	Handling & Disposal of Coal, Overburden & Waste	5-37
5.28.10	Coal Removal, Handling and Storage	5-37
5.28.20	Overburden	5-37
5.28.30	Mine Development & Non-coal Waste Removal	5-37
	Processing Waste	5-38
	Hazardous Waste	5-38
	Sediment Pond Waste	5-38
	Sanitary Waste	5-39
5.29	Management of Mine Openings	5-39
5.30	Operational Design and Plans	5-39

TABLE OF CONTENTS (Continued)
CHAPTER 5

SECTION	DESCRIPTION	PAGE
5.32	Sediment Control	5-39
5.33	Impoundments	5-40
5.34	Roads	5-40
5.35	Spoil	5-41
5.36	Coal Mine Waste	5-41
5.37	Regraded Slopes	5-41
5.40	Reclamation Plan	5-42
5.41	General	5-42
	MW-1 Supply Well Abandonment	5-42
	Temporary Cessation	5-43
5.42	Narratives, Maps and Plans	5-44
5.42.10	Time Table	5-44
	Final Surface Configuration	5-45
	Interim Reclamation	5-45
5.42.40	Bond Release	5-45
5.42.50	Removal of Sedimentation Pond	5-46
5.42.60	Roads	5-46
5.42.70	Final Abandonment of Mine Openings & Disposal Areas	5-47
5.42.71	Closure and Management of Mine Openings	5-47
5.42.72	Excess Waste	5-48
5.42.80	Estimate of Reclamation Costs	5-48
5.53	Backfilling and Grading	5-49
	Removal of Highwalls	5-49
	Terracing and Erosion Control	5-49
	Refuse Piles	5-50
	Surface Coal Mining	5-50
5.60	Performance Standards	5-50

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)

CHAPTER 5

LIST OF PLATES

PLATE NUMBER	DESCRIPTION
5-1	Old Works
5-2	Mining Projections

Plates 5-2A, 5-2B and 5-2C have been removed.

5-3	Overall Surface Facility Map
5-3a	Enlarged Surface Facility Map
5-4	Proposed In-Mine Sump
5-5	Subsidence Control Point Locations
5-6	Truck Loadout
5-7	Rock Dust Silo
5-8	Electrical Substation Installation
5-10	Road Profile and Cross Section

Plate 5-11 has been removed

5-12	Aerial Photography
5-13	Aerial Photography
5-16	~~Reclamation (Phase I)~~Sediment Control Details
5-17	Reclamation ~~(Phase II)~~ Contours

CHAPTER 5

LIST OF PLATES (continued)

PLATE NUMBER	DESCRIPTION
5-17A~~ ~~, B, C, D	Reclamation ~~Cross Sections~~Profiles
5-18	Underground Bath House (As Built)
5-19	Hilfiker Welded Wire Wall Details (3 Sheets)
5-20	Original Surface Contour Map
~~5-17B~~	~~Reclamation Cross Sections~~
~~5-18~~	~~Underground Bathhouse, As Built~~
~~5-19~~	~~Typical Road Sections, 3 sheets~~
~~5-20~~	~~Original Surface Contour Map~~

~~Note: Bold number plates and appendices are included with this submittal.~~5-21 New Foot Bridge

CHAPTER 5

LIST OF APPENDICES

APPENDIX NUMBER	DESCRIPTION
5-1	Geomechanics Laboratory Report
5-2	Coal Pillar Sizing Report
5-3	Coal Pillar Safety Factor Calculations
5-4	Coal Pillar Safety Factor Calculations
5-5	BLM Report
5-6	Terratek Report
5-7	Method Used to Determine Maximum Surface Limit of Possible Subsidence
5-8	Subsidence Monitoring Plan
5-9	Deleted
5-10	Spill Prevention and Countermeasure Control Plan (SPCC) January 21, 1992
5-11	Culinary Water Supply
5-12	Sewage Plans
5-13	Coal Silo Calculations
5-14	UPDES Permit
5-15	Contract Document & Specifications for Haul Road Improvement Project

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 ~~A~~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
5-29	~~Burma Evaporation Pond~~

Unused (Burma Pond Appendix 7-66)

5-30 Relocate UPDES Outfall #002 to Huntington Creek

CHAPTER 5

ENGINEERING

5.10 Introduction

This chapter will present the Operation Plan, Reclamation Plan, Design criteria, and Performance standards which will affect the mining operations of the Crandall Canyon Mine. The facilities and structures have been and/or will be designed in such a way to minimize the potential impacts of mining operations at the mine site.

5.11 General Requirements

The methods, calculations, maps, plans, and cross-sections pertinent to the operations of the Crandall Canyon Mine Facilities and subsequent reclamation operations are presented in the following sections. These designs are required to comply with the design within the R645-301-500 regulations.

5.12 Certification

All maps, cross-sections, designs, and plans, as required will be prepared by or under the direction of and certified by a professional engineer or land surveyor.

5.13 Compliance with MSHA Regulations and MSHA Approvals

As required by MSHA, the surface of the mine site is inspected on a quarterly basis, as mandated by law, and on spot inspections as deemed necessary by the governing agency. All mine openings are inspected on a quarterly basis and/or more often if deemed necessary by MSHA. GENWAL will comply with the requirements of both DOGM and MSHA regarding these facilities.

5.14 Inspections

All engineering inspections, except those described under R645-301-514.330, will be conducted by a registered professional engineer or other qualified professional specialist under the direction of the professional engineer.

The existing sedimentation pond will be inspected by a professional engineer or a qualified person under the supervision of a professional engineer on an annual basis. The inspection report, see Figure 5-1, will be certified by the professional engineer and be provided to the Division as part of the annual report.

Quarterly inspections will be performed by a qualified person for appearance of structural weakness and other hazardous conditions, as specified in R645-301-330.

CERTIFICATION REPORT

On _____,199_, an inspection of GENWAL Resources sedimentation pond number 1 revealed the following:

A. The pond has been constructed and maintained in accordance with the approved plan.

B. The pond's embankment appeared sound with no signs of instability or hazardous conditions.

C. The water evaluation was _____ feet. The water depth was _____ feet.

D. The existing storage capacity is _____ acre-feet -which is greater than/less than 3.988 acre-feet required by the Mining and Reclamation plan.

E. The pond is inspected quarterly for signs of structural weakness or problems.

F. Comments and Remarks _____

_____

_____

_____

_____

_____

I have performed the above inspection on this pond to comply with R645-301-514 and do hereby certify the inspection to be a true and accurate representation of the pond at this time.

_____

Signature

_____

Date

Figure 5-1. Certification Report Form.

SEDIMENTATION POND INSPECTION REPORT *

DATE	TIME	DECANT LEVEL	DISCHARGE	CONTROL DEVICE	DIKE	INSPECTED BY

* Note any appearances of instability, structural weakness, and other hazardous conditions; and changes in piezometer readings.

Figure 5-2. Sedimentation Pond Inspection Report Form.

The Sedimentation Pond Inspection Report Form is used to record information from each inspection and is located at the mine site.

5.15 Reporting and Emergency Procedures

5.15.10 Reporting a Slope Failure

At any time a slope failure occurs which may have a potential adverse effect on public, property, health, safety, or the environment, GENWAL will notify the Division promptly of the problem and of any remedial measures planned to correct the problem. If any examination or inspection of the sedimentation pond discloses that a potential hazard exists, the Division will be notified by the fastest available means of the hazards and of the remedial measures to correct such hazards. GENWAL will comply with any remedial measures requested by the Division and agreed upon by the operator.

5.15.20 Impoundment Hazards

If any examination or inspection discloses that a potential hazard exists, GENWAL will promptly inform the Division of the finding and of the emergency procedures formulated for public protection and remedial action. If adequate procedures cannot be formulated or implemented, the Division will be notified immediately.

5.15.30 Temporary Cessation

In the event of a temporary cessation of mining operations, as defined by the Division, GENWAL will notify the Division as soon as possible. GENWAL will effectively support and maintain all surface access openings to the underground operations, and secure surface facilities in areas in which there would be no current operations but operations would resume under an approved permit.

Before temporary cessation of coal mining and reclamation operations for a period of 30 days or more, or as soon as it is known that a temporary cessation will extend beyond 30 days, GENWAL will submit to the Division a notice of intention to cease or abandon operations. This notice will be as required by R645-301-515.321.

5.20 Operation Plan

This section presents the operations plan for the Crandall Canyon Mine.

5.21 General

This section presents a description of the plan for operation of the permit area, including descriptions of previously mined and presently mined areas, surface and subsurface facilities, land owner and right-of-way maps, permit area maps, and other feature maps which apply.

5.21.11 Previously Mined and Presently Mined Areas

Plates 5-1 and 5-2 show the location and extent of past and present underground mining operations.

5.21.12 Existing Surface and Subsurface Facilities and Features

The locations of surface and subsurface man-made features within, passing through, or passing over the proposed permit area are combined on Plates 5-3, 7-5 and 7-5A. Other detailed plans are as shown on Plate 5-4 (In Mine Sump), Plate 2-2 (Top Soil Storage Piles), Plate 5-6 (Truck Loadout Facility), Plate 5-7 (Rock Dust Silo), Plate 5-8 (Electrical Substation), and Plates 7-4A and 7-6A (Sedimentation Pond Details and Cross-Sections).

The design and details for the USFS road within the permit area are shown on Plate 5-19, sheet 5 of 9 (Concrete Turnaround), sheet 6 of 9 (Layout of the USFS road), sheet 7 of 9 (Gabion Wall), sheet 8 of 9 (Rock Wall Details), and sheet 9 (Upper Parking Area).

5.21.13 Landowners and Right-of-Entry and Public Interest Maps

The landowners of record, both surface and subsurface, included in or contiguous to the permit area, are shown on Plate 1-1. The permit area on which GENWAL has the legal right to enter is shown on Plate 5-2.

~~Appendix~~Appendices 1-1, 1-2, 1-3, 1-4, 1-5 and 1-13 show~~s~~ the legal right of the applicant to enter and conduct coal mining and reclamation operations, and the measures to be used to ensure that the interests of the public and landowners affected are protected under R645-103-234.

GENWAL has included the entire T 16 S, R 7 E, SW1/4 of section 5 in the permit area. GENWAL owns in fee (surface and coal) the entire SW1/4 of section 5, which was previously known as the Dellenbach property. GENWAL acquired the property from ARCO. Previously, only a small portion of the SW1/4 of section 5 had been included in the permit area. Expansion of the surface facility area requires the inclusion of this fee section within the permit area boundary.

GENWAL is requesting an Incidental Boundary Change in order to mine a long, narrow block of coal adjacent to projected longwall panels in Section 2, T. 16 S., R. 6 E. This block contains about 40,000 tons of federal coal that would not otherwise be mined. An Incidental Boundary Change would allow for maximum recovery of the coal reserves by allowing the longwall setup ~~entires~~entries and panels to be moved westward but, in no case, would the longwall panels extend into the 22~~-~~-degree angle projected downward from the surface expression of the Joe's Valley Fault. The ~~amending the~~amended permit boundary would include approximately 50 acres in T 16 S, R 6 E as the Incidental Boundary Change area. Refer to Plates 1-1 and 5-2 for GENWAL's existing lease area and the Incidental Boundary Change Area. This addition would allow GENWAL to mine additional coal reserves located on the eastern edge of sections 3 and 10 from their proposed underground workings in section 2 thus optimizing the coal reserves in this area. This coal would not be mineable from the west due to the Joe~~s~~'s Valley fault, nor from the north or south because of limited access.

GENWAL will obtain a coal right-of-way (application has been submitted) from the BLM in order to extend the longwall panels up to the western boundary of section 2. By extending the longwall panels to the western edge of section 2, a total of approximately 300,000 additional tons could be mined in this area of the mine. The Incidental Boundary Change area would consist of first mining only. The right-of-way would accommodate the setup rooms and barrier pillars for the longwall panels allowing the panels to be extended to the western boundary of section 2. The legal description for the area included in the Incidental Boundary Change is as follows:

T. 16 S., R. 6 E.	Section 3	E1/2 E1/2 SE1/4 NE1/4	10 acres
		E1/2 E1/2 NE1/4 SE1/4	10 acres
		E1/2 SE1/4 SE1/4	20 acres
	Section 10	NE1/4 NE1/4 NE1/4	10 acres
		TOTAL	50 acres

Refer to Plate 5-2 for mine projections in the IBC area.

GENWAL acquired federal lease UTU-78953 (South Crandall tract) on June 2003 (refer to Appendix 5-24 for right of entry information.) Lease UTU-78953 is described as follows:

T. 16 S., R. 7 E.	Section 4	W1/2 SW1/4,	80.00 acres
		S1/2 SW1/4 NW1/4	20.00 acres
	Section 5	SE1/4	160.00 acres
		S1/2 SE1/4 NE1/4	20.00 acres
	Section 8	E1/2	320.00 acres
		NE1/4 NW1/4	40.00 acres
		S1/2 NW1/4	80.00 acres
	Section 9	NW1/4	160.00 acres
		TOTAL	880.00 acres

GENWAL Resources acquired the SITLA/PacifiCorp sublease in February 2004 (Refer to Appendix 1-14 for right-of-entry information.) This sublease is described as follows:

T. 16 S., R. 7 E.	Section 8	NW¼NW¼	40.00 acres

GENWAL Resources acquired the Nielson Fee Lease in April 2004 (Refer to Appendix 1-15 for right-of-entry information.) This sublease is described as follows:

T. 16 S., R. 7 E.	Section 8	SW¼	160.00 acres

It should be noted that throughout this Mining and Reclamation Plan the combined area (1080 acres) of Federal Lease UTU-78953, the SITLA/PacifiCorp -sublease and the Nielson Fee Lease ~~is~~are collectively referred to as the South Crandall lease area, the South Crandall tract, the South Crandall mining area and other similar terms.

GENWAL Resources acquired the modification of Federal Lease U-68082 in February~~,~~ 2005. (Refer to Appendix 1-15 for right of entry information.) This modification is described as follows:

T.15S., R. 7 E.	Section 32	W½NW¼	80.00 acres
		NW¼SW¼	40.00 acres
		Total	120.00 acres

The Forest Service and GENWAL have agreed to ~~than~~an arrangement whereby a certain portion of the trailhead parking lot can be utilized for GENWAL~~'~~ employee parking under the terms of the existing special use permit. To facilitate the flow of public traffic in and out of the trailhead, GENWAL will construct a barricaded exit from the trailhead out through the existing material storage area. This exit will be kept clear of materials, supplies, vehicles and all other potential obstructions so that the public will have unimpeded egress from the trailhead parking area at all times. Employee parking will be restricted to those designated areas as shown on the drawing in Appendix 5-26, so that a 30' wide area along the perimeter of the parking lot is maintained for public parking and run-around. Within this perimeter parking area no employee parking will be allowed. Signs will be installed to delineate the appropriate designated parking areas. Under the terms of the existing Forest Service special use permit GENWAL will continue to utilize the perimeter area of parking lot for snow storage during the winter months when the public no longer uses the trailhead.

To provide for better utilization of this area the trailhead will be expanded slightly, by less than 0.01 acres, by removing an irregular part of the bank at the upper end of the lot. (Refer to Appendix 5-26). Within this area of excavation topsoil will be salvaged and stockpiled in accordance with the approved reclamation plan. A minimum of 24" of topsoil/subsoil will be salvaged and stored at topsoil pile #4 located at the mouth of Crandall Canyon. A minimum of 32 cubic yards of topsoil material will be salvaged from this bank. Any additional material below the top 24" which, based on visual observation, appears to be suitable growth medium will also be salvaged. Once this

additional topsoil material has been placed on the existing storage pile, it will be re-vegetated as required by the Forest Service special use permit. The newly created slope-bank at the ~~t~~Trailhead will be re-seeded with a final-reclamation seed mix, exclusive of any clover and/or alfalfa.

5.21.14 Mine Maps and Permit Area Maps

Plate 1-1 shows leases of the existing permit area (including the South Crandall lease area and the U-68082 lease mod area) and defines the Incidental Boundary Change area. Plate 5-2 shows the boundaries of all areas affected by mining operations, including the proposed underground workings within the IBC area. Plate 5-3 shows the disturbed surface area within the permit area including the culvert expansion. The location and extent of potential subsidence is shown on Plate 6-2.

5.21.15 Land Surface Configuration Maps

Topographic maps used by GENWAL to depict surface contours within the permit area are represented on Plate 5-3.

5.21.16 Maps and Cross-Sections of the Features and Proposed Features

Maps produced by GENWAL show the facilities, disturbed area, disturbed area boundary, (Plate 5-3), explosive storage (there is no explosive storage on the surface), and point source discharges (Plate 7-5). These maps are located within this application.

5.21.17 Transportation Facilities Maps

This application describes each road and conveyor system to be constructed and used by the applicant as required by R645-301-527. Maps supporting this section include Plates 5-3, 5-6, 5-10, 5-19, 7-5, 7-5A, and 7-5C.

5.21.18 Support Facilities

Drawings showing support facilities are located on Plates 5-3, 5-6, 5-7, 5-8, 5-18, 7-5, 7-5A, and 7-5C.

5.21.20 Signs and Markers

Signs and Markers are posted, maintained, and removed by the operator; will be of uniform design that can be easily seen and read, be made of durable material, and conform to local laws and regulations, and be maintained during all activities to which they pertain. Identification signs will be placed, maintained, and marked in accordance with R645-301-243.

5.21.24 Mine and Permit Identification Signs

Mine and permit identification signs will be displayed in accordance with R645-301-521.240 through R645-301-521.244.

5.21.25 Perimeter Markers

The perimeter of all areas affected by surface operations or facilities are or will be clearly marked.

5.21.26 Buffer Zone Markers

Signs which have been or will be erected for buffer Zones as required by R645-301-731.600 will be clearly marked.

5.21.27 Topsoil Markers

Markers have been and will be erected to mark where topsoil or other vegetation-supporting material is stockpiled as required under R645-301-234.

5.22 Coal Recovery

The Bureau of Land Management (BLM) and the Utah State Division of Natural Resources govern the conservation and royalty payments of the coal located within GENWAL's proposed permit boundary. Mining plans must be approved by the BLM before mining can occur within the new area. A Resource Recovery Protection Plan (R2P2) is currently on file with the BLM and all federal coal will be mined in accordance with the R2P2 to ensure the diligent development and extraction of all mineable coal. (See Appendix 5-24 and Appendix 5-24A)

The lower Blackhawk Formation of the Wasatch Plateau is known to contain two mineable seams in this general area. These two seams are locally referred to as the Hiawatha and Blind Canyon (lower and upper coal respectively) seams. Drilling which began in March of 1985, and has since concluded, revealed that the upper seam is not of mineable thickness in previous Lease Area. In the South Crandall lease area both seams are mineable. In the U-68082 lease mod area only the Hiawatha seam is mineable.

In the State lease (M-21568) GENWAL has committed to drilling 150 foot "up-holes" every half-mile in the mains prior to second mining. Installation of the 150 foot up-holes will allow for location and evaluation of the overlying seams for coal production. Mine development plans for the upper seam will be developed and submitted for approval if the horizontal extent and mining conditions make mining the upper seam economically feasible. The BLM has determined the upper seam is not mineable and during 1985, approval was given by both the BLM and the Division to commence pillaring of the lower seam.

GENWAL will mine from rock to rock in areas where coal is less than 8' thick and geologic conditions allow. However, in areas where the top is poorly consolidated (i.e., shale partings are present with laminae of carboniferous materials with slickensides) and the roof is not self-supporting, coal top may be left. In addition, on development only, in areas where the coal is more

than 8' thick, coal top or bottom may be left. Within the physical limitations of the mining equipment retreat coal will be mined rock-to-rock in order to maximize resource recovery.

GENWAL has found that in areas of the mine, cutting coal higher than 8' on development results in excess rib sloughage, exposing miners to unnecessary dangers. GENWAL has found that width to height (w/h) ratios lower than 5.6 results in large slabs (2' - 3' thick and 8' high) separating from pillars and sliding or rotating into the entry. These slabs cause an immediate safety hazard to personnel working or traveling in the area and may be classified as accumulations by MSHA. Cleaning up the slabs results in more slabs sloughing which reduces the size of the pillar and results in entries that are wider than legally allowed. For these reasons, GENWAL may not cut higher than 8' on development. Although maximum recovery is an important design criteria~~a~~on, other considerations must be looked at in the final analysis in the extraction of coal. These factors consider the insurance of protection of personnel and the environment. Coal reserves will not be recovered in the following areas:

1. Areas where the coal thickness is less than 5'. Mining below this height is not feasible under current economic conditions.

2. Solid coal barriers will be left to protect main entries from mined out panels and to guarantee stability of the main entries for the life of the mine.

3. Solid coal barriers will be left between particular panels for roof and floor protection.

4. When extreme hazardous conditions exist, and personnel safety is compromised, coal extraction could then be terminated in that area of concern.

5. Coal will only partially be recovered in areas under existing perennial streams within the specified angle of draw with the consent of the Forest Service and approval by the Division. Expected recovery at GENWAL is predicted to be 80% in panels and 60% overall.

6. In areas of development in coal height of 8' or greater, top and/or bottom coal may be left.

7. In panels where the coal height exceeds the effective mining height of the mining equipment, including longwall equipment, either top or bottom coal will be left.

Mining in the South Crandall lease area will be done in accordance with the approved Resource Recover and Protection Plan (R2P2) (See Appendix 5-24). This plan was recommended for approval by the BLM on Nov. 12, 2004. This plan states that full extraction mining (i.e., longwall mining) is not authorized in panels BC-4 and HIA-5 in areas with less than 600' overburden unless it can be determined that these areas can be mined without adverse impacts to the Little Bear Canyon

municipal watershed. Final approval of full extraction mining in these panes will be addressed as a modification to the approved R2P2. Multiple seam mining beyond spring site LB-7 in Little Bear Canyon is contingent upon a monitoring plan approved by the Division in concurrence with the Forest Service at least two years prior to mining in that area.

Maps 5-2 (BC) and 5-2 (H) and Appendix 7-63 show the areas with less than 600' cover affected by this R2P2 condition. These maps show which areas are planned for longwall mining and which areas are planned to be mined with continuous miner units.

According to stipulation #17 of Federal Lease UTU-78953 (see App. 1-13) the Castle Valley Special Service District water treatment plant (constructed as water replacement for Little Bear Spring) must be operational prior to mining in the following areas:

- Mill Fork Graben - Area within 1,000 feet of the southeast corner of the lease in Section 8 (corner of Sections 8, 9, 17, and 16 in T, 16 S., R. 7 E., SLM).

- North of Little Bear Spring (possible water-bearing fracture system) - Area within 1,000 feet of the southern boundary of the lease in Section 9, T. 16 S., R. 7 E., SLM).

It should be noted that under the currently approved R2P2 there is no mining being proposed in either of these areas. The water treatment plant is scheduled for completion in January 2005.

5.23 Mining Methods

GENWAL will use both Room and Pillar and longwall mining methods for coal production. Projected mine development is depicted on Plate 5-2. In general, room and pillar development mining will be accomplished using continuous mining methods. Retreat mining will use longwall mining and room and pillar methods. The mine plan has been developed to maximize coal recovery in an economical manner.

Second (recovery) mining by continuous miner will occur in those areas which are not longwall mined (Plate 5-2) and will be done in accordance with the approved MSHA roof control plan. Specifically, in areas where long-wall panels cannot be installed due to the presence of stream buffer protection zones or in perimeter areas with irregular boundaries, room and pillar methods will be utilized to maximize coal recovery and still maintain regard for environmental and safety concerns listed in Section 5.22 above. All pillars in the mine, with the exception of barrier pillars or other pillars needed to protect the outcrop, will be fully extracted. However, safety or economic reasons may dictate some pillars or partial pillars remain in place. Pillars used to protect mains, submains, and fire breaks will be left until final retreat or when they serve no useful purpose.

Mining in the Incidental Boundary Change area will consist primarily of longwall gateroads, setup rooms and barrier pillars. (No room and pillar mining will be conducted in the Incidental Boundary Change Area or adjacent areas.) First mining will be done with continuous miners. The longwall entries will be extended to the west but in no case will they extend past the 22-degree angle of draw projected from the surface expression of the Joes's Valley Fault. No pillars will be removed during mining in the Incidental Boundary Change area and consequently, no subsidence will occur. No surface disturbance or breakouts will occur within the Incidental Boundary Change area. Refer to Plate 5-2.

When mining in the longwall gate entry nears the fault (between 200-300 feet away) an underground drill will be used to drill west toward the fault to determine its location. The drill will drill horizontally toward the fault up to 50 feet ahead of the entry face. If the fault is not encountered, the continuous miner will advance about 30-40 feet toward the fault, leaving at least 10 feet of coal between the entry and the end of the hole. The drill will again drill ahead. This sequence will continue until either water or fault gouge is encountered in the hole or the entry has been developed to its maximum extent (providing no fault was detected). If the fault is encountered prior to reaching the bleeder entries, then mining will stop and the bleeder entries will be relocated. At least 10 feet of solid coal will be left between the face of the entry and the fault. GENWAL will notify the Forest Service and DOGM if substantial water is produced from the drill holes or the fault. Any appreciable outflow from the fault will be monitored.

At least one horizontal hole will be drilled in the headgate and tailgate of each panel. Should water be encountered by the drill hole, the hole would be evaluated. If flow is low to moderate and the flow rate diminishes, drilling would be re-initiated. However, if the flow is high (greater than

50 gallons per minute) and the end of the hole close to the fault, the hole would immediately be plugged and entry development would stop at least 10 feet from the end of the hole.

Although large amounts of water and high pressure have not been previously encountered by mining near the fault, an emergency plan to handle water inundation from the fault has been developed. The plan consists of the following actions:

1. Pull equipment back from face

2. Erect two Kennedy stoppings at least 2 feet apart

3. Place appropriate sized de-water pipe w/valve at bottom of stoppings

4. Pump quick drying cement into the space between the stopping

5. After minimum drying time, close water valve

5.23.10 Mining Operation

The mine was developed in an area of old works in the Hiawatha seam. Coal was produced from this operation during the period of 1940 through 1955 and was sold locally for domestic use. Certain sections of the old-mine were reopened so that water sumps, ventilation, and coal haulage facilities were re-established. Plate 5-2 illustrates the manner in which the old workings were modified and repaired in order to bring them into compliance with current regulations and the overall mining plans of GENWAL**.**

Where necessary, the old workings were widened to accommodate a 48-inch coal haulage conveyor. Proper roof supports were placed in areas where questionable roof control conditions were encountered.

The mining operations has~~s~~ve accessed the Hiawatha seam by drifting into the seam from the coal outcrop. The portal area for the Hiawatha seam has three entries: one intake ventilation entry, which will also serve as a haulage route, one neutral coal haulage conveyor entry, and one return airway. The portal access area for the mine has the necessary surface support items such as a ventilation fan, conveyor belt drive, power, etc.

5.23.20 Mining History

The Hiawatha seam**,** is the only seam to be mined on the leases, has an average thickness of 7.5 feet. The coal heights encountered range from 5.5 to 11 feet except in the sandstone roll area

which is approximately 4.5' high as shown on Plate 6-2. The coal within the permit area is high volatile bituminous. The seam will be accessed at an elevation of 7895 feet. The old works in the Hiawatha seam are accessible and it appears that the immediate roof is a competent sandstone, with bedding ranging from laminated to massive, interrupted by an occasional shale-siltstone lenses varying in thickness from approximately six-inches to two-feet. Roof falls in the old works are confined to the siltstone lenses, and where observed, are usually at intersections of rooms and entries. Falls are generally over the width of the opening extending rib to rib and less than 2-feet thick. The historic mine development plans for the Hiawatha seam are illustrated on Plate 5-2.

Mining was completed in lease ML-21569 as shown Plate 5-2. 1st North, a four-entry system with 100' X 60' pillars, has been developed off Main West and runs up the eastern side to the northern boundary of the lease, while 1st Right, a five-entry system with 100' X 50' pillars, has been developed up the western side to the northern boundary of the lease. 1st North was used as mains for development of pillar sections 1st Left through 9th Left while 1st Right was used as the bleeder for these pillar sections. 1st Left through 9th Left sections have been developed and pillared. 1st North, 1st Right, and Main West will not be retreat mined. These three sections will be left intact to be used as mains in future mining. Typical entry width is 20' wide.

Lease UTU-68082 has been accessed to the east by the use of the 1st North Submains. First (1st) Right through 4th Right have been developed and 2nd mined while 5th, 6th, and 7th Right (longwall gates) still need to be developed to accommodate 6th and 7th Right longwall panels.

GENWAL attempted to access Sections 25 and 30 of Lease UTU-68082 from 1st North section and 1st Right pillar section. This attempt failed due to low coal height. Isopachs show better coal height on the north and west side of Lease UTU-68082. This area will be accessed through Main West by the development of gates for longwall mining.

Lease UTU-68082, sections 26 and 35, will be accessed by the use of the Main West section. Main West will be developed to the west through Section 35. Longwall panels will be developed north off Main West as shown on Plate 5-2.

Lease ML-21568 has been accessed from Main West by a five-entry system (South Mains) which extends southward from the Main West Section along the eastern edge of the lease as shown on Plate 5-2. A five-entry bleeder system, 2nd South Bleeder, will be developed in conjunction with the longwall panels (Plate 5-2). Longwall mining will commence with 1st Right South longwall panel and end with the 5th Right South longwall panel and will be accessed from South Mains.

Lease UTU-68082 in Section 1 and 6 will be accessed by the use of the South Mains developed in State Lease ML-21568. Sections 1st Left South through 11th Left South will be developed in that order with the bleeder be developed in conjunction with each section. One longwall panel will be pulled on the east side of South Mains between 1st and 2nd Left South sections (Plate 5-2). 3rd through 11th Left South sections will be room and pillar sections.

GENWAL has made application to the BLM for a right-of-way in order to access federal coal reserves in sections 3 and 10, T. 16 S., R. 6 E. This Incidental Boundary Change application is for a 50-acre modification to the existing permit boundary.

5.23.3 Underground Equipment

Typical mining equipment used in this area will be employed to mine coal in this permit area. Two continuous miners will be employed to mine coal in this lease area. The following is a list of equipment, or equivalent, that may be utilized underground and on the surface as required:

Joy Miners (2) 12 cm 12 (5.5 - 11.5' cutting height)

Roof Bolters (2)

HDDR 13 Fletcher (Min. 6' operating height) (2)

TD143 Lee Norse

Feeder Breakers (2) Stamler 54" (1) Long Airdox 118"

Battery powered scoops and face haulage

Various Electrical Equipment

Long Airdox continuous haulage system

Stamler continuous haulage system

The Longwall System will include:

- 4LS-2 Joy Longwall Shearer
- Kloeckner-Becorit Shields (effective 5-7' height) H & B pan line
- H & B head and tail drives
- American Longwall Stage loader
- Appurtenant pumps
- Diesel shield haulers
- Other appurtenant equipment as needed.

5.23.4 Geotechnical

Within the projected mining area, conclusions from existing drill hole data (see Appendix 6-5) and from BLM databases excludes the possibility of multiple mineable seams being present. The coal seam to be mined on the GENWAL leases occurs in the lower part of the Blackhawk Formation. The Formation ~~is comprised of~~comprises approximately 1000 feet of gray carbonaceous shales, siltstones, coals, and interbedded sandstones of late Cretaceous age. The Star Point Sandstone, a massive cliff forming 700 to 900 foot thick sandstone unit, underlies the Blackhawk Formation and its top serves as a useful lithologic landmark in the area.

An isopach map of the Hiawatha coal seam overburden appears in Plate 6-6. Overburden thickness above the area to be mined in the permit area ranges from 750' to 2400'. Coal pillar height ranges from 5' to 10' in the permit area. A uniaxial compressive strength of 2400 psi (geomechanical tests, Appendix 5-1) was used in the pillar safety factor calculations.

The formations in the physiographic area dip gently 1 to 3 degrees westward off the west flank of the San Rafael Swell. However, locally the mine is relatively flat experiencing a 0 to 2 degree dip to the southeast. The regional structure is broken by several north-south trending, high angle normal faults which offset the lithologic units from less than 1 foot to 250 feet or more. No faults are projected to be encountered within the proposed mine development area.

5.23.5 Initial Pillar Design

Methods used to evaluate safety factors of the pillar design are discussed in Appendix 5-2. Current data indicate that minimum acceptable safety factors range from 1.5 to 2.5. Calculations of previous pillar safety factors are found in Appendix 5-3. Lease ML-21568 pillar safety factors for rooms and main entries ranged from 1.37 to 1.96 and 1.39 to 2.45 respectively. Pillar safety factors for rooms and main entryways in Lease ML-21569 range from 1.47 to 2.45 and 1.78 to 4.37, respectively.

As the ratio of pillar length to height approaches 12, pillars are regarded as being able to bear and load. The pillar recovery plan currently approved by MSHA, DOGM, and the USFS was designed by GENWAL employees with the aid of MSHA Technical Support in Denver and information in a technical report "Coal Pillar Sizing, GENWAL Mine" prepared by Mr. Dan W. Guy of Blackhawk Engineering Co. on 10-1-84. The purpose of the Blackhawk Engineering Report was to evaluate the use of 60' x 60' centers on the entries and rooms during panel development.

5.23.5 Revised Pillar Design

Because pillar sloughage did not develop as had been previously calculated, a new pillar design study was undertaken to determine more precisely the existing site conditions. Using values obtained from the above studies, coupled with the new Seratta studies, and 10 years of mining experience at the Crandall Canyon Mine**,** a new pillar design was determined. The new data conclude that safety factors alone are not adequate for sizing pillars and that site specific overburden conditions must be considered. The table located on page 29 in Appendix 5-2 present the new factors of safety developed for pillar size and overburden thickness.

Roof span design is derived from the accepted practice in the Wasatch Plateau of 20 foot entry and crosscut widths. Previous experience in the Crandall Canyon and nearby mines have supported this roof span width. Roof spans in Leases ML-21568 and ML-21569 ~~is~~are 20 feet in entries and crosscuts. Roof support bolting will consist of a minimum 4 foot resin pins with 5 foot centers during development of each section with the exception of the right-of-way UTU-66838. This lease has roof support consisting of a minimum of 4 foot resin pins with 4 foot centers. The floor of the coal seam grades from a clayey shale less than one foot thick to massive sandstone.

5.23.6 Barrier Perimeters

The barrier pillar around the perimeter of the property has been designed according to Utah mining regulations which is based upon the following formula:

Width = 2 * coal thickness of coal to be extracted in
feet + 5 * overburden thickness in feet / 100 + 10'

The perimeter pillar is shown on Plate 5-2. The following selected points were used to establish the pillar size at various locations:

Location	Overburden	Barrier	Coal Height
1. Southwest Corner Tract 1	550 feet	50 feet	6 feet
2. Northwest Corner Tract 2	1550 feet	100 feet	6 feet
3. Western Boundary (Max.)	1700 feet	108 feet	6 feet
4. Northwest Corner U-054762	1500 feet	97 feet	6 feet

5.23.7 Annual Production of Coal

Annual coal production in 1991, 1992, 1993 and 1994 was 877,500, 1,178,089, 1,474,824 and 1,660,900 raw tons, respectively. During 1993-1995 total production tonnage was approximately 1,750,000 raw tons annually. This production was achieved by the use of continuous mining machines, continuous haulage equipment, and/or diesel driven coal haulers. From 1995 to the end of the century total production coal tonnage is forecasted to be 2,500,000 tons, with the aid of longwall mining.

5.23.8 Access ~~T~~to Future Reserves

Access to future reserves will be maintained by the North Mains entries, Main West entries, 1st North, and 1st Right sections. North Mains will maintain access to the mine as well as Main West. Main West will also maintain access to the west and to the South. 1st North will maintain access to the north and east, while 1st Right will maintain access to the north and west. (See Plate 5-2 and page 5-15A). Access to federal coal south and east of the Dellanback fee parcel (i.e., the South Crandall LBA) will be maintained.

5.23.9 Projected Mining by Future Permit for the Planned Life of the Mine

All coal around the permit area has the potential for future mining by the Crandall Canyon Mine. The projected mining for the Incidental Boundary Change area, the Dellanback fee parcel, and the South Crandall lease area is shown on Plate 5-2.

Operating Schedule and Employment

The mine employ~~ee~~s approximately 125 people at present. The mine will operate four eight -hour production shifts per day, five days a week. Two maintenance crews will operate 8 hours a day, five days a week, to accommodate rockdusting and general cleanup of the mine. When market or mining conditions dictate, production can be expanded to seven days per week, 52 weeks per year.

5.23.10 Safety Training

The mine is equipped with modern emergency facilities and has an organized safety program. All mine employees are required to meet MSHA first aid and safety training requirements. Visitors are required basic training before entering the mine.

5.23.11 Fire Protection

Fire protection will be maintained in accordance with all Federal and State regulations pertaining to coal mining operations. Additionally the fire prevention plan can be found in Appendix 5-18.

5.23.12 Water Systems, Dust Suppression, Dewatering, and Electrical

The sump areas, as shown on Plate 5-4, will have a capacity of approximately 3.0 acre feet of water. The impoundment walls are constructed of concrete blocks with mortared joints and sealed on both sides. All the contact areas around the walls are sealed with concrete to prevent seepage. These sumps are constructed to allow the sediment to settle out and have an oil skimmer installed, as shown on Plate 5-4, to allow the water to be pumped directly to Crandall Creek under a UPDES permit. All water pumped to Crandall Creek will meet all effluent limitations and will be sampled in accordance with the UPDES permit requirements. Refer to Plate 5-3 for the location of the UPDES discharge point.

5.24 Blasting

There are no structures or dwellings within one mile of the mine permit area; there are no residents within one half mile of the blasting site.

All surface blasting will be done under the direction of a person trained, examined and certified as provided for under the R645 coal rules, Section 105, which is regulated by the Utah Division of Oil, Gas and Mining.

The use of explosives will be done in accordance with R645-31-524 and all applicable Federal laws for storage and use.

All records as required in R645-301-524.700 will be kept at the mine site or at the office for a period of at least three years.

GENWAL will post blasting signs, in accordance with R645-301-524.510, 511 and 512, that is along the edge of any blasting area that is within 100 feet of any public road and at the point where any other road provides access to the blasting area, as well as at all entrances to the permit area from public roads.

GENWAL will control access to the area immediately prior to and after the blast until the certified blaster determines all is clear according to R645 524.531 and 532.

Signals, audible within a half mile, will be given prior to and after the blast as outlined in R645-301-465 and according to the posted sign containing a description of the signals.

All surface blasting will be done between sunrise and sunset, unless other criteria ~~is~~are met in R645-301-524.420. Blasting will be done so as no fly rock will leave the permit area, where practical. Netting or other protective means will be used to achieve this where there exists a possibility of this occurrence. Flyrock traveling in the air or along the ground will not be cast from the blasting site more than ½ the distance to the nearest occupied structure; beyond the area of control required under R645-301-524.530.

For blasts that require more than 5 pounds of explosives, GENWAL will publish a schedule of the blasts and submit a blasting plan to the Division for approval. The blasting plans will be included in Appendix 5-23A.

5.25 Subsidence

The term "subsidence" applies to the deformation or movement in the overburden. The thickness of the overburden ranges from zero at the outcrop to approximately 2400 feet, as shown on Plate 6-2. In general, the strength of the overburden is typical of the late Cretaceous sediments being mined in Eastern Utah and Western Colorado. However, it should be noted that the overburden at the Crandall Canyon mine has substantially more massive sandstones than in other areas (i.e., the Deer Creek Mine). Thus, providing greater overburden strengths and reducing the potential for significant subsidence.

Four methods have been utilized to arrive at the range of the possible maximum subsidence at the Crandall Canyon Mine. The methods are: Dunrud's (USGS) equation (discussed in the text below); Boundary Element Method (BEM) using "TABEX-2D" and a Finite Element Mathematical (FEM) simulation using "ANSYS (Appendix 5-6); and the National Coal Board (NCB) of England Technique (Appendix 5-6). The amount of subsidence varies from 3.9', 5.5', 3.34', and 0.25', respectively. Experience at the mine indicates that the 0.25' range of subsidence most accurately represents specific site conditions under room and pillar conditions and the projected maximum of 3.34' under longwall conditions.

The magnitude of vertical subsidence is a function of coal height, overburden depth, stratigraphy, mining technique, and distance from barrier pillars. According to Dunrud's work completed in 1980, based upon a study of subsidence in an underground coal mine at Somerset, Colorado, (USGS 1980), the maximum amount of subsidence expected is equal to 70% of the coal height extracted, (Figure 5-4). The Somerset subsidence curves are included because the overburden characteristics are similar to those encountered at Crandall Canyon and the lack of reported data indicating amounts of subsidence for western underground coal mines.

The maximum subsidence experienced for western coal mines according to Peng, ranges from 33 to 65% and Gentry and Abel cited examples of 70% of the coal height extracted. Thus, to be conservative, a 70% value will be used within this report. The maximum value may be reduced by the amount of coal not recovered in the mining areas, i.e., 20% of the coal is expected to be unrecoverable in the pillared areas at the Crandall Canyon Mine and approximately 12% for the longwall areas. For the areas near an unmined solid pillar the maximum amount of subsidence is reduced (irrespective of the mining method) according to the graph shown in Figure 5-5 based upon work by Gentry and Abel.

The largest magnitude of subsidence that may occur is 3.9 feet at a point 40 feet east of the section line between Sections 5 and 6 and 1522 feet south of the section line between Sections 32 and 5. The values were calculated by reducing the coal heights shown on Plated 5-2 by 20% which represents the unrecoverable coal in the pillared areas (using a six foot coal height), then multiplying by 70% to obtain the maximum possible subsidence value from Figure 5-4 which assumes a worse case scenario. The subsidence values were reduced according to Figure 5-5 for areas that border a barrier pillar along the perimeter of the lease shown on Plate 5-2.

Horizontal movement which would create slope failure along the escarpment is not expected to occur due to subsidence because only limited coal outcrop occurs within the lease (the east side of the lease area). Within that area of old works no pillar extraction is anticipated.

As with areas in the western part of lease SL-062648 and at the Co-Op's Trail Canyon and Bear Canyon Mines and the Beaver Creek #4 mine, no escarpment failure has occurred. Horizontal movement creating tension or compression cracks ~~can not~~cannot be projected due to the overburden thickness and lack of jointing density and attitude data along the surface rock exposures.

In addition, GENWAL will second mine no closer than 200 feet to any outcrop (with the exception of portals) and, in accordance with Forest Service Stipulation #20, no mining will be done within a zone that might impact the Joe's Valley Fault. This area is determined by a 22~~-~~-degree angle-of-draw (from vertical) eastward from the surface expression of the Joe's Valley Fault was used to project the outer limits of subsidence. Thus, subsidence will not intercept the Joe's Valley Fault. If subsidence does occur along the western perimeter, all effects of the subsidence will be maintained within the mining permit boundary. No perennial streams will be affected. On the Dellenbach fee tract mining will not extend closer than 200 feet from the outcrop (other than portals) and no closer than 50 feet from the property boundaries. It should be noted that the mine projections and timing for the Dellenbach tract, and the South Crandall lease and the U-68082 lease mod area are shown on Plate 5-2.

It is accepted practice in this area to use two sources of information for subsidence evaluation. The sources are: 1) "Some Engineering Geologic Factors Controlling Coal Mine Subsidence in Utah and Colorado"~~,Geologic~~"Geologic Survey Professional Paper 969, by C. Richard Dunrud, 1976, and 2) "SME Mining Engineering Handbook",~~"~~ Volume 1, by Arthur B. Cummins and Ivan A. Given, 1973. The conclusions based upon the above source material are tempered by on site evaluation and actual experience based on similar mining conditions in late Cretaceous overburdens with similar thicknesses and strengths. The surface area topography within the lease is shown on Plate 3-1, 3-1a, 1-1 and others. The topographic map shows the relative steep sloping sides of the canyons which contains Crandall Canyon Creek, Blind Canyon Creek, and Horse Canyon Creek where rock outcrops are abundant. However, there are few, if any, talus slopes.

5.25.10 Subsidence Control Plan

The Subsidence Control Plan contained herein addresses specifically those items that are required by R645-301-525 Pertaining to Subsidence. This plan is an amendment to the original application filed on December 17, 1980, by GENWAL the SUBSIDENCE CONTROL PLAN FOR GENWAL COAL COMPANY, INC., as prepared by David A. Skidmore and L. G. Manwaring of Coal Systems Inc., on August 28, 1981; and the Mid~~-~~term permit revisions dated 5-30-86. The format of the currently approved COAL SYSTEMS report will be used with the conclusions based upon the results of the drilling of the Blind Canyon seam which was obtained in April~~,~~ 1985, and

the Hiawatha seam data obtained to date during mine development. The original application was submitted pursuant to the following: Title 40, Chapter 10, Utah Code Annotated, 1943, as amended, the "Cooperative Agreement between the United States Department of Interior and the State of Utah"; the Surface Mining Control and Reclamation Act (P. L. 95-87); and all regulations promulgated under those Acts affecting mining operation conducted in the State of Utah.

It should be noted that, according to the stipulations of federal lease UTU-78953, there will be no second mining or subsidence under Little Bear Creek within the South Crandall lease area.

Surface Features and Facilities Subject to Subsidence.

An examination of the surface area as well as of state, federal, and county records indicate there are no ~~man made~~manmade structures, utilities~~ right-of-ways~~' rights-of-way and public or private resources necessitating protection from subsidence (Plates 5-12, 5-13, and 5-3) within the mine permit boundaries. In addition, aerial inspection of the permit and adjacent area confirmed the absence of existing man~~-~~-made structures. The occurrence of subsidence will not produce material damage or diminution of value of properties or foreseeable use of lands. Possible effects of mine subsidence on groundwater resources are discussed in Chapter 7. Creeks within the area include Crandall Canyon Creek, Blind Canyon Creek, and the left fork of Horse Canyon. Both forks of Crandall Creek are considered to be perennial at least up to the federal lease boundary with State Lease ML-21568.

The surface in the area is controlled and administered by the United States Forest Service with a small southern parcel of land owned by GENWAL (Plate 2-1). The land is used for domestic grazing in the areas of gentle slope and wildlife habitat and recreation over the total acreage. The vegetative resources will not be negatively impacted by subsidence. Thus, the current land use is expected to continue. Similar mining conditions and practices exist at Beaver Creek #4 Mine and CO-OP's Trail Canyon and Bear Creek mines and no significant loss of vegetation has occurred at those sites.

The Crandall Canyon Mine on the western half of lease SL-062648 has experienced second mining under conditions similar to Huntington Canyon and has not experienced any vegetation change, subsidence or escarpment failure. Visual impact will only be observed in the case of a total escarpment failure. Tension cracks, if any do develop, as viewed from the bottom of the canyons will not be visible and the maximum subsidence of three feet when viewed from below and at a distance of greater than ½ mile will not be visible. As per the USFS, there is no marketable timber in the area of potential subsidence.

Since the original submittal, several operations and construction modifications have been submitted to satisfy regulatory compliance requirements. Consideration was given to the subsidence experienced at nearby mines (CO-OP, Beaver Creek #4) exhibiting similar overburden composition and mining methods, on site inspections at the operating Crandall Canyon, CO-OP and Beaver Creek #4 mines and calculation based upon ~~a~~ generally accepted formulas using limited physical coal strength data in determining coal pillar sizes, barrier pillar design and direction of mining. The aforementioned mines were observed from the surface to note any surface effects from subsidence from pillar mining. No substantial ~~affects~~effects from mining have been observed. The Crandall

Canyon Mine has pillared coal in areas with as little cover as approximately 200' of overburden. The CO-OP

and Beaver Creek #4 mines have pillared under the same types of escarpments as are located at the Crandall Canyon Mine with no apparent failures.

5.25.11 Methods of Coal Removal

The reserve area will be mined in the room and pillar and longwall methods. These methods are described in Section 5.23 of this chapter.

5.25.12 Description of Physical Conditions

The depth of cover is shown on Figure 6-6. Seam thickness of the Hiawatha coal seam is shown on Plate 6-3. The Bear Canyon and Blind Canyon seam thicknesses are shown on Plates 6-4 and 6-5). Structure of the top of the Hiawatha seam is shown on Figure 5-8. A description of the Lithology of the area is found in appendix 6-6. Other mine progress, interval, subsidence, and lithologic maps within this section and in the mine planning section also address the description of physical conditions.

5.25.13 Measures to Prevent Subsidence

In areas where mining may cause undesirable surface movement, steps will be taken to control or prevent subsidence. To prevent subsidence, permanent support can be achieved by selectively mining certain areas, leaving support pillars of coal, and/or by not mining specific areas. Although planned subsidence is not projected outside of the permit area due to the mining of the Hiawatha coal seam within the area of the Crandall Canyon Mine, potential subsidence may occur within areas of retreat mining sections.

The main objectives are to delineate the areas within the lease and adjacent lands that may be affected by subsidence and to determine the extent of the disturbance. Significant guiding design criteria are as follows:

1. Barrier pillars within the lease boundaries left intact to protect adjacent lands.

2. First mining only areas which significantly reduces the potential chances of subsidence.

3. Research indicates that a 20-degree "angle of draw" be used to project maximum extent of subsidence.

A 20-degree~~s~~ angle-of-draw was used to project a protection area for perennial streams within the mining area. The 20-degree angle was determined by two documents which show this angle of draw to be representative of the area. A Bureau of Land Management letter to the Utah State Division of Oil, Gas, and Mining dated Dec. 11, 1991 states that possible draw angle should be in the 15 to 20 degree range. This conclusion was made on previous history of subsidence occurring in the Wasatch Plateau/Book Cliffs area. This letter is provided as Appendix 5-5.

Appendix 5-6 is a report, "Preliminary Study of Potential Subsidence Over the GENWAL Coal Mine~~"~~." This report includes subsidence calculations, subsidence history, analysis, and charts with final conclusions showing that there may be a maximum subsidence result of 3 to 4 inches within the boundaries of the leased area, and the angle of draw is expected to be approximately 20 degrees.

4. Protection of perennial streams using only first mining directly under and within a 20-degree angle of draw of the stream. GENWAL recognizes that the Division of Wildlife Resources, the Division of Oil, Gas, and Mining, and the United States Forest Service consider all perennial streams to be important to wildlife. A buffer zone is shown on Plate 5-2 where no subsidence will take place until GENWAL has delineated those reaches which exhibit perennial flow, and shown that mining activity will not adversely ~~effect~~affect these stream reaches.

5. Protection of the Joe's Valley Fault. As depicted on Plate 6-2, the maximum possible subsidence with respect to a 22-degree angle of draw is within the permit area, As shown on Plate 5-2, Mining Projections, all mining will occur within the permit boundary. No mining will be done within limits that might impact the Joe's Valley Fault. In accordance with Forest Service Stipulation #20, a 22-degree angle-of-draw (from vertical) eastward from the surface expression of the Joe's Valley Fault was used to project the outer limits of subsidence.

6. There are no plans to backfill any area of the mine with waste material in order to reduce subsidence. In order to delineate the maximum limit of possible subsidence in the vicinity of the Crandall Canyon Mine area, a positive limit (draw) angle of 20 degrees from vertical (70 degrees from horizontal) from the lease boundaries was used. A correction for topographic variability was made in order to accurately determine the maximum surface limit of subsidence. The maximum surface limit of possible subsidence is shown on Plate 6-2. A discussion of the methodology used in determining the maximum limit of subsidence is given in Appendix 5-7. Draw angles of 15 degrees or less have been observed in moderately strong overburdens in the Book Cliffs.

The data contained in Appendix 5-2 were used to determine the potential for subsidence under any perennial streams which may be present within the permit area. Plate 7-16 defines the

perennial reaches of Horse and Crandall Canyons, as substantiated by field surveys in 1991 and 1992. Using the data from Plate 7-16 only the lower portions of Crandall Canyon have perennial sections under which first mining may occur.

Overburden thicknesses in the upper perennial reaches of Crandall Canyon have been determined to be about 540 feet. Using a pillar size of 70 x 65 and the worst case analytical condition, the factor of safety has been calculated to be 2.2. The coal outcrops within Blind and Horse (both the north and south forks of Horse Canyon) Canyons are above the perennial portions of the stream. Thus, no subsidence will occur under perennial sections of Horse Canyon (the Blind Canyon drainage is ephemeral).

All state appropriated water within the subsidence zone of the South Crandall lease area is shown on Plates 7-14 and 7-15. Plates 5-2(H) and 5-2(BC) show the mine plan for the South Crandall lease area. Plate 5-2(H) shows the mine plan for the U-68082 lease mod area. These maps depict which areas will be longwalled (full extraction) and which areas will be developed as first-mining only. Subsidence Survey Letters of Notification to surface owners and water conservancy districts are included in Appendix 5-25.

The following state appropriated waters are located within the subsidence zone: 93-383, 93-381, 93-483, 93-191, 93-190 and 93-1180. Information about quality, quantity, and ownership of these waters can be found in Chapter 7, Table 7-6, and in Appendix 7-1.

5.25.14 Subsidence Monitoring

The applicant commits to implement the proposed subsidence control plan and applicant hereby incorporates the same into this submittal. An aerial monitoring system for the Crandall Canyon Mine which has been accepted for implementation and vertical and horizontal controls have been established using ground control stations, shown on Plate 5-5. (The program is included as Appendix 5-8). Baseline flight lines were flown over Sections 31 and 32 of T15S R9E, Sections 5 and 6 T16S R7E, Sections 1 and 2 T16S R6E, and Sections 35 and 36 T15S R6E in October of 1989. Selected portions and/or all of Sections 34, 35, and 36 T15S R6E and Sections 2 and 3 T16S R6E (Plate 5-5) will be included in the 1995 Fall Survey to ensure that all projected mined areas within LBA#9 are included in the subsidence monitoring program. Control points within and adjacent to the leased area (including the South Crandall lease area) have been established and located by surveying practices. Prior to mining the area was photographed and a pin map was generated.

Aerial surveys will be conducted by GENWAL each year for the areas above and within the 20-degree angle of draw of the actual mined area. Based on a written request by the Forest Service, GENWAL is revising the subsidence monitoring plan. Monitoring will now be conducted annually until subsidence of less than one foot has been measured for three consecutive surveys showing that subsidence is substantially complete.

The following information will be forwarded to the Division on an annual basis when it becomes available:

1. A current map of the underground workings with areas delineated as to where the second mining will begin.
2. The approximate dates when second mining will commence and terminate.
3. The date of monitoring.

4. The vertical and horizontal positions of all monitoring points and pins, directly over and within the 20-degree angle of draw to the mined area, surveyed by aerial photography for that specific year.

There was and has been no evidence of escarpment subsidence or failure. There are no further plans to monitor escarpments in the area not visible from Huntington or Crandall Canyons. The subsidence/escarpment survey results were recorded and submitted to the appropriate regulatory authority. No escarpment failure occurred.

5.25.15 Anticipated Effects of Planned Subsidence

If subsidence does occur, surface effects may include minimal ground lowering and temporary tensional fractures at the margins of the subsided area. Any subsidence occurring on the 160-acre Dellenbach fee tract should have minimal effects on the surface. There are no escarpments, raptor nests, archeology sites, streams or springs located the Dellenbach tract. This tract (surface and underground) is privately owned by Genwal Resources Inc. The tract is within the presently approved permit area and is included in the current subsidence monitoring plan.

Subsidence monitoring for the South Crandall lease area and the U-68082 lease mod area will be done according to the existing plan approved for the Crandall Canyon mine. Pre-subsidence base-line aerial surveys have been completed and the initial survey control monuments have been installed on the ground. Additional control points (monuments) will be installed as mining progresses. (Refer to Plates 5-2 and 5-5 for the location of the existing and future monuments.)

In much of the area of the South Crandall lease area, both the Hiawatha and the Blind Canyon seams are proposed for full extraction longwall mining. In these areas the combined thickness of both seams ranges upward to about 12 feet. If surface subsidence in these areas is 80% of total mined seam thickness, then it may be possible to see nearly 10 feet of subsidence in some areas of the lease after mining. It should be noted that the Forest Service and BLM have imposed a special stipulation in the South Crandall federal lease specifically to provide additional protection to the Little Bear spring system. These lease stipulations prohibit full-extraction mining in the following areas;

a) area under the Little Bear stream channel with less than 600' of overburden.
b) area within 1000' of the southeast corner of the lease (to protect the Mill Fork ~~g~~Graben.)
c) area within 1000' of southern boundary of lease (to protect possible water-bearing fracture system.)

GENWAL personnel will conduct a surface inspection of all areas where subsidence has occurred no sooner than 6 months but no later than 12 months after extraction mining has occurred.

Multiple seam mining beyond spring site LB-7 in Little Bear Canyon is contingent upon a monitoring plan approved by the Division in concurrence with the Forest Service at least two years prior to mining in that area.

5.25.16 Mitigation of Damages

As previously presented within this chapter, no material damage or diminution of value or foreseeable use of lands is expected to occur. GENWAL has been in consultation with the BLM and received their concurrence with the conclusions presented in this document, a copy of the BLM correspondence may be found in Appendix 5-5. Displacement of wildlife due to subsidence may be minimal. However, springs within the potential subsidence limit are a significant resource to the local wildlife and may be impacted.

Seeps and springs within the possible subsidence limit emit water from the North Horn Formation, Price River Formation, Blackhawk Formation, and the Castlegate Sandstone. A limited number of seeps and springs are found to issue from the Blackhawk Formation and Castlegate Sandstone units within the area of possible subsidence limits. These seeps and springs show only limited use by deer and elk. Subsidence from mining in these areas will have minimal impacts on water supplies from seeps and springs in the vicinity of the mine. Water monitoring and the Probable Hydrologic Consequences are discussed in detail in Chapter 7 of this permit.

Seeps and springs within the possible subsidence limit of mining emit water from the North Horn and Price River Formations 100 to 2100 feet (10 to 210 times the coal bed thickness) above the interval to be mined. If repeated subsidence via roof failure occurs, elastic deflation is believed to occur at a distance of nine coal seam thicknesses (90 feet) above the coal. If any tension cracks do develop, they should be sealed by clay migration occurring during elastic deformation. As a result, these seeps and springs should not be affected by subsidence. However**,** monitoring will be conducted as described in Chapter 7.

GENWAL recognizes the fact that the Division of Wildlife Resources, the Division of Oil, Gas, and Mining and the USFS consider all seeps and springs to be important to wildlife. If, during the monitoring of the springs, non-climatic diminutions of flow from any seep or spring in the area are substantiated, GENWAL will notify the Division of Wildlife Resources, the Division of Oil, Gas, and Mining, the State Engineer and the U. S. Forest Service. If documentation concludes that mining efforts at the Crandall Canyon Mine have reduced or eliminated the flow from the seeps and springs, then acceptable remedial action plans will be submitted for approval and subsequently installed.

In the event subsidence negatively impacts grazing, the applicant will compensate the owner or appropriate the party by paying the fair market value for the loss experienced. Compensation will be made after the grazing loss is proven to have resulted from surface subsidence related to the operation of the Crandall Canyon Mine.

Should any structures such as roads, bridges, etc., be adversely impacted as a direct result of subsidence directly related to the operation of the Crandall Canyon Mine, the operator will repair or replace the structure, whichever is more economical.

Mitigation for potential disruption to the Little Bear Spring will be accomplished through the construction of a water treatment plant which will provide replacement water for the spring if mining activity in the South Crandall lease area affects the quality or quantity of the spring. Construction of this water treatment plant will be done under the provisions of a water replacement agreement between GENWAL Resources, Inc. and the Castle Valley Special Service District who maintain culinary water rights to Little Bear Springs. A copy of this water replacement agreement is included in Appendix 7-51.

Subsidence projections for the South Crandall lease area are depicted on Plates 5-2(H) and 5-2 (BC). Subsidence projections for the U-68082 lease mod area are shown on Plate 5-2(H).

The powerline that crosses the South Crandall lease was built by GENWAL to serve the Crandall Canyon mine. There are no other users on this line. This powerline follows the highline of the ridge and is more than 1500' above the coal seam to be extracted. Due to the depth of cover no damage to this powerline is expected due to subsidence. As full extraction mining approaches under the powerline GENWAL will monitor the situation to ensure that the potential for damage to the powerline is minimized. Most of the powerline within the subsidence zone is visible from the Genwal mine and can be inspected by mine personnel. The section of line on the ridge will be inspected during annual subsidence monitoring. Much of this line utilizes double pole X-braced structures which are inherently stable in design. This line is equipped with ground fault protection which will automatically and instantly de-energize the line in the event of any damage, including grounding and/or short circuiting. Vegetation has been cleared on either side of the powerline within the right-of-way. The powerline runs over the area that was mined out by the ARCO #4 mine, and there was no resulting damage. If any damage occurs, GENWAL will be out of power and will immediately make arrangements for any necessary repairs.

It shall be noted that the extent of possible subsidence in the U-68082 lease mod area is difficult to predict because the extent of mining in this area is extremely speculative due to the low coal (5' and less) in this area. However, in keeping with special lease stipulation #1 (see Appendix 1-15A, Attachment 3) there will be no second mining (and hence no subsidence) in any areas where the cover is less than 50 times the seam height plus 50', or approximately 300' overburden. A detailed discussion of this stipulation can be found in Appendix 3-20, (Final Environmental Assessment, Modification of Federal Coal Lease UTU-68082, U.S. Forest Service.)

Genwal has discussed the powerline situation with officials of Utah Power & Light (Dale Robertson), transmission and Distribution; Greg Bean, System Engineering, and Aaron Gibson, Customer Service Representative, verbal communication February 8, 2005). These representatives are very familiar with the surface effects of full extraction longwall mining and are in agreement that the risk to this line is quite minimal. GENWAL commits to immediately notify the Forest Service in the event of any damage to the powerline so that proper fire preventative measures can be implemented as required.

5.25.20 Subsidence Control

GENWAL will comply with all provisions of the approved subsidence control plan and will correct any material damage resulting form subsidence to surface lands as a direct result of the operation of the Crandall Canyon Mine. This will be done to the extent technically and economically feasible, by restoring the land to a condition capable of maintaining the value and reasonably foreseeable uses which it was capable of supporting before subsidence.

The mine plan is designed so that mining will not result in material damage to perennial streams or impoundments having a storage volume of 20 acre feet, or which could result in environmental degradation or safety hazards to streams and associated structures.

5.25.30 Public Notice of Proposed Mining

At least six months prior to mining, or within that period if approved by the Division, all owners and occupants of surface property will be notified, by mail, identifying specific areas in which mining will take place, dates that specific areas will be undermined, and the location or locations where the operator's subsidence control plan may be examined.

5.26 Mine Facilities

The existing surface facilities were partially located in a predisturbed area and the only area where the coal outcropped in the lease area. The existing surface facilities are located in a very limited disturbed area. The culvert expansion project adds the minimally necessary area for additional and improved facilities. The use of a 72" diameter culvert, through which Crandall Creek is routed, is the primary feature used to minimizing the disturbed area within the steeply sloped canyon. See Plate 5-3 for the surface layout and Plates 3-7, 3-8, and 3-9 and 5-20 for the premining land configuration.

A construction sequence for the culvert expansion project is included in Appendix 7-50.

The new facilities will incorporate several design features which will minimize the spread of coal fines and dust compared to the existing facility.

1) With the new system, all coal will be reclaimed by underground feeders located in the reclaim tunnel below the coal pile. During normal operations, coal will not have to be handled by heavy equipment (i.e., dozers and loaders) as with the existing facility.

2) The new coal pile will be contained by the hillside on the south, the new upper mine pad on the west, and the new road extension on the north. This containment will help prevent the pile from spreading. Concrete road barricades (Jersey Barriers) will be placed along the outside edge of the road from the new truck turnaround to the new loadout and beyond which will further limit the spread of coal and coal fines onto the roadway. This new pile configuration is in contrast to the existing design wherein the coal pile is located immediately adjacent to the road and migration of coal onto the roadway is not uncommon especially where mobile equipment is constantly working the pile during the loading and reclaim process.

3) The new truck loadout will be constructed outside of the road alignment in contrast to the existing facility where the loadout is situated directly within the roadway. Because the new loadout will be a state-of-the-art computer controlled facility, coal spills will be minimal compared to the existing facility. However, what little coal spillage that may occur with the new system will be cleaned up immediately and coal fines will report directly to the new sediment pond without being swept across the roadway as is now the case with the existing facility. With the new facility, the coal pile, crusher facility and loadout will all be located on the same side as the sediment pond and away from the existing roadway.

A Forest Service road use permit was obtained from the United States Forest Service, Manti-La Sal National Forest, Price, Utah in order to upgrade, use, and maintain the road to the mine permit area. This Forest Development road does not lie within the permit area and is not included as part of this permit application. The Forest Service road that lies within the disturbed area boundaries is included in the permit area for the purpose of drainage control.

The topsoil was stripped according to the plan, stockpile, and seeded with the topsoil stockpile seed mix. The topsoil stockpiles are protected from encroachment by placing earthen berms, straw bails, silt fences, or equivalent where needed.

There are no pre-existing structures or facilities located within the permit area. GENWAL has constructed a metal building (80' x 40') that is used as an outside shop. A new warehouse and office complex (50' x 25') has been built east of and connected to the existing shop. An additional 30' x 20' shop bay has been approved for construction by the Division and is projected to be constructed in the future.

During the summer of 1990, a power line from Utah Power & Light was brought in across the top of the canyon. At this time the use of the diesel generator was terminated. Presently, a state of the art substation and transformer provide all power needs. The high voltage lines from the substation to the mine are run underground in cement covered conduit thus eliminating the need of overhead power poles and transmission lines.

The oil storage and fuel containment area (80' x 20') is located at the west end of the old loadout area. This containment area is of sufficient volume to hold the volume of the largest storage tank found within the containment area plus any additional storm water. The containment area has a valve connected to the drain inside the wall. The valve and drain will provide a means for removing any spills or water in the containment area. A certified SPCC plan outlining emergency action as per R645-301-730 is available at the mine site (Appendix 5-10). Refer to Plate 5-3 for all surface buildings and structures.

An underground bathhouse has been constructed to provide shower and sanitary facilities for the miners. This underground bathhouse was designed and installed in accordance with all State Health, MSHA, and Forest Service regulations. These agencies were contacted prior to the design and implementation for their input and approval as necessary. The water and sewage plans can be found in Appendix 5-11 and 5-12, respectively.

After the South Crandall portals were constructed, three small material storage sheds were placed on the site near the portals (see Plate 5-3). These sheds are all less than 20' x 25' and are of temporary type construction. They are used to store ~~foof-bolt~~roof-bolt resin, electrical parts and other miscellaneous items. These sheds will be removed prior to final reclamation.

Two mine fans located on the surface, as shown on Plate 5-3, are used to ventilate the mine workings to insure a sufficient amount of oxygen for mine employees to continue operations within the mine. Other structures such as cement guard rails and cement walls have been constructed, with the Division's approval, and are listed within pages 5-33 and 5-34. This list includes the approximate date of completion of each structure and the description of each construction project.

Shotcrete was sprayed onto the cut-slope above the portals, the portal roads, and the coal storage area, as shown on Plate 5-3. A 4" square wire mesh was used, being spaced approximately 1" to 2" away from the existing slope. The wire mesh was secured to the slope with standard metal clips and bolts. Two-inch PVC pipe, perforated for drainage, was inset 2 to 3 feet into the slope at two different elevations, approximately 6" to 12" from the bottom of the project and 12" to 24" from the top of the project. These pipes were spaced 6 to 10 feet apart for the entire length of the project, with 2" to 4" of shotcrete then being sprayed onto the wire mesh. The intent of the project is to stabilize the cut slope to eliminate sloughage and enhance safety for person~~a~~nel.

Specifications for Shotcreting Cut Slopes

Average slope:	1/3:1
Matting:	11 gauge 2" x 4" or 9 gauge 4" x 4" wire mesh 6' wide x full length of slope
Securement:	5/8" x 24" long bolts w/ plates or 3/4" x 24" long rebar type anchors w/ plates
Drainage:	2" PVC pipe, 24" long, perforated, located at top and bottom of slope, 6' to 10' on centers. Pipes will be inset into the slope with the end extending outside the shotcrete. Drainage of the slope will be collected by the 2" PVC pipes and allowed to flow to the outside of the shotcrete.
Shotcrete: (per batch)	1800 lbs sand 800 lbs pea gravel 425 lbs cement 400 lbs fly ash
Application:	Applied with a Reed Sova III or Reed M40 pump w/ accelerator. Minimum thickness applied 2"

See Figure 5-10 for a cross sectional detail of shotcrete application.

This MRP covers the expansion of the surface facilities as shown on Plate 5-3. It should be noted that this represents the initial phase of the Crandall Canyon mine surface improvement. As shown, surface improvements will include a new intake portal, a new belt conveyor portal and a new fan portal.

The new portals will be constructed along the south side of the upper pad of the existing mine-yard (refer to Plate 5-3). This area is presently serving as the parking lot and material storage yard. The new portals will consist of an intake portal, a fan portal, and a belt portal. The intake portal will be used to accommodate fresh air intake into the mine, and also to provide primary travel access into the mine for employees and materials. The fan portal will support a ventilation fan which will suck return ventilation air out of the mine. The belt entry will be located south of the existing coal pile and will contain the main conveyor belt hauling coal out of the mine.

Construction of the portals will be done within the existing permitted disturbed area boundary. The existing disturbed area boundary will not be increased. The existing sediment pond has been sized to accommodate this new portal construction area, so no changes to the sediment pond will be required. Except for adding a new culvert under the access ramp to the new portal, none of the previously approved and existing surface drainage structures will be affected.

In the area of the new south portals, the base of the coal seam is located approximately 17' above (i.e., higher than) the level of the existing mine-yard. An earthen ramp will be constructed on the existing pad to gain access up to the level of the coal seam. In the area of the intake and fan portals, the existing hill slope will be excavated with a back-hoe to expose the coal seam in preparation for construction of the portal canopies. A small elevated pad will also be constructed in front of the fan portal on which the mine fan can later be installed. This fan pad will be constructed as a continuation of the access ramp leading to the intake portal. The access ramp to the intake portal and the fan pad will be constructed partially using the earthen material generated in the process of facing up the coal seam and partially using fill material hauled in from an off-site borrow source. The imported fill material will come from the same source (i.e., the same borrow pit) that supplied the pad material for the recently completed surface expansion. This borrow site would be the Nielson Construction commercial borrow pit located in Huntington Canyon below the power plant. As the access ramp is being constructed, a new culvert (C-11A) will be added to handle sheet flow drainage from the upper material yard (see Plate 7-5).

As the access ramp and fan pad are constructed from the existing yard surface up to the level of the coal seam outcrop, some of the new fill material will be placed up against the intervening existing undisturbed slope. Part of the access ramp/fan pad will therefore be constructed on top of the existing slope. Before this ramp/pad is constructed, topsoil along the existing slope below the fan pad and access ramp will be protected in-place using a geotextile cover placed along the undisturbed slope under the fill material. This topsoil protection technique would be identical to the approved method used during construction of the existing surface expansion facilities (Phase I surface expansion).

After the access ramp and fan pad have been constructed (and the underlying in-place topsoil protected with geotextile), the portal excavation can begin. Prior to starting the portal cuts, the existing topsoil at the portal sites will first be salvaged. Topsoil conditions along the south slope

portal area is similar to the conditions at the adjacent coal pile area where topsoil was salvaged during August, 1998. This topsoil salvage effort is described in appendix 2-5, Part II, prepared by Pat Johnson, soil scientist. At that area, according to Ms. Johnson's report, the depth of true topsoil was 3" but an average of 8" - 9" of material was taken due to the operating nature of the backhoes which were employed in the salvage process. In addition, an intensive soil inventory and site investigation was performed on the south slope on August 18, 1998 and is included in Appendix 2-6.

In order to minimize the area of additional disturbance associated with the construction of the south portals, these portals will be constructed by excavating individual pockets into the hillside for each portal rather than along a common highwall. Topsoil has already been removed from the belt portal site. By utilizing individual pocket cuts for the portals the total area of new disturbance is expected to be less than 4500 sq. ft. (0.11 acres). Topsoil will be removed from the areas of the south portal pocket cuts prior to excavation as described in Section 2.31.1. According to the Nyenhuis survey, the upper two feet (24 inches) is suitable for salvage. Based on the Nyenhuis soil survey, it is anticipated that approximately 9000 cu. ft. (333 yds.) of topsoil will be salvaged from the intake and fan portal cuts.

The salvaged topsoil will be stored on the existing topsoil pile #4 located off-site at the bottom of Crandall Canyon. This topsoil pile is constructed on Forest Service land under a Special Use Permit issued on 8/17/87. This pile #4 was originally constructed in 1997 during Phase 1 of the surface facility expansion. At that time it was designed and constructed sufficiently large to accommodate the additional topsoil storage requirements for the Phase 2 south portal construction. The Forest Service has concurred with the addition of the south portal topsoil to this pile. All topsoil removal, salvage and storage will be over-seen, directed and monitored by an independent soils scientist approved by the Division. A report of the topsoil salvage operation will be prepared by the soil scientist and added to the MRP upon completion as Appendix 2-5, Part III.

After the portal sites have been faced up construction of the portal canopies will begin. These canopies will be constructed from 6" steel I-beams and 1/4" steel plate according the MSHA guidelines. These canopies will measure approximately 8' high by 20' wide and will extend underground as far as needed to insure adequate roof protection. The canopies will be anchored to concrete footers. These canopies will provide a safe structure from which the miners can begin driving the entries back into the coal seam. These portal canopies will be similar to the existing portal canopies. After the intake and fan entries have been driven into the hillside and connected together underground with a cross-cut, work can then be started on construction of the mine fan installation. The fan will be an 8' diameter Spendrup or Joy axial vane (or equivalent) electric-powered fan. It will not have a diesel powered back up. It will be mounted on concrete foundations located on the newly constructed fan pad. The fan installation will be very similar to the existing fan structure. While the fan is being installed, the miners will drive the belt entry from inside the mine out to the belt portal. During this phase of development, mined coal will be moved away from the surface with a front-end loader, a mobile radial stacker, or some other temporary means of conveyance. After the belt portal connection is completed, a new conveyor truss will be

installed from a concrete landing at the belt portal out to the existing coal pile. The conveyor will be 48" wide, supported on a steel box truss which will extend from the new portal to the existing stacking tube. An intermediate bent support may be required, depending on final engineering. If this bent is required, it will be anchored to a concrete foundation constructed on the existing coal pad. The conveyor will be covered to minimize fugitive dust. The air quality permit will be revised prior to construction to include the new conveyor (see Appendix 5-23). This truss/bent structure will be similar to the existing truss/bent structure, but only one fourth as long. All coal from the mine will then be delivered directly to the existing coal pile and will be crushed and loaded on trucks through the existing coal handling facilities.

The access ramp leading into the portals will be approximately 100' long and 20' wide. It will have jersey barrier guards along both sides. The ramp will be constructed from the imported fill material, laid down in 12" - 18" lifts, and compacted to 90%. The only vehicles using the ramp will be underground mine vehicles going in and out of the mine. Therefore, the ramp is not considered a road. Drainage from the ramp will be handled by the existing drainage structures and the new culvert (C-11A) as shown on Plate 7-5. It is estimated that approximately 3500 cubic yards of fill will be needed to construct the access ramp/fan pad. This quantity will be verified after construction on the as-built plans.

Power, water, communications, and other mine infrastructure will be supplied to the south portals as an extension of the pre-existing Crandall Canyon Mine facilities.

Figure 5-11 depicts a typical cross-section through the south portals, showing the pocket cut, access ramp, in-situ soil geotextile protection, and the portal canopy construction.

Figure 5-12 depicts a typical cross section along the south portal conveyor belt structure.

GENWAL is also considering a second possible option for constructing the south portal intake and fan portals. Instead of constructing a ramp up to the level of the coal seam, short tunnels would be driven from the existing yard level up to the coal seam. In this scenario the pocket cuts would be ~~be~~ made into the hillside lower down at the same level as the existing pad. This level is approximately 15' below the base of the coal seam. Since the coal seam sits directly on top of the Star Point Sandstone, this sandstone out~~-~~crops at the existing yard level. Tunneling would begin in the sandstone and ramp up underground to the coal seam.

If the tunnels are driven at an incline of 10% they will be about 160' long to where they intersect the base of the coal seam. At 8' high and 20' wide, excavation of the two tunnels (intake and fan) would generate approximately 1900 cu yds. of material during construction. This tunnel excavation material will consist of sandstone mixed with coal. This excess material would be disposed of by placing it in a 6' deep layer along the existing fill bank located between the upper material yard and the coal storage pad. This embankment is part of the designated coal storage area and currently is covered with coal. Therefore, after the tunnel excavation material is layered onto the embankment, it too will be covered over by the active coal pile for the remaining life of the mine. Refer to Figure 13-a and 5-13b for more details of this tunneling construction option.

Upon final reclamation the tunnel excavation material would be hauled back into the mine tunnels where it would be sealed up prior to backfilling the portals. Backfilling and reclamation of the portal pocket cuts would be the same, regardless of whether the ramp or tunnel option is selected. If GENWAL elects the tunnel construction option, topsoil will be salvaged in exactly the same manner as described previously. The amount of topsoil salvaged, stored and redistributed would be the same regardless. If the tunnel option is selected, there would be no additional in-place topsoil required to be protected with geotextile, because there would be no fill material placed up against the hillside.

If this option is selected, GENWAL commits to ensuring the protection of the hydrologic balance for surface and groundwater systems as required by R645-301-731. The tunnel excavation material will be tested for acid- and toxic-forming material and the analytical results of this testing will be presented to the Division. The hydrologic balance will be protected in the following manner.

a) The excavation material will consist of fragmented Star Point sandstone. This sandstone outcrops naturally in the minesite area and is one of the major geological features which determine the character of Crandall Canyon and many other canyons in the Wasatch Plateau. This predominant sandstone is not known to be acid- or toxic-forming anywhere in the Utah coalfields. However, further site-specific testing of the sandstone will be conducted prior to any construction.

b) The proposed location of the material storage is on top of the existing pad fill. Any runoff from this area would report to the existing sediment pond.

c) The existing pad fill in the proposed storage area varies between 10' and 40' thick over the bypass culvert and is densely compacted. This thickness of compacted fill material is sufficient to preclude any leaching downward into the bypass culvert or groundwater.

5.26.10 Coal Handling

Coal exits the mine on a 48" conveyor belt, is transferred onto a 48" overhead conveyor belt and drops into the run of mine coal stockpile. The coal is reclaimed from the stockpile and is conveyed to crusher station. Crushed coal is then conveyed directly to the silo. From the silo, it is weighed and loaded into coal trucks.

An automated coal processing facility has been installed at the GENWAL mine site. The facility, as-built layout, can be found on Plate 5-6. Design calculations are located in Appendix 5-13.

Coal from the mine is delivered to a concrete stacking tube. This structure will support a nominal 30,000 ton storage pile. The coal is reclaimed from the pile through an underpile drawdown system designed to feed a reclaim conveyor. Reclaimed coal is screened and crushed to a 2 x 0 product, then transported to a computer-operated batch-weight truck loadout facility. From there it is loaded into the trucks and transported off the minesite to market. The new surface facilities has~~s~~ve been painted a neutral gray color to blend with the existing environment with minimal visual obtrusiveness.

After the new facilities are operational, the old loadout facilities were completely dismantled and removed from the site. The truck scales were also removed and the road repaved and re-established as a two~~-~~-lane road meeting Forest Service standards. Coal and coal debris will be cleaned from the loadout area and from around the existing retaining wall area. The rehabilitated loadout site will be used for storage of snow and/or road traction material in the winter time and other suitable storage needs in the summer time. A slotted culvert has been installed on the roadway below this storage area. The slotted drain will direct any road runoff and material tracked down the road into the sediment pond for treatment.

5.26.12 Power System, Transmission Lines, Substations, Feeders

Power for the mine, both underground and surface use, is provided by transmission lines from Utah Power, and Light. The substation and transformer built by PEMCO provides 7200 volts to surface and underground power centers. The power lines run in underground cement covered conduit from the substation to a visual disconnect located by the bathhouse portal. From the visual disconnect it travels through 4" steel conduits into the mine. All electrical installations meet the appropriate 30 CFR Part 75 and 77 MSHA regulations. The placement of electrical installations can be found on Plate 5-3. Plate 5-8 gives a detailed layout of the substation and transformer facility.

Utility poles located on the surface will be constructed to protect raptors, all wires will be insulated and there will be no exposed conductors. All electrical installations will be done in accordance with MSHA regulations.

5.26.13 Surface Equipment

Underground supply equipment will be used on the surface as needed. The following is a list of equipment used exclusively on the surface:

Fork Lift	Snow Plow	Front End Loader
Pick-up Trucks	Diesel Tractors	Bobcat tractor
Dozer		

5.26.14 Culinary Water System

The culinary water used at the mine is purchased from a vendor who is supplied from a state approved water system, or taken from the deep well (MW-1) located at the mine portals. This deep well has been installed in accordance with state health regulations for culinary use. The culinary water is placed in containers designed for this purpose. Drinking water at the mine is provided as bottled water.

The water used underground is placed in the mine sumps located underground. The location of the sumps will change as mining progresses across the reserve and will not remain in ~~any one~~anyone area permanently.

5.26.15 Sewage System

The bathhouse, located underground, and a new proposed bathhouse for the culvert expansion project is designed and constructed in accordance with the State Health Department's rules and regulations. The sewage will be contained in a concrete holding tank and pumped by a licensed contractor and disposed of at a State approved sewage treatment plant. The sanitary facilities underground will comply with all MSHA regulations. The sewage facility can be found in Appendix 5-12.

5.26.16 Sedimentation Control Structures and Water Treatment Facilities

The existing sedimentation pond was reconstructed during the 1986 and 1989 construction seasons and enlarged during the culvert expansion project in accordance with R645-301-526.300, as detailed in the Runoff and Sediment Control Plan located in Chapter 7.

Underground sumps will be built in order to effectively treat underground water before discharging into Crandall Creek, refer to Plate 5-4 for the sump locations. All discharge into the creek will meet effluent limitations of the UPDES permit and monitored in accordance with that permit, (Appendix 5-14). The sediment pond and the underground sumps are the only water treatment facilities proposed at the mine site.

In the fall of 2009 the company constructed a facility on the surface to treat the excessive iron content in the mine discharge water. Details of this facility can be found in Appendix 7-65.

5.26.21 Utility Installation and Protection

All coal mining and reclamation operations will be conducted in a manner which minimizes damage, destruction, or disruption of services provided by oil, gas, and water wells; oil, gas, and coal slurry pipelines, railroads; public utilities; etc. which pass over, under, or through the permit area, unless otherwise approved by the owner of those facilities and the Division.

5.26.22 Operation of Support Facilities

Support facilities will be operated in accordance with a permit issued for the mine to which it is incident or from which its operation results.

5.26.3 Water Pollution Control

See "Waste Disposal Plans" under the Mining Operation section of this chapter.

In the fall of 2009 the company constructed a facility on the surface to treat the excessive iron content in the mine discharge water. Details of this facility can be found in Appendix 7-65

5.26.4 Air Pollution Control

Coal mining and reclamation activities will be conducted in accordance with R645-301-420 and the Air Quality Approval Order issued by the Utah Division of Air Quality (Appendix 4-7).

5.27 Transportation Facilities

The coal from the mine will be transported to the rail loadout or final destination by truck. The trucks are typical 45 ton tandem trailer coal haulers used in the Utah coal fields. GENWAL uses a loading site on the Utah Railway located at Mohrland, Utah, a loading facility on the Southern Pacific Railway in Wellington, Utah, and other independently owned loadouts within the Carbon/Emery county area.

The Forest Development Road from Huntington Creek to the truck turn around area was constructed under the definition of a class one road and will be maintained as a primary road, in compliance with the road use permit issued by the U. S. Forest Service, Manti-La Sal National Forest. The forest access road will remain as part of the post mining land use in accordance with the Forest Service Permit (Appendix 1-2). The Forest Service Access Road, upgraded under the definition of a class two road, is maintained as a primary road. The road connects the main pad area**,** the truck turn around area, and the Forest Service Parking/Turnaround to the Huntington Canyon Road (State Route 31). The road is designed, maintained and will be restored in accordance with the Forest Service road use permit.

The road from the lower pad area to the upper pad area was built under the definition of a class two road and is maintained as a primary road. It is designed (as shown on Plate 5-10),

maintained and restored in accordance with R645-301-527.120. The Ancillary road to the portal area was built under the definition of a class three road and was designed (as Shown on Plate 5-10), is maintained and restored in accordance with R645-527.130.

The Forest Service Development road has been designed and was approved by the USFS prior to construction. The design drawings are on file with the Manti-La Sal National Forest in Price, Utah. During the 1991 construction season GENWAL Resources Inc. improved and asphalted the Forest Service Development road and surface facilities area of the Crandall Canyon Mine (as shown on Plate 5-3). The improvement information covering the haul road and facilities area is addressed in Appendices 5-15, 5-16, and 5-17.

The Forest Service road (primary road) is utilized by coal haul trucks, mining equipment (on a limited basis), support vehicles, employees, and recreational users (public). The two roads located on the permit area, the portal pad road and the access road to the main pad, are utilized by both surface and underground mining equipment, support vehicles, and employee vehicles. The ancillary road to the portal area is utilized by service vehicles on a very limited basis. The ancillary road to the upper unused area has been reseeded.

The forest parking area past the mine site was preserved for recreational/forest service parking and with verbal approval for the short term storage or mine equipment being onloaded/offloaded or moved as a part of upgrading or retrofitting.

Because of the limited space available at the existing site, snow removal and storage is now a problem. Currently, under agreement with the Forest Service, limited snow storage is allowed in the Forest Service trailhead parking area. This practice is less than ideal however. Snow storage in this area limits the amount of available public parking. Snow melt and runoff from the snowpiles often makes the parking area muddy in the springtime and makes sediment control into nearby Crandall Creek more challenging. The expanded operations area should relieve congestion at the site and free up both the parking area and the Forest Service road and make snow storage in the parking area unnecessary. Snow storage will become available in the area of the existing loadout facilities once these facilities have been removed and the area cleaned up properly as part of the overall site expansion project. Snowmelt from this new storage area will be able to report directly to the sediment pond located nearby. There will be absolutely no snow storage in the sediment pond itself.

After construction of the surface expansion is completed, the Forest Development Road 50248 will be returned to double lane width through the permit area to the Forest Service trailhead parking area. This will be accomplished by the following:

a) The existing loadout facilities will be removed and cleaned up and the road will be widened, realigned, and repaved through this area.

b) The existing ~~truckscales~~truck scales and exit ramp will be removed from the middle of the road and the roadway will be re-established and repaved in this area.

c) The existing oil storage shed will be rehabilitated and the roadway will be regraded and repaved in this area. This storage facility has been designed and constructed to adequately contain the volume of the largest storage tank plus the additional volume of any direct precipitation which may accumulated within the containment area.

d) The existing roadway from the loadout up to the truck turnaround area will be widened by approximately 15 feet. This will result in an additional (third) lane which can be used by the trucks as a stacking lane as they wait to enter the loadout to be loaded. This will free up the existing road for unobstructed two-way, two-lane traffic to facilitate public use of the road for Forest related activities.

e) The turn-around area will also be widened to allow the trucks to turn in a standard counter-clockwise direction and thereby eliminate the present practice of clockwise cross traffic turnarounds.

f) Construction of the high speed, high efficiency truck loadout will in and of itself help minimize the congested conditions which now exist within the mine site. Presently trucks are often forced to stop along the Forest Service road while waiting to be loaded. The expanded coal storage capabilities and the new high-speed truck loading facilities will allow the trucks to be loaded in a continuous, uninterrupted basis, thereby eliminating the major cause of tie-ups and congestion.

g) After the Forest Service road has been re-established, (i.e., realigned and repaved) the roadway will be striped to properly delineate the travelway through the mine site areas to the Forest Service Trailhead. The travel lanes will be clearly marked to help separate public traffic on the road from truck traffic associated with the coal operations. Signs will also be installed to direct the public to the trailhead and to instruct the public as to which areas within the minesite should be avoided in order to prevent conflicts with the ongoing operations. These direction signs will be readily visible to the motoring public and will conform to the Manual of Uniform Traffic Control Devices.

The plan view for roads may be found on Plate 5-3. The typical cross section for each road and their corresponding profile may be found on Plate 5-10.

The coal trucks exit to the east of the loadout facility and onto the USFS road (see Plate 5-3). Roads in the permit area are inspected in order to determine the maintenance required to minimize and correct erosion problems before they become extensive. Maintenance will be performed as required to control erosion. This maintenance will include maintaining the ditches, resurfacing when needed and maintaining proper drainage.

See Plates 5-3, 5-10, 5-19, and Appendix 1-2 for more sections and details of the roads within the permitted boundaries. If a road is damaged by a catastrophic event, such as a flood or earthquake, it will be repaired as soon as practical after the damage has occurred.

5.28 Handling and Disposal of Coal, Overburden, Excess Spoil and Coal Mine Waste

5.28.10 Coal Removal, Handling, and Storage

See Section 5.26 of this chapter. See Section 5.4 for removal and reclamation.

5.28.20 Overburden

See Section 5.28.30 for removal and reclamation.

5.28.30 Spoil, Mine Development Waste, and Noncoal Waste Removal, and Overburden

The Crandall Canyon Mine produces a run of mine product for final sale~~, t~~. This product does not contain any mine~~-~~-related rock or development waste. The method of mining used at the Crandall Canyon mine produces no development waste~~, h~~. However, small amounts of rock waste are generated in unexpected roof falls and overcasts. This rock waste is not brought to the surface, but is disposed of on pillar lines or stored in areas that have been mined or where no second mining is to be done. The material disposed of on the pillar lines will be of the same nature that naturally caves in the pillaring process~~, t~~. Therefore, no leachate will be formed other than that associated with normal pillaring.

In no event will the disposal of this material interfere with future recovery of the coal resource without consent of the BLM or the managing agency of the coal resource. In the unlikely event either rock, development, and/or processing waste is encountered, and the volume exceeds the capacity that can be disposed of along pillar lines; GENWAL commits to disposing of the waste in a DOGM approved disposal facility. GENWAL will notify and consult with DOGM regarding disposal sites; all waste disposal will be done in accordance with MSHA regulations.

The waste generated by the normal underground mining activities will be brought outside the mine for disposal. No oil or grease will be intentionally disposed of underground. All solid waste brought to the surface will be disposed of in a trash container until the container becomes full, at which time the container will be transported to a State approved landfill for final disposal.

At the present time the landfills to be used will be the state~~-~~-approved Nielson landfill or American Kinfold landfill (M&P Enterprises, which are located next to the county landfill, approximately 1.5 miles north of Orangeville, Utah, and if another State approved landfill becomes available and is more cost effective, then this landfill will be utilized. The operator will notify the Division prior to any waste disposal in any landfill other than those mentioned. The location of the new landfill and a statement from the DOH indicating the landfill permit number, the permit term and any conditions that the DOH has concerning the disposal of noncoal waste will be submitted to the Division. In no event will liquids be disposed of in landfills that are not permitted to handle such

material. Scrap metal and used equipment will be removed from the mine unless safety considerations prevent removal.

Oil contaminated soil from the gas and oil storage area will be disposed of prior to reclamation or moving of the facility. If oil or gas spills occur outside the containment area, the spill will be contained, cleaned up and disposed of in a permitted facility. The contaminated material will be disposed of at a facility licensed to accept oil/gas contaminated soil, or remediated onsite with appropriate approvals from the pertinent regulatory agencies.

Processing Waste

No processing waste is generated at the Crandall Canyon Mine. Only coal is removed from the mine, all of which is trucked off site and sold. Exploratory drill hole data and mining conditions indicate that no development or processing waste will be produced. However, in the unlikely event either rock, development and/or processing waste is encountered, and the volume of waste generated exceeds the capacity that can be disposed of along pillar lines, GENWAL commits to disposing of the waste in a DOGM approved disposal facility. GENWAL will notify and consult with DOGM regarding disposal sites. All disposal operations will be in compliance with Utah Coal Mining regulations R645-301-536 and R645-301-746.

Hazardous Wastes

In the unlikely event that hazardous or toxic material is encountered, GENWAL will notify the Division as well as the State Health Department; the hazardous or toxic material(s) will be disposed of at a facility permitted to accept the specific contaminants found.

Sediment Pond Waste

Sediment removed from the pond during the cleaning process will be hauled to an approved waste disposal facility. Prior to cleaning the sediment pond, representative sediment samples will be collected and analyzed for any acid- and/or toxic forming materials (as listed on page 5-39A). If the analytical results exceed the toxic limit, the waste material will be handled and disposed of in compliance with regulations applicable to acid- and/or toxic forming materials. GENWAL will notify DOGM if the analytical results of the samples show that acid or toxic forming materials are present.

Sanitary Waste

There are less than 10 regularly assigned employees on the surface per shift. These surface employees use the bathhouse for their sanitary waste needs. Waste from the underground bathhouse toilets and showers is pumped to a holding tank located underground. When required the holding tank is pumped and the materials are disposed of by a licensed contractor at a State Health approved disposal site (See Appendix 5-12). GENWAL will keep records of the sewage pumped from the tank by the contractor. The sanitary waste needs for the miners underground will be handled in accordance with MSHA regulations.

5.29 Management of Mine Openings

Five portals have been placed on the Star Point Sandstone in the Hiawatha coal seam. Four of the five portals are used while one of the portals is sealed. Three portals are used for intake ventilation, beltline, and return ventilation. The fourth portal opening is used for access to the underground bathhouse. Two identical fans located at the return portal will operate in parallel. One fan will discharge horizontally and the second vertically.

These portals existed during previous mining attempts and will be utilized during current mining operations. The highwall above the portals has been secured and canopies have been installed to maintain the portals at MSHA standards. During operation of the Crandall Canyon Mine, access to all mine openings are controlled by the operator during working and nonworking hours. Due to public access through the mine site, a security person is located at the mine during times of no work or when surface personnel are not present. Permanent sealing of underground openings is discussed in **S**ection 5.42.71 of this chapter.

5.30 Operational Design and Plans

5.32 Sediment Control

The design of the sediment control structures is presented in Chapter 7, Section 7.42 of this document. The designs are intended to minimize the disturbance to the hydrologic balance by disturb~~ut~~ing the smallest practical area at any one time during the mining operation through progressive backfilling, grading, and prompt revegetation as required in R645-310-353.200, and to stabilizing the backfilled material to promote a reduction of the rate and volume of runoff in accordance with the regulations.

5.33 Impoundments

The only impoundment on the Crandall Canyon Mine site is the sedimentation pond. The design of the sediment control structures is presented in Chapter 7, Section 7.42 of this document. The sedimentation pond meets criteria of R645-301-533 as shown in Appendix 7-10, page 7.

EarthFax Engineering, Inc. previously conducted the sediment pond design and stability analysis (Chapter 7**,** Section 7.42 and Appendix 7-6) which determined that the old sediment pond was stable under static and seismic conditions. The redesigned pond, constructed in conjunction with the surface facility expansion, does meet the minimum regulatory requirement of 1v:5h combined upstream and downstream side slopes. Refer to Appendix 7-4 for additional detail on the sediment pond.

5.34 Roads

The primary roads associated with the Crandall Canyon Mine have been located on the most stable available surfaces. They have been surfaced with materials (gravel, road base, asphalt, etc.) approved by the Division as being sufficiently durable for the anticipated volume of traffic and weight and speed of vehicles using the road. All roads falling under DOGM regulations are built on cut material and, as a result, no embankments were used during road construction. The roads are routinely maintained to include repairs to the road surface, blading, filling potholes and adding replacement surface material when needed. Culverts and ditches have been installed and are maintained to sustain the life of the roads during the operational life of the mine. See Plate 7-5A for the location of culverts and Appendix 7-11 for the culvert designs. See Section 5.27 for further information on these roads.

The area not designated as a primary road is the upper pad. This area has been asphalted to the approval of the Division. The pad is utilized for parking, loading and unloading of supplies and equipment, storage for those supplies, a staging area for new and rebuilt underground equipment, and access to the primary road to the portal area. It is maintained to include repair to the pad surface, blading, filling potholes and adding replacement surface material when needed. Roads within the permit area used for mining operations will comply ~~to~~with R645-301-534.100 through R645-534.340.

After the new expansion facilities were completed, the existing loadout facility, including the truckscales, were dismantled and removed from the site. The oil storage shed will also be rehabilitated. The area was then regraded and repaved, allowing the Forest Service road to be re-established as a two~~-~~-lane road. In addition, the existing roadway heading up to the truck turnaround area was widened by approximately 15 feet. This resulted in an additional third lane which can be used by the trucks as a stacking lane as they wait to be loaded. This will free up the existing road for unobstructed two way, two lane traffic to better accommodate public, Forest related use of the road. The turn around area will also be widened to allow the trucks to turn in a standard counter~~-~~clockwise direction and thereby eliminate the present practice of clockwise cross traffic turn arounds.

The expanded coal storage capabilities and the new high-speed truck loading facilities now allow the trucks to be loaded in a continuous, uninterrupted basis, thereby eliminating the major cause of tie-ups and congestion.

5.35 Spoil

There are no permanent refuse sites located on the property. All spoil is controlled and maintained as described in Section 5.28.30 and Section 7.54 of Chapter 7.

5.36 Coal Mine Waste

See Section 5.28 of this chapter.

5.37 Regraded Slopes

The following information supplied is incorporated within the currently approved mine plan and variances have been granted. If a slide should occur within the permit area, GENWAL will notify the regulatory authority and comply with the remedial measures required by the regulatory agency.

The applicant concurs, that 1:1 excavation slopes are not suitable in the superficial topsoil deposits and have included slope rounding of these slopes at 1.5:1. If the factor of safety of 0.72 was correct, most areas of the existing canyon would already have failed as the natural slope approaches 1:1 in the entire canyon. Any excavation slope greater than 1:1 (with exception of slope rounding) would be unrealistic and impose unnecessary impact far beyond the current limits. In many instances, a 1.5:1 excavation slope is not realistic as the topography of the canyon exceeds this value.

Careful monitoring of construction in critical areas will be necessary to identify and use the correct design profile (i.e., 1:1, 1/2:1, or 1/4:1 slopes). The stability of the recontoured slopes has been demonstrated by the interim reclamation in evidence at the property. A number of these slopes are in excess of the proposed 1.5 to 1 final reclamation contours and have been in place for ~~over~~more than ten (10) years. GENWAL will continue to observe these slopes and in the event that a failure occurs or evidence of instability is noted, such as sloughing, tension fractures, etc., all appropriate regulatory authorities will be notified and an acceptable plan to modify the proposed final reclamation contours will be agreed upon at a minimum of five (5) years prior to cessation of mining.

The roads are used to access the portal and substation areas and operations area as shown on Plate 5-3. Cut slopes of 0.25h:1v for competent bedrock, 0.5h:1v for fractured bedrock and 1h:1v

for shallow surficial deposits less than four feet deep overlaying bedrock are proposed for the portal access roads.

A slope stability investigation was submitted by Delta Geotechnical Consultants and is included as Appendix 5-19 with a safety factor of 0.72 for the shallow surficial deposits of the proposed 1:1 cut slopes. Since the safety factor does not comply with UMC 817.162 ~~(c)~~© requirements, cut slopes with 1:1 slopes will be rounded to 1.5:1 in the shallow superficial material. Appendix 5-16 is a stability analysis of the storage pad (upper pad) at the Crandall Canyon Mine prepared by EarthFax Engineering, Inc. A reclamation slope stability analysis has been prepared by JME Consultants and is included in Appendix 5-21. This analysis shows that the minimum static safety factor of 1.3 for the reclamation fill slopes will be met.

5.40 Reclamation Plan

NOTE: See Appendix 5-22(A) for the stand-alone reclamation plan for the East Mountain Emergency Drillpads and Access Roads. See Plate 1-1 for the location of these drillpads and access roads.

5.41 General

When no longer needed for mining operations, all entry ways or other openings to the surface from the underground mine will be sealed and backfilled. The permanent closures will be constructed to prevent access to the mine workings by people, livestock, and wildlife. Potential surface drainage will also be kept from entering the sealed entries.

Prior to final sealing of any openings, the BLM will require an on site inspection and a submission of formal sealing methods for approval of the BLM. The formal sealing methods will be presented as a plan including cross sections demonstrating the measures taken to seal or manage mine openings will comply with R645-301-529.100. At the time that the mine closure plan is submitted to the BLM, a copy will be forwarded to the Division for concurrence and approval and for addition to the mine plan on file. A copy will also be placed at the Emery County Recorder's office.

A formal plan will be submitted to the BLM for approval prior to final sealing of any openings. As per their on site inspection and plan approval, the openings will be sealed. All surface equipment, as well as structures, including all concrete foundations, will be removed by the applicant after the permanent cessation of operations.

MW-1 Supply Well Abandonment

Upon permanent cessation of mining operations, the water supply well, MW-1, will be permanently abandoned in accordance with regulations promulgated by the Utah Division of Water Rights. This will include filling of the well with a neat cement grout in accordance with the regulations.

Temporary Cessation

If operations are to be temporarily suspended for 30 days or longer, the applicant will submit a notice of intention to the Division. This notice will include a description of the extent and nature of existing surface and underground disturbance prior to temporary cessation. The statement will also cover the type of reclamation which will have been accomplished to date and also include the type of ongoing monitoring, number of opening closures, water treatment activities and other topographic rehabilitative efforts which have been or will be undertaken during this period. The applicant will maintain and secure the surface facilities and mine openings.

GENWAL will implement the temporary cessation regulations as follows:

(a) GENWAL shall effectively support and maintain all surface access openings to underground operations, and secure surface facilities in areas in which there are no current operations~~, but~~. When conditions become more favorable, operations ~~are to~~will be resumed under an approved permit. Temporary abandonment shall not relieve GENWAL of its obligation to comply with any provisions of the approved permit.

(b) Before temporary cessation of mining and reclamation operations for a period of thirty days or more, or as soon as it is ~~down~~known that a temporary cessation will extend beyond thirty days, GENWAL shall submit to the Division a notice of intention to cease or abandon operations. This notice shall include a statement of the exact number of surface acres and the horizontal and vertical extent of subsurface strata which have been in the permit area prior to cessation or abandonment, the extent and kind of reclamation of surface area which will have been accomplished, and identification of the backfilling, regrading, revegetation, environmental monitoring, underground opening closures, and water treatment activities that will continue during the temporary cessation.

(c) Each mine entry which is temporarily inactive but has a further projected useful service under the approved permit application, shall be protected by barricades or other covering devices, fenced and posted with signs to prevent access into the entry and to identify the hazardous nature of the opening. These devices shall be periodically inspected and maintained in good operating condition by GENWAL.

(d) Each exploration hole, other drill hole, bore hole, shaft, well or other exposed underground opening which has been identified in the approved permit application for use to return underground workings, or to be used to monitor ground water conditions, shall be temporarily sealed until required for actual use.

(e) As a security measure, a 6' chainlink fence (located on plate 5-3) with barbed wire along the top will be installed around the perimeter of the main office building to deter trespassing by unauthorized persons, at any time during cessation it is deemed necessary to protect the property. Iron gates will also be installed to protect all doors on the main building and treatment plant building to keep unauthorized persons from entering the buildings.

5.42 Narratives, Maps, and Plans

5.42.10 Timetable

All reclamation, other than areas handled in interim reclamation, will commence with removal of the surface structures, redistribution of the cut and fill materials and final grading of disturbed surface areas. Within 30 days following completion of final grading (which should be in August), topsoil from the stockpile will be redistributed. Nutrients and soil amendments, if shown to be required by soil tests, shall be applied to the redistributed topsoil before the end of October. Seeding, transplanting and mulching will then proceed when moisture conditions are optimal for planting and seeding. Seeding will commence as soon as the seedbed is finished in the late fall. Tree planting will be done in conjunction with seeding or in the following spring, as soon as one can work the soil.

A reclamation sequence for the mine yard, including the proposed culvert expansion project, is described in Appendix 5-22.

Timetable-Reclamation Activities: First available season following cessation of mining

Normal Access- May 15,

Begin demolition- May 15
Structure removal- May 15 to June 30
Seal portals- Sept 1 to Sept 30
Asphalt Removal- June 15 to June 30
Earthwork/recontouring- May 15 to September 30
Topsoil redistribution- August 30 to Oct 15
Drainage Construction- Sept 1 to Sept 30
Hydroseeding- Sept 15 to Oct 30
Seeding/Planting- Oct 1 to Oct 30

Final Reclamation- (cessation of mining)

Year 1	May	June	July	Aug.	Sept.	Oct.
Struct. remove	_____					
Portal Seals					____	
Asphalt remove		___				
Earthwork/recontour	_____	_____	_____	_____		
Construct foot bridge	_____	_____	_____			
Topsoil redistribution/final grade				_____	_____	
Drainage Construction					____	
Seeding/Mulching						_____
Planting						____

Year 2 through 10

Vegetation Monitoring	July 1 to August 30
Hydrologic Monitoring	June 1 to Oct 30 (4 times)
Subsidence Monitoring	July 1 to Oct 30

5.42.20 through 5.42.32 Final Surface Configuration

All areas affected by surface operations will be graded and restored to approximate original contour. All final grading will be done along the contour to minimize erosion and instability unless this operation becomes hazardous to the equipment operators. Backfilling and grading will proceed so as to eliminate the cut slopes and highwalls. Refer to Plates 5-1~~6~~7, 5-17A, 5-17B, 5-17C and 5-17~~A~~D. The proposed culvert expansion project will supply all backfill material needed to achieve approximate original contour and to reclaim existing highwalls.

A reclamation map showing post construction interim reclamation area, Plate 7-5, and final reclamation, ~~Plates 5-16,~~Plate 5-17, and 5-17A through 5-17D, accompanies this document. Slope rounding on Plate 5-3 has been revised to meet the required slope of 1.5:1 at the specified reclaimed cross sections.

Interim Reclamation

All surface areas disturbed during construction and which are not needed for mining operations were revegetated in the fall of the year following completion of the construction. This revegetation was performed as described in Chapter 3 of this document.

Disturbed areas within the mine plan area that contribute water directly to the sediment pond have undergone interim reclamation. The goal of this reclamation was to achieve vegetative cover that will minimize erosion thus reducing the amount of soil material entering the sediment pond. To achieve this goal, a standard of 80% vegetative cover was met. Ocular estimates of cover are made each fall (early September) to determine if supplemental seeding is warranted.

A reclamation map showing post construction interim reclamation areas and final reclamation accompanies this chapter as Plate 5-17. The correct number of acres to be revegetated in final reclamation is 8.73 acres.

5.42.40 Bond Release

Before seeking bond release, GENWAL will provide a description of all temporary structures to be removed and reclaimed. No permanent sedimentation ponds, impoundments, and treatment

facilities that meet the requirements of the R645 rules for permanent structures will remain after final reclamation~~, Phase 2~~.

5.42.50 Timetable and Plans, Removal of Sedimentation Pond

The sediment pond will remain after the mining operations and through ~~phase 1 reclamation until adequate revegetation has been established to control erosion. Reclaimed disturbed~~the demolition and removal of all buildings and structures slated for removal. Furthermore, the sediment pond will remain through a portion of the earthwork/recontouring phase of reclamation, as the earthwork will begin at the up-canyon end of the site. Disturbed area drainages will be routed to the pond and diversions will be maintained to preserve the integrity of the pond ~~until requirements of R645-301-763.100 have been met. These diversions can be found on Plate 5-16 and 7-5.~~

~~Upon approval of phase 1 revegetation~~as long as possible.

Shortly before the earthwork progression reaches the pond, the sediment pond will be cleaned out and the material disposed of in the approved method. ~~The sediment which accumulates in~~Once the sediment pond ~~as a result of runoff from the reclaimed area should only be topsoil that has eroded from the reclaimed site (care will be taken not to mix the pond liner with this topsoil). This topsoil will be excavated, stockpiled and allowed to dry. Once the topsoil has been dried the sediment~~has been cleaned satisfactorily, the pond will be removed and the area regraded to remove any capability to impound water. Topsoil will be redistributed over the reclaimed sediment pond site and the area reseeded.

Removal of the sediment pond was included during final reclamation to comply with the direct request of the Price Office of the U.S. Forest Service.

5.42.60 Roads

The Forest Service Development Road from Huntington Creek to the Forest Service turn around will remain as part of the post mining land use in accordance with the Forest Service permit shown in Appendix 1-2. During reclamation, the Forest Service access road will be altered to comply with the special use permit. GENWAL has and maintains a "reclamation" bond with the Forest Service which covers the costs for the proposed post-mining road configuration.

As stipulated in the existing Forest Service special use permit (8/26/89) covering the road, during final reclamation the width of the 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 and subgrade removed from the permit area as part of this road narrowing will be taken to a RCRA-approved disposal site.

Based ~~on recent~~upon past correspondence, the Forest Service ~~now~~has indicate~~s~~d that it prefers to have the asphalt totally removed from the road surface upon final reclamation. However, the presence of the memorial may dictate the road to be repaved. GENWAL commits to reclaiming the

road through the ~~minesite~~mine site to the specifications stated in the Road Use Permit at the time of final reclamation.

All other roads used for the operation of the Crandall Canyon Mine, within the permit boundaries, will be reclaimed in accordance with R645-301-542.610 through R645-301-542.640.

5.42.70 Final Abandonment of Mine Openings and Disposal Areas

The old truck loadout was dismantled once the new loadout facility became operational. The loadout structures were removed and the excess coal around the area was cleaned up and hauled to the new coal stockpile area. This area will provide a place to store material as well as snow and salt in the winter time.

After the new loadout facilities ~~was~~were constructed, the ~~existing~~old loadout area was removed and the area rehabilitated and cleaned up. These rehabilitation measures include~~d~~ the following:

a) The existing loadout facilities ~~will be~~were dismantled and removed from the site, including the coal bin, crushers, scalehouse and loading chute.

b) The existing truck scale ~~will be~~was removed from the middle of the road and the roadway ~~will be~~was regraded and repaved.

c) The existing oil shed ~~will be~~was rehabilitated and the roadway ~~will be~~was regraded and repaved in this area.

d) The existing coal pile/storage area ~~will be~~was totally cleaned up. All coal and coal products ~~will be~~were removed. The area ~~will~~was then ~~be~~ swept and vacuumed.

e) The hillside below the coal storage area ~~will be~~was dressed up. The mine discharge waterlines ~~will be~~were relocated in a more orderly fashion. Coal products ~~will be~~were vacuumed from the hillside.

The old truck loadout area is the current location of the mine discharge water treatment area. This area will be reclaimed per Appendix 5-22 at final reclamation.

5.42.71 Closure and Management of Mine Openings

When no longer needed for mining operations, all entry ways or other openings to the surface from the underground mine will be sealed and backfilled. Prior to the sealing of the mine openings, ~~all~~loose combustible material will be removed from the underground bathhouse. All structures that will interfere with sealing of the mine openings will also be removed. The permanent closures will be constructed to prevent access to the mine workings by people, livestock, and wildlife. Potential surface drainage will also be kept from entering the sealed entries.

~~All~~Loose combustible material will be removed from underground where possible and hauled to a state approved land fill. The portals will be backfilled with soil and two rows of solid concrete blocks placed across each entry and then backfilled to the surface and recontoured as shown on Plate 5-17. The block stoppings will be placed as far from the surface as is necessary to obtain a competent top and bottom.

5.42.72 through 5.42.742 Excess Waste

All waste material generated from the removal of the structures will be removed from the property and sold as scrap or disposed of in a state approved land fill. See **S**ection 5.28 of this chapter for more detail on excess waste and spoil.

5.42.80 Estimate of Reclamation Costs

Estimate of reclamation costs are included under Appendix 5-20.

5.53 Backfilling and Grading

Backfilling and regrading of disturbed lands has been designed to restore all disturbed areas affected by surface operations to the approximate original contour of the land. This is made possible by the fill material required by the 1997 facility expansion project. Reclamation of affected areas, including revegetation is outlined in Chapter 3, Section 3.41.

During reclamation, the subsoils or backfill material will be laid down in 12" to 18" lifts, unless noted otherwise in the drawings or appendices, and compacted through repeated travel by heavy equipment. This method has been utilized by a number of mines in the area and appears to give excellent compaction prior to topsoiling. In areas with slopes of less than 30%, the subsoil will be ripped to a depth of 18" prior to topsoil placement. In areas having average slopes of more than 30% the subsoil will be ripped to a depth of 12", where practical. Topsoil will then be redistributed in a manner that achieves an approximate, uniform stable thickness and other specifications stated in Chapter 2, Section 2.42 of this document.

Removal or Reduction of Cut Slopes and Highwalls

Prior to backfilling and grading of the highwall area above the portals and the cutslopes above the old coal loadout area and the pocket cuts at the south portals, existing shotcrete, wire mesh, clips, and other related material will be removed and disposed of in an appropriate manner. ~~All noncombustible material generated from the removal of shotcrete will be disposed of underground (within the mine) prior to the sealing of the portals.~~ All other waste generated will be removed and disposed of in an appropriate State permitted land fill.

Backfilling and grading will proceed so as to eliminate the cut slope, pocket cuts and highwall to the extent possible. Refer to Plate 5-3 for the highwall location. The cut slope above the coal stockpile area will be backfilled to match the approximate original contour with fill material from the Expansion Area pad. The Forest Service Trailhead Access Road will be left in place, but the surface will be modified to meet design specifications, as directed, by the Forest Service (see Appendix 1-2). See Plate 5-17 for the Forest Service road location.

The stability of the reclaimed highwall and cutslopes has a safety factor greater than 1.3 and is shown in Appendix 5-21.

No highwalls or remnants will remain after reclamation.

Terracing and Erosion Control

No terracing will be done. All final grading and surface preparation of overburden completed prior to the redistribution of the topsoil will be done along the contour to minimize erosion in areas with slopes less than 30%. In areas with slopes greater than 30% the grading, preparation and placement in a direction other than generally parallel to the contour will be used.

Refuse Piles

There are no refuse piles at the Crandall Canyon mine site.

Surface Coal Mining

There will be no surface coal mining at the Crandall Canyon Mine.

5.60 Performance Standards

All mining and reclamation operations at the Crandall Canyon Mine will be conducted in accordance with the R645 rules and this permit.

CHAPTER 7

HYDROLOGY
(R645-301-700)

TABLE OF CONTENTS
CRANDALL CANYON MINE, MINE AND RECLAMATION PLAN
CHAPTER 7
HYDROLOGY

SECTION	DESCRIPTION	PAGE
7.10	Introduction	7-1
7.11	General Requirements	7-1
7.12	Certification	7-1
7.13	Inspection	7-1
7.20	Environmental Description	7-1
7.21	General Requirements	7-2
7.22	Cross Sections and Maps	7-2
7.23	Sampling and Analysis	7-2
7.24	Baseline Information	7-2
7.24.1	Groundwater Information	7-3
	Scope	7-3
	Methodology	7-3
	Regional Groundwater Hydrology	7-4
	Mine Plan Area Aquifers	7-5
	Groundwater Development and Mine Dewatering	7-11
	Water Supply	7-11
	Mine Dewatering	7-11
	Effects of Mining Operation on Groundwater	7-12

TABLE OF CONTENTS (Continued)
CHAPTER 7

SECTION	DESCRIPTION	PAGE
	Mitigation and Control Plan	7-14
7.24.2	Surface Water Information	7-15
	Scope	7-15
	Methodology	7-15
	Regional Surface Water Hydrology	7-15
	Mine Plan Area Surface Hydrology	7-16
	Blind Canyon Drainage	7-20
	Surface Water Development and Control	7-22
	Water Supply	7-22
7.24.3	Geologic Information	7-22
7.24.4	Climatological Information	7-23
	General	7-23
	Existing Environment	7-23
	Precipitation	7-23
	Temperature	7-26
	Evaporation	7-26
	Wind	7-26
	Effects on Mining Operation on Air Quality	7-26
	Estimate of Uncontrolled Emissions	7-26

TABLE OF CONTENTS (Continued)
CHAPTER 7

SECTION	DESCRIPTION	PAGE
	Description of Controlled Measures	7-26
	Climatological and Air Quality Monitoring	7-26
7.24.5	Supplemental Information	7-26
7.24.6	Survey of Renewable Lands	7-27
7.24.7	Alluvial Valley Floors	7-27
7.25	Baseline Cumulative Impact Area Information	7-27
7.26	Modeling	7-28
7.27	Alternative Water Source Information	7-28
7.28	Probable Hydrologic Consequences Determination	7-29
7.29	Cumulative Hydrologic Impact Assessment	7-29
7.30	Operation Plan	7-29
7.31	General Requirements	7-29
7.31.1	Hydrologic Balance Protection	7-29
	Surface and Groundwater Protection Plan	7-29
7.31.21	Groundwater Monitoring Plan	7-29b
7.31.22	Surface Water Monitoring Plan	7-34
7.31.3	Acid- and Toxic- Forming Materials	7-42

TABLE OF CONTENTS (Continued)
CHAPTER 7

SECTION	DESCRIPTION	PAGE
7.31.4	Transfer of Wells	7-43
7.31.5	Discharges	7-43
7.31.52	Gravity Discharges	7-43
7.31.6	Stream Buffer Zones	7-43
7.31.7	Cross Sections and Maps	7-44
7.31.8	Water Rights and Replacement	7-44
7.32	Sediment Control Measures	7-44
7.33	Impoundments	7-44
7.34	Discharge Structures	7-44
7.35	Disposal of Excess Spoil	7-44
7.36	Coal Mine Waste	7-44
7.37	Noncoal Mine Waste	7-45
7.38	Temporary Casing and Sealing of Wells	7-45
7.40	Design Criteria and Plans	7-45
7.41	General Requirements	7-45
7.42	Sediment Control Measures	7-45
7.42.10	General Requirements	7-45
7.42.20	Siltation Structures	7-46
7.42.21	General Requirements	7-46

TABLE OF CONTENTS (Continued)
CHAPTER 7

SECTION	DESCRIPTION	PAGE
	~~ASCA's~~ASCA's & Small Area Exemptions	7-46
7.42.22	Sedimentation Pond	7-47
	Design	7-47
	Stability Analysis	7-48
	Runoff- and Sediment-Control Facilities	7-48
7.42.30	Diversions	7-50
7.42.40	Road Drainage	7-51
7.43	Impoundment	7-51
7.44	Discharge Structures	7-51
7.45	Disposal of Excess Spoil	7-51
7.46	Coal Mine Waste	7-51
7.47	Disposal of Noncoal Mine Waste	7-52
	Garbage	7-52
	Unusable Equipment	7-52
	Petroleum Products	7-52
7.48	Casing and Sealing of Wells	7-52
7.50	Performance Standards	7-52
7.51	Water Quality Standards and Effluent Limitations	7-53
7.52	Sediment Control Measures	7-53

TABLE OF CONTENTS (Continued)
CHAPTER 7

SECTION	DESCRIPTION	PAGE
7.52.10	Siltation Structures	7-53
7.52.20	Road Drainage	7-53
7.52.21	Erosion Control or Prevention	7-53
7.52.22	Suspended Solids	7-53
7.52.23	Effluent Standards	7-53
7.52.24	Surface and Groundwater Systems	7-53
7.52.25	Normal Water Flow	7-54
7.53	Impoundments and Discharge Structures	7-54
7.54	Disposal of Excess Spoil, Coal Mine Waste and ~~Noncoal~~Non-coal Mine Waste	7-54
7.55	Casing and Sealing of Wells	7-54
7.60	Reclamation	7-54
	Sealing of Mine Openings	7-54
	Removal of Surface Structures	7-55
	Disposition of Dams, Ponds and Diversions	7-55
	Recontouring	7-55
	Removal or Reduction of Highwall	7-55
	Terracing and Erosion Control	7-55
	Final Reclamation	7-56
7.70	References	7-57

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CHAPTER 7
FIGURES

FIGURE NUMBER	DESCRIPTION
7-1	Well completion and lithologic logs for MW-1
7-2	Results of slug withdrawal test in MW-1
7-3	Runoff curve numbers for forest-range in the Western U.S.
7-4	Curvilinear and triangular unit hydrographs
7-5	Head relationships for selected broad-crest weirs
7-6	Annual discharge of Huntington Creek
7-7	Monthly flow of Crandall Creek
7-8	Maximum and minimum daily flows of Crandall Creek
7-9	Deleted
7-10	Gradation of embankment, filter, and riprap materials
7-11	Typical straw-bale dike
7-12	Typical silt fence installation

(Note: Figures follow Chapter 7 text)

CHAPTER 7
LIST OF TABLES

TABLE NUMBER	DESCRIPTION	PAGE
7-1.	Deleted	
7-2.	Deleted	
7-3.	Deleted	
7-4.	Abbreviated groundwater analysis list	7-29
7-5.	Extended groundwater analysis list	7-30
7-5a.	Concentrations of Selected Constituents in Crandall Creek	7-17
7-6.	Surface water rights in the Crandall Canyon Mine Permit Area and adjacent areas	7-22
7-7.	Deleted	
7-8.	Abbreviated surface water analysis list	7-35
7-9.	Extended surface water analysis list	7-36
7-10.	Water Monitoring Program	7-39

(Note: Tables follow Chapter 7 text)

CHAPTER 7
APPENDICES

APPENDIX NUMBER	**DESCRIPTION**
7-1	Water Rights Information
7-2	Crandall Creek Flow Data
7-3	Crandall Creek Water-Quality Data
7-4	Sedimentation and Drainage Control Plan
7-5	Crandall Creek Flow Calculations
7-6	Deleted
7-7	Diversion Calculations
7-8	Deleted
7-9	Small Area Exemption Calculations
7-10	~~Delted~~Deleted
7-11	Deleted
7-12	Letter from U.S. Soil Conservation Service Concerning Alluvial Valley Floors in the Crandall Canyon Area
7-13	Municipal Watershed Description
7-14	Water Share Certificate
7-15	Probable Hydrologic Consequences Determination
7-16	Geologic Occurrence and Use of Seeps and Springs
7-17	Seep and Spring Flow Rate and Temperature Measurements

Note: Bold number plates and appendices are included with this submittal.

LIST OF APPENDICES (continued)

APPENDIX NUMBER	DESCRIPTION
7-18	Seep and Spring Specific Conductivity Measurements
7-19	Seep and Spring PH Measurements
7-20	Seep and Spring Field Water-Quality Summary
7-21	Underground Water Budget - January 15, 1991
7-22	Underground Sump Design - Lease ML-21569
7-23	Blind Creek, Crandall Creek, and Horse Creek Flow Calculations
7-24	Slug and Bail Test Results
7-25	USFS Intermountain Research Station Proposal
7-26	Research & Mining Time Table
7-27	Manti LaSal National Forest Soil Data
7-28	Soil Erodibility Calculations
7-29	Pre- & Post-Mining Composite Land Type Percent Slope Calculations
7-30	Manti LaSal National Forest Vegetation Data
7-31	Percent Ground & Crown Cover Calculations
7-32	Pre-mining Soil Loss Nomographs
7-33	Post-mining Soil Loss Nomographs
7-34	Manti LaSal National Forest Land Types
7-35	Calculations of Runoff Curve Numbers for the Composite Land Types

LIST OF APPENDICES (continued)

APPENDIX NUMBER	DESCRIPTION
7-36	Calculations of Stream Channel Density
7-37	Pre- & Post-mining SEDROUT Outputs
7-38	Blind Canyon Channel Erosion & Cumulative Drainage Erosion
7-39	Erosion Calculation Methodology, Blind Canyon Watershed
7-40	Terratek Subsidence Study
7-41	Implication for Self-Healing of Fractures
7-42	Crandall and Blind Canyons Water Quality Data (GENWAL)
7-43	Crandall and Blind Canyons Field Water Quality Measurements (GENWAL)
7-44	Indian Creek Flow Data (USFS)
7-45	Indian Creek Water Quality Summary (USFS)
7-46	Monitoring Well Lithologic Logs
7-47	Monitoring Well Water Quality Data
7-48	Supplemental Information, Hydrologic Conditions
7-49	Mitigation ~~For~~for Blind Canyon Creek
7-50	Construction Sequence - 72" Culvert
7-51	Little Bear Spring Water Replacement Agreement
7-52	Supplemental Hydrogeologic Information for LBA 11
7-53	Summary of New Isotopic Information for LBA 11
7-54	Results of In-Mine Slug Tests
7-55	Investigation of Alluvial Ground Water System in Mill Fork Canyon

7-56 Investigation of Potential for Little Bear Spring Recharge

7-57 Determination of Recharge Location of Little Bear Spring (Dye Tracing)

7-58 Summary of Hydro logic Baseline Information, South Crandall Lease

7-59 Little Bear Spring Study (Initial study, 1998) AquaTrack

7-60 Little Bear Spring Study (Expanded Study, 1999) AquaTrack

7-61 Mill Fork Resistivity Study, 2001 AquaTrack

7-62 Little Bear Spring (2nd Expanded Study, 2001) AquaTrack

7-63 Hydrology/Geology Map of Little Bear Watershed

7-64 Baseline Information for the U-68082 Lease Mod Area

7-65 Mine Discharge Water Iron Treatment Facility

7-66 Burma Evaporation Basin

CHAPTER 7
LIST OF PLATES

PLATE NUMBER	DESCRIPTION
PLATE 7-1	Crandall Creek Plan and Profile
PLATE 7-2	Crandall Creek Cross Sections
PLATE 7-3	Proposed Pond Details
PLATE 7-4	**DELETED**
PLATE 7-4A	**DELETED**
PLATE 7-5	Drainage Map
PLATE 7-5A (1, 2)	As-Built Cross Sections
PLATE 7-5B	**DELETED**
PLATE 7-5C	Watershed Boundary Map
PLATE 7-6	**DELETED**
PLATE 7-6A	**DELETED**
PLATE 7-7	Exploration Drill Hole and Hiawatha Coal Outcrop Locations
PLATE 7-8	Blind Canyon Watershed Land Types
PLATE 7-9	Terratek Blind Canyon Watershed Subsidence Modeling
PLATE 7-10	Blind Canyon Watershed Land Types & Drainage
PLATE 7-11	Pre & Postmining Blind Canyon Topography
PLATE 7-12	Seep and Spring Locations
PLATE 7-13	**DELETED**
PLATE 7-14	Groundwater Rights

LIST OF PLATES (continued)

PLATE NUMBER	DESCRIPTION
PLATE 7-15	Surface Water Rights
PLATE 7-16	Stream Monitoring Stations, Crandall Canyon Mine Area
PLATE 7-17	Blind Canyon Drainage Cross Section Location (Approx.)
PLATE 7-18	Water Monitoring Sites Map

Note: Bold number plates and appendices are included with this submittal.

CHAPTER 7

HYDROLOGY

7.10 Introduction

This chapter presents a description of the hydrologic considerations for permitting of the Crandall Canyon Mine operations. The information in this chapter was provided by the staff of GENWAL Resources, Inc. and by various consultant firms as noted under specific sections. Conclusions drawn herein are based upon detailed field reconnaissance and spring/seep surveys of the area, limited exploratory drilling and published hydrologic information on the area.

7.11 General Requirements

This chapter presents a description of:

- existing hydrologic resources,
- proposed operations and the potential impacts to the hydrologic resources,
- methods of compliance with design criteria and performance standards, and
- hydrologic reclamation plans for the Crandall Canyon Mine operations.

7.12 Certification

All maps, plans and cross-sections presented in this chapter which deal with the design of facilities or the determination of watershed characteristics have been certified by a professional engineer.

7.13 Inspection

Impoundments included in the runoff control plan will be inspected as described in Section 5.14 of this application.

7.20 Environmental Description

This section presents a description of the hydrologic resources within the Crandall Canyon Mine permit area and the South Crandall Lease area and the U-68082 lease mod area. Refer to Appendix 3-20, "Final Environmental Assessment, Modification of Federal Coal Lease UTU-68082, U.S. Forest Service" for additional information regarding hydrology in the lease mod area.

7.21 General Requirements

This section presents a description of the hydrologic resources within the Crandall Canyon Mine permit area and the –South Crandall Lease area and the U-68082 lease mod area.

7.22 Cross Sections and Maps

Figures 7-1 through 7-12 and Plates 7-1 through 7-17 of this chapter depict existing surface and groundwater occurrences within and adjacent to the Crandall Canyon Mine permit area and the –South Crandall Lease area and the U-68082 lease mod area. These figures also illustrate the topography, streams, springs, wells, water monitoring locations, and other hydrologic design information pertinent to the Crandall Canyon Mine and the –South Crandall Lease area and the U-68082 lease mod area. Refer to 7-63 for a detailed map of the Little Bear Canyon watershed showing mining projection, geology and location of seeps below the Castle Gate sandstone where cover is less than 600' above the coal seams.

Plates 7-14 and 7-15 have been updated to show the groundwater and surface water rights within and adjacent to the South Crandall lease area and the U-68082 lease mod area. Plates 7-12 (seep and spring) and 7-16 (stream monitoring) have also been updated relative to the South Crandall lease area and the U-68082 lease mod area. Note that Plate 7-13 has been deleted from the MRP.

7.2 Sampling and Analysis

All water samples are collected and analyzed according to methods in either the "Standard Methods for the Examination of Water and Waste Water" or the 40 CFR parts 136 and 434.

7.24 Baseline Information

(It should be noted that the Dellenbach fee tract is included in the currently approved permit area. All current data for hydrologic, geologic, and climatologic information applies to the Dellenbach tract.) Baseline hydrologic information for the– South Crandall Lease area is summarized in Appendix 7-58. Baseline hydrologic information for seeps, springs, and streams in the U-68082 lease mod area are summarized in Appendix 7-64.

In response to concerns for the possible effect of mining on certain seeps in the Little Bear drainage, GENWAL commits to preparing a map identifying and showing the general location of vegetation in the area that could potentially be affected by mining in Little Bear Canyon, and will also prepare a detailed map of the vegetation associated with the spring/seep sites (LBA7, LB7A, LB7B, LB7C, LB5A and LB12) in Little Bear Canyon. This mapping will be done in the 2005 field season. This information will then be added to the MRP as an appendix.

7.24.1 Groundwater Information

This section is a comprehensive view of the groundwater hydrology for the Crandall Canyon Mine permit and surrounding area and the ~~the~~ South Crandall Lease area and the U-68082 lease mod area.

Scope

This section presents discussions of groundwater conditions within and adjacent to the permit area, which consists of lease areas SL 062648 and U 054762, State leases ML21568 and ML21569, UTU-68082 and the South Crandall Lease area, UTU-78953 and the U-68082 lease mod area (Plate 7-12). Conclusions drawn herein are based upon detailed seep and spring surveys of the area, limited exploratory drilling, results of stream monitoring, and the results of groundwater investigations conducted by others in the region of the mine.

Methodology

Seep and spring surveys were conducted in 1985, 1987, and 1989 through 1993, within an area that extended approximately one mile north, west, and south of the boundaries of the permit area. Springs and seeps in the South Crandall Lease area were monitored again during 2003. Seeps, springs, and streams in the U-68082 lease mod area were monitored again during 2004. The study area for the survey was bounded by Huntington Creek on the east, the east-west ridge between the North Fork of Horse Canyon and the South Fork of Huntington Creek on the north, Bald Ridge and Bald Mountain in Scad Valley to the west, and Mill Fork on the south.

An aerial reconnaissance of the survey area was initially conducted to provide an indication of spring locations and site accessibility. The area was then traversed on foot to allow springs and seepage points to be precisely located, examined, and sampled. Geologic conditions at all seeps and springs were noted in the field, including lithologic and structural controls and the geologic formation from which the seepage issued. Signs of usage were also noted. The flow rate was visually estimated and (if sufficient water was present) a sample of the water was collected. The temperature of the water issuing from the spring was measured at the site. All samples were subsequently analyzed in the field for pH and specific conductance.

Hydrologic characteristics of the North Horn, Price River, Castlegate, Blackhawk Formation and Star Point Sandstone are reviewed in this section. Locations of seeps and springs monitored during 1985, 1987, 1989 through 1993, and during 2003, and during 2004 are shown on Plate 7-12. The geologic occurrence and use of seeps and springs are found in Appendix 7-16. Flow rate and temperature measurements appear in Appendix 7-17. Specific conductivity and pH measurements are found in Appendices 7-18 and 7-19 respectively. Field water-quality measurements are summarized in Appendix 7-20. Laboratory analytical reports for groundwater collected from the eight quarterly sampled seep/spring locations are also contained in Appendix 7-20. Hydrologic baseline information from the South Crandall Lease area is summarized in Appendix 7-58. Hydrologic baseline from the U-68082 lease mod area is summarized in Appendix 7-64.

Seep and spring surveys were conducted in the area around the IBC (Federal Right-of Way UTU-77975~~)~~) area during 1987, 1989 and 1990. No seeps or springs were identified in the IBC area. The area was resurveyed by Gary Gray and Erik Petersen in 1998.

Regional Groundwater Hydrology

Six formations outcrop in the Mine Permit Area (Plate 6-1). According to Doelling (1972), the Masuk Shale Member of the Mancos Shale (Km on Plate 6-1) is a light gray to blue-gray marine sandy shale in the mine vicinity. This unit is exposed at the mouth of Crandall Canyon and in adjacent areas along Huntington Creek. The Masuk Shale Member yields water locally to seeps and springs but does not serve as a regionally important aquifer (Danielson et al., 1981).

The Star Point Sandstone (Ksp) is predominantly a light-gray massive sandstone with minor interbedded layers of shale and siltstone near its base (Doelling, 1972). In the vicinity of the mine, the Star Point Sandstone is 350 to 450 feet thick. The Star Point Sandstone yields water to several minor and some major springs where fractured and jointed.

The Blackhawk Formation (Kb) is the principal coal-bearing unit in the region (Doelling, 1972). This formation consists of interbedded layers of sandstone, siltstone, shale, and coal, and reaches a thickness of about 1000 feet in the mine area. The principal coal seam (the Hiawatha seam) is present at the base of the formation. The formation yields water to springs and coal mines when fractured. At GENWAL the water has been encountered within the Starpoint Sandstone approximately 50-100 feet below the contact point with Hiawatha seam.

The Price River Formation overlies the Blackhawk Formation and consists of the tan to brown cliff-forming Castlegate Sandstone (Kc) and the slope forming Upper Price River Member (Kpr). Fluvial sandstones of the Castlegate are massive and medium- to coarse-grained. In the area of the mine, the Castlegate is approximately 200 feet thick. The Castlegate yields water locally to seeps and springs**,** but does not serve as an important regional aquifer because it is commonly drained within short distances from its recharge area due to deeply incised canyons (Danielson et al., 1981).

The Upper Price River Member (Kpr) consists predominantly of friable calcareous sandstone**s** interbedded with pebbly conglomerates and shales. It forms steep receding slopes and reaches a maximum thickness of about 600 feet in the mine areas (Doelling, 1972). This formation yields water locally to seeps and springs (Danielson et al., 1981). However, like the Castlegate Sandstone, deeply incised canyons in the area prevent the Upper Price River Member from being an important regional aquifer.

The uppermost formation that outcrops within the permit area is the North Horn Formation (Tkn). This formation consists of interbedded limestones, sandstones, and shales (Doelling, 1972). Due to the presence of low-permeability strata in the formation, downward

vertical migration of groundwater is limited. Consequently, springs in the North Horn Formation are formed where perched groundwater is forced to flow laterally in the subsurface until the formation intersects the land surface, forming a spring.

Investigations by Danielson et al. (1981) indicated that most, if not all, groundwater in the region is derived from snow melt. Recharge tends to be limited in areas underlain by the Price River Formation and older rocks (relative to recharge in areas underlain by younger rocks) due to slope steepness and relative imperviousness (both of which promote runoff rather than infiltration of snow melt).

Detailed potentiometric surface data are not available for the region surrounding the permit area. However, the deeply incised canyons interrupt the flow of groundwater in much of the area. Danielson et al. (1981) suggest that groundwater generally moves from high areas of recharge to low areas of drainage, principally along stream channels.

The predominant chemical constituents in most springs in the region are calcium and bicarbonate (Danielson et al., 1981). Dissolved solids concentrations generally range from about 50 to 750 milligrams per liter. Regionally, the concentrations of major dissolved constituents in water from individual geologic units is highly variable, due to the complex lithologic nature of the area (Danielson et al., 1981).

Mine Plan Area Aquifers

Results of the initial seep and spring inventories conducted in the study area were submitted previously to DOGM (EarthFax Engineering, 1985a, 1985b). All data associated with subsequent seep and spring inventories are located within this MRP. Locations of the seeps and springs discovered during the inventories are shown on Plate 7-12. Data collected during the inventories are included in Appendices 7-16 through 7-20. Data from the 2003 inventories in the South Crandall Lease area are presented in Appendix 7-58.

Approximately 60% of all the seeps and springs found during the early-season surveys had flows of one gallon per minute or less (Appendix 7-17). These flows typically decreased by the time of the late-season surveys, with most of the low-flow sources issuing only as seeps or being dry. The majority of seeps and springs issue from bedding planes separating porous sandstones or fractured zones from underlying low-permeability siltstone and shale beds.

The primary exception to the above generality is flow from seeps and springs along the western edge of UTU-68082 which discharge from the North Horn Formation, alluvium covering the North Horn Formation, or from Tufa deposits in Upper Joes Valley. Flow from most of these seeps and springs is attributed to discharge from the Joes Valley fault zone.

The occurrence of groundwater at Trail Mountain (Lines, 1985) is very similar to that at Crandall Canyon. The major water bearing unit at both mines is the Blackhawk-Star Point aquifer. The Trail Mountain Mine is overlain by perched aquifers in the Blackhawk, Castlegate, Price River, and North Horn Formations; these perched aquifers are separated by unsaturated zones (Lines, 1985). Seep and spring survey results at Crandall Canyon and at the

South Crandall Lease area also reveal the presence of perched aquifers in the same formations. As at Trail Mountain, this perching

occurs where more-permeable strata (aquifers) overlie less-permeable strata (aquitards and aquicludes) (Lines, 1985; Appendix 7-16).

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The distribution of seeps and springs among the formations present at both the Trail Mountain (Lines, 1985) and Crandall Canyon (Appendix 7-16-) mines is very similar. At both mine areas the largest percentage of seeps and springs are found in the North Horn and Price River Formations. Similarly, in both mine areas the smallest percentage of seeps and springs are found in the Castlegate Sandstone Formation and Blackhawk Formation. Some springs and seeps discharge from the Star Point Sandstone in the South Crandall Lease area. Little Bear Spring, which is a developed spring that provides municipal water to nearby towns, discharges from a fracture system in the Star Point Sandstone.

Because of its importance as a municipal water supply source and its proximity to proposed mining areas, Little Bear Spring has been extensively studied. Several hydrologic studies have been performed since 1977 to investigate the recharge source for Little Bear Spring. These studies have agreed that the spring flow is supported by a fault/fracture system. Since Little Bear Spring lies more than 300 feet below the level of the mineable coal seams and past mining encountered the fault/fracture system without significant inflow of water, there is general consensus among the Castle Valley Special Service District (CVSSD), mine operators, scientific community, and the regulatory agencies that adverse effect to the spring are unlikely. (Forest Service, BLM Joint Decision Notice/Finding of No Significant Impact, Coal Lease Application UTU-78953)

Several studies have been done that suggest a northerly component of flow feeding Little Bear Spring. These studies include:

(i) Vaughn Hansen Associated, *Water Quality and Hydrologic Study in Vicinity of Huntington Creek Mine No. 4 and Little Bear Spring*, Prepared for Swisher Coal Company, August1977.

(ii) Hydro-Sciences, Inc., *Ground Water Hydrology in the Vicinity of the Huntington No. 4 Mine*, Prepared for ARCO Coal Company, December 19, 1980.

(iii) Beaver Creek Coal Company, *Huntington Canyon No. 4 Mining and Reclamation Plan*, Prepared for UDOGM, 1983.

(iv) Utah Geological and Mineral Survey, *Effects of Coal Mining at Huntington Canyon No. 4 Mine on Little Bear Spring, Emery County*, Prepared for Castle Valley Special Services District, Job No. 84-005, January 21, 1984.

(v) Vaughn Hansen Associated, *Hydrologic Conditions in Huntington Canyon No. 4 Mine*, 1984.

These referenced studies are available for review at the ~~Division's~~Division's Public Information Center.

Other studies indicate that the Little Bear Spring may possibly be fed by fault/fracture system which intercepts surface water in Mill Fork Canyon southwest of the South Crandall

Lease area. These scientific investigations include an investigation of the Little Bear Spring groundwater system and the groundwater systems encountered in the Crandall Canyon Mine (Appendix 7-52), a solute and isotopic investigation of groundwater from Little Bear Spring and the Star Point Sandstone and Blackhawk Formation groundwater systems the Crandall Canyon Mine (Appendix 7-53), an
investigation of the hydraulic conductivity of the Star Point Sandstone in the vicinity of the Crandall Canyon Mine (Appendix 7-54), an investigation of the alluvial groundwater system in Mill Fork Canyon with implications for recharge to Little Bear Spring (Appendix 7-55), an investigation of the potential for Little Bear Spring recharge in Mill Fork Canyon (Appendix 7-56), and a fluorescent dye-tracing study that conclusively demonstrates the hydraulic connection between the stream/alluvial groundwater system in Mill Fork Canyon and Little Bear Spring (Appendix 7-57). Sunrise Engineering also performed a series of investigations using a proprietary geophysical technique that demonstrated a hydraulic connection between Little Bear Spring and the surface drainage in Mill Fork Canyon. These investigations are included as Appendix 7-59, Appendix 7-60, Appendix 7-61, and Appendix 7-62.

While the flow mechanisms conveying water to Little Bear Spring are not completely understood, additional hydrologic studies performed since the Mill Fork EA was written have indicated that adverse impacts to the spring are not expected due to the vertical separation between the coal seams and flow. (Forest Service, BLM Joint Decision Notice/Finding of No Significant Impact, Coal Lease Application UTU-78953)

The low flow rates from most of the seeps and springs emitting from the Blackhawk Formation (Appendices 7-16, ~~and~~ 7-17, and 7-58) result from the low hydraulic conductivity of the formation where it remains unfractured. Laboratory permeability data from a core sample taken in T17S-R6E-Sec27 at Trail Mountain indicate an average horizontal hydraulic conductivity of 1.3×10^{-2} feet per day, and an average vertical hydraulic conductivity of 3.8×10^{-3} feet per day for sandstone units of the Blackhawk Formation (Lines, 1985).

Shale and siltstone samples of the Blackhawk Formation have maximum horizontal and vertical hydraulic conductivities of only 1.0×10^{-7} and 1.2×10^{-6} feet per day, respectively (Lines, 1985). These low hydraulic conductivities of the shales and siltstones indicate that these finer-grained sediments within the Blackhawk serve as barriers to the downward migration of water. As a result, water recharge into the Blackhawk, either from adjacent formations, snow melt, or rainfall is allowed to percolate vertically through sandstone beds until a siltstone/shale bed is encountered at which time the water is forced to travel laterally along the bedding plane to the surface.

Similarly, the majority of the seeps and springs in the Castlegate, Star Point and North Horn Formations observed in the field surveys in Crandall Canyon also issue from bedding planes. Due to the presence of these vertical permeability barriers, the aquifers in the North Horn, Price, River, Castlegate, as well as in the upper portions of the Blackhawk Formations are perched, with no direct
communication to the underlying regional Star Point aquifer. Consequently, any dewatering of the perched Star Point aquifer resulting from mining the Hiawatha Coal of the Blackhawk Formation has little potential of affecting seeps and springs in the area (Lines, 1985).

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Most of the seeps and springs in and around the state lease areas, and the UTU-68082 leases principally drain perched aquifers in the North Horn and Price River Formations (Appendix 7-16). The North Horn and Price River Formation perched aquifers lie 470 to over 2410 feet above the top of the Hiawatha Coal Seam. These aquifers exist along bedding planes and are perched with ~~nodirect~~no direct hydraulic connection to the existing or proposed mine workings in the Hiawatha coal bed.

As a result, mine dewatering is anticipated to have minimal, if any effects on these seeps and springs.

Lesser numbers of seeps and springs drain the perched aquifers in the Blackhawk Formation and lie approximately 420 or more feet above the potentiometric surface of the regional Star Point aquifer. With no direct communication to the underlying regional aquifer these water sources should not be affected by mine dewatering, if it occurs.

Elevations of perched aquifers overlying the Hiawatha Coal Seam are evidenced by the occurrence of seeps and springs (Plate 7-12). The locations of seeps and springs suggest that perched aquifers may be present in the following areas:

Approx. Elev.	**Location**	**Geologic Formation**
10,160 feet	Sec. 12,T16S,R6E, SE	North Horn
9,440 feet	Sec. 12,T16S,R6E, NE	Price River - base
8,720 feet	Sec. 1,T16S,R6E, NW	Blackhawk - top
9,920 feet	Sec. 2,T16S,R6E, SW, NW SW	North Horn
10,240 feet	Sec. 2,T16S,R6E, SW	North Horn
10,480 feet	Sec. ~~35T~~35,T,15S,R6E, SE	North Horn
10,240 feet	Sec. ~~35T~~35,T,15S,R6E, NW	North Horn - base
9,280 feet	Sec. ~~31T~~31,T,15S,R7E, SW	Price River
9,680 feet	Sec. ~~25T~~25,T,15S,R6E,S ~~½~~½	Castlegate

Seeps and springs northwest of the permit area discharge from the North Horn Formation or alluvium covering the North Horn Formation in Upper Joe's Valley. In contrast to other seeps and springs in the study area, flows from many of these water sources increased substantially between the spring/early summer surveys and the fall surveys (Appendix 7-17). This anomalous water flow trend is attributed to three factors:

First is the groundwater recharge from the Joe's Valley Fault Zone. These water sources lie in two linear positions parallel to the fault zone. Those springs occurring in the valley bottom directly east or immediately contiguous to Indian Creek, and those springs on the west hillslope above Indian Creek which also follows the trace of the fault zone.
Secondly, recharge from water in the colluvium and alluvium on the west-facing slope of East Mountain flows downhill toward Upper Joe's Valley and discharges into the valley alluvium. The relatively late arrival (mid-summer) of this water is due to the lag time created as this snow melt-derived water travels through the soil to the valley floor.

Thirdly, the seeps and springs in Upper Joe's Valley lie in a different drainage basin than those in the rest of the study area, a drainage basin which has a contrasting flow pattern to that present in the Huntington Creek tributaries on the east-facing slopes of East Mountain

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According to the approved current mine plans for the UTU-68082 (LBA No. 9) area (which is bounded at the east margin of the LBA by the north and south trending Joes Valley Fault Zone) mining will not occur within approximately 1000 feet of the fault zone.

During the period of March and April 1987, a monitoring well (MW-1) was installed at the Crandall Canyon Mine in the location indicated in Plate 7-13. MW-1 provides less than 1 gpm of water and is used to supplement the water withdrawn from Crandall Creek for in-mine usage. MW-1 was drilled using air-rotary methods to a total depth of 375 feet, and encountered Star Point Sandstone through its entire depth (Figure 7-1).

The driller indicated that the formation was relatively homogenous except in the zone from 290 to 335 feet, where the sandstone became coarser. It is from this zone that the well is producing water, with water first being encountered at a depth of about 315 feet. The static water level, approximately one week after completion of the well, was at a depth of 186.1 feet below ground surface, indicating the presence of a significant upward pressure component (approximately 130 feet) within the saturated zone.

After completion of the well, a slug test was performed on the well to determine the approximate hydraulic characteristics of the Star Point Sandstone at the mine site. This test was performed by inserting approximately 10 feet of drill stem below the water surface and allowing the water level to stabilize over a period of 3.75 hours. Although water level recovery was measured during this period, the data are not adequate for slug-test analysis since the drill stem was present within the zone of influence of the injection test, thus displacing additional water during the recovery period.

Following stabilization of the water level, the drill stem was rapidly removed from below the water level and the resulting recovery to static conditions was measured for a period of more than 2 hours. Data collected from this test have been provided to the Division in a letter addressed to Mr. Dave Cline from Richard B. White of EarthFax Engineering, Inc. and dated April 30, 1987. Data collected for the first 700 seconds of the test are provided in Figure 7-2.

In-mine monitoring wells MW-4 and MW-5 were installed, completed, and developed in January, 1992. Monitoring well MW-3 is located in an area that was sealed in 1979 and is now inaccessible. Water-level data collected in January, 1992 from MW-2, MW-4, and MW-5 were used to produce the potentiometric surface map depicted on Plate 7-13. Slug tests were also performed on MW-4 and MW-5. (See Appendix 7-24).

The slug test data were analyzed using a method developed by Bouwer and Rice (1976). According to this method:

$$K = r_c^2 \frac{\ln(R_e/r_w)}{2L} \frac{1}{t} \ln \frac{y_o}{y_t} \qquad (7\text{-}1a)$$

where K = hydraulic conductivity (feet per day)

r_c = radius of the casing (feet)

r_w = radius of the well

L = length of the screened section (feet)

t = time since test began (seconds)

y_o = maximum drawdown during test of drawdown immediately following slug injection or withdrawal (feet)

y_t = drawdown at time t (feet)

$$\ln(R_e/r_w) = \frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w}^{-1}$$

where H = depth from static water level to the base of the producing zone

C = a dimensionless coefficient as a function of L/r_w obtained from Figure 3 of Bower and Rice (1976, p.426)

For the slug test conducted at MW-1,

r_c = r_w = 0.25 ft (hole radius of 3 inches)

L = 335-290 = 45 ft (length of the producing zone according to the driller's records)

H = 335-187 = 148 ft (distance between the static water level and the base of the producing zone

y_o = 2.50 ft (see Figure 7-2)

y_t = 2.10 ft at t = 400 s (see Figure 7-2)

$$\ln(R_e/r_w) = \frac{1.1}{\ln(148/0.25)} + \frac{6.6}{45/0.25}^{-1} = 4.8$$

By means of equation (7-1a) and these data, a hydraulic conductivity of 0.1 foot per day was calculated. Assuming that the 45-foot producing zone accounts for the entire thickness of the aquifer at the location of MW-1, this value converts to a transmissivity of 4.5 square feet per day.

Slug tests from MW-4 and MW-5 were analyzed using the same equation and the hydraulic conductivity for MW-4 was determined to be 0.6 foot per day (2.3 square feet per day) and 2.5 foot per day (13.0 square feet per day) for MW-5. The data sheets for MW-4 and MW-5 slug tests are included in Appendix 7-24. These determined transmissivities are similar to those measured by Lines (1985) from pumping tests performed in the Star Point Sandstone near Trail Mountain approximately 10 miles southwest of Crandall Canyon.

According to Danielson et al. (1981), the flow of groundwater in the region is generally from high-elevation recharge areas toward major canyons. In most locations, the piezometric surface in the Star Point Sandstone is below the mine floor. Minor inflow to the existing mine workings has been from the roof, even though the floor of the mine within the western third of the mine area is below the elevation of Crandall Creek. Most groundwater inflow into the mine occurs from sandstone paleochannels in the mine roof, especially where these sandstone rocks are fractured. In the westernmost portion of the Crandall Canyon Mine, the piezometric surface in the Star Point is at or slightly above the elevation of the mine floor. In these areas, minor amounts of groundwater weeps into the mine from fractured sandstone in the mine floor. In addition, as noted above, the depth to groundwater at the mouth of the mine (at MW-1) is approximately 186 feet below ground surface. Thus, it is reasonable to assume that groundwater within the Star Point Sandstone beneath the mine does not discharge into Crandall Creek.

Although the regional stratigraphic dip is to the west (see Chapter 6), the local strata generally dip to the southeast. As shown on Plate 7-13, the direction of groundwater flow in the Star Point Sandstone beneath the mine is generally eastward, from East Mountain to Huntington Canyon.

In the area of Trail Mountain (located approximately 10 miles southwest of Crandall Canyon) the hydraulic gradient of groundwater in the Star Point Sandstone varies from about 0.11 foot per foot in the recharge area near the ridge line to about 0.03 foot per foot in the discharge area in Straight Canyon (Lines, 1985). Due to the similarity of the geologic conditions in the two areas (Waddell et al., 1981), similar hydraulic gradients are expected in the East Mountain recharge area and Huntington Canyon discharge area, respectively.

Usage of most seeps and springs within the survey area is confined to deer, elk, and other wildlife and limited seasonal usage by livestock. Flowing surface water within each watershed does contribute to downstream water users such as industry, domestic water supplies, and recreation (i.e., cold water fisheries). As would be expected, wildlife usage of the springs is most abundant where flows are greatest and the sources are most accessible. Little Bear Spring has been developed for municipal use by adjacent municipalities.

Data indicate that the specific conductance of water issuing from springs in June generally increased with increasing stratigraphic depth. This is in agreement with the findings of Danielson et al, (1981). Springs issuing from the Price River Formation typically had a specific conductance, during the June survey, ~~that~~which varied from 150 to 450 umhos/cm at 25~~-~~°C while

those issuing from the Blackhawk Formation and Star Point Sandstone had a specific conductance varying from 500 to 1000 umhos/cm at 25°C.

The pH of water issuing from springs in the survey area showed no trends within or between formations. Values varied from 6.80 to 8.57, averaging 7.74. Hence, spring water in the study area is slightly alkaline.

In those springs with sufficient water to sample, pH generally increased slightly between June and October. Increases normally amounted to 0.1 to 0.5 pH unit. Specific conductance showed no consistent pattern between the June and October data, with approximately as many increases as decreases between June and October.

Water temperatures vary widely at the site. In general, water temperatures are lowest in springs issuing from fractures and highest in springs issuing from shallow colluvium over bedrock. Lower water temperatures generally occurred in the springs with relatively low specific conductances.

Appendix 7-42 contains water quality results for selected springs from 1988 through 1991. These water quality analyses generally have included pH, temperature, conductivity or TDS, total manganese (as Mn), and either total or dissolved iron (as Fe). Baseline discharge and water quality data from the South Crandall Lease area is included in Appendix 7-58. Baseline discharge and water quality data from the U-68082 lease mod area is included in Appendix 7-64.

Groundwater Development and Mine Dewatering

Water Supply

A few of the seeps or springs inventoried during the spring/seep surveys have been developed for beneficial use. No water wells used for consumption by humans or animals, other than MW-1, are known to exist within the study area of the spring inventory. However, groundwater which reaches the surface water within each watershed does contribute to downstream water users in Huntington Creek who have the water allocated for industry, domestic water supplies, agriculture, and recreation (i.e., cold water fisheries). Little Bear Spring has been developed as a municipal water source for adjacent municipalities.

Appendix 7-1 contains a listing of groundwater rights (and their associated seeps and springs) in and adjacent to the permit area (within a 1-mile perimeter boundary). This data was obtained from the files of the Utah Division of Water Rights. Locations of these water rights are denoted in Plate 7-14. Appendix 7-1 also shows what groundwater right corresponds to the seeps and springs observed in the field inventories.

Mine Dewatering

An underground water budget (amended August 23, 1994) appears in Appendix 7-21. Based on the water budget, current underground use of water for the mine equipment averages

14.3 gpm throughout the year. Infiltration along the mine floor and sumps totals 10 gpm and evaporation due to mine ventilation equals 50 to 60 gpm. Coal moisture content accounts for 68.5 gpm. The combined approximate total equals 150 gpm. The quantity of mine inflow that is lost to evaporation and infiltration are estimates based on experience at other mines, and the infrequent need to discharge into Crandall Creek. Additional water depletion analysis for Fish and Wildlife Service is provided in Chapter 3.

Although worst-case estimates of mine inflow are greater than the present inflow rate, the actual inflow rate to be encountered is unknown. In order to effectively treat mine inflow an additional sump and pump house will be built in the southeastern corner of Lease ML-21569 (Appendix 7-22). This new sump will be equipped with a Worthington pump capable of pumping 150 gpm at 400 psi. This proposed sump will serve as the primary treatment facility for mine inflow, as well as the active water supply for mining operations. The existing sump will be maintained as a secondary water treatment facility. If discharge is required, water to be discharged will be initially treated in the proposed sump in Lease ML-21569, then pumped to the secondary (presently existing) sump, prior to discharge into Crandall Creek.

In the event mine inflow rates exceed the capacity of these treatment facilities to treat the mine inflow to meet the discharge limit criteria outlined in the UPDES Permit (UPDES Permit No. UT0024368, authorizing two discharge points), GENWAL commits to modifying these treatment+ facilities and/or constructing additional facilities in order to ensure compliance with the UPDES Permit. Treatment facilities to be considered include enlargement and/or construction of additional underground sumps and/or surface settling ponds. If excessive water volumes are encountered the

use of flocculants and gel-logs will be considered as stopgap measures until more permanent treatment facilities are in-place.

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Make-up water for in-mine use is pumped from Crandall Creek into the main mine sump at no more than 75 gallons per minute (pump capacity). At its lowest recorded flow, at the lower flume, a minimum of 100 gallons per minute remains within Crandall Creek even when the mine is withdrawing water for in-mine use.

The majority of natural water inflow is occurring in the old mine workings (Leases U054762 and SL-062648). According to GENWAL personnel, natural mine inflow accounts for less than 400,000 gallons per year of the total water used in-mine. Only negligible mine inflow has been encountered in Lease UTU-68082 and State Lease ML-21569. Currently, water used in mining operations is being pumped to State Lease SL-21569 from the sump in the old mine workings. All inflow water is used in underground mining operations.

Effects of Mining Operation ~~On~~on Groundwater

Mine dewatering (resulting in removal of water from the aquifers) is the primary mechanism by which the groundwater system may be impacted. As previously stated, it is believed that the water emitting from seeps and springs in State Leases ML-21568 and ML-21569, as well as areas within and adjacent to UTU-68082 (LBA No.9) and groundwater supporting

springs and seeps in the –South Crandall Lease area (UTU-78953), originate from perched aquifers with no direct communication with the regional Star Point aquifer. Although groundwater discharging from Little Bear Spring travels through a fracture system in the Star Point Sandstone, it is believed that the fracture system is the conveyance system for the ~~the~~ groundwater. Groundwater migrating through the pore spaces in the Star Point Sandstone near the spring likely does not contribute any significant quantity of groundwater to the spring. This conclusion is based on the very low hydraulic ~~coductivity~~conductivity of unfractured Star Point Sandstone described in a subsequent section (see also Appendix 7-54). Thus, dewatering resulting from mining the Hiawatha Coal of the Blackhawk Formation has little potential for impact on the regional aquifer or for a diminution of flow from Little Bear Spring. This observation is in agreement with conditions present at Trail Mountain as reported by Lines (1985).

Laboratory permeability data reported by Lines (1985) on cores collected from the Blackhawk Formation indicate that the hydraulic conductivity of shale and siltstone units of this formation is typically four to six orders of magnitude lower than the hydraulic conductivity of the sandstone units. The relatively higher hydraulic conductivity of the sandstones of the Blackhawk Formation compared with the siltstones and shales indicates that the finer-grained sediments of the formation serve as barriers to the downward movement of water. As water recharges the Blackhawk Formation (either through snow melt, rainfall, or subsurface seepage from an adjacent formation) it percolates downward within the sandstone beds. However, upon reaching a less-permeable siltstone or shale layer, the water is forced to flow laterally to the surface, issuing at the interface between two units of contracting hydraulic conductivity.

Notable exceptions to the above generality concerning the Blackhawk Formation are present at springs that issue from fractured sandstone within the formation. Examples of this phenomenon are present in springs SP-53 through SP-58 (Plate 7-12), where flow rates greater than 100 gallons per minute have been measured. Travertine deposits are common at these springs, which suggests that the recharge area for these springs is dominated by calcium carbonate. In areas, the upper portion of the Blackhawk Formation may serve more as a conveyance body rather than a significant source of water to these springs.

Results of slug tests on MW-1, MW-4 and MW-5 indicate that the Star Point Sandstone in the Crandall Canyon area has a hydraulic conductivity of 0.1 to 2.5 ft/day. Based on an average hydraulic conductivity of 1.0 ft/day, an average hydraulic gradient of 0.025 ft/ft (see Plate 1-8), an average Star Point porosity of 0.14 (Lines, 190\85) and the modified Darcy equation (Freeze and Cherry, –1979), the average linear velocity of groundwater flowing through the Star Point Sandstone beneath Lease #UTU-68082 and adjacent areas is approximately 0.2 ft/day.

Results of slug tests performed on the in-mine Star Point Sandstone wells MW-2, MW-6A, MW-7, and MW-6 by Mayo and Associates in 1997 (Appendix 7-54) indicated an average hydraulic conductivity of unfractured Star Point Sandstone of approximately 0.005 ft/day. Using information from these wells, the calculated average linear velocity of groundwater moving through the Star Point Sandstone is even less than 0.2 ft/day~~.~~.

It is of note that laboratory permeability data provided by Lines (1985) from core samples collected approximately 10 miles south of Crandall Canyon indicate that the Star Point Sandstone has an average horizontal hydraulic conductivity of $2.3x10^{-2}$ ft/day and an average vertical hydraulic conductivity of $8.8x10^{-3}$ feet per day. With the range of slug test results at the mine and the lower values reported by Lines (1985), the velocity presented above is considered to be a maximum.

The potentiometric surface of the Star Point aquifer directly underlying the Hiawatha Seam (the coal bed mined at Crandall Canyon) is shown on Plate 7-13. The water table rises to the northwest under East Mountain at an average angle of 3 degrees, and lies from 50 to 115 feet below the Hiawatha coal seam. This regional water table is 150 feet below ground surface in the area of the mine portal, and up to 2220 feet below the surface under East Mountain in Sec. 2,T.16S.,R.6E.

Mitigation and Control Plan

Based on information presented in the preceding section, only minimal impacts on groundwater resources in the permit area may result. A probable hydrologic consequences determination that includes the South Crandall Lease area is included as a portion of this chapter and is located in Appendix 7-15. Installation of the main bypass culvert will not alter the Probable Hydrologic Consequences.

Mitigation for potential disruption to the Little Bear Spring will be accomplished though the construction of a water treatment plant which will provide replacement water for the spring. Construction of this water treatment plant will be done under the provisions of a water replacement agreement between GENWAL Resources, Inc. and the Castle Valley Special Service District who maintain culinary water rights to Little Bear springs. A copy of this water replacement agreement is included in Appendix 7-51. With construction of this water treatment plant an uninterrupted supply of culinary water will be assured irrespectively of whether mining can be conclusively shown to have affected Little Bear Spring. This is in compliance with special stipulation #17 of federal lease UTU-78953 (see Appendix 1-13).

Currently, treatment of mine water prior to discharge into Crandall Creek includes the use of two underground sumps. Discharge to Crandall Creek has occurred only 5 times prior to 1994 (UPDES Permit - Appendix 5-14).

7.24.2 Surface Water Information

Scope

This section presents discussion of surface water conditions within and adjacent to the permit area (lease areas SL062648 and U 054762, state leases ML21568 and ML21569, and UTU-68082) and in the South Crandall Lease area (UTU-78953) and the U-68082 lease mod area. Conclusions drawn herein are based upon a field reconnaissance of the area and a review of published hydrologic information.

Methodology

The U.S. Geological Survey established a gaging station at the mouth of Crandall Creek in 1978. The gaging station was maintained through water year 1984. Data collected from this station were obtained from the Water Resource Division of the USGS in Salt Lake City and used to determine seasonal variations in flows in areas adjacent to the mine plan area. Additional information is provided from Parshall flumes and instantaneous stream flow measurements by GENWAL in Blind Canyon, Horse Canyon, Indian Creek, Crandall Canyon, No Name Canyon, Little Bear Canyon, and several unnamed drainages in the South Crandall Lease area (Appendix 7-23, 7-58).

Regional Surface Water Hydrology

The region (including the existing permit area, the U-68082 lease mod area and the South Crandall Lease area) is drained by a combination of ephemeral, intermittent and perennial streams. Two watersheds within the permit area have both intermittent and perennial sections within the stream drainage: Crandall Canyon and Horse Canyon. Two additional perennial streams occur adjacent to the permit area: Indian Creek (which drains to Joe's Valley Reservoir) and Huntington Creek. There are no perennial drainages in the South Crandall Lease area, although the Forest Service considers the Little Bear drainage a "perennially functioning stream".

Crandall Creek is an east-flowing tributary of Huntington Creek, one of the major tributaries of the San Rafael River. Huntington Creek had annual flows near the city of Huntington ranging from 25,000 to 150,000 acre-feet during the period of October 1931 through September 1973, averaging 65,000 acre-feet per year (Waddell et al., 1981). Variations in the annual flow of Huntington Creek near Huntington are depicted on Figure 7-6. Approximately 50 to 70 percent of stream flow in the mountain streams of the region occurs during May through July (Waddell et al., 1981). Stream flow during this late spring/early summer period is the result of snow melt runoff.

Horse Canyon is also an east-flowing tributary of Huntington Creek. Instantaneous flow measurements collected during 1991 indicate that peak flow occurred during May and June with

approximately 2500 gpm at station H-1 (see Plate 7-16). Minimal flow was observed during August, September, and October at approximately 15 gpm. No flow was observed at station HS-5 (located on the south fork of Horse Canyon near the fork) during September of 1992. Additionally, the main channel of Horse Canyon was observed to be dry approximately 340 feet above the fork. Stream flow and temperature measurements for Horse Canyon can be found in Appendix 7-23.

The quality of water in Huntington Creek and other similar streams in the area varies significantly with distance downstream. Waddell et al. (1981) found that concentrations of dissolved solids varied from 125 to 375 milligrams per liter in reaches of major streams above major diversions to 1600 to 4025 milligrams per liter in reaches below major irrigation diversions and population centers. The major ions at the upper sites were found to be calcium, magnesium, and bicarbonate, whereas sodium and sulfate became more dominant at the lower sites. They attributed these changes to (a) diversion of water containing low dissolved solids concentrations, (b) subsequent irrigation and return drainage from moderate to highly saline soils, (c) groundwater seepage, and (d) inflow of sewage and pollutants from population centers.

Average annual sediment yields within the Huntington Creek drainage basin range from approximately 0.1 acre-feet per square mile in the headwaters area to about 3.0 acre-feet per square mile near the confluence with the San Rafael River (Waddell et al., 1981). Increases in sediment yield with increasing distance downstream is generally the result of the water contacting increasing amounts of shale and sandstone in the downstream direction (Waddell et al., 1981).

Periodic instantaneous stream flow measurements for Indian Creek, collected by the U.S. Forest Service, are found in Appendix 7-44. These measurements were collected in Sec. 17,T.17S.,R.6E., during the period of July 1970 through April 1977. During seep and spring inventories conducted in the area by GENWAL in October and November of 1989, 1990, and 1991, the upper portion of Indian Creek was observed to be dry at elevations above 9120 feet in Sec. 34,T.15S.,R6.6E.

Observations of drainages located along the west facing slope of East Mountain in T15S R6E Section 35 W1/2 have been made during the seep and spring surveys from 1985 to 1990. The drainages have been found to be dry during all fall seep and spring surveys. Flow was observed during the fall 1991 survey; however, flow was not measured due to the existing field conditions (rain and melting snow) that would mask any natural perennial flow or lack of flow. Appendix 7-48 contains additional information concerning hydrologic conditions for the UTU-68082 (LBA No. 9) areas.

Mine Plan Area Surface Hydrology

The permit area (including the –South Crandall Lease area and the U-68082 lease mod area) is drained by a combination of ephemeral, intermittent, and perennial streams. The watersheds are steep (with average slopes often exceeding 50 percent) and well vegetated (with percent covers also often exceeding 50 percent).

Within the –South Crandall Lease area, no perennial streams have been identified. Based on the discharge data for these drainages (Appendix 7-58), the drainages in the –South Crandall Lease would be considered ephemeral or intermittent. There are no perennial streams in the U-68082 lease mod area (see Appendix 7-64). The reaches of No Name Canyon creek would all be considered ephemeral or intermittent. The Forest Service considers parts of the Little Bear Canyon drainage as a “–“perennially functioning stream”-.”.

Flow measurements collected at the U.S. Geological Survey gaging station at the mouth of Crandall Creek can be found in Appendix 7-2. Flow measurements from a flume in Blind Creek, and estimated in Horse Creek are contained in Appendix 7-23. The Crandall Creek data are summarized in Figures 7-7 (monthly flow volumes) and 7-8 (monthly maximum and minimum flow rates) for the period of record (October 1978 - September 1984). Data collection from the Crandall Canyon gaging station was discontinued by the USGS in 1984.

As noted in Figures 7-7 and 7-8, the flow data for Crandall Creek are not complete for the winter months in most years, because of freezing conditions. Assuming an average flow of 30 acre-feet per month for the period of missing record, the average annual flow for the six-year period of data contained in Appendix 7-2 was 2740 acre-feet.

According to Figure 7-8, maximum flow rates in Crandall Creek normally occur in the months of May or June, while minimum recorded flows occurred during the months of September through November. During the period of record, the maximum recorded daily flow rate has been 88 cubic feet per second (on May 30, 1983). The minimum recorded daily flow rate was 0.28 cfs (on several days in September 1981). Lower minimum flows may have occurred during the winter months when data are lacking.

Plan and profile views of Crandall Creek adjacent to the surface facilities are shown on Plate 7-1. Selected cross sections are provided on Plate 7-2. As noted, Crandall Canyon is steep, with channel slopes normally exceeding 5 percent. The channel bottom is approximately 10 feet wide and side slopes are steep (generally greater than 100 percent).

Surface water-quality data collected from Crandall Creek by GENWAL are contained in Appendix 7-3 and summarized in Table 7-5A. These data, collected between June 1983 and November 1985, indicate that the dominant ions in Crandall Creek are calcium and bicarbonate. Total dissolved solids concentrations in the stream have varied from 180 to 286 milligrams per liter, with lower concentrations normally occurring during the high-flow season. Total suspended solids concentrations in Crandall Creek have varied during the period of record from <0.5 to 5.0 milligrams per liter (see Appendix 7-3). As expected, the highest suspended solids concentrations generally occur during periods of highest stream flow.

Parshall flumes were installed by GENWAL in– Blind Canyon in July 1991 and in Crandall Canyon in May 1988. Locations of the lower and upper Crandall Canyon flumes

(CF-1 and CF-1, respectively), and Blind Canyon flume (BF) are shown on Plate 7-16. Charts and tabulated flow data collected from the flumes are presented in Appendix 7-23.

Periodic instantaneous stream flow measurements collected in 1991 by GENWAL in Blind Canyon, Horse Canyon, and the north and south branches of Crandall Creek appear in Appendix 7-23. These measurements were collected from the locations shown on Plate 7-16. When the area was accessible, these measurements were collected monthly from January through June, bi-monthly from July through September, and monthly from October through December. During seep and spring surveys performed in the area by GENWAL in October 1989, the South Fork of Horse Canyon was observed to be dry above the forks (Plate 7-16). Blind Canyon was observed to be dry in October 1989 above the midpoint between stations B-2 and B-3 (Plate 7-16). See also Appendix 7-23 for additional evaluations on flow through September 1992.

Water quality data collected by the U.S. Forest Service from Indian Creek are summarized in Appendix 7-45.

Water quality and discharge data –for streams in the– South Crandall Lease area are presented in Appendix 7-58. Water quality and discharge data for seeps, springs, and streams in U-68082 lease mod area are presented in Appendix 7-64.

Table 7-5A
Concentrations of Selected Constituents in Crandall Creek

Constituent	Maximum (mg/1)	Date	Minimum (mg/1)	Date	Mean (mg/1)
Upper Station[a]	60 Samples				
Total Diss. Solids	320	11/24/87	180		4/08/85 255
Total Susp. Solids	1472	5/16/84	0		7/17/86 59.3
pH[b]	8.28	10/29/86	6.75	1/14/84	7.78
Total Iron	0.34	6/28/83	<0.05	Several	0.06
Diss Iron	<0.05	Several	<0.05	Several	<0.05
Total Manganese	0.03	Several	<0.01	Several	0.01
Lower Station[a]	52 Samples				
Total Diss. Solids	323	1/29/86	165	11/07/84	259
Total Susp. Solids	1468	5/16/84	0	7/17/86	57.8
pH[b]	8.66	11/20/86	6.95	11/01/84	7.75
Total Iron	0.25	6/28/83	<0.05	Several	<0.05
Diss Iron	<0.05	Several	<0.05	Several	<0.05
Total Manganese	0.03	Several	<0.01	Several	0.01

(a) See Figure 7-8
(b) In standard pH units solids concentrations generally occur during period of highest flow.

Analytical results are for samples collected from 1971 through 1978. Samples were collected from Sec. 17,T.17S.,R6E.

Laboratory analytical results of water samples collected by GENWAL at the Crandall and Blind Canyon flume locations appear in Appendix 7-3. Crandall Canyon water quality data have been collected from July 1983 to 1991. Blind Canyon water quality data represent the period of November 1990 to 1991.

Surface water-quality data contained in Appendix 7-3 indicate that the dominate constituents in Crandall Creek are calcium and bicarbonate. Total dissolved solids concentrations in the stream have generally varied from 200 to 300 milligrams per liter, with lower concentrations in the streams have generally varied from 200 to 300 milligrams per liter, with lower concentrations normally occurring during the high-flow season. The highest suspended solids concentrations generally occur during periods of highest flow and are a result of overgrazing in the upper Crandall Canyon Watershed.

Blind Canyon Drainage Study

In consultation with the Division of Oil, Gas and Mining, Utah State Lands, the Manti-La Sal National Forest, the U.S. Forest Service Intermountain Research Station, and the U.S. Bureau of Land Management, GENWAL Resources Inc. committed to participating in a scientific study in which the pillars beneath the unnamed drainage in Blind Canyon in Utah State Lands (T15S-R6E-Sec 36) will be retreat-mined to determine effects of retreat-mining produced subsidence on watershed erosion and stream flow. This study would monitor the actual effects of mining as proposed in Section 36. The U.S.F.S. Intermountain Research Station's research proposal appears in Appendix 7-25. This research proposal has been developed during close communication between the Intermountain Research Station and GENWAL Resources Inc. (Appendix 7-25). GENWAL Resources Inc. has committed to help finance the U.S.F.S. Intermountain Research Station's study, and perform subsidence monitoring, collection of Blind Canyon water quality and discharge data, as well as provide additional field support.

The approximate number and locations of cross-sections to be measured by the Intermountain Research Station personnel, and the current profile of the Blind Canyon Drainage from the Western Section Line of T15S-R6E-S36 to Route 31 appear on Plate 7-17. The locations and number of cross-sections may be modified by the researchers as ground conditions dictate. A final drainage profile and actual cross-section locations will be provided to DOGM when they are known. In addition to the cross-sections depicted on Plate 7-17, approximately 25 cross-sections in Crandall Canyon will be measured to serve as a control.

A timetable of research and mining to be conducted is found in Appendix 7-26. This timetable was developed in consultation with the U.S.F.S. Intermountain Research Station's Principal Investigator, to ensure that baseline data will be collected prior to retreat mining subsidence within the study area. As part of an agreement between GENWAL Resources Inc. and the above-referenced parties, pre- and post-mining erosion calculations for the Blind Canyon drainage have been calculated to determine the maximum worst-case amount of increased erosion

that could occur as a result of –retreat mining. These calculations appear in Appendices 7-27 through 7-38. An overview of the erosion calculations is presented in Appendix 7-39. Final results of these calculations are presented in Appendix 7-38. Drawings applicable to the erosion calculations appear in Plates 7-8, 7-9, 7-10, 7-11, and 7-12.

Appendix 7-38 results indicate a worst-case erosion volume exiting State Lease ML-21569 (T15S-R6E-S36) that could potentially be transported onto Manti-La Sal National Forest land to be 0.145 ac-ft (one time event). Appendix 7-37 presents the pre-and post-SEDROUTE outputs. An increase of 0.006 ac-ft (annually) is calculated. This value is the sum of potential headcutting (Appendix 7-38) and SEDROUTE calculations (Appendix 7-37). In order to calculate a worst-case erosion value the following have been assumed:

1) all potentially erodible material is transported down the Blind Canyon drainage off of State Section 36 onto Manti-La Sal National Forest Service land,

2) headcutting erosion is calculated on rills (A, B, C, and –D) (Plate 7-9), all ephemeral drainages,

3) headcutting is calculated for drainage "E" (Appendix 7-9), a drainage reach that also exhibits ephemeral flow, and

4) erosion is calculated at the eastern edge of Section 36 (stations 14.5 through 19) (Plate 7-9), over an area where a barrier pillar exists and erosion is extremely unlikely. Drainage erosion between stations 14.5 and 19 is extremely unlikely given the absence of a nick-point produced by retreat-mining (downward hydraulic jump), from which erosion can advance from in an upstream direction resulting in erosion. The more likely occurrence is for all but the smallest sizes of suspended sediment (colloidal) to be deposited upstream of station 14.5, and not reach Manti-La Sal Forest Service land further downstream.

The Manti-La Sal National Forest Service desires an equal or greater amount of sediment to be trapped elsewhere in the Manti-La Sal National Forest to offset potential increases of sedimentation on Forest Service land that could result from retreat-mining of State Section 36. As discussed with the U.S.F.S. Research Station personnel, and officials of the Manti-La Sal National Forest Service, erosion control measures cannot be implemented within the Blind Canyon drainage, on the State of Utah or Manti-La Sal National Forest Service lands, due to potential impacts on the U.S.F.S. Intermountain Research Station's study.

Consultations with Manti-La Sal National Forest Service personnel have resulted in identification of a site, Nuck Woodward Canyon where an erosion enhancement procedure can be conducted to reduce an equal or greater amount of sediment entering Huntington Creek. The enhancement procedure consists of graveling approximately 1/2 mile of the U.S.F.S road from the intersection of Route 31 to the trailhead area of the Nuck Woodward Canyon. An agreement whereby GENWAL donates $15,000 to the Manti-La Sal Forest to fund the Forest Service graveling of this road is provided in Appendix 7-49. This mutually agreed upon action by

GENWAL Resources Inc. and the Manti-La Sal National Forest, satisfies the U.S.F.S.'s "Net Beneficial Impact Policy." Additionally, GENWAL commits to remediating any adverse effects of retreat mining.

Thin-section microscopy and x-ray diffraction analyses of shales obtained from Crandall Canyon Mine overburden reveal the presence of a variety of bentonitic (swelling) clays. Moreover, carbonate cementation characteristics observed in thin-section and at outcrops, as well as groundwater analytical results, suggest pore-fluid chemistry conditions promote sealing of subsidence fractures (Appendix 7-41). This appendix also references a U.S. Forest Service study which indicates physical closure of subsidence fractures. The Crandall Canyon Mine overburden mineralogy, as well as physical closure of tension fractures, will aid in the protection of perched aquifers and surface waters.

SURFACE WATER DEVELOPMENT AND CONTROL

Water Supply

No extensive surface water development has occurred in the mine permit area or adjacent areas. GENWAL has historically pumped water from the stream near the sedimentation pond and from the sediment pond for use underground. GENWAL agrees to not pump from Crandall Creek at a rate that will cause the instream flow to decrease below 0.30 cfs. For the purpose to this determination, flow rates were measured using the flume at the "Lower Stream Station" indicated on Plate 7-7. No other points of development are known to exist on Crandall Creek or adjacent streams in the immediate vicinity of the mine plan area.

Appendix 7-1 presents a listing of surface water rights within the permitted and adjacent areas as obtained from the files of the Utah Division of Water Rights. Listing of these rights are noted on Plate 7-15 and summarized in Table 7-6.

Only one water-supply intake is known to exist on Crandall Creek. This intake is located immediately upstream from the sedimentation pond and is operated by GENWAL to obtain water for use at the mine. A search of records on file with the Utah Division of Water Rights and an examination of physical conditions along Crandall Creek and Huntington Creek indicate that no other water-supply intakes exist within one mile of the confluence of the two streams. It should be noted that an underground monitoring well (MW-1) drilled in 1987, currently serves as a water supply well for the mine. The use of this well supplements Crandall Creek for in-mine process water.

7.24.3 Geologic Information

Geologic information required for Sections 724.310 and 724.320 is provided in Chapter 6 and in this chapter under Sections 7.24.1 and 7.24.2.

7.24.4 Climatological Information

General

The Air Pollution Control Plan has been approved with conditions by the Department of Health letter of February 3, 1992. An amended Letter of Intent to Modify ~~GENWAL's~~GENWAL's existing Air Pollution Control Plan was submitted to the Executive Secretary of the Division of Air Quality in September, 1995. Fugitive dust control measures to be used in connection with the GENWAL Mine facility are included within the remainder of this Section. The addition of the culvert expansion and a proposed increase in coal production has been included in the amended letter of intent.

The climatological information presented below is believed to be applicable to the ~~-~~South Crandall Lease area and the U-68082 lease mod area.

EXISTING ENVIRONMENT

Precipitation

Monthly Averages

Jan.	2.90"	Feb.	2.18"	Mar.	2.53"
Apr.	0.72"	May	1.67"	June	0.19"
July	0.96"	Aug.	2.29"	Sept.	0.32"
Oct.	0.40"	Nov.	2.66"	Dec.	3.18"

Yearly Average: 20.00"

Mean Monthly: 1.75"

TABLE 7-6

Surface Water Rights in the Crandall Canyon Mine Permit Area & Adjacent Areas

W.U. Claim No.	Owner	Claim Allotment	Use	Period of Use	Source
93-134	U.S. Forest Service	(d)	Stockwater	Jun 21 to Sept 30	Stream
93-175	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-181	U.S. Forest Service	(b)	Stockwater	July 1 to Aug 30	Stream
93-182	U.S. Forest Service	(d)	Stockwater	May 21 to Aug 30	Stream
93-183	U.S. Forest Service	(a)	Stockwater	July 6 to Aug 25	Stream
93-184	UT State Lands~~&~~ & Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-188	U.S. Forest Service	(d)	Stockwater	June 21 to Aug 30	Stream
93-190	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 10	Stream
93-191	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-192	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-193	U.S. Forest Service	(E)	Stockwater	July 1 to Sept 30	
93-197	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-198	U.S. Forest Service	(e)	Stockwater	July 1 to Sept 10	Stream
93-199	~~Pacificorp~~PacifiCorp DBA UP&L	(j)	Stockwater	Jan 1 to Dec 31	Stream
93-201	U.S. Forest Service	(e)	Stockwater	July 1 to Sept 30	Stream
93-219	Huntington Clev. Irr. Co.	(i)	Varied*	Jan 1 to Dec 31	Stream
93-258	UT State Lands~~&~~ & Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-336	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-377	U.S. Forest Service	(f)	Stockwater	June 1 to Sept 30	Stream
93-383	UT State Lands~~&~~ & Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-483	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-606	U.S. Forest Service	(a)	Stockwater	June 6 to Sept 25	Stream
93-1180	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream

93-1590	U.S. Forest Service	(g)	Stockwater	June 21 to Sept 30	Stream
93-1673	U.S. Forest Service	(h)	Stockwater	June 6 to Sept 20	Stream

TABLE 7-6 (continued)

Surface Water Rights in the Crandall Canyon Mine Permit Area & Adjacent Areas

(a) Part of water right WUC 93-1403 on Crandall Canyon Allotment
(b) Part of water right WUC 93-507 on Horse Creek Allotment
(c) Part of water right WUC 93-500
(d) Part of water right WUC 93-116 on Gentry Mountain Allotment
(e) Part of water rights WUC 93-193, -198, -201, -1410, -1411, -1412, -1413, and -1414 on Crandall Canyon Allotment
(f) Part of water right WUC 93-377 on Little Joe's Valley Allotment
(g) Part of water right WUC 93-1588 on Trail Mountain Allotment
(h) Part of water rights WUC 93-985, -1632, and -1677 on Joe's Valley Allotment
(vi) Part of water right WUC-93-219, a7941
(j) Claims 199, 1183

* Irrigation, stockwatering, domestic, power, industrial

Temperature

Summer Range: +32 to +90 Degrees Fahrenheit
Winter Range: -10 to +40 Degrees Fahrenheit

Evaporation

Potential evapotranspiration of 18 to 21 inches per year.

Wind

Average direction of prevailing winds from west and northwest. The average velocity of prevailing winds representative of the proposed mine plan area is 12 miles per hour as determined by the Utah State Climatological office.

EFFECTS OF MINING OPERATION ON AIR QUALITY

Estimate of Uncontrolled Emissions

The estimate of uncontrolled particulate emissions was determined by GENWAL and submitted to the State of Utah Department of Health for a coal production rate of 3,500,000 tons per year.

Description of Control Measures

Refer to Appendix 4-7 for measures that will be specifically committed to, for implementation. The air quality approval order authorizes the increase in coal production with the conditions noted therein.

A description of the controls and design features associated with the yard expansion can be found in Chapter 5 under section 5.26.

Climatological and Air Quality Monitoring

GENWAL does not require a continuous monitoring plan for the limited amount of dust, ~~particuate~~particulate emissions or diesel exhaust. **(**See State of Utah, Division of Health recommendations for monitoring letter included as Appendix 4-7**)**.

7.24.5 Supplemental Information

Because GENWAL has an existing and approved permit it is not anticipated that any additional information will be required for the PHC**.**

7.24.6 Survey of Renewable Resource Lands

All renewable resource survey information is included in the Subsidence Control Plan in Section 5.25.

7.24.7 Alluvial Valley Floors

The permit area is located in a narrow V-shaped canyon with –upland areas and steep hillslopes. The mine and permit area and the– South Crandall Lease area are covered by a thin veneer of colluvial deposits and residual soils. The only alluvial materials are associated with the immediate stream channel which is less than 20 feet wide. These alluvial deposits are discontinuous as many portions of the stream are located directly on bedrock. As a result, the area is not underlain by an alluvial valley floor.

The area occupied by the surface facilities is a steep, narrow canyon hillslope and v-shaped narrow canyon bottom. No agricultural activities have been conducted in the area in the past nor will they be in the future due to the limited width of alluvium along the stream (less than 20 feet), to restrictive climatic conditions, and the limiting physical properties of the alluvial materials. Hence, the Crandall Creek area adjacent to the surface facilities is not an alluvial valley floor. This negative determination was also determined by the U.S. Soil Conservation Service (see Appendix 7-12).

7.25 Baseline Cumulative Impact Area Information

Sufficient information was provided by GENWAL during the initial permitting of the Crandall Canyon Mine for the Division to develop a Cumulative Hydrologic Impact Assessment (CHIA).

Geologic Information pertaining to Little Bear Spring

The Little Bear Spring is located close to the southern boundary of the South Crandall Lease area. This spring is an important source of culinary water for many residents of Emery County. In order to ensure that the spring would be protected from the effects of mining in the South Crandall lease –area. ~~the~~The Forest Service and the BLM required a number of detailed hydrology studies to ascertain the source of the spring. Based on the result of these studies the federal government has concluded that the potential for mining this lease to alter the flow of Little Bear Spring is low and has issued a Finding of No Significant Impact (FONSI) regarding the proposal to conduct mining operations within the lease. The following studies were required by the Forest Service and BLM prior to leasing action and are included in this MRP as appendices in Chapter 7. Each report includes an extensive discussion of the geology of the South Crandall tract as relates to the occurrence of ground-water, aquifers, and recharge sources of the Little Bear Spring.

App 7-51 Little Bear Spring Water Replacement Agreement
App 7-52 Supplemental Hydrogeologic information for LBA 11
App 7-53 Summary of New Isotopic Information for LBA 11

App 7-54 Results of In-Mine Slug Tests
App 7-55 Investigation of Alluvial Ground Water System ~~In~~in Mill Fork Canyon
App 7-56 Investigation of Potential for Little Bear Spring Recharge
App 7-57 Determination of Recharge Location of Little Bear Spring (Dye Tracing)
App 7-58 Summary of Hydrologic Baseline Information, South Crandall Lease
App 7-59 Little Bear Spring Study (Initial study, 1998) AquaTrack
App 7-60 Little Bear Spring Study (Expanded Study, 1999) AquaTrack
App 7-61 Mill Fork Resistivity Study, 2001 AquaTrack
App 7-62 Little Bear Spring (2nd Expanded Study, 2001) AquaTrack

7.26 Modeling

No hydrologic model has been~~–~~ prepared or conducted at this site, nor is any planned.

7.27 Alternative Water Source Information

GENWAL recognizes the fact that the Division of Wildlife Resources, the U.S. Forest Service, the Division of Oil, Gas & Mining, and the State Engineer consider all seeps and springs to be important to wildlife and downstream users. If, during the monitoring of the springs, it is determined that over the course of time a spring has been dewatered, GENWAL will notify the Division of Wildlife Resources, the Division of Oil, Gas and Mining, the U.S. Forest Service, the State Engineer, and any affected downstream users. A determination as to the probable cause of diminished flow will **be** made and if mining activities are found to be the cause, work will begin on an acceptable mitigation plan involving the use of guzzlers or other replacement measures acceptable to GENWAL, DOGM, the U.S. Forest Service, the State Engineer, and affected downstream users. The Utah Division of State Lands and Forestry will also be conferred with in formulating any mitigation plans that will affect the lands in the State Leases.

These replacement measures will be designed in cooperation with the Division of Wildlife Resources, the Division of Oil, Gas and Mining and the U.S. Forest Service and placed in the area of the effected spring. No other sources of water, other than the springs located by the seep and spring survey, are known to exist in the mine plan area. GENWAL owns shares in the Huntington-Cleveland Irrigation Company that can be transferred if required, to meet the demands of an alternate water supply. A copy of the water share certificate which would be used as an alternative water source is included in Appendix 7-14.

Mitigation for potential disruption to the Little Bear Spring will be accomplished though the construction of a water treatment plant which will provide replacement water for the spring. Construction of this water treatment plant will be done under the provisions of a water replacement agreement between GENWAL Resources, Inc. and the Castle Valley Special Service District who maintain culinary water rights to Little Bear springs. A copy of this water replacement agreement is included in Appendix 7-51. With construction of this water treatment plant an uninterrupted supply of culinary water will be assured irrespectively of whether mining can be conclusively shown to have affected Little Bear Spring. This is in compliance with special stipulation #17 of federal lease UTU-78953 (see Appendix 1-13).

7.2 Probable Hydrologic Consequences Determination

The Probable Hydrologic Consequences (PHC) is included as a separate document in Appendix 7-15. Installation of the culvert expansion project does not change the conclusions presented in the current PHC.

7.29 Cumulative Hydrologic Impact Assessment

The Division has prepared a Cumulative Hydrologic Impact Assessment (CHIA) for this operation in the initial permit. A complete PHC is provided in Appendix 7-15 to aid in the determination as to whether a new CHIA is required for this renewal.

7.30 Operation Plan

7.31 General Requirements

This section describes the groundwater and surface water protection plan and water quality monitoring program implemented within the existing permit area and to be implemented for the refuse disposal site. The purpose of the groundwater and surface water protection plan is to minimize the potential for water pollution and changes in water quality and flow for surface and groundwater within and adjacent to disturbed areas. The purpose of the water quality monitoring program is to identify the potential impacts of coal mining operations on the hydrologic balance.

7.31.1 Hydrologic Balance Protection

Surface and Groundwater Protection Plan

GENWAL has included a plan to protect the surface and groundwater in the area of the mine facilities, topsoil storage site and refuse disposal site. The plan will ensure protection of the ground water and surface water resources of the sites by handling earth and refuse materials in a manner that prevents or controls, using the best technology currently available, the discharge of pollutants to the hydrologic system. Additionally, the GENWAL commits to handle acid- and toxic-forming materials, if encountered in the future, in a manner that will minimize acid- and toxic-forming discharge to surface or groundwater. The design details of the water protection plans are presented in Section 7.42 of this application.

In order to prevent material damage to the hydrologic balance and to protect the hydrologic systems possibly associated with the Joes Valley fault system, GENWAL plans to drill ahead before mining in the Incidental Boundary Change area adjacent to the Joes Valley fault in T. 16 S., R. 6 E. Sections 3 and 10.

When mining in the longwall gate entry nears the fault (between 200-300 feet away), an underground drill will be used to drill west toward the fault to

determine its location. The drill will drill horizontally toward the fault up to 50 feet ahead of the entry face. If the fault is not encountered, the continuous miner will advance about 30-40 feet toward the fault, leaving at least 10 feet of coal between the entry and the end of the hole. The drill will again drill ahead. This sequence will continue until either water or fault gouge is encountered in the hole or the entry has been developed –to its maximum extent (providing no fault was detected). If the fault is encountered prior to reaching the bleeder entries, then mining will stop and the bleeder entries will be relocated. At least 10 feet of solid coal will be left between the face of the entry and the fault.

Other indicators have been experienced during mining up next to ~~Joe's~~Joe's Valley Fault. Any of these indicators being present will affect the above mining sequence. The indicators, which we have experienced are severe rib rashing in some cases; in others the ribs will stand up showing no rib rash. Severe water pressures have never been encountered. Large flows of water have occurred from cracks in the roof, but these flows have been associated with sand channels rather than the fault.

One horizontal hole will be drilled in the 10, 11 12 13 and 14th west panels. Should water be encountered by the drill hole, entry development would terminate at that point. Although large amounts of water and high pressure have not been previously encountered by mining near the fault, an emergency plan to handle water inundation from the fault has been developed. The plan consists of the following actions:

1. Pull equipment back from face
2. Erect two Kennedy stoppings at least 2 feet apart
3. Place appropriate sized de-water pipe w/valve at bottom of stoppings
4. Pump quick drying cement into the space between the ~~stopping~~stoppings
5. After minimum drying time, close water valve

As a secondary measure of precaution, no longwall mining will take place in the 22 degree angle of draw projected from the Joes Valley fault. Therefore no subsidence from mining operations will intersect the fault or fault zone. Any hydrologic conditions specific to the Joes Valley Fault will not be impacted through mining or subsidence –based on accessibility of the sites. Water monitoring reports will be submitted to the Division on a quarterly basis, and a summary report will be submitted yearly with the Annual Report for the mine.

All test and measurement instruments are operated, maintained and calibrated in accordance with the ~~manufacturers~~manufacturer's instructions. The results of all field measurements are recorded and initialed by the sampler. When laboratory measurements are required, a specific set of sample bottles are pre-ordered from the laboratory. Bottles received from the laboratory are clean, pre-acidified and color-coded. Once the sample bottles are filled, they are individually labeled with water-proof, smudge-proof labels, placed in ice chests with ice packs and returned to the laboratory as soon as possible to insure proper holding times are met.

7.31.21 Groundwater Monitoring Plan

As noted in Section 7.24.1 only four springs were found during the June 1985 seep and spring survey within the area of potential subsidence with flow rates of one to two gallons per minute (SP-16, SP-17, SP-30, SP-36). By the time of the fall survey, all seeps and springs with the area of potential subsidence except SP-30 and SP-36 had dried up. Spring SP-30 was found to be dry during 1986 and in subsequent years to the present. The flow from SP-30 originally measured in 1985 is most likely attributable to higher than normal precipitation during 1983-1985. SP-30 occurs as diffuse seepage from the Blackhawk Formation above the mine portals and is collected in a diversion pipe to avoid problems at the portal face. Flow at SP-36 issues from a sandstone-shale contact within the Blackhawk Formation and showed evidence of use by elk and deer. All major springs (flows of at least five gallons per minute) found during the June 1985 survey were located outside of the area of potential subsidence at that time.

The Federal Lease #UTU-68082 and State Leases have since been added to the permit area, and the area of potential subsidence has therefore expanded. Additional spring and seep surveys were conducted in 1987, 1989, through 1993. The proposed groundwater monitoring program described below is based on the results of those surveys and is designed to evaluate impacts from the entire permit area, including the State Leases and Lease #UTU-68082 (LBA 9). A table clarifying the groundwater monitoring program is shown in Table 7-10 at the end of Chapter 7 text.

Previous to August 1994, groundwater monitoring for the Crandall Canyon Mine area included collection of water quality and quantity data from eleven springs as well as points of significant inflow to the underground workings. Based on the permit modification to include UTU-68082 (LBA #9), GENWAL conducts the monitoring of fourteen seeps and springs:

SP-30 and SP-36 are monitored to determine potential impacts in the immediate vicinity of the mine. SP-58 is monitored as an indicator of long-term changes in groundwater issuing from the Blackhawk Formation in ~~a~~an area that will not be affected by mining operations. The magnitude of these changes will be useful when interpreting changes at SP-30 and SP-36.

SP2-24, SP2-9, SP-47A, and SP1-3 are monitored since a water right has been filed on the springs by the U.S. Forest Service. Springs SP1-19 and SP1-22 are monitored as indicators of the water supply in the upper reaches of Blind Canyon and the North Fork of Crandall Canyon.

SP1-33, SP1-47, and SP2-1 are monitored as an indicator of changes in groundwater emanating near the western border of East Mountain, contiguous to Joe's Valley Fault.

SP1-9 (also SP1-19 mentioned above is located within this state lease) located in Lease ML-21569 and SP1-24 in lease ML-21568 are monitored to evaluate the effects of potential subsidence in the state leases. Plate 7-12 shows the location of each spring.

Samples were collected from each of the fourteen seeps/springs listed above, plus seeps SP2-14 and SP2-23, during the spring of 1994 and analyzed for both quantity and quality. Based on the information collected during 1994 and the past seep and spring surveys, springs SP-36, SP-58, SP2-9, SP2-24, SP1-33, and SP1-9 are monitored quarterly for quantity and quality. The remaining springs (SP-30, SP2-1, SP1-47, SP1-24, SP1-19, SP-47A, SP1-3, and SP1-22) are monitored for quantity and field chemical parameters only. Springs SP2-14 and SP2-23 have been removed from the list of springs to be monitored due to extremely low or no flow over the past few years and SP2-9, which is contiguous to these two springs, is a good indicator of the water quality and quantity for that area of the mine permit. Monitoring at the fourteen seeps/springs will continue on a quarterly basis.

Following reclamation the samples will be collected semiannually until the surety bond is released. At least one of these samples will be collected during the low-flow period (normally the fourth quarter). These samples are collected as close as possible to the point of issuance of the springs. Samples are– analyzed according to the list of parameters in Table 7-4 which includes, flow, pH, conductivity or TDS, total iron, and total manganese as required by R645-301-724.1.

Samples collected during the low-flow period of the year (fourth quarter) will be analyzed according to the list of parameters contained in Table 7-5 (as requested in guidelines from DOGM) in the years 1990, 1995, 2000, and at 5-year intervals thereafter until the surety bond is released.

Even though SP-30 has been dry since the original measurement in 1985, monitoring at SP-30 will continue. By continuing to monitor SP-30, flow trends, as they relate to precipitation patterns, can be observed. Substitution of another spring in the vicinity was considered and dismissed due primarily to the long term monitoring correlation stated above and because there exists a lack of flowing springs in the vicinity of old mine workings. Additionally, when the physiographic location of the mine portal is compared with similar locations in adjacent canyons (~~ie;~~i.e.; Blind Canyon, Horse Canyon, Little Bear, and Mill Fork) there are an apparent absence of springs on these mid to upper south facing hill slopes (Plate 7-12). The apparent absence of seeps and springs in these areas is primarily related to the geologic nature and limiting hydrologic characteristics of the Blackhawk Formation in its upper strata.

In conjunction with the –South Crandall Lease (UTU-78953) and the SITLA/PacifiCorp sublease GENWAL will monitor four springs. The monitoring plan for the –South Crandall Lease is described below. Monitoring site locations are shown on Plate –7-18. The monitoring protocols for each of the monitored springs are presented in Table 7-10.

The monitoring plan for springs includes springs in the Castlegate Sandstone, Blackhawk Formation, and Star Point Sandstone. As demonstrated in the PHC, it is believed that the

potential for diminution of flow or degradation of the water quality of springs discharging from the Price River or North Horn Formations is remote.

Little Bear Spring will be regularly monitored to verify that impacts to not occur and to document the relationship between climatic variability and discharge from the spring. Quarterly water quality sampling at the spring will occur and the samples will be analyzed for the parameters listed in Table 7-4. Discharge from the spring is monitored by the Castle Valley Special Service District.

Springs LB-7, LB-7A, LB-7B, AND LB-7C discharge near the contact of the Blackhawk Formation and Castlegate Sandstone in Little Bear Canyon. Spring LB-12 discharges from the Blackhawk Formation near the bottom of Little Bear Canyon. These springs will be monitored quarterly for flow and field water-quality parameters. NOTE: multiple seam mining beyond spring site LB-7 in Little Bear Canyon is contingent upon a monitoring plan approved by the Division in concurrence with the Forest Service at least two years prior to mining in that area.

It should be noted that access to Little Bear Canyon can be hazardous. When ice or snow is present it can become unsafe to traverse the cliffs, and steep, rugged slopes in the canyon. It can also be dangerous to wade across Huntington Creek when stream flows are high. In consideration of these difficulties, a diligent attempt will be made each quarter to monitor the springs at times when conditions permit. However, there will likely be times when these springs are not accessible for monitoring.

Spring LB-5A discharges from a sandstone channel in the upper Blackhawk Formation overlying proposed mining areas. To monitor for potential impacts to groundwater systems in the Blackhawk Formation, LB-5A will be monitored quarterly for Table 7-4 parameters including flow and field water-quality parameters.

Spring SP-79 discharges from the Star Point Sandstone in the northeast portion of the proposed South Crandall Lease area. To monitor for potential impacts to Star Point Sandstone groundwater systems (stratigraphically below the mined coal seam) quarterly monitoring of this spring will occur. SP-79 will be monitored according to Table 7-4 parameters including flow and field water-quality parameters.

SP-18 and SP-22 are located in the Shingle Canyon (aka No Name Canyon) area in ~~th~~the northeast part of the permit area. SP-18 issues from the contract between the Blackhawk formation and the Star Point sandstone near the confluence of the drainage. SP-22 is located higher in right fork of Shingle Creek in the Blackhawk above the elevation of the coal seam to be mined. These springs will be monitored to verify that effects of mining in the U-68082 lease modification area. These springs will be monitored for flow and field parameters quarterly.

TABLE 7-4

Abbreviated Groundwater Analysis List

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°(°C)

Laboratory Measurements:

Total dissolved solids
Total hardness (as $CaCO_3$)
Total Alkalinity
Bicarbonate (as HCO_3)
Carbonate (as CO_3)
Calcium (as Ca)
Chloride (as Cl)

Dissolved iron (as Fe)
Total Iron (as Fe)
Magnesium (as Mg)
Total Manganese (as Mn)
Potassium (as K)
Sodium (as Na)
Sulfate (as SO_4)

TABLE 7-4(A)

Mine-Water Discharge Analysis List

Field Measurements:

Ferrous iron
pH
Dissolved oxygen
Conductivity
Temperature
Flow

Laboratory Measurements:

Calcium (dissolved)
Potassium (dissolved)
Sodium (dissolved)
Magnesium (dissolved)
Silica
Chloride
Hot acidity by Standard Method 2310B4(a)
Aluminum (total and dissolved)
Iron (total and dissolved)
Manganese (total and dissolved–)
Sulfate
Alkalinity (total, carbonate, and bicarbonate)
TDS
Suspended solids

Isotopic Laboratory Measurements:

Tritium
Carbon-14
Deuterium
Oxygen-18

Note: All Mine-Water Discharge monitoring data will be submitted to the Division monthly. Water chemistry and field measurement data will be submitted electronically using the Division's Division's water monitoring database EDI system. Isotopic laboratory measurement data will be submitted when the results become available from the laboratories. Mine-water discharge rate data will be provided in spreadsheet format.

Note: A test for carry--over of treatment chemicals will be done if Flocculent is being used in the treatment process. If flocculent is not used a carry--over of treatment test is not required.

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TABLE 7-5

Extended Groundwater Analysis List

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)

Laboratory Measurements:

Total dissolved solids
Total hardness (as $CaCO_3$)
Total Alkalinity
Acidity
Aluminum (as Al)
Arsenic (as As)

Barium (as Ba)
Bicarbonate (as HCO_3)
Baron (as B)
Carbonate (as CO_3)
Cadmium (as Cd)(Dissolved)
Calcium (as Ca)(Dissolved)

Chloride (as Cl)
Copper (as (Cu)(Dissolved)
Dissolved Iron (as Fe)
Total Iron (as Fe)

Lead (as Pb)(Dissolved)
Magnesium (as Mg)(Dissolved)
Dissolved Manganese
Total Manganese (as Mn)
Molybdenum (as Mo)(Dissolved)

Nitrogen-Ammonia (as NH_3)
Nitrite (as NO_2)
Nitrate (as NO_3)
Potassium (as K)(Dissolved)
Phosphate (as PO_4)

Selenium (as Se)(Dissolved)
Sodium (as Na)(Dissolved)
Sulfate (as SO_4)
Zinc (as Zn)

All samples are preserved as soon as practicable after collection. Samples are collected and analyzed according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434.

On a quarterly basis an inventory will be conducted of the active portion of the mine to identify the location and geologic occurrence of mine inflows that exceed three gallons per minute. In consultation with DOGM, certain of these inflows (if they occur) will be selected for continued monitoring. Previously, only one such inflow existed, flowing from the roof of the mine from an exploratory hole (DH-1) that was vertically drilled from within the permit area at the location shown on Plate 3-2 (listed as "DRILL HOLE"). Flow from this hole was originally controlled with a valve. However, the overlying perched aquifer no longer produces a flow sufficient to monitor.

After selection of the inflow points to be monitored, data will be collected on a quarterly basis and analyzed according to Table 7-4. Samples collected during the low-flow period (normally the fourth quarter) will be analyzed according to Table 7-5 in the years 1990, 1995, 2000, and at 5-year intervals thereafter. Monitoring and sampling of the selected mine inflow points will continue**,** according to this schedule**,** in safely accessible portions of the mine.

Water rights apparently have been filed for two additional springs in the area surrounding the lease areas (93-1407 and 93-1408 on Plate 7-14). As noted in Section 7.24.1 the source at 93-1407 was not discovered until the fall of 1990. Until this time it was surmised to exist as only a seep (similar to 93-1408 (SP-47). Since its discovery GENWAL has committed to monitoring and sampling SP-1407 (SP-47a) in the groundwater monitoring plan submitted with the Right-of-Way application. Source 93-1408 existed as a seep in June but was dry in October, 1985. Hence, it was decided not to monitor 93-1408 on a long-term basis since it does not flow at a sufficient rate to permit sample collection. SP-47 was observed to be dry in October, 1989 and in June of 1990.

GENWAL installed monitoring wells near the mine portal (MW-1), and in the East Mains near their junction with the North Mains (MW-2) (Plate 7-13). Monitoring well MW-3 is located in an area sealed in 1979, and is now inaccessible. Monitoring wells MW-4 and MW-5 were installed in January 1992. These locations were chosen in areas where access will be maintained as long as possible.

Each underground monitoring well was drilled using air-rotary techniques (see Appendix 7-46 for completion diagrams). MW-1 was drilled to a total depth of 375 feet (Figure 7-1). As 6 5/8-inch diameter steel casing was cemented within a 10-inch diameter hole to a depth of 100 feet. A 6-inch diameter open hole completion exists from 100 to 375 feet. MW-2 was drilled to a total depth of 134 feet. Four-inch casing was set to 5 feet. A 3-inch open hole completion exists from 5 to 134 feet. Drilling of a larger diameter hole at greater depth was precluded by the inability of a larger drill rig to mobilize underground.

Monitoring well MW-4 was drilled to a depth of 111.5 feet. The hole has a 5" casing set to a depth of 4 feet, and a 1.5 inch PVC casing for the remainder, with a slot screen in the bottom 10 feet. MW-5 was drilled to a depth of 116.8 feet. It has a 5" casing to a depth of 4 feet, and a 2 inch PVC casing for the remainder, with a slot screen in the bottom 40 feet.

After drilling, each hole was surged with air to remove fines that had accumulated in the holes. Surging continued until the water discharging from the holes was visibly clear. A cap was placed over the surface casing to allow closure of each well when not in use.

Construction and initial sampling of the underground monitoring wells was completed in June, 1989 and June, 1992. Lithologic/completion logs of the wells have been submitted to DOGM along with the results of analyses of the first samples collected from the wells. An interpretation of the hydrogeology of the Star Point Sandstone beneath the mine appears in Section 7.24.1.

Water-level measurements and water-quality samples will be collected from the monitoring wells on a quarterly basis following completion during the first two years following completion of the in-mine wells and in the years 1990, 1995, 2000 and in 5-year intervals thereafter. During the operational period of the mine, water-quality samples collected from all wells will be analyzed according to the list provided in Table 7-4. Monitoring will continue according to this schedule in accessible wells until two years after the completion of surface reclamation activities.

Each monitoring well will be pumped prior to sampling to purge it of stagnant water standing in the hole. In the case of M-1, purging will be accomplished using a submersible pump. A bailer will be used for purging and sampling MW-2, MW-4 and MW-5. In each case, purging will continue until at least 3 times the volume of water standing in the well has been pumped. Samples will be collected directly from the discharge line of the pump. Samples will be preserved and stored in accordance with U.S. Environmental Protection Agency guidelines.

Groundwater monitoring data collected from the area will be submitted to DOGM on a quarterly basis. On an annual basis, a report will be submitted to DOGM summarizing all data collected during the year and containing an analysis of the mine water balance, accounting for mine inflows, outflows, consumptive uses, and sump storage (a copy of the annual report will also be given directly to the Price office of the U.S. Forest Service).

After the completion of mining activities and during the post-mining/reclamation period, water-level and quality samples will be collected annually from the designated springs and MW-1 until the termination of bonding. In-mine wells will be inaccessible following reclamation. Samples will be collected during the latter portion of the summer to represent low-flow conditions. Samples thus collected will be analyzed for the parameters listed in Table 7-4. A report will be submitted to DOGM on an annual basis summarizing the results and assessing mining impacts and system recovery since mining ceased.

7.31.22 Surface Water Monitoring Plan

Two 36-inch Parshall flumes were installed in July 1985 on Crandall Creek (one upstream from the surface facilities and one downstream (see Plate 7-16). A 12-inch Parshall flume has been installed in Blind Canyon to monitor possible effects of mining in State Lease ML-21569. These flumes are equipped with Stevens Type-F water-level recorders to allow the collection of continuous flow data. Charts will be changed and the flumes inspected on a monthly basis. Flume location and stream monitoring stations are shown on Plate 7-16.

Water quality samples will be collected from the flume locations quarterly, and analyzed according to the list contained in Table 7-8. In the years 1990, 1995, 2000 and every fifth year thereafter the samples collected during the low-flow period (normally fourth quarter) will be analyzed according to Table 7-9. All samples will be analyzed for total and dissolved constituents according to the indicated lists. Sampling and analysis will be conducted quarterly until the surface areas are reclaimed, at which time sampling will be conducted semiannually until the surety bond is released. For perennial streams, those samples will be collected during high-flow (normally second quarter) and low-flow (normally fourth quarter) periods. Discharges from the sedimentation pond will be analyzed in accordance with the UPDES permit for the facility.

Stream flow observations made during drilling operations as well as seep and spring surveys suggest that large portions of the south fork of Horse Creek, and both the north and south forks of Crandall Creek have only ephemeral and intermittent flows within State Leases ML-21568 and ML-21569 and portions of UTU-68082. Plate 7-16 shows the points of transition between perennial and intermittent flow for Horse Creek, Blind Creek, the north and south forks of Crandall Creek, and Indian Creek. Blind Creek has been determined to be intermittent.

Stream channel monitoring stations have been established along both the north and south forks of Crandall Creek, and the south branch of Horse Creek to determine what stream reaches exhibit perennial flow. Stream flow and water temperature were measured twice monthly from May through July, and monthly during the remainder of 1991 when the area was accessible. Stream monitoring results are found in Appendix 7-23. Stream monitoring was again done on September 28, 1992. These results are also contained in Appendix 7-23. Stream monitoring ceased at the end of 1992.

To provide for proper monitoring of Indian Creek (in Upper Joe's Valley) a 36-inch Parshall flume was installed. This flume is equipped with a Stevens Type-F water-level recorder to allow the collection of continuous flow data. Charts will be changed and the flumes inspected on a monthly basis. The location of this flume is depicted on Plate 7-16. Because of its higher elevation and limited access this flume is typically operational from June 1 through November 1 of any given year. If seasonal variations and access allow, this station will be operated for longer periods.

Water quality samples will be collected from the Indian Creek flume location quarterly (weather permitting), and analyzed according to the list contained in Table 7-8. In the years 1995, 2000 and every fifth year thereafter the samples collected during the low-flow period (normally fourth quarter) will be analyzed according to Table 7-9. All samples will be analyzed for total and dissolved constituents according to the indicated lists. When flumes or other monitoring devices are no longer required, they will be removed and the affected areas will be restored.

No retreat mining will be conducted within the designated stream channel buffer zones. Horse Canyon is located hydraulically upgradient and north of the UTU-68082 (LBA No. 9) north

boundary line. Current mine plans show that because of limited coal height that neither development mining ~~or~~nor retreat mining will occur beneath Horse Canyon and the stream channel buffer zones. Since mining has already occurred under Blind Canyon, Crandall Canyon, and beneath the upper reaches of the left fork (South Fork) tributary of Horse Canyon, any adverse effects to the respective streams should manifest as reduced stream flow and a continuous high volume inflow into the mine workings. If it is found that stream flows in Blind Canyon and Crandall Canyon have been impacted by mining, then a decision to monitor Horse Canyon on a continuous basis will be made.

In conjunction with the ~~-~~South Crandall Lease (UTU-78953) and the SITLA/PacifiCorp sublease GENWAL will monitor four creeks. The monitoring plan for the ~~-~~South Crandall Lease is described below. Monitoring site locations are shown on Plate ~~-~~7-18. The monitoring protocols for each of the monitored creeks are presented in Table 7-10.

Little Bear Canyon Creek will be monitored quarterly for Table 7-8 parameters including flow and field water-quality parameters. The creek will be monitored approximately 100 feet above the confluence with Huntington Creek (Plate 7-18). Based on the range of discharge anticipated at the creek (see Appendix 7-58) discharge measurements at Little Bear Canyon Creek will likely be performed using a 90° v-notch weir or a portable 3-inch Parshall flume.

The ephemeral drainage in SW 1/4 of Section 4 T16S R7E will be monitored quarterly for Table 7-8 parameters including flow and field water-quality parameters. No discharge was observed in this drainage during drought conditions in 2003. If flow occurs in this drainage, the discharge will be measured using appropriate portable discharge measuring devices.

Monitoring station IBC-1 monitors the drainage located along the border of Sections 5 and 6, T16S, R7E. This drainage will be monitored quarterly for Table 7-8 parameters including flow and field water-quality parameters. Discharge in this drainage has been meager (Appendix 7-58) and discharge ~~-~~will likely be measured using a stopwatch and a calibrated bucket. The potential for impacts to this drainage are considered remote because only a small region in the extreme northwestern portion of the ~~-~~South Crandall Lease area is drained by this drainage. However, to verify that no impacts to this drainage occur, and to document the effects of climatic variability on stream discharge in the region, this creek will be monitored.

The creek in Section 5 T16S, R7E will be monitored quarterly for Table 7-8 parameters including flow and field water-quality measurements. This creek drains most of the northeastern portion of the ~~-~~South Crandall Lease area, where the initial mining in the ~~-~~lease area will occur. Additionally, the upper forks of this drainage will be monitored for flow and field water-quality measurements will be performed. Flow at each of the monitoring sites on this drainage has been meager. Thus, flow measurements will likely be performed using a stopwatch and a calibrated bucket.

In conjunction with mining in the U-68082 lease modification area GENWAL will monitor surface flow in Shingle Canyon (aka No Name Canyon), for flow and field parameters quarterly.

This site is located immediately ~~down stream~~downstream from the confluence of the right and left forks of the canyon, and is shown on Plate 7-18.

The Crandall Canyon Mine discharge pipeline is designed to convey mine discharge water from the Crandall Canyon Mine directly to Huntington Creek through a buried pipeline (bypassing flow to Crandall Canyon Creek). In conjunction with the deployment of the new pipeline, two new surface-water monitoring stations on Huntington Creek are added to the surface-water monitoring plan. These include HCAP (Huntington Creek above the pipeline outlet) and HCBP (Huntington Creek below pipeline outlet). These two monitoring stations are included in the surface-water monitoring plan to quantify potential changes to Huntington Creek that may possibly occur as a result of the discharge of water from the pipeline to the creek. Station HCAP is located on Huntington Creek immediately above the location of the pipe outlet to evaluate upstream water quality conditions. Station HCBP is located a sufficient distance downstream from the pipeline outlet to allow for mixing of the pipeline water with the Huntington Creek receiving water.

Information regarding the quality of the water discharging from the Crandall Canyon Mine has been submitted to the Utah Division of Oil, Gas and Mining Coal Water Quality Database. Based on the quality of the water discharging from the mine, water-quality monitoring at HCAP and HCBP will be performed for the parameters specified in Table 7-8(A). The quality of the mine discharge water will continue to be monitored and regulated through the mine's UPDES permit.

Swift, turbulent flow conditions are commonly present in Huntington Creek near the location of stations HCAP and HCBP. The stream channel in these locations locally contains large rocks and generally has an irregular channel geometry that creates non-laminar flow conditions. The performance of wading stream flow measurements under such conditions is problematic. Additionally, there are significant safety hazards to monitoring personnel associated with the performance of wading flow measurements in Huntington Creek under these conditions. Accordingly, the discharge values reported for monitoring events according to Table 7-8(A) will be either 1) that reported by Emery Water Conservancy District stream gauges or other suitable gauge data (when available), or 2) the results of an approximate measurement of flow in the Huntington Creek that may be performed using techniques that do not require monitoring personnel to enter the stream.

TABLE 7-8

Abbreviated Surface Water Analysis List

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)
Dissolved oxygen (ppm)

Laboratory Measurements:

Total dissolved solids
Total suspended solids
Total settleable solids
Total hardness (as $CaCO_3$)
Total Alkalinity
Bicarbonate (as HCO_3)

Carbonate (as CO_3)
Calcium (as Ca)
Chloride (as Cl)
Dissolved Iron (as Fe)
Total Iron as (Fe)
Magnesium (as Mg)

Dissolved Manganese
Total Manganese (as Mn)
Potassium (as K)
Sodium (as Na)
Sulfate (as SO_4)
Oil and Grease
Cation - Anion balance

TABLE 7-8(A)

Huntington Creek Analysis List

Field Measurements:

Flow (cfs)*
pH
Specific conductance (umhos/cm)
Temperature (°C)
Dissolved oxygen (mg/L)

Laboratory Measurements:

Total dissolved solids (TDS) (mg/L)
Total suspended solids (TSS) (mg/L)
Total Iron (mg/L as Fe)

*Note: Due to safety considerations and practical difficulties associated with performing wading stream flow measurements in Huntington Creek near the pipeline outlet location, the discharge values reported for monitoring events according to Table 7-8(A) will be either 1) that reported by Emery Water Conservancy District stream gauges or other suitable gauge data (when available), or 2) the results of an approximate measurement of flow in Huntington Creek that may be performed using techniques that do not require monitoring personnel to enter the stream.

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TABLE 7-9

Extended Surface Water Analysis List
(Baseline Parameters)

Field Measurements:
Flow
pH
Specific conductance (umhos/cm)
Temperature (°C)
Dissolved oxygen (ppm)

Laboratory Measurements:

Total dissolved solids
Oil and Grease
Cation - Anion balance
Total suspended solids
Total settleable solids
Total hardness (as $CaCO_3$)
Total Alkalinity

Acidity as ($CaCO^3$)
Aluminum (as Al)
Arsenic (as As)
Bicarbonate (as HCO_3)
Boron (as B)
Carbonate (as CO_3)

Cadmium (as Cd)
Calcium (as Ca)
Chloride (as Cl)
Copper (as Cu)(Dissolved)
Dissolved iron (as F)
Total iron as (Fe)
Lead (as Pb)(Dissolved)
Magnesium (as Mg)(Dissolved)

Dissolved Manganese
Total Manganese (as Mn)
Molybdenum (as Mo)(Dissolved)
Nitrogen-Ammonia (as NH_3)
Nitrite (as NO_2)

Nitrate (as NO_3)
Potassium (as K)(Dissolved)
Phosphate (as PO_4)
Selenium (as Se)(Dissolved)
Sodium (as Na)(Dissolved)

Sulfate (as SO_4)
Zinc (as Zn)(Dissolved)

Table 7-10 Water Monitoring Program

Ground Water

Springs

1	SP-30	No Side Lower Crandall	Flow and field parameters quarterly
2	SP-36	No Side Lower Crandall	Flow, field parameters, and Table 7-4 parameters quarterly
3	SP-58	Forks of Crandall Crk.	Flow, field parameters, and Table 7-4 parameters quarterly
4	SP2-24	Top of East Mountain	Flow, field parameters, and Table 7-4 parameters quarterly
5	SP2-9	Top of East Mountain	Flow, field parameters, and Table 7-4 parameters quarterly
6	SP47A	Pt No of Crandall Mine	Flow and field parameters quarterly
7	SP1-3	Top of East Mountain	Flow and field parameters quarterly
8	SP1-19	Top of East Mountain	Flow and field parameters quarterly
9	SP1-22	Top of East Mountain	Flow and field parameters quarterly
10	SP1-33	Upper ~~Joe's~~Joe's Valley	Flow, field parameters, and Table 7-4 parameters quarterly
11	SP1-47	Upper ~~Joe's~~Joe's Valley	Flow and field parameters quarterly
12	SP2-1	Upper ~~Joe's~~Joe's Valley	Flow and field parameters quarterly
13	SP1-9	Top of East Mountain	Flow, field parameters, and Table 7-4 parameters quarterly
14	SP1-24	Top of East Mountain	Flow and field parameters quarterly
15	LB-5A	Little Bear Canyon	Flow, field parameters, and Table 7-4 parameters quarterly
16	LB-7	Little Bear Canyon	Flow, field parameters quarterly
17	LB-7A	Little Bear Canyon	Flow, field parameters quarterly
18	LB-7B	Little Bear Canyon	Flow, field parameters quarterly
19	LB-7C	Little Bear Canyon	Flow, field parameters quarterly
20	LB-12	Little Bear Canyon	Flow, field parameters quarterly
21	SP-79	Huntington Canyon trib.	Flow, field parameters, and Table 7-4 parameters quarterly
22	Little Bear Spring		Flow, field parameters, and Table 7-4 parameters quarterly
23	SP-18	Shingle Canyon	Flow, field parameters quarterly.
24	SP-22	Shingle Canyon	Flow, filed parameters quarterly.

In-Mine Monitoring Wells **

1	DH-1	Main North (Dry)	Flow, field parameters, and Table 7-4 parameters quarterly
2	DH-2	In Sealed Area	Flow, field parameters, and Table 7-4 parameters quarterly
3	MW-1	At Portals	Flow, field parameters, and Table 7-4 parameters quarterly
4	MW-2	At Mouth of Main East	Flow, field parameters, and Table 7-4 parameters quarterly
5	MW-3	In Sealed Area	Flow, field parameters, and Table 7-4 parameters quarterly
6	MW-4	In Sealed Area	Flow, field parameters, and Table 7-4 parameters quarterly
7	MW-5	Destroyed	Flow, field parameters, and Table 7-4 parameters quarterly
8	MW-6	Main South (DEEP)	Flow, field parameters, and Table 7-4 parameters quarterly
9	MW-6a	Main South (No of Dike)	Flow, field parameters, and Table 7-4 parameters quarterly
10	MW-7	Main West	Flow, field parameters, and Table 7-4 parameters quarterly
11	MW-8	Main South (So of Dike)	Flow, field parameters, and Table 7-4 parameters quarterly

** Note: Monitoring of all In-Mine Monitoring wells has been discontinued since the mine was sealed up following the 2007 collapse of the mine. (See Plate 7-18 for locations)

Surface Water

Streams

1	Upper Flume Crandall Creek	Flow, field parameters, and Table 7-8 parameters quarterly
2	Lower Flume Crandall Creek	Flow, field parameters, and Table 7-8 parameters quarterly
3	Horse Canyon Creek	Flow, field parameters, and Table 7-8 parameters quarterly
4	Blind Canyon Creek	Flow, field parameters, and Table 7-8 parameters quarterly
5	Indian Creek	Flow, field parameters, and Table 7-8 parameters quarterly
6	IBC-1	Flow, field parameters, and Table 7-8 parameters quarterly
7	Section 4 Creek	Flow, field parameters, and Table 7-8 parameters quarterly
8	Section 5 Creek (lower)	Flow, field parameters, and Table 7-8 parameters quarterly
9	Section 5 Creek (Upper Right Fork)	Flow and field parameters quarterly
10	Section 5 Creek (Upper Left Fork)	Flow and field parameters quarterly
11	Little Bear Creek	Flow, field parameters, and Table 7-8 parameters quarterly
12	Shingle Creek	Flow, Field parameters quarterly.
13	Huntington Ck. Ab. Pipe (HCAP)	Flow, field and lab parameters per Table 7-4(B) quarterly
14	Huntington Ck. B. Pipe (HCBP)	Flow, field and lab parameters per Table 7-4(B) quarterly

UPDES

1	001	Sediment Pond Discharge	Flow, field parameters, and UPDES parameters per occurrence
2	002	Mine Water Discharge	Flow, field parameters, and UPDES parameters monthly

Mine Discharge

1	Pre-002 Pre-treated Mine Water	Flow, field parameters and Table 7-4(A) parameters monthly

Ledge seep water flow:

The treatment area is separated from the portal bench above by a massive sandstone ledge of bare sandstone rock. There are several seeps emanating from this ledge and this seep water drains down the ledge toward the area of the settling basin. Based on previous measurements, the flow is minimal (approximately 2-5 gpm), but constant. A concrete trough has been poured behind the existing retaining wall (between the ledge rock and the back of the wall) to collect this seepage water and route it through a 4" PVC pipe to the settling basin overflow culvert inlet. In this manner the seepage water is contained, can be monitored, and is also subject to treatment thru dilution. The flow data collected from monitoring this seep will be provided to the Division and will assist in determining the most appropriate geotechnical method for future reclamation of this area, i.e., final reclamation. Monitoring will be conducted monthly, although freeze/thaw conditions in winter months will have to be factored into interpreting the data. The monitoring information will be provided to the Division (via the electronic water monitoring data base) on a monthly basis and will continue until the Division determines that it is no longer necessary, and at a minimum, until such time as the revised final reclamation plan has been approved, since this information will be needed in order to properly design the approximate-original-contour requirements for the "old loadout area".

Baseline water quality samples will be collected quarterly from the stream monitoring station below the forks in Horse Canyon at location H-1 (Plate 7-16) and analyzed according to the list contained in Table 7-8. Instantaneous flow estimates will be made for stations H-1, HS-5, and HN-1 during the spring and summer water quality sampling event. This monitoring will continue for a period of three years at which time the need for continued monitoring of Horse canyon will be evaluated.

Surface-water monitoring data will be submitted to DOGM on a quarterly basis. At the end of each calendar year, an annual summary will be submitted. This annual summary will analyze and describe variations in flows and quality during the year and will include tables, graphs, hydrographs, etc. as appropriate.

If available data (testing within 24 hours of proposed discharge) indicate that the water in the pond meets the effluent limitations contained in R614-301-751 and any applicable UPDES permits, this water will be pumped directly to Crandall Creek. Any direct discharges will be monitored at the beginning and end of pumping from the pond. The pump inlet will be placed on a floating spring to avoid pulling excess sediment into the discharge table during pumping. Water will be pumped from below the water surface to avoid introduction of oil to the discharge water.

During the post-operational period, surface-water data will be collected from the upper and lower stations shown in Plate 7-7 and the inflow to the sedimentation pond as indicated on Plate 5-16. Flow data will be collected continuously from the flumes at the upper and lower Crandall Creek stations and twice annually (during the high- and low-flow seasons) from the sedimentation pond inflow during the post-mining period. In addition, water-quality samples will be collected from each station during the high- and low-flow seasons following mining. These samples will be analyzed for the parameters listed in Table 7-8. Data thus collected will be submitted to DOGM on a quarterly basis.

The post-mining reports will contain not only the laboratory and field data but also an assessment of current impacts from mining on surface-water systems and the amount of recovery of the system since mining. Surface-water monitoring following mining will continue until the termination of the bonding period.

7.31.3 Acid- and Toxic- Forming Materials

As discussed in Section 5.28.30, waste rock is not produced during mining operations. When incidental quantities of rock are encountered, the rock is left in the mine and will not be removed at any time in the future; thus, no negative effects are expected from the acid-forming potential of strata which overlie and underlie the Hiawatha seam. However, to further characterize the acid-forming potential of strata immediately above and below the Hiawatha seam, GENWAL collected additional roof- and floor-rock samples from three locations within the current mine workings (including the state lease and Lease #UTU-68082 areas). These new data also show the

materials to be non-acid/non-toxic forming. Analytical results from these three sets of samples are contained in Appendix 6-2.

The presence of acid- or toxic-forming materials has been determined by laboratory testing (as defined in "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining"). These data are contained in Appendix 6-2. If waste material is generated it will be tested for acid- or toxic-forming materials on a yearly basis or prior to disposal. If such material is identified, it will be stored in an enclosed area (i.e. dumpster) or within a containment (bermed) area until such time as it can be disposed of.

7.31.4 Transfer of Wells

Before final bond release, exploratory or monitoring wells will be sealed in a safe and environmentally sound manner in accordance with Sections 7.38 and 7.65.

7.31.5 Discharges

The Applicant will not discharge into the underground mine, unless specifically approved by the Division and/or meets the approval of MSHA. Discharges will be limited to the following:

1. Water
2. Coal processing waste
3. Fly ash from a coal-fired facility
4. Sludge from an acid-mine-drainage treatment facility
5. Flue-gas desulfurization sludge
6. Inert materials used for stabilizing underground mines
7. Underground development waste.

7.31.51 Gravity Discharges

The angle at which the coal bed is inclined from the horizontal (dip) prevents any gravity discharge of water from the surface entries.

7.31.6 Stream Buffer Zones

The disturbed area is drained by ephemeral "streams" which are tributaries to Crandall Creek. The undisturbed drainages will enter Crandall Canyon above and below the culvert. Stream buffer zones will be maintained above and below the culvert. Portions of the road lie within 100' of Crandall Creek. The sediment pond outslope is contiguous to Crandall Creek, a perennial stream at the mine facility area.

Crandall Creek water quality is protected from the impacts of the mine by the use of revegetation, silt fences and/or straw bales, and rip-rapped channels. In addition, buffer zone signs have been installed to indicate the area beyond which no disturbance shall take place. For additional information concerning stream buffer zone protection see Section 3.23.300 of this permit.

7.31.7 Cross Sections and Maps

Cross sections and maps, as required for R645-301-731.700, are presented within this application.

7.31.8 Water Rights and Replacement

In the event that the monitoring program identifies an impact to the water source in the permit and adjacent areas, the replacement of water rights will be addressed as described in Section 7.27 of this application.

7.3 Sediment Control Measures

The sediment control measures for the Crandall Canyon Mine operations are discussed in Section 7.42 of this application. This includes design, operation and maintenance of applicable siltation structures, sedimentation pond, diversions, and road drainage, as required.

7.33 Impoundments

There are no permanent impoundments associated with GENWAL's operations. Temporary impoundments of water collected for runoff control will occur in the sediment ponds and containment berms. The design of these structures is presented in Section 7.42 and 7.43 of this application.

7.34 Discharge Structures

Discharge from the sediment ponds is conveyed by ~~a~~an 18-inch CMP culvert (principal spillway) and an open channel concrete lined emergency spillway. The outlets of these spillways are protected by riprap. This design complies with R645-301-744.

7.35 Disposal of Excess Spoil

No significant excess spoil has been or will be developed by operating the underground mine. The only anticipated excess material will be from the sediment ponds. This limited volume of material will be removed from the ponds transported to an approved refuse disposal site, disposed of underground or sold with the coal.

7.36 Coal Mine Waste

Any refuse will be disposed of in accordance with the designs presented in Chapter 5 and Section 7.46 of this application.

7.37 Noncoal Mine Waste

Noncoal mine waste will be stored and final disposal of noncoal waste will comply with R645-301-747.

7.38 Temporary Casing and Sealing of Wells

Each well which has been identified in the approved permit application to be used to monitor ground water conditions will comply with R645-301-748 and be temporarily sealed before use. Drilling and Sealing of such wells will be done according to the procedure described in Chapter 6, Section 6.41.

7.40 Design Criteria and Plans

7.41 General Requirements

The runoff control plans for the Crandall Canyon Mine facilities includes the diversion of the undisturbed runoff from areas contributing to the facilities, the collection of all runoff from disturbed areas associated with the sites and the containment and treatment of this disturbed runoff through the use of sediment ponds, ~~strawbales~~straw bales, silt fence, riprap, mulches and revegetation.

7.42 Sediment Control Measures

7.42.10 General Requirements

Appropriate sediment control measures will be designed, constructed and maintained using the best technology currently available to:

1. Prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area.

2. Meet the effluent limitations under R645-301-751.

3. Minimize erosion to the extent possible.

Sediment control measures include practices carried out within and adjacent to the disturbed area. The sedimentation storage capacity of practices in and downstream from the disturbed areas will reflect the degree to which successful mining and reclamation techniques are applied to reduce erosion and control sediment. Sediment control measures consist of the utilization of proper mining and reclamation methods and sediment control practices, singly or in combination. Sediment control methods include, but are not limited to:

1. Retaining sediment within disturbed areas;

2. Diverting runoff away from disturbed areas;

3. Diverting runoff using protected channels or pipes through disturbed areas so as not to cause additional erosion;

4. Using straw dikes, riprap, check dams, mulches, vegetative sediment filters, dugout ponds and other measures that reduce overland flow velocities, reduce runoff volumes or trap sediment;

5. Treating with chemicals/paving;

6. For the purposes of UNDERGROUND COAL MINING AND ~~—~~ ~~———~~RECLAMATION ACTIVITIES, treating mine drainage in underground sumps.

7.42.20 Siltation Structures

7.42.21 General Requirements

Additional contributions of suspended solids and sediment to stream flow or runoff outside the permit area will be prevented to the extent possible using the best technology currently available.

Alternate Sediment Control Areas and Small Area Exemptions

There are seven ASCA sites associated with this property. All ~~ASCA's~~ASCA's are maintained to minimize additional contributions of suspended solids and sediment to stream flow or runoff outside the permit area. Details on the ~~ASCA's~~ASCA's are included in Appendix 7-4.

As a result of the Crandall Canyon Mine disaster of August 6, 2007, the mine has been de-activated and the portals have been sealed. Mine water inflow has built up to the extent that water is now discharging from the portals and is discharged through a 12" pipe into Crandall Creek under UPDES permit UT0024368. The mine is presently discharging approximately 400-500 gallons per minute, with the flow fluctuating with ~~barametric~~barometric pressure and seasons. In early 2009 the iron concentrations in the water began to exceed UPDES limits. Because there is no way to treat the water underground the company constructed an aeration treatment system located on the surface in the ~~"~~"old loadout~~"~~" area, immediately below the portal bench. Complete details of the treatment facility can be found in Appendix 7-65. While the facility is neither an ASCA nor a small area exemption, it represents a small area within the disturbed area wherein runoff is treated along with the mine discharge water and discharges through an approved UPDES outfall point, and therefore does not drain to the sediment pond.

A suitably constructed barricade has been constructed between the treatment facility and the road which prevents any disturbed area drainage from entering the treatment facility area, and similarly prevents any of the mine discharge water from running over the adjacent disturbed area and reporting to the sediment pond. See Plate 5-3 for the location of the facility

At the lower end of the treatment facility, the treated ~~minewater~~mine water is collected into a buried pipeline which crosses underneath the road and connects to the existing discharge line. In this manner 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. At the present time (January, 2012) 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 negotiations between the company and the Division, as mandated by the Board of Oil, Gas and Mining. Until such time as the final terms of these on-going negotiations have been fully implemented, 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.

Runoff- and Sediment-Control Facilities

Results of analyses to determine the required size and hydraulics of the sedimentation pond are included in Appendix 7-4. Details of the sedimentation pond required for compliance with 30 CFR 77.216-1 and 30 CFR 77.216-2 are contained in Appendix 7-8. Permanent disposal of the sediment removed during cleanout will be in accordance with Section 535.

Prior to any discharges through the decant system on the sedimentation pond, a sample will be collected to determine total suspended solids, settleable solids, total dissolved solids, oil and grease, total iron, total manganese concentrations, and pH. The sample will be collected by opening the gate valve on the dewatering device, allowing water to flow from the pond through the primary spillway for a sufficient time to collect a sample of the water, and then immediately shutting the gate valve to prevent further dewatering. This sample will then be submitted to a laboratory for analyses of the indicated parameters.

After receipt of analytical results from the laboratory, if the pH and concentrations of total suspended solids, settleable solids, total dissolved solids, oil and grease, total iron, and total manganese are within the acceptable limits, water will be discharged from the pond through the dewatering device. If the parameters of concern are not within the acceptable limits, no water will be discharged through the device.

During discharge of water to Crandall Creek from the sedimentation pond, samples of the water will be collected at the discharge point at the beginning and end of the discharge time. These samples will be sent to a laboratory following the discharge period for analyses of total suspended solids, settleable solids, total dissolved solids, total iron, total manganese, oil and grease, and pH. Analytical results will be submitted to the Division with the subsequent quarterly report.

The emergency spillway discharges onto the boulder-covered slope adjacent to the sedimentation pond. Boulders that cover this slope were blasted from the cut above the pond during construction of the mine-access road. Due to the large size of the boulders, laboratory size-fraction analyses could not be conducted. However, the boulders are visually estimated to range in size up to at least 10 feet in diameter. It is further estimated that approximately 80 percent of the coarse rock on the slope is finer than 8 feet in diameter, 30 percent is finer than 5 feet in diameter, and 10 percent is finer than 3 feet in diameter.

The blasted rock has an approximate thickness of 15 to 20 feet at the top of the slope and 5 to 6 feet at the bottom of the slope. The soil that underlies the rock is a silty sand. Size-fraction analyses presented by Delta Geotechnical Consultants (1982) indicate that this soil is 70 percent sand and 30 percent silt and clay (the latter being minus 200 mesh).

The emergency spillway is lined with riprap and a filter blanket to reduce erosion potential. A concrete cutoff has also been installed immediately downstream of the inlet. The concrete cutoff ensures that the emergency spillway will not erode during a discharge event. Grading of the riprap, filter blanket, and embankment materials are shown in Figure 7-10. The spillway will discharge directly onto the boulder-covered slope. Due to the extreme thickness of the boulders and cobbles on the slope, additional erosion protection below the emergency-spillway outflow will not be required.

All new fill required to modify the embankment will be placed in 6-inch lifts. This new fill will be compacted in place by repeated passes of a front-end loader or equivalent prior to placing the next lift. Compaction will continue until the density of the material is at least 90 percent of Proctor density (as determined by sandcone density tests in the field).

As included in the original design, the interior of the pond will be lined with a 12-inch thick local, compacted clay to reduce seepage from the pond and, thereby, increase the stability of ~~The~~the embankment. The clay liner will be placed in 6-inch lifts and compacted during placement by at least four passes of a front end loader or equivalent. The initial layer will be disk-harrowed into the bottom of the pond prior to completion.

After pond cleanout, the thickness of the clay liner will be sampled by means of a bucket auger at 8 locations. Three holes will be placed along the ingress/egress route and five additional holes will be randomly selected from the remaining pond area. If any of the holes penetrate less than 10 inches of clay, additional clay will be compacted into the deficient areas of the pond.

Flow conditions in Crandall Creek adjacent to the sedimentation pond were examined to determine if flood flows may erode the downstream toe (see Appendix 7-5). As noted, the peak flow from the 100-year, 24-hour precipitation event will encroach 0.6 foot above the toe of the embankment. Thus, a riprap protective layer (with a median rock diameter of 12.5 inches) was placed along the lower 2.0 feet of the embankment as shown in Plate 7-4. Placement of this riprap will serve an incidental purpose of increasing the stability of the dam by placing additional weight on the downstream toe (Figure 7-10).

Following construction of the sedimentation pond as designed herein, all disturbed areas associated with pond construction (with the exception of the interior of the pond) will be revegetated ~~–~~with the temporary seed mixture. This mixture was developed in consultation with Lynn Kunzler of the Division and Walt Nowak of the U.S. Forest Service. This mixture provides rapid growth species, sod-forming species, and species that are compatible with other plants.

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Seeding will be done in the late fall, just prior to the first heavy snowfall of the year (Plummer et al., 1968). Seeding will be accomplished by hydroseeder. Mulch will be placed after seeding. The mulch, which consists of two tons of straw or grass hay per acre of disturbed area, will be spread over the area to be planted ~~–~~by hydromulcher.

Following seeding, the revegetated outslopes of the pond will be inspected during normal pond inspections to determine the effectiveness of the seeding. Straw-bale dikes will be added as necessary to control excessive gullying on the dam face. These dikes will be installed as noted by Figure 7-11.

7.42.30 Diversions

Diversion UD-1 is a 42" culvert placed along the western edge of the site at the location shown on Plate 7-5 to divert water from a 95-acre undisturbed watershed around the yard area. Analyses and design information associated with this and other diversions associated with the site are contained in Appendix 7-4. (Table 10)

Two additional diversions were designed to convey water from undisturbed areas away from the disturbed site. One (UD-2) was constructed in the northwest portion of the site along the proposed substation pad. UD-2 is an open ditch diversion. UD-3 is a 24" culvert diversion located in the northeastern portion of the site to convey water away from the portal area. Design details are presented in Tables 8 and 10 respectively in Appendix 7-4.

As a result of the Crandall Canyon Mine disaster of August 6, 2007, the mine has been de-activated and the portals have been sealed. During the process of constructing the seals much of the UD-3 culvert diversion structure was damaged beyond repair. Upon further evaluation it was determined that the undisturbed drainage from WSUD-3 above the portals could be diverted into the existing surface drainage ditches rather than try to re-establish it back across the portals as it had been previously. The drainage from WSUD-3 is now proposed to report to disturbed drainage ditch DD-8, then to culvert C-1, then to ditch DD-5, then culvert C-12, and ultimately into the sediment pond. As shown in Tables 3, 5, 6 and 7 of Appendix 7-4, all ditches and culverts are presently sized to adequately handle the additional runoff from the undisturbed area. Also, as shown in Table 11 of Appendix 7-4, the sediment pond is also adequately sized to handle this additional contribution. The existing inlet structure to culvert UD-3 is a substantially constructed concrete box located about 20' above the intake portal. This structure will remain in place. The existing culvert is an 18" PVC pipe, which is undamaged in the area immediately above the portal. This pipe will be cut off about 10' below the inlet structure and fitted with a PVC 90 degree elbow. From this elbow a new segment of 12" HDPE pipe will be routed over and around the intake portal and allowed to discharge into the existing disturbed drainage ditch DD-8 which runs along the portal access road. Due to the short length and steepness of this new segment, calculations show that use of a 12" pipe will easily handle the anticipated flow. This HDPE pipe will be supported by cables anchored into the concrete inlet box, and by an existing steel lamp-post located above the portal. The semi-flexible nature of the replacement pipe will allow it to be directed around the portal to ditch DD-8. Details of the pipe sizing and schematic drawings of the installation plans for this re-routed culvert can be found in Figures 13A and 13B of Appendix 7-4.

The existing culverts in the mine yard were examined to determine their adequacy with respect to passing the peak flow. Details of these designs are provided in Appendix 7-4.

Similarly, ditches within the disturbed area are designed to pass the peak flow from the 10-year, 6-hour storm. Typical cross sections and design calculations are contained in Appendix 7-4 for these ditches. Ditches have been evaluated for adequacy in passing the 10 year-24 hour storm and found to be of adequate size (see Appendix 7-4).

A berm was placed around the (un-used) power substation area to prevent runoff water that accumulates thereon from flowing across the remainder of the site. A small channel on the

substation pad collects water from the pad and adjacent undisturbed areas. A stilling basin was placed at the downstream end of this diversion to trap sediment prior to discharging into UD-1.

Expansion Area Surface Water Drainage and Sediment Control

Water on the extended mining pad associated with the proposed culvert expansion comes from two sources. The pad itself and two watershed areas located in undisturbed terrain to the south of the proposed pad. Runoff from the pad and watersheds is collected and controlled by the use of drainage ditches and culverts. All runoff diverted through the drainage ditches and culverts go into a sediment pond. The watersheds are shown on Plate 7-5. The location of drainage ditches and culverts can be also be found on Plate 7-5.

All diversion ditches have been designed to have a triangular channel with a minimum depth of one foot and side slopes of 1H:1V. During the periods of peak flow at least 3" of the channel depth will be freeboard. The calculations associated with drainage ditch design can be found in Appendix 7-4.

7.42.40 Road Drainage

All of ~~GENWAL's~~GENWAL's roads have been designed, located and constructed as required by the regulations R645-301-742.410 through R645-301-742-423.5.

7.43 Impoundment

There are no permanent impoundments associated with the GENWAL facilities. Temporary impoundments of water collected for runoff control will occur in the sediment pond. The physical design of the sediment pond are certified designs as required in R645-301-512 and are presented in Section 5.33 and Appendix 7-4 of this application. The sediment pond does not meet the criteria for MSHA regulations. The hydrologic design for the sediment pond is presented in Section 7.42.20 and Appendix 7-4. On cessation and reclamation of mining and disposal activities, the sediment pond will be removed.

7.44 Discharge Structures

The sediment pond is equipped with a decant, a riser pipe (cmp) principle overflow and a rip-rapped open-channel emergency spillway. Sediment pond details are covered under Section 7.42.20 and in Appendix 7-4.

7.45 Disposal of Excess Spoil

No significant excess spoil will be developed by the underground mine. In the event spoil is generated during the mining operations, this will be transported to an approved disposal site. The handling of these materials will comply with R645-301-745.

Iron sludge material from the ~~minewater~~mine water treatment facility (described in Appendix 7-65) will be hauled off-site and disposed of at the Burma evaporation basin facility as described in Appendix 7-66.

7.46 Coal Mine Waste

The disposal and placement of any refuse materials will be conducted in accordance with the plans presented in Chapter 5 of this application.

7.47 Disposal of Noncoal Mine Waste

Garbage

Solid waste generated from mining activities, such as garbage and paper products, is disposed of in large trash "dumpsters" located near the portal. A contract garbage hauling service, empties the contents of the dumpsters on a weekly basis and hauls the garbage to an approved dump or landfill.

Unusable Equipment

All salvageable mining equipment is sold to local scrap dealers: items such as broken bolts, worn out engine parts, and items which might be recycled. Any machinery or large parts are placed in a stockpile near the material storage area for periodic salvage by local scrap dealers. No mining equipment will be merely abandoned.

Petroleum Products

Oil and grease wastes are collected in tanks and returned to distributors for refining or used as heating fuel. In case of spills, a spill control plan has been developed and is located at the mine site.

7.48 Casing and Sealing of Wells

Following completion of reclamation, the monitoring wells for the mine site will be plugged and abandoned in accordance with R645-301-631 and R645-301-748. This will prevent the potential for disturbance to the hydrologic balance.

7.50 Performance Standards

All coal mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area and support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302. For the purpose of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, operations will be conducted to assure the protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

The following sections, 7.51 through 7.55 provide a commitment to meet the requirements of the applicable laws. Specific plans for accomplishing compliance are provided under the applicable, referenced sections of this Mining and Reclamation Plan.

7.51 Water Quality Standards and Effluent Limitations

Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

7.52 Sediment Control Measures

Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760. Refer to sections 7.32, 7.42 and 7.60 of this plan.

7.52.10 Siltation Structures

Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763. Refer to sections 7.32, 7.42 and 7.63 in this plan.

7.52.20 Road Drainage

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to R645-301-732.400, R645-301-742-400, and R645-301-762. Refer to sections 7.32, 7.40 and 7.62 in this plan.

7.52.21 Erosion Control or Prevention

Control or prevent erosion, siltation and the air pollution attendant to erosion by vegetating or otherwise stabilizing all exposed surfaces in accordance with current, prudent engineering practices.

7.52.22 Suspended Solids

Control or prevent additional contributions of suspended solids to steam flow or runoff outside the permit area.

7.52.23 Effluent Standards

Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under R645-301-751. Refer to section 7.51 in this plan.

7.52.24 Surface and Groundwater Systems

Minimize the diminution to, or degradation of, the quality or quantity of surface and groundwater systems.

7.52.25 Normal Water Flow

Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

7.53 Impoundments and Discharge Structures

Impoundments and discharge structures will be located, maintained, constructed and reclaimed to comply with R645-301-733, R645-301-734, R645-301-743 and R645-301-745 and R645-301-760. Refer to sections 7.33, 7.34, 7.43, 7.45 and 7.60 in this plan.

7.54 Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste

Disposal areas for excess spoil, coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed to comply with R645-301-735, R645-301-736, R645-301-745, R645-301-746, R645-301-747 and R645-301-760. Refer to sections 7.35, 7.36, 7.45, 7.46 7.47 and 7.60 in this plan.

7.55 Casing and Sealing of Wells

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738. Refer to sections 7.38, 7.48, and 7.65 in this plan.

7.60 Reclamation

Sealing of Mine Openings

The Applicant has drilled from the Hiawatha seam upwards to the Blind Canyon seam as described in Chapter 6. The drilling occurred in areas that pillar extraction will occur and no provisions were made to seal the bore hole.

Temporary sealing of the portals, if needed, will be accomplished by the construction of protective barricades or other covering devices, fenced and posted with signs indicating the hazardous nature of the opening. Permanent closure plans will include sealing the portals as per the request of the U.S.G.S. (See Section 5.29).

Upon cessation of mining operations all drift openings to the surface from underground will be backfilled, regraded and reseed as per Section 5.40 of this plan. Prior to final sealing of any openings, the U.S.G.S. will require an on-site inspection and a submission of formal sealing

methods for approval. The formal sealing methods will be presented as a plan including cross sections demonstrating the measures taken to seal or manage mine openings will comply with R645-301-529.

Removal of Surface Structures

All waste material generated from the removal of the structures will be removed from the property and sold as scrap or disposed of in the appropriate approved state land fill. The only structures to remain after the mining operation will be the sedimentation system and all necessary diversions required to insure routing of disturbed area drainage to the pond and diversions to maintain the integrity of the pond until the requirements are met. The diversion ditch is shown on Plate 5-16.

Upon cessation of mining operations, the water supply well (MW-1) will be permanently abandoned in accordance with regulations promulgated by the Utah Division of Water Rights. This will include filling of the well with a neat cement grout in accordance with the regulations.

Disposition of Dams, Ponds and Diversions

Upon final cessation of mining the area will be reclaimed. Upon completion of the reclamation earthwork the sediment pond will be cleaned out and the material disposed of in the approved method. Once it is determined that the pond is no longer required for sediment control of the reclaimed area and Phase I reclamation has been deemed complete, the pond will be cleaned out again. The pond will only be reclaimed after vegetation has been established on the site and Phase I reclamation has been approved. The material in the pond should only be topsoil that has eroded from the reclaimed site, (care will be taken not to mix the pond liner with this topsoil). This topsoil will be stockpiled and allowed to dry at the edge of the pond. Once the topsoil has been dried, the sediment pond will be reclaimed and the topsoil spread on top of the pond area.

Recontouring

All areas affected by surface operations will be graded and restored to approximate original contour that is compatible with natural surroundings and postmining land use. For approximate contours prior to ~~GENWAL's~~GENWAL's surface disturbance refer to the topography south of the road on ~~-~~Plate 5-20. The final regraded contours can be found on Plate 5-17.

Removal or Reduction of Cut Slopes & Highwalls

Backfilling and grading will proceed so as to eliminate the cutslopes and highwalls. This can be done by recontouring as per Section 5.40 of this Plan. The portals will be backfilled with soil and two rows of solid concrete blocks placed across each entry and then backfilled to the surface and recontoured as shown on Plate 5-17. The cut slope above the coal stockpile will be backfilled with material from the culvert expansion project.

Terracing and Erosion Control

No terracing will be done. All final grading, preparation of overburden before replacement of topsoil will be done along the contour to minimize erosion and instability unless this operation becomes hazardous to equipment operators in which case the grading, preparation and placement in a direction other than generally parallel to the contour will be used.

Final Reclamation

All areas affected by surface operations will be graded and restored to approximate original contour. All final grading will be done along the contour to minimize erosion and instability unless this operation becomes hazardous to the equipment operators. Backfilling and grading will proceed so as to eliminate the cut slopes and highwalls. Refer to Plates 5-16 and 5-17. Backfilling and grading will be done according to the reclamation timetable as originally submitted.

If possible, the topsoil will be redistributed in the late fall (late September or early October) just prior to the seeding to keep the seedbed free of weeds and annual grasses. Should weeds and annual grasses become established before seeding, they will be removed prior to seeding, refer to Chapters 2 and 3 for additional information.

Typical cross sections and topographic maps which adequately represent the existing land configuration of the area affected by surface operations are shown on Plates 3-7, 3-8 and 3-9 for existing ground as well as Plate 5-20 for premining topography and the geotextile-covered area. Postmining reclamation cross sections and surface topography will be as near to premining as is possible and practical, as noted on Plate 5-17.

A reclamation map showing post construction interim reclamation areas and final reclamation accompanies this document as Plates 7-16 and 5-17. Slope rounding on Plate 5-3 has been revised to meet the required slope of 1.5:1 at the specified reclaimed cross sections. Two distinct areas showing post construction interim reclamation and final reclamation can be found on Plates 7-5.

Reclamation hydrology is discussed in Appendix 7-4.

CHAPTER 7

FIGURES

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7.70 References

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The findings, determinations, and assertions contained in this document are not final and subject to change following the public comment period.

STATE OF UTAH
DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
SALT LAKE CITY, UTAH
AUTHORIZATION TO DISCHARGE UNDER THE
UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM
(UPDES)

In compliance with provisions of the Utah *Water Quality Act, Title 19, Chapter 5, Utah Code Annotated (UCA) 1953, as amended* (the *"Act"*),

GENWAL RESOURCES, INC., CRANDALL CANYON MINE

is hereby authorized to discharge from its facility located in Crandall Canyon (Emery County), approximately 15 miles northwest of Huntington, Utah, with outfalls located as indicated in the permit, to receiving waters named

CRANDALL CREEK AND HUNTINGTON CREEK (TRIBUTARY TO THE COLORADO RIVER)

in accordance with discharge point, effluent limitations, monitoring requirements and other conditions set forth herein.

This modified permit shall become effective on MONTH/DATE, 2020

This permit and the authorization to discharge shall expire at midnight, January 31, 2023.

Signed this DATE day of MONTH, 2020.

Erica Brown Gaddis, PhD
Director

DWQ-2020-008791

PN DRAFT

TABLE OF CONTENTS

I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS 3
- A. Definitions 3
- B. Description of Discharge Points 7
- C. Narrative Standard 8
- D. Specific Limitations and Self-monitoring Requirements 8

II. STORM WATER DISCHARGE REQUIREMENTS 16
- A. Coverage of This Section 16
- B. Prohibition of Non-Storm Water Discharges 16
- C. Storm Water Pollution Prevention Plan Requirements 16
- D. Comprehensive Site Compliance Evaluation 22
- E. Monitoring and Reporting Requirements 23
- F. *EPCRA Section 313* Requirements 25

III. MONITORING, RECORDING AND REPORTING REQUIREMENTS 29
- A. Representative Sampling 29
- B. Monitoring Procedures 29
- C. Penalties for Tampering 29
- D. Reporting of Monitoring Results 29
- E. Compliance Schedules 29
- F. Additional Monitoring by the Permittee 29
- G. Records Contents 30
- H. Retention of Records 30
- I. Twenty-four Hour Notice of Noncompliance Reporting 30
- J. Other Noncompliance Reporting 31
- K. Inspection and Entry 31

IV. COMPLIANCE RESPONSIBILITIES 33
- A. Duty to Comply 33
- B. Penalties for Violations of Permit Conditions 33
- C. Need to Halt or Reduce Activity not a Defense 33
- D. Duty to Mitigate 33
- E. Proper Operation and Maintenance 33
- F. Removed Substances 33
- G. Bypass of Treatment Facilities 34
- H. Upset Conditions 36
- I. Toxic Pollutants 36
- J. Changes in Discharge of Toxic Substances 36
- K. Industrial Pretreatment 37

V. GENERAL REQUIREMENTS 39
- A. Planned Changes 39
- B. Anticipated Noncompliance 39
- C. Permit Actions 39
- D. Duty to Reapply 39
- E. Duty to Provide Information 39
- F. Other Information 39
- G. Signatory Requirements 39
- H. Penalties for Falsification of Reports 40
- I. Availability of Reports 41
- J. Oil and Hazardous Substance Liability 41
- K. Property Rights 41
- L. Severability 41
- M. Transfers 41
- N. State Laws 41
- O. Water Quality-Re-opener Provision 42
- P. Toxicity Limitation-Re-opener Provision 42

PN DRAFT

I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Definitions.

1. "7-day and weekly average" is the arithmetic average of all samples collected during a consecutive 7-day period or calendar week whichever is applicable. The 7-day and weekly averages are applicable only to those effluent characteristics for which there are 7-day average effluent limitations. The calendar week, beginning on Sunday and ending on Saturday, shall be used for purposes of reporting self- monitoring data on discharge monitoring report forms. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for that calendar week shall be included in the data for the month that contains the Saturday.

2. "10-year, 24-hour precipitation event" means the maximum 24-hour precipitation event with a probable recurrence interval of once in 10 years. This information is available in *Weather Bureau Technical Paper No. 40*, May 1961 and *National Oceanographic and Atmospheric Administration Atlas 2*, 1973 for the 11 Western States, and may be obtained from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

3. "30-day and monthly average" is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.

4. "*Act*" means the "*Utah Water Quality Act*".

5. "Best Management Practices" (BMP's) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMP's also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

6. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

7. "Chronic toxicity" occurs when the inhibitory concentration to 25% of the population (IC_{25}) is less than or equal to 77.4% effluent.

PN DRAFT

8. "Coal pile runoff" means the rainfall runoff from or through any coal storage pile.

9. "Composite samples" shall be flow proportioned. The composite sample shall contain, as a minimum, at least four (4) samples collected over the composite sample period. Unless otherwise specified, the time between the collection of the first sample and the last sample shall not be less than six (6) hours nor more than 24 hours. Acceptable methods for preparation of composite samples are as follows:

   a. Constant time interval between samples, sample volume proportional to flow rate at time of sampling;

   b. Constant time interval between samples, sample volume proportional to total flow (volume) since last sample. For the first sample, the flow rate at the time the sample was collected may be used;

   c. Constant sample volume, time interval between samples proportional to flow (i.e., sample taken every "X" gallons of flow); and,

   d. Continuous collection of sample, with sample collection rate proportional to flow rate.

10. "*CWA*" means *The Federal Water Pollution Control Act*, as amended, by *The Clean Water Act of 1987*.

11. "Daily Maximum" (Daily Max.) is the maximum value allowable in any single sample or instantaneous measurement.

12. "EPA" means the United States Environmental Protection Agency.

13. "Director" means Director of the Utah Division of Water Quality.

14. "Flow-weighted composite sample" means a composite sample consisting of a mixture of aliquots collected at a constant time interval, where the volume of each aliquot is proportional to the flow rate of the discharge.

15. "Grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

16. "IC_{25}" is the concentration of toxicant (given in % effluent) that would cause a 25% reduction in mean young per female or a 25% reduction in overall growth for the test population.

PN DRAFT

17. "Illicit discharge" means any discharge to a municipal separate storm sewer that is not composed entirely of storm water except discharges pursuant to a UPDES permit (other than the UPDES permit for discharges from the municipal separate storm sewer) and discharges from fire fighting activities, fire hydrant flushing, potable water sources including waterline flushing, uncontaminated ground water (including dewatering ground water infiltration), foundation or footing drains where flows are not contaminated with process materials such as solvents, springs, riparian habitats, wetlands, irrigation water, exterior building wash down where there are no chemical or abrasive additives, pavement wash water where spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used, and air conditioning condensate.

18. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.

19. "Point Source" means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharges. This term does not include return flows from irrigated agriculture or agriculture storm water runoff.

20. "Runoff coefficient" means the fraction of total rainfall that will appear at a conveyance as runoff.

21. "*Section 313* water priority chemical" means a chemical or chemical categories which:

    a. Are listed at *40 Code of Federal Regulations (CFR) 372.65* pursuant to *Section 313* of *Title III* of the *Emergency Planning and Community Right-to-Know Act (EPCRA)* (also known as *Title III* of the *Superfund Amendments and Reauthorization Act* of 1986);

    b. Are present at or above threshold levels at a facility subject to *EPCRA, Section 313* reporting requirements, and

    c. Meet at least one of the following criteria:

        (1) Are listed in *Appendix D* of *40 CFR 122* on *Table II* (organic priority pollutants), *Table III* (certain metals, cyanides, and phenols) or *Table IV* (certain toxic pollutants and hazardous substances);

PN DRAFT

(2) Are listed as a hazardous substance pursuant to *Section 311(b)(2)(A)* of the *CWA* at *40 CFR 116.4*; or

(3) Are pollutants for which EPA has published acute or chronic toxicity criteria.

22. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

23. "Significant materials" includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under *Section 101(14)* of *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*; any chemical the facility is required to report pursuant to *EPCRA Section 313*; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with storm water discharges.

24. "Significant spills" includes, but is not limited to: releases of oil or hazardous substances in excess of reportable quantities under *Section 311* of the *Clean Water Act* (*see 40 CFR 110.10* and *40 CFR 117.21*) or *Section 102* of *CERCLA* (*see 40 CFR 302.4*).

25. "Storm water" means storm water runoff, snowmelt runoff, and surface runoff and drainage.

26. "Time-weighted composite" means a composite sample consisting of a mixture of equal volume aliquots collected at a constant time interval.

27. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

28. "Waste pile" means any non-containerized accumulation of solid, non-flowing waste that is used for treatment or storage.

PN DRAFT

Acronym List

BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CFR	Code of Federal Regulations
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPCRA	Emergency Planning & Community Right-to-Know Act
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TRE	Toxicity Reduction Evaluation
TSS	Total Suspended Solids
UAC	Utah Administrative Code
UCA	Utah Code Annotated
UPDES	Utah Pollutant Discharge Elimination System
WET	Whole Effluent Toxicity

Unit List

mg/L	milligrams per liter
MGD	million gallons per day
ml/L	milliliters per liter
SU	standard units
µg/L	micrograms per liter

B. Description of Discharge Points.

The authorization to discharge provided under this permit is limited to those outfalls specifically designated below as discharge locations. Discharges at any location not authorized under a UPDES permit are in violation of the *Act* and may be subject to penalties under the *Act*. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge may be subject to criminal penalties as provided under the *Act*.

Outfall Number	Location of Discharge Point
001	An 18-inch pipe on the east side of the sediment pond discharging directly to Crandall Creek. Coordinates: 39° 27' 38" north, 111° 09' 59" west.

PN DRAFT

Outfall Number	Location of Discharge Point
002-A (existing)	Spillway of mine water treatment settling basin into a 12-inch discharge pipe to the Crandall Creek bypass culvert. Coordinates: 39° 27' 38" north, 111° 09' 59" west.
002-B (proposed)	Mine water discharges from an 8-inch discharge pipe into Huntington Creek near Crandall Canyon Road, with Coordinates: 39° 27.790' north, 111° 08.725' west, as proposed.

C. Narrative Standard.

It shall be unlawful, and a violation of this permit, for the permittee to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste, or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures.

D. Specific Limitations and Self-monitoring Requirements.

1. Effective immediately, and lasting through the life of this permit, there shall be no chronic toxicity in Outfalls 001 or 002 as defined in *Parts I.A.7 and I.D.6*, and determined by test procedures described in *Part I. D.6* of this permit.

2. Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfalls 001 and 002. Such discharges shall be limited and monitored by the permittee as specified below in *Parts I.D.2*. through *I.D.7*.

PN DRAFT

Effluent Characteristics	Effluent Limitations				Monitoring Requirements	
	30 Day Average	7 Day Average	Daily Minimum	Daily Maximum	Sample Frequency	Sample Type
Flow, [1]MGD a/	0.73	[2]NA	NA	Report	Monthly	Continuous Recorder
TSS, mg/L	25	35	NA	70	Monthly	Grab
Total Iron, mg/L b/	NA	NA	NA	1.24/3.5	Monthly	Grab
Total Selenium, mg/L b/	NA	NA	NA	Report	Quarterly	Grab
Oil & Grease, mg/L c/	NA	NA	NA	10	Monthly	Grab
Total Aluminum, mg/L b/	NA	NA	NA	1.12	Monthly	Grab
TDS, mg/L d/	Report	NA	NA	1200	Monthly	Grab
pH, standard units	NA	NA	6.5	9.0	Monthly	Grab
DO, mg/L	NA	NA	5.5	NA	Monthly	Grab
Sanitary Waste e/	NA	NA	NA	None	Monthly	Visual
Chronic Whole Effluent Toxicity [3]	NA	NA	NA	Pass, IC_{25} > 77.4% effluent	Quarterly	Composite
Total Arsenic, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Boron, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Cadmium, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Chromium, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Copper, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Lead, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Mercury, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Nickel, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Silver, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Cyanide, mg/L f/	NA	NA	NA	NA	Quarterly	Grab
Total Zinc, mg/L f/	NA	NA	NA	NA	Quarterly	Grab

[1] MGD: million gallons per day *[2] NA: not applicable* *[3]See Biomonitoring Requirements*

a/ Flow is limited to 0.73 MGD as a thirty day average for Outfalls 001 and 002 combined. If no flow from Outfall 001, Outfall 002 can have the total flow 30-day average of 0.73 MGD.

b/ Total Iron concentrations shall be limited at 1.24 mg/L for existing Crandall Canyon Outfalls 001 & 002-A. Total Iron concentrations shall be limited to 3.5 mg/L for the new Outfall 002-B into Huntington Creek.

Total Selenium shall be monitored quarterly at Outfall 002(A&B) only.

Total Aluminum shall be limited and monitored monthly at Outfall 002(A&B) only.

c/ In addition to monthly sampling for oil and grease, a visual inspection for oil and grease, floating solids, and visible foam shall be performed at least twice per month at 001 and 002. There shall

PN DRAFT

be no sheen, floating solids, or visible foam in other than trace amounts. If sheen is observed, a sample of the effluent shall be collected immediately thereafter and oil and grease shall not exceed 10 mg/L in concentration.

d/ The TDS concentration from each of the outfalls shall not exceed 1200 mg/L as a daily maximum limit. No tons per day loading limit will be applied if the concentration of TDS in the discharge is equal to or less than 500 mg/L as a thirty-day average. However, if the 30-day average concentration exceeds 500 mg/L, then the permittee cannot discharge more than 1 ton per day as a sum from all discharge points. Upon previous determinations by the Director that the permittee is not able to meet the 500 mg/L 30-day average or the 1 ton per day loading limit, the permittee is required to continue to participate in and/or fund a salinity offset project to include the TDS offset credits as appropriate.

The salinity-offset project shall include TDS credits on a ton-for-ton basis for which the permittee is over the 1 ton per day loading limit. The tonnage reduction from the offset project must be calculated by a method similar to one used by the Natural Resources Conservation Service, Colorado River Basin Salinity Control Forum, or other applicable agency.

If the permittee will be participating in the construction and implementation of a new salinity-offset project, then a project description and implementation schedule shall be submitted to the Director at least six (6) months prior to the implementation date of the project, which will then be reviewed for approval. The salinity offset project description and implementation schedule must be approved by the Director and shall be appended to this permit.

If the permittee will be funding any additional salinity-offset projects through third parties, the permittee shall provide satisfactory evidence to the Director that the required funds have been deposited to the third party within six (6) months of project approval by the Director. A monitoring and adjustment plan to track the TDS credits shall continue to be submitted to the Director for each monthly monitoring period during the life of this permit. Any changes to the monitoring and adjustment plan must be approved by the Director and upon approval shall be appended to this permit.

e/ There shall be no discharge of sanitary waste and visual observations performed at least monthly shall be conducted.

f/ These metals shall be monitored as required at both outfalls if discharge occurs. The permittee is required to get the lowest detection limit possible using standard methods and certified laboratories.

PN DRAFT

3. Should any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period that is less than or equal to the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) may, at outfall 001, substitute the following limitations for the limitations contained in *Part I.D.2*. All other limitations and monitoring not listed below remain the same.

Parameter	Alternative Effluent Limitations			
	Average Monthly	Average Weekly	Minimum Daily	Maximum Daily
Flow, MGD	Report			Report
pH, standard units			6.5	9.0
Settleable solids (SS), milliliter/liter				0.5
Total Suspended Solids (TSS), mg/L	Report	Report		Report
Total Iron, mg/L				Report
Total Dissolved Solids (TDS) mg/L b/	Report			Report

In order to substitute the above limitations, the sample collected during the storm event must be analyzed for all permitted parameters specified under *Part I.D.2*. Such analyses shall be conducted on either grab or composite samples. All manual pond dewatering must meet all limitations of *Part I.D.2*.

4. Should any discharge or increase in the volume of a discharge caused by precipitation within any 24-hour period that is greater than the 10-year, 24-hour precipitation event (or snowmelt of equivalent volume) may, at outfall 002, substitute the following limitations for the limitations contained in *Part I.D.2*. All other limitations and monitoring not listed below remain the same.

Parameter	Alternative Effluent Limitations			
	Average Monthly	Average Weekly	Minimum Daily	Maximum Daily
Flow, MGD	Report			Report
pH, standard units			6.5	9.0
Settleable solids (SS), milliliter/liter				Report
Total Suspended Solids (TSS), mg/L	Report	Report		Report
Total Iron, mg/L				Report
Total Dissolved Solids (TDS) mg/L b/	Report			Report

PN DRAFT

In order to substitute the above limitation, the sample collected during the storm event must be analyzed for all permitted parameters specified under *Part I.D.2*. Such analyses shall be conducted on either grab or composite samples. All manual pond dewatering must meet all limitations of *Part I.D.2*.

5 The operator shall have the burden of proof that the increase in discharge was caused by the applicable precipitation event described in *Part I.D.3* and *I.D.4*. The alternate limitations in *Part I.D.3* and *I.D.4* shall not apply to treatment systems that treat exclusively underground mine water (i.e. Outfall 002). The alternate limitations apply to Outfall 001 only.

For rainfall, to waive TSS and total iron limitations, the permittee must prove that the discharge occurred during the precipitation event, or within 48 hours after measurable precipitation has stopped. In addition, to waive settleable solids limitations, the permittee must prove that the discharge occurred during the precipitation event, or within 48 hours after precipitation greater than the 10-year, 24-hour event has stopped.

For snowmelt, to waive TSS and total iron limitations, the permittee must prove that the discharge occurred during pond inflow from the snow melt event, or within 48 hours after pond inflow has stopped. In addition, to waive settleable solids limitations, the permittee must prove that the discharge occurred during pond inflow from the snow melt event, or within 48 hours after pond inflow volume greater than the 10-year, 24-hour event has stopped.

The permittee must submit documentation that the treatment facilities were properly operated and maintained prior to and during the storm event with any request for relief from primary limitations. The division shall determine the adequacy of proof. As part of this determination, the division shall evaluate whether the permittee could have controlled the discharge in such a manner that primary limitations could have been met, whether proper sediment storage levels were maintained and the ponds had sufficient water and sediment capacity for the storm event, plus other relevant factors. All manual pond dewatering must meet all limitations of *Part I.D.2*.

All data/documentation required by the permittee which cannot be reported on applicable discharge monitoring report forms (DMRs) shall be reported in a letter as an attachment to the DMR. Submittal of documentation of containment, maintenance and precipitation records above does not exempt the permittee from the notification requirements of this permit.

PN DRAFT

6. Whole Effluent Testing - Chronic Toxicity. Starting on the effective date of this permit, the permittee shall quarterly conduct chronic short-term toxicity tests on a composite sample of the final effluent. The sample shall be collected at outfalls 001 and/or 002 depending on which are discharging.

The monitoring frequency shall be quarterly. Samples shall be collected on a two-day progression; i.e., if the first sample is on a Monday, during the next sampling period, sampling shall be on a Wednesday. If chronic toxicity is detected, the test shall be repeated in less than four weeks from the date the initial sample was taken. The need for any additional samples, and/or a Toxicity Reduction Evaluation (TRE) (*see Part I.D.7.*) shall be determined by the Director. If the second test shows no chronic toxicity, routine monitoring shall be resumed.

The chronic toxicity tests shall be conducted in general accordance with the procedures set out in the latest revision of *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, Fourth Edition, October 2002, EPA-821-R-02-013* as per *40 CFR 136.3(a) TABLE IA-LIST OF APPROVED BIOLOGICAL METHODS*. Tests will be conducted quarterly using both Ceriodaphnia dubia and Pimephales promelas (fathead minnow) species. A CO_2 atmosphere may be used (in conjunction with an unmodified test) in order to account for pH drift.

Chronic toxicity occurs when the IC_{25} is less than or equal to an effluent concentration of 77.4%. If any of the acceptable control performance criteria are not met, the test shall be considered invalid.

Quarterly test results shall be reported along with the Discharge Monitoring Report Form (DMR) submitted for the end of the reporting calendar quarter. For example, biomonitoring results for the calendar quarter ending March 31st shall be reported with the standard DMR due April 28th, with the remaining biomonitoring quarterly reports submitted with standard DMR due the next month after each quarter. Biomonitoring results shall be reported on a biomonitoring DMR form, shall be consistent with the latest revision of the *Region VIII NPDES Whole Effluent Toxics Control Program,* and shall include all chemical and physical data as specified.

If the results for a minimum of ten consecutive testing events indicate no chronic toxicity, the permittee may request a reduction in testing frequency and/or reduction to one species. The Director may approve, partially approve, or deny the request based on results and other available information. If approval is given, the modification may take place without a public notice.

PN DRAFT

The current Utah whole effluent toxicity (WET) policy is in the process of being updated and revised to assure its consistency with the Environmental Protection Agency's national and regional WET policy. When the revised WET policy has been finalized and officially adopted, this permit may be reopened and modified to incorporate satisfactory follow-up chronic toxicity language (chronic pattern of toxicity, preliminary toxicity investigation, and/or toxicity identification evaluation (TIE)/TRE, etc.) without a public notice, as warranted and appropriate.

7. Toxicity Reduction Evaluation. If toxicity is detected during the life of this permit and it is determined by the Director that a TRE is necessary, the permittee shall be so notified and shall initiate a TRE immediately thereafter. The purpose of the TRE will be to establish the cause of the toxicity, locate the source(s) of the toxicity, and control or provide treatment for the toxicity.

A TRE may include but is not limited to one, all, or a combination of the following:

a. Phase I - Toxicity Characterization

b. Phase II - Toxicity Identification Procedures

c. Phase III - Toxicity Control Procedures

d. Any other appropriate procedures for toxicity source elimination and control

If the TRE establishes that the toxicity cannot be eliminated immediately, the permittee shall submit a proposed compliance plan to the Director. The plan shall include the proposed approach to control toxicity and a proposed compliance schedule for achieving control. If the approach and schedule are acceptable to the Director, this permit may be reopened and modified.

If the TRE shows that the toxicity is caused by a toxicant(s) that may be controlled with specific numerical limitations, the permittee may:

a. Submit an alternative control program for compliance with the numerical requirements.

b. If necessary, provide a modified biomonitoring protocol that compensates for the pollutant(s) being controlled numerically.

PN DRAFT

If acceptable to the Director, this permit may be reopened and modified to incorporate any additional numerical limitations, a modified compliance schedule if judged necessary by the Director, and/or a modified biomonitoring protocol.

Failure to conduct an adequate TRE, or failure to submit a plan or program as described above, or the submittal of a plan or program judged inadequate by the Director, shall be considered a violation of this permit.

PN DRAFT

II. STORM WATER DISCHARGE REQUIREMENTS

A. Coverage of This Section.

1. Discharges Covered Under This Section. The requirements listed under this section shall apply to storm water discharges from the industrial facility.

a. Site Coverage. This section covers discharges of storm water associated with industrial activity to waters of the State from the confines of the facility listed on the cover page. Specific monitoring requirements have been included and are based on the requirements of the UPDES Multi Sector General Permit for Storm Water Discharges Associated with Industrial Activity, Permit No. UTR000000.

B. Prohibition of Non-Storm Water Discharges.

The following non-storm water discharges may be authorized under this permit provided the non-storm water component of the discharge is in compliance with this section; discharges from fire fighting activities; fire hydrant flushing; potable water sources including waterline flushing; drinking fountain water; irrigation drainage and lawn watering; routine external building wash down water where detergents or other compounds have not been used in the process; pavement wash waters where spills or leaks of toxic or hazardous materials (including oils and fuels) have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; uncontaminated compressor condensate; uncontaminated springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials such as solvents.

C. Storm Water Pollution Prevention Plan Requirements: Contents of the Plan. The plan shall include, at a minimum, the following:

1. Pollution Prevention Team. Each plan shall identify a specific individual or individuals within the facility organization as members of a storm water Pollution Prevention Team who are responsible for developing the storm water pollution prevention plan and assisting the facility or plant manager in its implementation, maintenance, and revision. The plan shall clearly identify the responsibilities of each team member. The activities and responsibilities of the team shall address all aspects of the facility's storm water pollution prevention plan.

PN DRAFT

2. Description of Potential Pollutant Sources. Each plan shall provide a description of potential sources which may reasonably be expected to add significant amounts of pollutants to storm water discharges or which may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all activities and significant materials, which may be reasonably expected to have the potential as a significant pollutant source. Each plan shall include, at a minimum:

   a. Drainage. A site map must be maintained indicating drainage areas and storm water outfalls. For each area of the facility that generates storm water discharges associated with the waste water treatment related activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow and an identification of the types of pollutants that are likely to be present in storm water discharges associated with the activity. Factors to consider include the toxicity of the pollutant; quantity of chemicals used, produced or discharged; the likelihood of contact with storm water; and history of significant leaks or spills of toxic or hazardous pollutants. Flows with a significant potential for causing erosion shall be identified. The site map shall include but not be limited to:

      (1) Drainage direction and discharge points from all wastewater associated discharges.

      (2) Location of any erosion and sediment control structure or other control measures utilized for reducing pollutants in storm water runoff.

      (3) Location of any handling, loading, unloading or storage of chemicals or potential pollutants such as caustics, hydraulic fluids, lubricants, solvents or other petroleum products, or hazardous wastes and where these may be exposed to precipitation.

      (4) Locations where any major spills or leaks of toxic or hazardous materials have occurred

      (5) Location of any sand or salt piles.

PN DRAFT

(6) Location of fueling stations or vehicle and equipment maintenance and cleaning areas that are exposed to precipitation.

(7) Location of receiving streams or other surface water bodies.

(8) Locations of outfalls and the types of discharges contained in the drainage areas of the outfalls.

b. Inventory of Exposed Materials. An inventory of the types of materials handled at the site that potentially may be exposed to precipitation. Such inventory shall include a narrative description of significant materials that have been handled, treated, stored or disposed in a manner to allow exposure to storm water between the time of 3 years prior to the effective date of this permit; method and location of onsite storage or disposal; materials management practices employed to minimize contact of materials with storm water runoff between the time of 3 years prior to the effective date of this permit and the present; the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of any treatment the storm water receives.

c. Spills and Leaks. A list of significant spills and significant leaks of toxic or hazardous pollutants that occurred at areas that are exposed to precipitation or that otherwise drain to a storm water conveyance at the facility after the date of 3 years prior to the effective date of this permit. Such list shall be updated as appropriate during the term of the permit.

d. Sampling Data. A summary of existing discharge sampling data describing pollutants in storm water discharges from the facility, including a summary of sampling data collected during the term of this permit.

e. Summary of Potential Pollutant Sources and Risk Assessment. A narrative description of the potential pollutant sources from the following activities associated with treatment works: access roads/rail lines; loading and unloading operations; outdoor storage activities; material handling sites; outdoor vehicle storage or maintenance sites; significant dust or particulate generating processes;

PN DRAFT

and onsite waste disposal practices. Specific potential pollutants shall be identified where known.

3. Measures and Controls. The facility shall develop a description of storm water management controls appropriate for the facility, and implement such controls. The appropriateness and priorities of controls in a plan shall reflect identified potential sources of pollutants at the facility. The description of storm water management controls shall address the following minimum components, including a schedule for implementing such controls:

   a. Good Housekeeping. All areas that may contribute pollutants to storm waters discharges shall be maintained in a clean, orderly manner. These are practices that would minimize the generation of pollutants at the source or before it would be necessary to employ sediment ponds or other control measures at the discharge outlets. Areas where good housekeeping practices should be implemented are storage areas for raw materials, waste materials and finished products; loading/unloading areas and waste disposal areas for hazardous and non-hazardous wastes. Examples of good housekeeping measures include; sweeping; labeling drums containing hazardous materials; and preventive monitoring practices or equivalent measures.

   b. Preventive Maintenance. A preventive maintenance program shall involve timely inspection and maintenance of storm water management devices (e.g., cleaning oil/water separators, catch basins) as well as inspecting and testing facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems.

   c. Spill Prevention and Response Procedures. Areas where potential spills that can contribute pollutants to storm water discharges can occur, and their accompanying drainage points, shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures, storage requirements, and use of equipment such as diversion valves in the plan should be considered. Procedures and equipment for cleaning up spills shall be identified in the plan and made available to the appropriate personnel.

PN DRAFT

d. Inspections. In addition to the comprehensive site evaluation required under *Part II.D.*, qualified facility personnel shall be identified to inspect designated equipment and areas of the facility on a periodic basis. The following areas shall be included in all inspections: loading and unloading areas for all significant materials; storage areas, including associated containment areas; waste management units; and vents and stacks from industrial activities. A set of tracking or follow-up procedures shall be used to ensure that appropriate actions are taken in response to the inspections. Records of inspections shall be maintained. The use of a checklist developed by the facility is encouraged.

e. Employee Training. Employee training programs shall inform personnel responsible for implementing activities identified in the storm water pollution prevention plan or otherwise responsible for storm water management at all levels of responsibility of the components and goals of the storm water pollution prevention plan. Training should address topics such as spill response, good housekeeping and material management practices. The pollution prevention plan shall identify how often training will take place, but training should be held at least annually (once per calendar year). Employee training must, at a minimum, address the following areas when applicable to a facility: petroleum product management; process chemical management; spill prevention and control; fueling procedures; general good housekeeping practices; proper procedures for using fertilizers, herbicides and pesticides.

f. Record Keeping and Internal Reporting Procedures. A description of incidents (such as spills, or other discharges), along with other information describing the quality and quantity of storm water discharges shall be included in the plan required under *Part II.C*. Inspections and maintenance activities shall be documented and records of such activities shall be incorporated into the plan.

g. Non-storm Water Discharges.

(1) Certification. The plan shall include a certification that the discharge has been tested or evaluated for the presence of non-storm water discharges. The certification shall include the identification of

PN DRAFT

potential significant sources of non-storm water at the site, a description of the results of any test and/or evaluation for the presence of non-storm water discharges, the evaluation criteria or testing method used, the date of any testing and/or evaluation, and the onsite drainage points that were directly observed during the test. Certifications shall be signed in accordance with *Part V.G.* of this permit.

(2) Exceptions. Except for flows from fire fighting activities, sources of non-storm water listed in *Part II.B. (Prohibition of Non-storm Water Discharges)* that are combined with storm water discharges associated with industrial activity must be identified in the plan. The plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

(3) Failure to Certify. Any facility that is unable to provide the certification required (testing for non-storm water discharges), must notify the Director within 180 days of the effective date of this permit. If the failure to certify is caused by the inability to perform adequate tests or evaluations, such notification shall describe: the procedure of any test conducted for the presence of non-storm water discharges; the results of such test or other relevant observations; potential sources of non-storm water discharges to the storm sewer; and why adequate tests for such storm sewers were not feasible. Non-storm water discharges to waters of the State that are not authorized by a UPDES permit are unlawful, and must be terminated.

h. Sediment and Erosion Control. The plan shall identify areas, which, due to topography, activities, or other factors, have a high potential for significant soil erosion, and identify structural, vegetative, and/or stabilization measures to be used to limit erosion.

i. Management of Runoff. The plan shall contain a narrative consideration of the appropriateness of traditional storm water management practices (practices other than those which control the generation or source(s) of pollutants)

PN DRAFT

used to divert, infiltrate, reuse, or otherwise manage storm water runoff in a manner that reduces pollutants in storm water discharges from the site. The plan shall provide that measures that the permittee determines to be reasonable and appropriate shall be implemented and maintained. The potential of various sources at the facility to contribute pollutants to storm water discharges associated with industrial activity (*see Part II.C.2, Description of Potential Pollutant Sources*) shall be considered when determining reasonable and appropriate measures. Appropriate measures or other equivalent measures may include: vegetative swales and practices, reuse of collected storm water (such as for a process or as an irrigation source), inlet controls (such as oil/water separators), snow management activities, infiltration devices, wet detention/retention devices and discharging storm water through the waste water facility for treatment.

D. Comprehensive Site Compliance Evaluation.

Qualified personnel shall conduct site compliance evaluations at appropriate intervals specified in the plan, but in no case less than once a year. Such evaluations shall provide:

1. Areas contributing to a storm water discharge associated with industrial activity shall be visually inspected for evidence of, or the potential for, pollutants entering the drainage system. Measures to reduce pollutant loadings shall be evaluated to determine whether they are adequate and properly implemented in accordance with the terms of the permit or whether additional control measures are needed. Structural storm water management measures, sediment and erosion control measures, and other structural pollution prevention measures identified in the plan shall be observed to ensure that they are operating correctly. A visual inspection of equipment needed to implement the plan, such as spill response equipment, shall be made.

2. Based on the results of the evaluation, the description of potential pollutant sources identified in the plan in accordance with *Part II.C.2. (Description of Potential Pollutant Sources)* and pollution prevention measures and controls identified in the plan in accordance with *Part II.C.3. (Measures and Controls)* shall be revised as appropriate within 2 weeks of such evaluation and shall provide for implementation of any changes to the plan in a timely manner, but in no case more than 12 weeks after the evaluation.

PN DRAFT

3. A report summarizing the scope of the evaluation, personnel making the evaluation, the date(s) of the evaluation, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with *Part II.C.3.i.* shall be made and retained as part of the storm water pollution prevention plan for at least 3 years after the date of the evaluation. The report shall identify any incidents of noncompliance. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed in accordance with *Part V.G (Signatory Requirements)* of this permit.

4. Deadlines for Plan Preparation and Compliance. The facility shall prepare and implement a plan in compliance with the provisions of *Part II* of this permit within 270 days of the permit effective date.

5. Keeping Plans Current. The facility shall amend the plan whenever there is a change in design, construction, operation, or maintenance, that has a significant effect on the potential for the discharge of pollutants to the waters of the state or if the storm water pollution prevention plan proves to be ineffective in eliminating or significantly minimizing pollutants from sources identified by the plan, or in otherwise achieving the general objective of controlling pollutants in storm water discharges associated with the activities at the facility.

E. Monitoring and Reporting Requirements

1. Quarterly Visual Examination of Storm Water Quality. The facility shall perform and document a visual examination of a storm water discharge associated with industrial activity from each outfall, except discharges exempted below. The examination must be made at least once in each of the following designated periods during daylight hours unless there is insufficient rainfall or snow melt to produce a runoff event: January through March; April through June; July through September; and October through December.

a. Sample and Data Collection. Examinations shall be made of samples collected within the first 30 minutes (or as soon thereafter as practical, but not to exceed 1 hour) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm

PN DRAFT

water pollution. The examination must be conducted in a well-lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable, the same individual should carry out the collection and examination of discharges for entire permit term.

b. Visual Storm Water Discharge Examination Reports. Visual examination reports must be maintained onsite in the pollution prevention plan. The report shall include the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the storm water discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution), and probable sources of any observed storm water contamination.

c. Representative Discharge. If the permittee reasonably believes multiple outfalls discharge substantially identical effluents, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by an outfall, the permittee may collect a sample of effluent from one such outfall and report that the observation data also applies to the substantially identical outfall(s) provided that the permittee includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that the permittee believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan.

d. Adverse Conditions. When a discharger is unable to collect samples over the course of the visual examination period as a result of adverse climatic conditions, the discharger must document the reason for not performing the visual examination and retain this documentation onsite with the results of the visual examination. Adverse weather conditions, which may prohibit the collection of samples,

PN DRAFT

include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricane, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

e. Inactive and Unstaffed Site. When a discharger is unable to conduct visual storm water examinations at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirement as long as the facility remains inactive and unstaffed. The facility must maintain a certification with the pollution prevention plan stating that the site is inactive and unstaffed so that performing visual examinations during a qualifying event is not feasible.

F. *EPCRA Section 313* Requirements.

1. In areas where *Section 313* water priority chemicals are stored, processed or otherwise handled, appropriate containment, drainage control and/or diversionary structures shall be provided. At a minimum, one of the following preventive systems or its equivalent shall be used:

   a. Curbing, culverting, gutters, sewers, or other forms of drainage control to prevent or minimize the potential for storm water run-on to come into contact with significant sources of pollutants; or
   b. Roofs, covers or other forms of appropriate protection to prevent storage piles from exposure to storm water and wind.

2. No tank or container shall be used for the storage of a *Section 313* water priority chemical unless its material and construction are compatible with the material stored and conditions of storage such as pressure and temperature, etc.

   Liquid storage areas for *Section 313* water priority chemicals shall be operated to minimize discharges of *Section 313* chemicals. Appropriate measures to minimize discharges of *Section 313* chemicals may include secondary containment provided for at least the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation, a strong spill contingency and integrity testing plan, and/or other equivalent measures.

PN DRAFT

3. Material storage areas for *Section 313* water priority chemicals other than liquids that are subject to runoff, leaching, or wind shall incorporate drainage or other control features that will minimize the discharge of *Section 313* water priority chemicals by reducing storm water contact with *Section 313* water priority chemicals.

4. Truck and rail car loading and unloading areas for liquid *Section 313* water priority chemicals shall be operated to minimize discharges of *Section 313* water priority chemicals. Protection such as overhangs or door skirts to enclose trailer ends at truck loading/unloading docks shall be provided as appropriate. Appropriate measures to minimize discharges of *Section 313* chemicals may include: the placement and maintenance of drip pans (including the proper disposal of materials collected in the drip pans) where spillage may occur (such as hose connections, hose reels and filler nozzles) for use when making and breaking hose connections; a strong spill contingency and integrity testing plan; and/or other equivalent measures.

5. Processing equipment and materials handling equipment shall be operated so as to minimize discharges of *Section 313* water priority chemicals. Materials used in piping and equipment shall be compatible with the substances handled. Drainage from process and materials handling areas shall minimize storm water contact with *Section 313* water priority chemicals. Additional protection such as covers or guards to prevent exposure to wind, spraying or releases from pressure relief vents from causing a discharge of *Section 313* water priority chemicals to the drainage system shall be provided as appropriate. Visual inspections or leak tests shall be provided for overhead piping conveying *Section 313* water priority chemicals without secondary containment.

6. Drainage from areas covered by *Parts II.F. 1*, *2*, *3*, or *4* should be restrained by valves or other positive means to prevent the discharge of a spill or other excessive leakage of *Section 313* water priority chemicals. Where containment units are employed, such units may be emptied by pumps or ejectors; however, these shall be manually activated.

   Flapper-type drain valves shall not be used to drain containment areas. Valves used for the drainage of containment areas should, as far as is practical, be of manual, open-and-closed design.
   If facility drainage is not engineered as above, the final discharge of all in-facility storm sewers shall be equipped to be equivalent with a diversion system that could, in the event of an uncontrolled

PN DRAFT

spill of *Section 313* water priority chemicals, return the spilled material to the facility.

Records shall be kept of the frequency and estimated volume (in gallons) of discharges from containment areas.

7. Other areas of the facility (those not addressed in *Parts II.F. 1*, *2*, *3*, or *4*, from which runoff that may contain *Section 313* water priority chemicals or spills of *Section 313* water priority chemicals could cause a discharge shall incorporate the necessary drainage or other control features to prevent discharge of spilled or improperly disposed material and ensure the mitigation of pollutants in runoff or leachate.

8. All areas of the facility shall be inspected at specific intervals identified in the plan for leaks or conditions that could lead to discharges of *Section 313* water priority chemicals or direct contact of storm water with raw materials, intermediate materials, waste materials or products. In particular, facility piping, pumps, storage tanks and bins, pressure vessels, process and material handling equipment, and material bulk storage areas shall be examined for any conditions or failures that could cause a discharge. Inspection shall include examination for leaks, wind blowing, corrosion, support or foundation failure, or other forms of deterioration or non-containment. Inspection intervals shall be specified in the plan and shall be based on design and operational experience. Different areas may require different inspection intervals. Where a leak or other condition is discovered that may result in significant releases of *Section 313* water priority chemicals to waters of the State, action to stop the leak or otherwise prevent the significant release of *Section 313* water priority chemicals to waters of the State shall be immediately taken or the unit or process shut down until such action can be taken. When a leak or non-containment of a *Section 313* water priority chemical has occurred, contaminated soil, debris, or other material must be promptly removed and disposed in accordance with Federal, State, and local requirements and as described in the plan.

9. Facilities shall have the necessary security systems to prevent accidental or intentional entry that could cause a discharge. Security systems described in the plan shall address fencing, lighting, vehicular traffic control, and securing of equipment and buildings.

10. Facility employees and contractor personnel that work in areas where *Section 313* water priority chemicals are used or stored shall

PN DRAFT

be trained in and informed of preventive measures at the facility. Employee training shall be conducted at intervals specified in the plan, but not less than once per year. Training shall address: pollution control laws and regulations, the storm water pollution prevention plan and the particular features of the facility and its operation that are designed to minimize discharges of *Section 313* water priority chemicals. The plan shall designate a person who is accountable for spill prevention at the facility and who will set up the necessary spill emergency procedures and reporting requirements so that spills and emergency releases of *Section 313* water priority chemicals can be isolated and contained before a discharge of a *Section 313* water priority chemical can occur. Contractor or temporary personnel shall be informed of facility operation and design features in order to prevent discharges or spills from occurring.

PN DRAFT

III. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling. Samples taken in compliance with the monitoring requirements established under *Part I* shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge. Sludge samples shall be collected at a location representative of the quality of sludge immediately prior to the use-disposal practice.

B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under *Utah Administrative Code (UAC) R317-2-10*, unless other test procedures have been specified in this permit.

C. Penalties for Tampering. The *Act* provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. Reporting of Monitoring Results. Monitoring results obtained during the previous month shall be summarized for each month and reported either using NetDMR or on a DMR Form (EPA No. 3320-1), post-marked no later than the 28th day of the month following the completed reporting period. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports including WET test reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (Part V.G.)*, and submitted by NetDMR, or submitted to the Division of Water Quality at the following address:

original to: Department of Environmental Quality
Division of Water Quality
195 North 1950 West
PO Box 144870
Salt Lake City, Utah 84114-4870

E. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Additional Monitoring by the Permittee. If the permittee monitors any parameter more frequently than required by this permit, using test procedures approved under *UAC R317-2-10* or as otherwise specified in

PN DRAFT

this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated. Only those parameters required by the permit need to be reported.

G. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. A copy of this UPDES permit must be maintained on site during the duration of activity at the permitted location.

I. Twenty-four Hour Notice of Noncompliance Reporting.

1. The permittee shall (orally) report any noncompliance that may seriously endanger health or environment as soon as possible, but no later than 24 hours from the time the permittee first became aware of circumstances. The report shall be made to the Division of Water Quality, (801) 536-4300, or 24-hour answering service (801) 536-4123.

2. The following occurrences of noncompliance shall be reported by telephone (801) 536-4123 as soon as possible but no later than 24 hours from the time the permittee becomes aware of the circumstances:

   a. Any noncompliance that may endanger health or the environment;

   b. Any unanticipated bypass that exceeds any effluent limitation in the permit *(see Part IV.G, Bypass of Treatment Facilities.)*;

PN DRAFT

c. Any upset which exceeds any effluent limitation in the permit *(see Part IV.H, Upset Conditions.)*; or,

d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit.

3. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and,

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

e. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period.

4. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Division of Water Quality, (801) 536-4300.

5. Reports shall be submitted to the addresses in *Part III.D*, *Reporting of Monitoring Results*.

J. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for *Part III.D* are submitted. The reports shall contain the information listed in *Part III.I.3*.

K. Inspection and Entry. The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

PN DRAFT

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the *Act*, any substances or parameters at any location.

PN DRAFT

IV. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and re-issuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions. The *Act* provides that any person who violates a permit condition implementing provisions of the *Act* is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions of the Act is subject to a fine not exceeding $25,000 per day of violation; Any person convicted under *UCA 19-5-115(2)* a second time shall be punished by a fine not exceeding $50,000 per day. Except as provided at *Part IV.G, Bypass of Treatment Facilities* and *Part IV.H, Upset Conditions*, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Removed Substances. Collected screening, grit, solids, sludge, or other pollutants removed in the course of treatment shall be buried or disposed of in such a manner to prevent any pollutant from entering any waters of the state or creating a health hazard. Sludge/digester supernatant and filter

PN DRAFT

backwash shall not directly enter either the final effluent or waters of the state by any other direct route.

G. Bypass of Treatment Facilities.

1. Bypass Not Exceeding Limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to *Parts IV.G.2. and IV.G.3*.

2. Prohibition of Bypass.

a. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

(1) Bypass was unavoidable to prevent loss of human life, personal injury, or severe property damage;

(2) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance, and

(3) The permittee submitted notices as required under *Part IV.G.3*.

b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in *Part IV.G.2a. (1), (2) and (3).*

3. Notice.

a. Anticipated bypass. Except as provided in *Part IV.G.2. and Part IV.G.3.b*, if the permittee knows in advance of the need for a bypass, it shall submit prior notice, at least ninety days before the date of bypass. The prior notice shall include the following unless otherwise waived by the Director:

PN DRAFT

(1) Evaluation of alternative to bypass, including cost-benefit analysis containing an assessment of anticipated resource damages:

(2) A specific bypass plan describing the work to be performed including scheduled dates and times. The permittee must notify the Director in advance of any changes to the bypass schedule;

(3) Description of specific measures to be taken to minimize environmental and public health impacts;

(4) A notification plan sufficient to alert all downstream users, the public and others reasonably expected to be impacted by the bypass;

(5) A water quality assessment plan to include sufficient monitoring of the receiving water before, during and following the bypass to enable evaluation of public health risks and environmental impacts; and

(6) Any additional information requested by the Director.

b. Emergency Bypass. Where ninety days advance notice is not possible, the permittee must notify the Director, and the Director of the Department of Natural Resources, as soon as it becomes aware of the need to bypass and provide to the Director the information in *Part IV.G.3.a.(1)* through *(6)* to the extent practicable.

c. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass to the Director as required under *Part III.I., Twenty-four-Hour Notice of Non-Compliance Reporting*. The permittee shall also immediately notify the Director of the Department of Natural Resources, the public and downstream users and shall implement measures to minimize impacts to public health and environment to the extent practicable.

PN DRAFT

H. Upset Conditions.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of *Part IV.H.2.* are met. Director's administrative determination regarding a claim of upset cannot be judiciously challenged by the permittee until such time as an action is initiated for noncompliance.

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   a. An upset occurred and that the permittee can identify the cause(s) of the upset;

   b. The permitted facility was at the time being properly operated;

   c. The permittee submitted notice of the upset as required under *Part III.I, Twenty-four Hour Notice of Noncompliance Reporting*; and,

   d. The permittee complied with any remedial measures required under *Part IV.D, Duty to Mitigate*.

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under *Section 307(a)* of *The Water Quality Act of 1987* for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

J. Changes in Discharge of Toxic Substances. Notification shall be provided to the Director as soon as the permittee knows of, or has reason to believe:

PN DRAFT

1. That any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

a. One hundred micrograms per liter (100 µg/L);

b. Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(7)* or (10); or,

d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

a. Five hundred micrograms per liter (500 µg/L);

b. One milligram per liter (1 mg/L) for antimony:

c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(9)*; or,

d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

K. Industrial Pretreatment. Any wastewaters discharged to the sanitary sewer, either as a direct discharge or as a hauled waste, are subject to Federal, State and local pretreatment regulations. Pursuant to *Section 307* of *The Water Quality Act of 1987*, the permittee shall comply with all applicable federal General Pretreatment Regulations promulgated at *40 CFR 403*, the State Pretreatment Requirements at *UAC R317-8-8*, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the wastewaters.

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In addition, in accordance with *40 CFR 403.12(p)(1)*, the permittee must notify the POTW, the EPA Regional Waste Management Director, and the State hazardous waste authorities, in writing, if they discharge any substance into a POTW which if otherwise disposed of would be considered a hazardous waste under *40 CFR 261*. This notification must include the name of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).

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V. GENERAL REQUIREMENTS

A. Planned Changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in the permit. In addition, if there are any planned substantial changes to the permittee's existing sludge facilities or their manner of operation or to current sludge management practices of storage and disposal, the permittee shall give notice to the Director of any planned changes at least 30 days prior to their implementation.

B. Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and re-issuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit.

E. Duty to Provide Information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records this permit requires to be kept.

F. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed by either a principal executive officer or ranking elected official.

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2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director, and,

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under *Part V.G.2.* is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of *Part V.G.2.* must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under *Part V.G.* shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Penalties for Falsification of Reports. The *Act* provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained

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under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000.00 per violation, or by imprisonment for not more than six months per violation, or by both.

I. Availability of Reports. Except for data determined to be confidential under *UAC R317-8-3.2*, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of Director. As required by the *Act*, permit applications, permits and effluent data shall not be considered confidential

J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the permittee of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under the *Act*.

K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. Severability. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 20 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in *Part V.M.2*.

N. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any

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applicable state law or regulation under authority preserved by *UCA 19-5-117*.

O. Water Quality-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. Water Quality Standards for the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.

2. A final wasteload allocation is developed and approved by the State and/or EPA for incorporation in this permit.

4. A revision to the current Water Quality Management Plan is approved and adopted which calls for different effluent limitations than contained in this permit.

P. Toxicity Limitation-Re-opener Provision. This permit may be reopened and modified (following proper administrative procedures) to include whole effluent toxicity (WET) limitations, a compliance date, a compliance schedule, a change in whole effluent toxicity protocol, additional or modified numerical limitations, or any other conditions related to the control of toxicants if one or more of the following events occur;

1. Toxicity is detected, as per Part I. D. 6 through I.D. 7 of this permit, during the duration of this permit.

2. The TRE results indicate that the toxicant(s) represent pollutant(s) that may be controlled with specific numerical limits, and the Director agrees that numerical controls are the most appropriate course of action.

3. Following the implementation of numerical control(s) of toxicant(s), the Director agrees that a modified biomonitoring protocol is necessary to compensate for those toxicant(s) that are controlled numerically.

4. The TRE reveals other unique conditions or characteristics, which in the opinion of the permit issuing authority justify the incorporation of unanticipated special conditions in the permit.

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State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

L. Scott Baird
Executive Director

DIVISION OF WATER QUALITY
Erica Brown Gaddis, PhD
Director

April 23, 2020

Karin Madsen, Engineering Tech
Genwal Resources, Inc.
PO Box 910
East Carbon, UT 84520
Via Email

Subject: Public Notice of Permit Modification
Genwal Resources, Inc. - Crandall Canyon Mine
UPDES Permit No. UT0024368

Dear Ms. Madsen:

Enclosed for your records is a copy of the Draft Modified UPDES Permit and Public Notice information for the facility referenced above. This information is being made available on-line at https://deq.utah.gov/public-notices/water-quality-public-notices during the 30-day public notice period as appropriate.

If you have any questions with regards to this matter, please contact Jeff Studenka at (801) 536-4395 or jstudenka@utah.gov.

Sincerely,

Dan Hall

Dan Hall, Acting Manager
UPDES Surface Water Section

DH/JAS/blj

Enclosures:
1. Draft Modified Permit (DWQ-2020-008791)
2. Fact Sheet Statement of Basis (DWQ-2020-008789)
3. Map of Outfall Relocation (DWQ-2020-010004)
4. Wasteload Analysis (DWQ-2020-010107 & DWQ-2020-010109)
5. Public Notice (DWQ-2020-009670)

Cc: Via Email w/Enclosures
Amy Clark, US EPA Region VIII
Orion Rogers, Southeast Utah Health Department
Scott Hacking, DEQ SE District Engineer
Steve Christensen, DOGM Coal Program Manager
Chris Cline, US Fish & Wildlife Services
Mike Fowlks, Utah Division of Wildlife Resources
Jason Gipson, Chief, Utah Regulatory Office, US Corps of Engineers

DWQ-2020-009668
FILE: UPDES Section 2

APPENDIX 1-19

UNITED STATES FOREST SERVICE SPECIAL USE PERMIT FOR THE WATER DISCHARGE PIPELINE FROM THE CRANDALL CANYON PORTALS TO HUNTINGTON CREEK

Authorization ID: PRI1907
Contact Name: GENWAL RESOURCES, INC
Expiration Date: 12/31/2049
Use Code: 915

FS-2700-4 (VER. 03/17)
OMB 0596-0082

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

SPECIAL USE PERMIT

Authority: FEDERAL LAND POLICY AND MGMT ACT, AS AMENDED October 21, 1976

GENWAL RESOURCES, INC of PO BOX 910 EAST CARBON UT UNITED STATES 84520 (hereinafter "the holder") is authorized to use or occupy National Forest System lands in the MANTI-LASAL NATIONAL FOREST or Price Ranger District unit of the National Forest System, subject to the terms and conditions of this special use permit (the permit).

This permit covers 1.52 acres or 2.09 miles in the Sec. 5, T. 16 S., R. 7 E., SALT LAKE MERIDIAN, Sec. 4, T. 16 S., R. 7 E., SALT LAKE MERIDIAN , ("the permit area"), as shown on the map attached as Appendix A. This and any other appendices to this permit are hereby incorporated into this permit.

This permit issued for the purpose of:

Allow Genwal Resources, Inc. to construct approximately 2 miles of 8 inch diameter high density polyethylene (HDPE) pipeline to gravity flow intercepted groundwater from the Crandall Canyon Mine portals to the Huntington Creek. With an energy dissipater to be installed near the outfall location, prior to the waters discharge from the pipeline, in order to prevent erosion of the existing bank. Located at T16S, R7E, Sec 4, 5. The proposed pipeline would be constructed within the northern portion of the existing right-of-way for the Crandall Canyon Road (Forest Service Road #50248), and the western bank of the Huntington Creek, near the existing roadway bridge for the Crandall Canyon Road. The proposed pipeline right-of-way width is 6 feet within the roadway, then 20 feet wide within the currently undisturbed area near Huntington Creek as a short portion at the end of the pipeline would deviate from the existing roadway. An additional 20 foot-wide temporary right-of-way is requested within the roadway during construction. Access covers for all manholes will be a lockable type to prevent unauthorized access. The proposed outfall location and proposed channel connecting the pipeline to Huntington Creek will be riprapped, with the new rock blending into the existing landscape to create as aesthetically pleasing of a site as possible.
The total acreage is estimated to be less than 2 acres on FS lands after construction with less than .25 acres to be new disturbance.
After the construction of the pipeline, all previously undisturbed areas will be revegetated and reclaimed. The proposed location of the discharge point appears to be already disturbed. This area will be seeded at the same time as the newly disturbed area. Any asphalt paving that will be removed for the project will be replaced. Any culverts damaged by the project will be repaired or replaced as required. The culvert carrying the Crandall Creek will not be disturbed.

The stipulations, plans, maps, or designs set forth in Appendix A (Map) and Appendix B (Design Features), attached hereto, are incorporated into and made a part of this permit.

TERMS AND CONDITIONS

I. GENERAL TERMS

A. AUTHORITY. This permit is issued pursuant to the FEDERAL LAND POLICY AND MGMT ACT, AS AMENDED October 21, 1976 and 36 CFR Part 251, Subpart B, as amended, and is subject to their provisions.

B. AUTHORIZED OFFICER. The authorized officer is the Forest or Grassland Supervisor or a subordinate officer with delegated authority.

C. TERM. This permit shall expire at midnight on 12/31/2049, 30 Years from the date of issuance.

D. CONTINUATION OF USE AND OCCUPANCY. This permit is not renewable. Prior to expiration of this permit, the holder may apply for a new permit for the use and occupancy authorized by this permit. Applications for a new permit must be submitted at least 6 months prior to expiration of this permit. Issuance of a new permit is at the sole discretion of the authorized officer. At a minimum, before issuing a new permit, the authorized officer shall ensure that (1) the use and

occupancy to be authorized by the new permit is consistent with the standards and guidelines in the applicable land management plan; (2) the type of use and occupancy to be authorized by the new permit is the same as the type of use and occupancy authorized by this permit; and (3) the holder is in compliance with all the terms of this permit. The authorized officer may prescribe new terms and conditions when a new permit is issued.

E. AMENDMENT. This permit may be amended in whole or in part by the Forest Service when, at the discretion of the authorized officer, such action is deemed necessary or desirable to incorporate new terms that may be required by law, regulation, directive, the applicable forest land and resource management plan, or projects and activities implementing a land management plan pursuant to 36 CFR Part 215.

F. COMPLIANCE WITH LAWS, REGULATIONS, AND OTHER LEGAL REQUIREMENTS. In exercising the rights and privileges granted by this permit, the holder shall comply with all present and future federal laws and regulations and all present and future state, county, and municipal laws, regulations, and other legal requirements that apply to the permit area, to the extent they do not conflict with federal law, regulation, or policy. The Forest Service assumes no responsibility for enforcing laws, regulations, and other legal requirements that fall under the jurisdiction of other governmental entities.

G. NON-EXCLUSIVE USE. The use or occupancy authorized by this permit is not exclusive. The Forest Service reserves the right of access to the permit area, including a continuing right of physical entry to the permit area for inspection, monitoring, or any other purpose consistent with any right or obligation of the United States under any law or regulation. The Forest Service reserves the right to allow others to use the permit area in any way that is not inconsistent with the holder's rights and privileges under this permit, after consultation with all parties involved. Except for any restrictions that the holder and the authorized officer agree are necessary to protect the installation and operation of authorized temporary improvements, the lands and waters covered by this permit shall remain open to the public for all lawful purposes.

H. ASSIGNABILITY. This permit is not assignable or transferable.

I. TRANSFER OF TITLE TO THE IMPROVEMENTS.

1. Notification of Transfer. The holder shall notify the authorized officer when a transfer of title to all or part of the authorized improvements is planned.

2. Transfer of Title. Any transfer of title to the improvements covered by this permit shall result in termination of the permit. The party who acquires title to the improvements must submit an application for a permit. The Forest Service is not obligated to issue a new permit to the party who acquires title to the improvements. The authorized officer shall determine that the applicant meets requirements under applicable federal regulations.

J. CHANGE IN CONTROL OF THE BUSINESS ENTITY.

1. Notification of Change in Control. The holder shall notify the authorized officer when a change in control of the business entity that holds this permit is contemplated.

(a). In the case of a corporation, control is an interest, beneficial or otherwise, of sufficient outstanding voting securities or capital of the business so as to permit the exercise of managerial authority over the actions and operations of the corporation or election of a majority of the board of directors of the corporation.

(b). In the case of a partnership, limited partnership, joint venture, or individual entrepreneurship, control is a beneficial ownership of or interest in the entity or its capital so as to permit the exercise of managerial authority over the actions and operations of the entity.

(c). In other circumstances, control is any arrangement under which a third party has the ability to exercise management authority over the actions or operations of the business.

2. Effect of Change in Control. Any change in control of the business entity as defined in paragraph 1 of this clause shall result in termination of this permit. The party acquiring control must submit an application for a special use permit. The Forest Service is not obligated to issue a new permit to the party who acquires control. The authorized officer shall determine whether the applicant meets the requirements established by applicable federal regulations.

II.IMPROVEMENTS

A. LIMITATIONS ON USE. Nothing in this permit gives or implies permission to build or maintain any structure or facility or to conduct any activity, unless specifically authorized by this permit. Any use not specifically authorized by this permit must be proposed in accordance with 36 CFR 251.54. Approval of such a proposal through issuance of a new permit or permit amendment is at the sole discretion of the authorized officer.

B. PLANS. All plans for development, layout, construction, reconstruction, or alteration of improvements in the permit area, as well as revisions to those plans must be prepared by a professional engineer, architect, landscape architect, or other qualified professional based on federal employment standards acceptable to the authorized officer. These plans and plan revisions must have written approval from the authorized officer before they are implemented. The authorized officer may require the holder to furnish as-built plans, maps, or surveys upon completion of the work.

C. CONSTRUCTION. Any construction authorized by this permit shall commence by Fall 2020 and shall be completed by Fall 2021.

III. OPERATIONS.

A. PERIOD OF USE. Use or occupancy of the permit area shall be exercised at least 365 days each year.

B. CONDITION OF OPERATIONS. The holder shall maintain the authorized improvements and permit area to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the authorized officer and consistent with other provisions of this permit. Standards are subject to periodic change by the authorized officer when deemed necessary to meet statutory, regulatory, or policy requirements or to protect national forest resources. The holder shall comply with inspection requirements deemed appropriate by the authorized officer.

C. OPERATING PLAN. The holder shall prepare and annually revise by January 1 an operating plan. The operating plan shall be prepared in consultation with the authorized officer or the authorized officer's designated representative and shall cover all operations authorized by this permit. The operating plan shall outline steps the holder will take to protect public health and safety and the environment and shall include sufficient detail and standards to enable the Forest Service to monitor the holder's operations for compliance with the terms and conditions of this permit. The operating plan shall be submitted by the holder and approved by the authorized officer or the authorized officer's designated representative prior to commencement of operations and shall be attached to this permit as an appendix. The authorized officer may require an annual meeting with the holder to discuss the terms and conditions of the permit or operating plan, annual use reports, or other concerns either party may have.

D. MONITORING BY THE FOREST SERVICE. The Forest Service shall monitor the holder's operations and reserves the right to inspect the permit area and transmission facilities at any time for compliance with the terms of this permit. The holder shall comply with inspection requirements deemed appropriate by the authorized officer. The holder's obligations under this permit are not contingent upon any duty of the Forest Service to inspect the permit area or transmission facilities. A failure by the Forest Service or other governmental officials to inspect is not a justification for noncompliance with any of the terms and conditions of this permit.

IV. RIGHTS AND LIABILITIES

A. LEGAL EFFECT OF THE PERMIT. This permit, which is revocable and terminable, is not a contract or a lease, but rather a federal license. The benefits and requirements conferred by this authorization are reviewable solely under the procedures set forth in 36 CFR 214 and 5 U.S.C. 704. This permit does not constitute a contract for purposes of the Contract Disputes Act, 41 U.S.C. 601. The permit is not real property, does not convey any interest in real property, and may not be used as collateral for a loan.

B. VALID EXISTING RIGHTS. This permit is subject to all valid existing rights. Valid existing rights include those derived under mining and mineral leasing laws of the United States. The United States is not liable to the holder for the exercise of any such right.

C. ABSENCE OF THIRD-PARTY BENEFICIARY RIGHTS. The parties to this permit do not intend to confer any rights on any third party as a beneficiary under this permit.

D. SERVICES NOT PROVIDED. This permit does not provide for the furnishing of road or trail maintenance, water, fire protection, search and rescue, or any other such service by a government agency, utility, association, or individual.

E. RISK OF LOSS. The holder assumes all risk of loss associated with use or occupancy of the permit area, including but not limited to theft, vandalism, fire and any fire-fighting activities (including prescribed burns), avalanches, rising waters, winds, falling limbs or trees, and other forces of nature. If authorized temporary improvements in the permit area are destroyed or substantially damaged, the authorized officer shall conduct an analysis to determine whether the improvements can be safely occupied in the future and whether rebuilding should be allowed. If rebuilding is not allowed, the permit shall terminate.

F. DAMAGE TO UNITED STATES PROPERTY. The holder has an affirmative duty to protect from damage the land, property, and other interests of the United States. Damage includes but is not limited to fire suppression costs and damage to government-owned improvements covered by this permit.

1. The holder shall be liable for all injury, loss, or damage, including fire suppression, prevention and control of the spread of invasive species, or other costs in connection with rehabilitation or restoration of natural resources resulting from the use or occupancy authorized by this permit. Compensation shall include but not be limited to the value of resources damaged or destroyed, the costs of restoration, cleanup, or other mitigation, fire suppression or other types of abatement costs, and all administrative, legal (including attorney's fees), and other costs. Such costs may be deducted from a performance bond required under clause IV.J.

2. The holder shall be liable for damage caused by use of the holder or the holder's heirs, assigns, agents, employees, contractors, or lessees to all roads and trails of the United States to the same extent as provided under clause IV.F.1, except that liability shall not include reasonable and ordinary wear and tear.

G. HEALTH AND SAFETY. The holder shall take all measures necessary to protect the health and safety of all persons affected by the use and occupancy authorized by this permit. The holder shall promptly abate as completely as possible and in compliance with all applicable laws and regulations any physical or mechanical procedure, activity, event, or condition existing or occurring in connection with the authorized use and occupancy during the term of this permit that causes or threatens to cause a hazard to the health or safety of the public or the holder's employees or agents. The holder shall as soon as practicable notify the authorized officer of all serious accidents that occur in connection with these procedures, activities, events, or conditions. The Forest Service has no duty under the terms of this permit to inspect the permit area or operations of the holder for hazardous conditions or compliance with health and safety standards.

H. ENVIRONMENTAL PROTECTION.

1. For purposes of clause IV.H and section V, "hazardous material" shall mean (a) any hazardous substance under section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601(14); (b) any pollutant or contaminant under section 101(33) of CERCLA, 42 U.S.C. 9601(33); (c) any petroleum product or its derivative, including fuel oil, and waste oils; and (d) any hazardous substance, extremely hazardous substance, toxic substance, hazardous waste, ignitable, reactive or corrosive materials, pollutant, contaminant, element, compound, mixture, solution or substance that may pose a present or potential hazard to human health or the environment under any applicable environmental laws.

2. The holder shall avoid damaging or contaminating the environment, including but not limited to the soil, vegetation (such as trees, shrubs, and grass), surface water, and groundwater, during the holder's use and occupancy of the permit area. Environmental damage includes but is not limited to all costs and damages associated with or resulting from the release or threatened release of a hazardous material occurring during or as a result of activities of the holder or the holder's heirs, assigns, agents, employees, contractors, or lessees on, or related to, the lands, property, and other interests covered by this permit. If the environment or any government property covered by this permit becomes damaged in connection with the holder's use and occupancy, the holder shall as soon as practicable repair the damage or replace the damaged items to the satisfaction of the authorized officer and at no expense to the United States.

3. The holder shall as soon as practicable, as completely as possible, and in compliance with all applicable laws and regulations abate any physical or mechanical procedure, activity, event, or condition existing or occurring in connection with the authorized use and occupancy during or after the term of this permit that causes or threatens to cause harm to the environment, including areas of vegetation or timber, fish or other wildlife populations, their habitats, or any other natural resources.

I. INDEMNIFICATION OF THE UNITED STATES. The holder shall indemnify, defend, and hold harmless the United States for any costs, damages, claims, liabilities, and judgments arising from past, present, and future acts or omissions of the holder in connection with the use or occupancy authorized by this permit. This indemnification provision includes but is not limited to acts and omissions of the holder or the holder's heirs, assigns, agents, employees, contractors, or lessees in connection with the use or occupancy authorized by this permit which result in (1) violations of any laws and regulations which are now or which may in the future become applicable; (2) judgments, claims, demands, penalties, or fees assessed

against the United States; (3) costs, expenses, and damages incurred by the United States; or (4) the release or threatened release of any solid waste, hazardous waste, hazardous materials, pollutant, contaminant, oil in any form, or petroleum product into the environment. The authorized officer may prescribe terms that allow the holder to replace, repair, restore, or otherwise undertake necessary curative actions to mitigate damages in addition to or as an alternative to monetary indemnification.

J. BONDING. The authorized officer may require the holder to furnish a surety bond or other security for any of the obligations imposed by the terms and conditions of this permit or any applicable law, regulation, or order.

1. As a further guarantee of compliance with the terms and conditions of this permit, the holder shall deliver and maintain a surety bond or other acceptable security, such as cash deposited and maintained in a federal depository or negotiable securities of the United States, in the amount of **$4,968.00** for Crandall Canyon Discharge Pipeline Reclamation. The authorized officer may periodically evaluate the adequacy of the bond or other security and increase or decrease the amount as appropriate. If the bond or other security becomes unsatisfactory to the authorized officer, the holder shall within 30 days of demand furnish a new bond or other security issued by a surety that is solvent and satisfactory to the authorized officer. If the holder fails to meet any of the requirements secured under this clause, money deposited pursuant to this clause shall be retained by the United States to the extent necessary to satisfy the obligations secured under this clause, without prejudice to any other rights and remedies of the United States.

2. The bond shall be released or other security returned 30 days after (a) the authorized officer certifies that the obligations covered by the bond or other security are met and (b) the holder establishes to the satisfaction of the authorized officer that all claims for labor and material for the secured obligations have been paid or released.

3. Prior to undertaking additional construction or alteration not covered by the bond or other security, or when the authorized improvements are to be removed and the permit area restored the holder may be required to obtain additional bonding or security.

L. INSURANCE. The holder shall furnish proof of insurance, such as a certificate of insurance, to the authorized officer prior to issuance of this permit and each year thereafter that this permit is in effect. The Forest Service reserves the right to review the insurance policy and require any changes needed to ensure adequate coverage of the United States in connection with the authorized use and occupancy. The holder shall send an authenticated copy of any insurance policy obtained pursuant to this clause to the authorized officer immediately upon issuance of the policy. Any insurance policies obtained by the holder pursuant to this clause shall name the United States as an additional insured, and the additional insured provision shall provide for insurance coverage for the United States as required under this clause and to the extent of the full limits of insurance available to the holder. The holder shall give 30 days prior written notice to the authorized officer of cancellation of or any modification to the insurance policy. The certificate of insurance, the authenticated copy of the insurance policy, and written notice of cancellation or modification of insurance policies should be sent to United States C/O Manti La-Sal Supervisors Office, 599-A Price River Drive, Price, UT 84501. Minimum amounts of coverage and other insurance requirements are subject to change at the sole discretion of the authorized officer on the anniversary date of this permit.

1. The holder shall have in force liability insurance covering losses, including those arising from strict liability, associated with the use or occupancy authorized by this permit arising from personal injury or death and third-party property damage in the minimum amount of $ as a combined single limit per occurrence.

2. Depending on the holder's operations, the Forest Service may require the holder to demonstrate the availability of funds to address any release or threatened release of hazardous materials that may occur in connection with the holder's use or occupancy. Any requirements imposed would be established on a case-by-case basis by the authorized officer based on the degree of environmental risk from the holder's operations. The storage and use of normal maintenance supplies in nominal amounts generally would not trigger financial assurance requirements.

V. RESOURCE PROTECTION

A. COMPLIANCE WITH ENVIRONMENTAL LAWS. The holder shall in connection with the use or occupancy authorized by this permit comply with all applicable federal, state, and local environmental laws and regulations, including but not limited to those established pursuant to the Resource Conservation and Recovery Act, as amended, 42 U.S.C. 6901 et seq., the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq., the Oil Pollution Act, as amended, 33 U.S.C. 2701 et seq., the Clean Air Act, as amended, 42 U.S.C. 7401 et seq., CERCLA, as amended, 42 U.S.C. 9601 et seq., the Toxic Substances Control Act, as amended, 15 U.S.C. 2601 et seq., the Federal Insecticide, Fungicide, and Rodenticide Act, as amended, 7 U.S.C. 136 et seq., and the Safe Drinking Water Act, as amended, 42 U.S.C. 300f et seq.

B. VANDALISM. The holder shall take reasonable measures to prevent and discourage vandalism and disorderly conduct and when necessary shall contact the appropriate law enforcement officer.

C. PESTICIDE USE.

1. Authorized Officer Concurrence. Pesticides may not be used outside of buildings in the permit area to control pests, including undesirable woody and herbaceous vegetation (including aquatic plants), insects, birds, rodents, or fish without prior written concurrence of the authorized officer. Only those products registered or otherwise authorized by the U.S. Environmental Protection Agency and appropriate State authority for the specific purpose planned shall be authorized for use within areas on National Forest System lands.

2. Pesticide-Use Proposal. Requests for concurrence of any planned uses of pesticides shall be provided in advance using the Pesticide-Use Proposal (form FS-2100-2). Annually the holder shall, on the due date established by the authorized officer, submit requests for any new, or continued, pesticide usage. The Pesticide-Use Proposal shall cover a 12-month period of planned use. The Pesticide-Use Proposal shall be submitted at least 60 days in advance of pesticide application. Information essential for review shall be provided in the form specified. Exceptions to this schedule may be allowed, subject to emergency request and approval, only when unexpected outbreaks of pests require control measures which were not anticipated at the time a Pesticide-Use Proposal was submitted.

3. Labeling, Laws, and Regulations. Label instructions and all applicable laws and regulations shall be strictly followed in the application of pesticides and disposal of excess materials and containers. No pesticide waste, excess materials, or containers shall be disposed of in any area administered by the Forest Service.

D. ARCHAEOLOGICAL-PALEONTOLOGICAL DISCOVERIES. The holder shall immediately notify the authorized officer of all antiquities or other objects of historic or scientific interest, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered in connection with the use and occupancy authorized by this permit. The holder shall follow the applicable inadvertent discovery protocols for the undertaking provided in an agreement executed pursuant to section 106 of the National Historic Preservation Act, 54 U.S.C. 306108; if there are no such agreed-upon protocols, the holder shall leave these discoveries intact and in place until consultation has occurred, as informed, if applicable, by any programmatic agreement with tribes. Protective and mitigation measures developed under this clause shall be the responsibility of the holder. However, the holder shall give the authorized officer written notice before implementing these measures and shall coordinate with the authorized officer for proximate and contextual discoveries extending beyond the permit area.

E. NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT (NAGPRA). In accordance with 25 U.S.C. 3002(d) and 43 CFR 10.4, if the holder inadvertently discovers human remains, funerary objects, sacred objects, or objects of cultural patrimony on National Forest System lands, the holder shall immediately cease work in the area of the discovery and shall make a reasonable effort to protect and secure the items. The holder shall follow the applicable NAGPRA protocols for the undertaking provided in the NAGPRA plan of action or the NAGPRA comprehensive agreement; if there are no such agreed-upon protocols, the holder shall as soon as practicable notify the authorized officer of the discovery and shall follow up with written confirmation of the discovery. The activity that resulted in the inadvertent discovery may not resume until 30 days after the forest archaeologist certifies receipt of the written confirmation, if resumption of the activity is otherwise lawful, or at any time if a binding written agreement has been executed between the Forest Service and the affiliated Indian tribes that adopts a recovery plan for the human remains and objects.

F. PROTECTION OF THREATENED AND ENDANGERED SPECIES, SENSITIVE SPECIES, AND SPECIES OF CONSERVATION CONCERN AND THEIR HABITAT.

1. Threatened and Endangered Species and Their Habitat. The location of sites within the permit area needing special measures for protection of plants or animals listed as threatened or endangered under the Endangered Species Act (ESA) of 1973, 16 U.S.C. 1531 et seq., as amended, or within designated critical habitat shall be shown on a map in an appendix to this permit and may be shown on the ground. The holder shall take any protective and mitigation measures specified by the authorized officer as necessary and appropriate to avoid or reduce effects on listed species or designated critical habitat affected by the authorized use and occupancy. Discovery by the holder or the Forest Service of other sites within the permit area containing threatened or endangered species or designated critical habitat not shown on the map in the appendix shall be promptly reported to the other party and shall be added to the map.

2. Sensitive Species and Species of Conservation Concern and Their Habitat. The location of sites within the permit area needing special measures for protection of plants or animals designated by the Regional Forester as sensitive species or as species of conservation concern pursuant to FSM 2670 shall be shown on a map in an appendix to this permit and may be shown on the ground. The holder shall take any protective and mitigation measures specified by the authorized officer as necessary and appropriate to avoid or reduce effects on sensitive species or species of conservation concern or their

habitat affected by the authorized use and occupancy. Discovery by the holder or the Forest Service of other sites within the permit area containing sensitive species or species of conservation concern or their habitat not shown on the map in the appendix shall be promptly reported to the other party and shall be added to the map.

H. CONSENT TO STORE HAZARDOUS MATERIALS. The holder shall not store any hazardous materials at the site without prior written approval from the authorized officer. This approval shall not be unreasonably withheld. If the authorized officer provides approval, this permit shall include, or in the case of approval provided after this permit is issued, shall be amended to include specific terms addressing the storage of hazardous materials, including the specific type of materials to be stored, the volume, the type of storage, and a spill plan. Such terms shall be proposed by the holder and are subject to approval by the authorized officer.

I. CLEANUP AND REMEDIATION.

1. The holder shall immediately notify all appropriate response authorities, including the National Response Center and the authorized officer or the authorized officer's designated representative, of any oil discharge or of the release of a hazardous material in the permit area in an amount greater than or equal to its reportable quantity, in accordance with 33 CFR Part 153, Subpart B, and 40 CFR Part 302. For the purposes of this requirement, "oil" is as defined by section 311(a)(1) of the Clean Water Act, 33 U.S.C. 1321(a)(1). The holder shall immediately notify the authorized officer or the authorized officer's designated representative of any release or threatened release of any hazardous material in or near the permit area which may be harmful to public health or welfare or which may adversely affect natural resources on federal lands.

2. Except with respect to any federally permitted release as that term is defined under Section 101(10) of CERCLA, 42 U.S.C. 9601(10), the holder shall clean up or otherwise remediate any release, threat of release, or discharge of hazardous materials that occurs either in the permit area or in connection with the holder's activities in the permit area, regardless of whether those activities are authorized under this permit. The holder shall perform cleanup or remediation immediately upon discovery of the release, threat of release, or discharge of hazardous materials. The holder shall perform the cleanup or remediation to the satisfaction of the authorized officer and at no expense to the United States. Upon revocation or termination of this permit, the holder shall deliver the site to the Forest Service free and clear of contamination.

VI. LAND USE FEE AND DEBT COLLECTION

A. LAND USE FEES. The holder shall pay an initial annual land use fee of $413.10 for the period from May 2020 to December 2024, and thereafter on January 1st every 5 years, shall pay an annual land use fee of $413.10. The annual land use fee shall be adjusted annually using the insert applicable indexing factor.

B. MODIFICATION OF THE LAND USE FEE. The land use fee may be revised whenever necessary to reflect the market value of the authorized use or occupancy or when the fee system used to calculate the land use fee is modified or replaced.

C. FEE PAYMENT ISSUES.

1. Crediting of Payments. Payments shall be credited on the date received by the deposit facility, except that if a payment is received on a non-workday, the payment shall not be credited until the next workday.

2. Disputed Fees. Fees are due and payable by the due date. Disputed fees must be paid in full. Adjustments will be made if dictated by an administrative appeal decision, a court decision, or settlement terms.

3. Late Payments

(a) Interest. Pursuant to 31 U.S.C. 3717 et seq., interest shall be charged on any fee amount not paid within 30 days from the date it became due. The rate of interest assessed shall be the higher of the Prompt Payment Act rate or the rate of the current value of funds to the United States Treasury (i.e., the Treasury tax and loan account rate), as prescribed and published annually or quarterly by the Secretary of the Treasury in the Federal Register and the Treasury Fiscal Requirements Manual Bulletins. Interest on the principal shall accrue from the date the fee amount is due.

(b) Administrative Costs. If the account becomes delinquent, administrative costs to cover processing and handling the delinquency shall be assessed.

(c) Penalties. A penalty of 6% per annum shall be assessed on the total amount that is more than 90 days delinquent and

shall accrue from the same date on which interest charges begin to accrue.

(d) Termination for Nonpayment. This permit shall terminate without the necessity of prior notice and opportunity to comply when any permit fee payment is 90 calendar days from the due date in arrears. The holder shall remain responsible for the delinquent fees.

4. Administrative Offset and Credit Reporting. Delinquent fees and other charges associated with the permit shall be subject to all rights and remedies afforded the United States pursuant to 31 U.S.C. 3711 et seq. and common law. Delinquencies are subject to any or all of the following:

(a) Administrative offset of payments due the holder from the Forest Service.

(b) If in excess of 60 days, referral to the United States Department of the Treasury for appropriate collection action as provided by 31 U.S.C. 3711(g)(1).

(c) Offset by the Secretary of the Treasury of any amount due the holder, as provided by 31 U.S.C. 3720 et seq.

(d) Disclosure to consumer or commercial credit reporting agencies.

5. Consolidated Payment. Payment of annual land use fees for 5 years shall be consolidated. The first consolidated payment shall be made on May 1, 2020, when the first full annual land use fee payment is due, and thereafter every 5 years from January 1st, until this permit expires.

VII. REVOCATION, SUSPENSION, AND TERMINATION

A. REVOCATION AND SUSPENSION. The authorized officer may revoke or suspend this permit in whole or in part:

1. For noncompliance with federal, state, or local law.

2. For noncompliance with the terms of this permit.

3. For abandonment or other failure of the holder to exercise the privileges granted.

4. With the consent of the holder.

5. For specific and compelling reasons in the public interest.

Prior to revocation or suspension, other than immediate suspension under clause VII.B, the authorized officer shall give the holder written notice of the grounds for revocation or suspension and a reasonable period, typically not to exceed 90 days, to cure any noncompliance.

B. IMMEDIATE SUSPENSION. The authorized officer may immediately suspend this permit in whole or in part when necessary to protect public health or safety or the environment. The suspension decision shall be in writing. The holder may request an on-site review with the authorized officer's supervisor of the adverse conditions prompting the suspension. The authorized officer's supervisor shall grant this request within 48 hours. Following the on-site review, the authorized officer's supervisor shall promptly affirm, modify, or cancel the suspension.

C. APPEALS AND REMEDIES. Written decisions by the authorized officer relating to administration of this permit are subject to administrative appeal pursuant to 36 CFR Part 214, as amended. Revocation or suspension of this permit shall not give rise to any claim for damages by the holder against the Forest Service.

D. TERMINATION. This permit shall terminate when by its terms a fixed or agreed upon condition, event, or time occurs without any action by the authorized officer. Examples include but are not limited to expiration of the permit by its terms on a specified date and termination upon change of control of the business entity. Termination of this permit shall not require notice, a decision document, or any environmental analysis or other documentation. Termination of this permit is not subject to administrative appeal and shall not give rise to any claim for damages by the holder against the Forest Service.

E. RIGHTS AND RESPONSIBILITIES UPON REVOCATION OR TERMINATION WITHOUT ISSUANCE OF A NEW PERMIT. Upon revocation or termination of this permit without issuance of a new permit, the holder shall remove all structures and improvements, except those owned by the United States, within a reasonable period prescribed by the

authorized officer and shall restore the site to the satisfaction of the authorized officer. If the holder fails to remove all structures and improvements within the prescribed period, they shall become the property of the United States and may be sold, destroyed, or otherwise disposed of without any liability to the United States. However, the holder shall remain liable for all costs associated with their removal, including costs of sale and impoundment, cleanup, and restoration of the site.

VIII. MISCELLANEOUS PROVISIONS

A. MEMBERS OF CONGRESS. No member of or delegate to Congress or resident commissioner shall benefit from this permit either directly or indirectly, except to the extent the authorized use provides a general benefit to a corporation.

B. CURRENT ADDRESSES. The holder and the Forest Service shall keep each other informed of current mailing addresses, including those necessary for billing and payment of land use fees.

C. SUPERSEDED PERMIT. This permit supersedes a special use permit designated n/a.

D. SUPERIOR CLAUSES. If there is a conflict between any of the preceding printed clauses and any of the following clauses, the preceding printed clauses shall control.

E. GROUND SURFACE PROTECTION AND RESTORATION (D-9).
The holder shall prevent and control soil erosion and gullying on National Forest System lands in and adjacent to the permit area resulting from construction, operation, maintenance, and termination of the authorized use. The holder shall construct authorized improvements so as to avoid accumulation of excessive amounts of water in the permit area and encroachment on streams. The holder shall revegetate or otherwise stabilize (for example, by constructing a retaining wall) all ground where the soil has been exposed as a result of the holder's construction, maintenance, operation, or termination of the authorized use.

F. NOXIOUS WEED AND EXOTIC PLANT PREVENTION AND CONTROL (D-10).
The holder shall be responsible for the prevention and control of noxious weeds and exotic plants arising from the authorized use. For purposes of this clause, noxious weeds and exotic plants include those species recognized as such by Federal, State, or local agency. The holder shall follow prevention and control measures required by Federal, State, or local agency. When determined to be necessary by the Authorized Officer, the holder shall develop a plan for noxious weed and exotic plant prevention and control. These plans must have prior written approval from the Authorized Officer and, upon approval, shall be attached to this permit as an appendix.

G. WATER FACILITIES AND WATER RIGHTS (D-25).
This permit does not confer any water rights on the holder. Any necessary water rights must be acquired by the holder in accordance with State law. Any expenses for acquiring water rights shall be the responsibility of the holder. The United States reserves the right to place any conditions on installation, operation, maintenance, and removal of facilities to pump, divert, store, or convey water on National Forest System lands covered by this permit that are necessary to protect public property, public safety, and natural resources on National Forest System lands in compliance with applicable law. The holder waives any claims against the United States for compensation in connection with imposition of any conditions on installation, operation, maintenance, and removal of water facilities under this permit.

H. IMPROVEMENT RELOCATION (X-33).
This authorization is granted with the express understanding that should future location of United States Government-owned improvements or road rights-of-way require the relocation of the holder's improvements, such relocation will be done by, and at the expense of, the holder within a reasonable time as specified by the Authorized Officer.

THIS PERMIT IS ACCEPTED SUBJECT TO ALL ITS TERMS AND CONDITIONS.

BEFORE ANY PERMIT IS ISSUED TO AN ENTITY, DOCUMENTATION MUST BE PROVIDED TO THE AUTHORIZED OFFICER OF THE AUTHORITY OF THE SIGNATORY FOR THE ENTITY TO BIND IT TO THE TERMS AND CONDITIONS OF THE PERMIT.

ACCEPTED:

_____

MATT EFAW SIGNATURE DATE
GENWAL RESOURCES

APPROVED:

_____

RYAN NEHL SIGNATURE DATE
MANTI LA-SAL
FOREST SUPERVISOR

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0082. The time required to complete this information collection is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

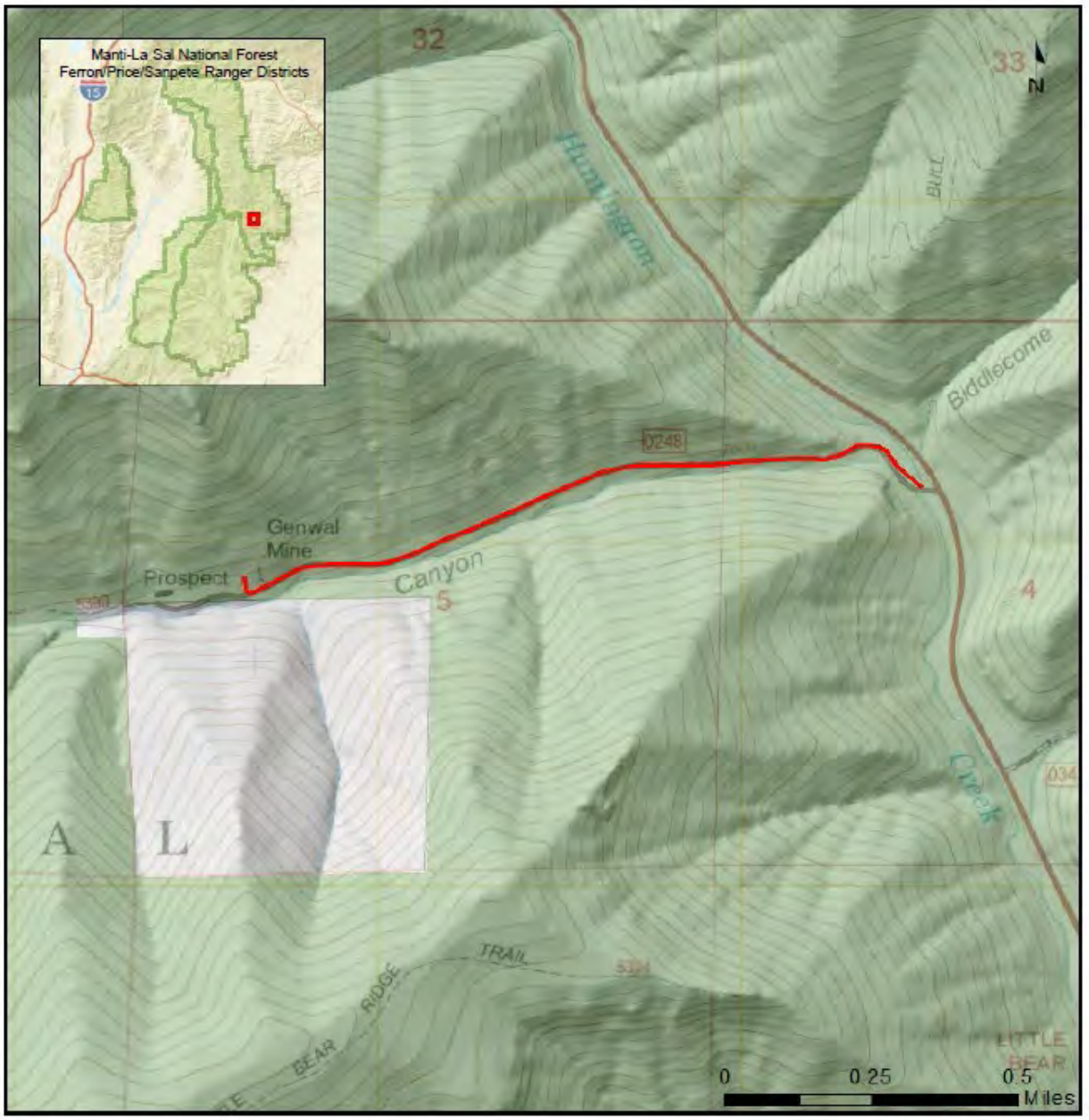
The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and, where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free (866) 632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (866) 377-8642 (relay voice). USDA is an equal opportunity provider and employer.

The Privacy Act of 1974 (5 U.S.C. 552a) and the Freedom of Information Act (5 U.S.C. 552) govern the confidentiality to be provided for information received by the Forest Service.

APPENDIX A

(Map)



Legend

- Proposed Pipeline
- National Forest
- Private

Location Map
Crandall Canyon Water Pipeline
November 21, 2019

The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary.
They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc.
Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification.

APPENDIX B - DESIGN FEATURES

CONSTRUCTION AND RECLAMATION

- The trench for the pipeline would be excavated with a trenching machine, track hoe excavator, or similar equipment. Topsoil and subsoil would be segregated and stockpiled separately adjacent to the trench. After the pipeline was installed, the stockpiled subsoil would be used to backfill the trench, and the topsoil would be replaced on the surface and graded to pre-disturbance contours.
- Large rocks that are unsuitable for fill would be placed on the surface within the road right-of-way, outside of the safety clear zone. If the excavated rock contrasts with the natural surface, the contrasting material would be removed from the right-of-way and disposed of in an appropriate location off-site.
- The pipeline would include a shut-off valve at the mine entrance.
- Bedding material would be placed in the trench below and above the pipeline. Such bedding material serves two principal functions: protection of the pipe from mechanical damage during installation and trench filling, and stabilization of the pipe in the event of seismic shifts or frost heaves.
- The pipeline would be buried with at least 5 feet of cover.
- Air vents and Carsonite posts would be installed approximately every 1,000 feet along the alignment; these features would be about 4 feet high but would be colored to be visually unobtrusive from the roadway.
- No permanent roads would be constructed during project implementation. All construction activities would take place alongside and within the right-of-way of existing roads.
- Construction is anticipated to take 3 to 4 months in 2020, depending on weather conditions and other factors.
- Stabilization and rehabilitation would be conducted according to the Green River District Reclamation Guidelines, as detailed in the Reclamation Plan to address the Scenic Byway concerns.
- All disturbed areas would be reseeded immediately following reclamation. Native species would be used.

NOXIOUS/INVASIVE WEEDS

- All disturbance areas would be monitored for noxious weeds annually, for a minimum of three growing seasons following completion of the project, or until desirable vegetation was established. If found, weeds would be treated as described in the reclamation plan.
- Clean all equipment with a power wash before entry onto public land to remove noxious weed seed. All equipment must be inspected by the COR or designated project inspector before entry onto public lands.
- Noxious weed free certification will be required for all straw or hay bales used for mulch, and for any seed mixes used for the project.
- Any seeding for erosion control and restoration will use an approved native seed and pollinator friendly mix specified for this project.
- Range Management personnel will review the area prior to operations to identify any weed pockets that should be treated or avoided during implementation. Construction/disturbance areas will be monitored for a minimum of three years following construction. Existing or new weed populations will be treated in accordance with existing noxious weed management decisions.

SOILS

- A temporary fence may be needed around the area of new disturbance that would remain in place until plant cover is sufficient to protect soil and erosion
- Reconstruct the disturbed area to original contours, particularly drainages.
- Topsoil will be salvaged, stockpiled, and replaced upon completion of construction. Topsoil storage will be identified with appropriate signage. Topsoil will not be stored beyond one growing season.
  After construction, Genwal Resources, Inc. would maintain the right-of-way and allow the pipeline to operate continuously. The pipeline is intended to be permanent: if the pipeline were decommissioned, it will be determined at that time whether it would be left in the ground to avoid further ground disturbance.

CULTURAL RESOURCES

- Evaluate, protect, and monitor all National Register eligible sites. The boundaries of all NRHP-eligible sites will be fenced prior to project implementation. These will be avoided during construction activities or managed as agreed through SHPO consultation. The use of wheeled or tracked equipment is prohibited within the fenced site boundaries.

- Discovery of previously unknown sites, surface or subsurface, may occur during project implementation. If discovered, project activity in the vicinity of the cultural resource would cease and the USFS representative notified immediately. All cultural resources shall be protected in accordance with Federal Laws.
- All persons associated with this project will be informed that they will be subject to prosecution for knowingly disturbing Euro-American and Native American historic and prehistoric archaeology sites, or for collection artifacts of any kind, including historic items and/or arrowheads and pottery fragments from Federal lands.

WATER RESOURCES

- A stormwater pollution prevention plan and spill prevention and response plan would be prepared and implemented to ensure compliance with the Clean Water Act during construction. Temporary erosion control measures could include sediment barriers such as silt fence or fiber rolls. Permanent erosion control measures would include trench breakers and revegetation where suitable with in the road right-of-way.
- The intercepted groundwater from the mine would be discharged in accordance with existing permits or policy.

WILDLIFE

Golden Eagle

- No proposed treatment related activities will be allowed within ½ mile of active nests from January 1-August 31, unless it is determined by a Wildlife Biologist that activities will not cause nest abandonment. Determinations may be related to direct line of sight, position of cliff, topography, etc.

MONITORING

The water quality of the mine discharge would be sampled at least monthly and analyzed for compliance with DEQ water quality numeric criteria and submitted to UDOGM monthly.

APPENDIX 5-22

CRANDALL CANYON MINE SITE RECLAMATION PLAN

(Revised April 2020)

CRANDALL CANYON MINE SITE RECLAMATION PLAN

HISTORICAL NOTE: Due to the tragic mine disaster of August 6, 2007, the Crandall Canyon Mine has been temporarily sealed. Water has gradually backed up in the mine and is now discharging from behind the temporary 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 directly below the Crandall Canyon Mine portals. Based upon data obtained from water sampling and monitoring conducted by Petersen Hydrologic, LLC and Genwal Resources, long-term treatment of the mine discharge water may not be required because naturally-occurring chemical processes within the mine appear to be reducing the iron content of the water to within compliance limits (see Appendix 5-30). The pre-treatment iron content of the mine-water discharge has been trending downward over the past several years. Due to the improved quality of the mine-water discharge, Outfall #002 of the UPDES Permit has been moved to the western bank of the Huntington Creek. The mine water is carried via a pipeline from the portals directly to the new outfall location per Appendix 5-30. The new pipeline and its associated structures will remain after final reclamation of the mine surface facilities due the projected continued water discharge from the mine portals.

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 and rescuers, owned and maintained by Emery County. This area is included as a portion of the final reclamation plan for the mine. See Appendix 5-27.

Final Reclamation

The final reclamation of the disturbed areas of the Crandall Canyon Mine site is described in outline form and in detail below. This description is based upon discussions in the text of Chapters 2, 3, 4, 5, and 7, which address the regulations regarding reclamation requirements. For reference purposes, several general areas within the mine yard have been determined. Please refer to Figure 1 of this Appendix for a map delineating the different areas within the mine site. Circumstances are present within some of these areas that require specialized reclamation practices. Those issues will be detailed below. Within each of these general areas, reclamation will follow a general sequence of 1) demolition, 2) backfilling, grading, 3) topsoil application, 4) apply hay mulch, 5) pocking (deep gouging), and 6) revegetation. However, in practice, these reclamation steps will be ongoing in several areas simultaneously. **The final step of reclamation, revegetation, for all the areas will not be done until the fall.**

Soil stabilization and sediment control after final reclamation is extremely important. Section R645-301-763.100 of the Utah Administrative Code requires sediment ponds to remain in-place for a minimum of two (2) years of the last augmented revegetation of a reclaimed mine

site. Genwal proposes to utilize a deep-gouging soil stabilization method known as “pocking,” in lieu of keeping the sediment pond in-place for two years. Pocking is a method of deep gouging newly topsoiled areas using a trackhoe or backhoe to excavate multiple shallow pits with diameters from three (3) to six (six) feet in diameter into the regraded and topsoiled slopes. The depths of these pits would range from 1.5 to three (3) feet, as measured from the rim of the pit. Soil from each excavated gouge is placed around each pit. The gouges are constructed in a random, overlapping pattern. When completed, walking across the area is typically difficult. Pocking enhances water collection from precipitation in the pits, which in turn enhances plant growth and development. Deep gouging also prevents soil loss through erosion as the pits collect the soil disturbed during precipitation events. Attachment #2 to this appendix further describes the advantages of the proposed pocking techniques utilized during final reclamation actions.

Genwal recognizes that the development of a feasible reclamation plan for final reclamation of the mine site 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 of this Appendix, was written in response to Genwal’s discussions held with JBR as the reclamation plan was being revised. Genwal believes 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 providing new and better reclamation ideas. Genwal commits to modifying the reclamation plan prior to final reclamation should better reclamation products and methodologies become available. This reclamation plan will be reviewed prior to implementation in order to incorporate applicable methodology and techniques which are considered best technology currently available (BTCA) at the time of reclamation.

Reclamation activities will not begin until all mining operations have been permanently ceased, and the portals and surface facilities are no longer needed to support the mine. All portals will have been sealed and backfilled. The four portals on the north side (Crandall Canyon Mine) are: bath house entrance, intake air entry, belt entry and fan (return air) entry. The three portals on the south side (Princess Mine) are the intake, belt and fan entries. The seals will be constructed approximately 25-35 feet inward from the portal openings, and will be built in accordance with MSHA regulations. Equipment necessary for sealing the portals 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 (see description below) to create an earthen plug.

Some permanent features are expected to remain after final reclamation has been completed. These features include the memorial to the fallen miners, and the concrete walkway from the parking area to the memorial site. A portion of the existing Expansion Area and 72"

diameter bypass culvert will also remain for access to the memorial on ground that is owned by Emery County per the Memorandum of Understanding (MOU) between Genwal and Emery County (Appendix 5-27). Also, a buried mine water discharge piping system from the Crandall Canyon Mine portals to Huntington Creek will also remain for permanent use (Appendix 5-30). The Forest Service Road that runs from State Highway 31 at the mouth of Crandall Canyon to the Forest Service Parking Area at the northwest corner of the mine site will remain after final reclamation, as will the existing Forest Service hiking trail extending to the west of the parking area. The paving for this roadway will be removed and the width of the roadway will be reduced per Forest Service requirements. The previously described pocks will also remain at the newly graded areas as described above.

Subsequent interim sediment control will be provided by the gouges (pocking) and surface mulch. Long-term sediment control of the reclaimed areas will be provided by the gouges and the vegetative regrowth.

Reference Area Descriptions

The reclamation plan has been divided into several general reference areas for the purpose of explanation. Reclamation actions will occur in multiple areas of the mine site during the same time intervals. These reference areas are depicted in Figure 1 of this appendix, and described in summary below.

Portal Area: The Portal Area consists of an inclined access road, the mine portals leading into the Crandall Canyon Mine underground workings, and support structures in this area atop the sandstone highwall upon the portal bench.

Expansion Area: In 1997, the surface facilities were expanded to the area south of the Forest Service road by culverting approximately 1,500 feet of the Crandall Canyon Creek through a 72" diameter bypass culvert. Earthen fill material was trucked in to construct the Expansion Area. The truck loadout facilities are now located within 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 material 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 channel and bypass culvert, and south of the existing Forest Service road. The South Slope Expansion Area includes the steeper hillside located south of the existing Crandall Creek channel and bypass culvert. 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 upon input from

reclamation specialists who have experience in steep-slope reclamation situations.

Old Substation Area: The Old Substation Area is 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 power line and associated poles, 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 Portal Area. This is the area where coal was previously stockpiled and loaded into trucks prior to construction of the 1997 expansion area. This area currently includes the area used for the water treatment facilities.

Forest Service Road: The Forest Service Road runs east-west through the mine site. The road is to be kept in place following reclamation activities, but will undergo a change in width per the Forest Service road permit requirements.

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. Installation of Temporary Sediment Control Structures in Preparation for Reclamation Operations
2. Demolition and Removal of Structures within the Disturbed Area
3. Removal of Asphalt Paving within the Disturbed Area
4. Expansion Area Fill Removal and Recontouring
5. Backfill, Regrade and Recontour to Approximate Original Contours (AOC)
6. Restoration of South and North Hillside Slopes - Expansion Area
7. Construction of the Fish Barrier in Crandall Creek
8. Removal and Disposal of the 72"
9. Removal of the Sedimentation Pond
10. Topsoiling and Pocking - North Slope of the Expansion Area
11. Topsoiling and Pocking - Recontoured Fill Areas
12. Restoration of the Stream Channel
13. Revegetation - South Slope of the Expansion Area
14. Revegetation of the Stream Channel
15. Revegetation - North Slope of the Expansion Area
16. Revegetation - Recontoured Areas
17. Completion of Forest Service Road and Parking Area
18. Topsoil Stockpile Locations Reclamation
19. Maintenance and Monitoring of Reclaimed Areas

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

4/97 Revised 4/2020

RECLAMATION PLAN DETAIL

1. Installation of Temporary Sediment Control Structures in preparation for Reclamation Operations

Prior to beginning any reclamation operations, temporary sediment control structures will be installed across the entire width of all drainage channels at the disturbed area boundaries, as well as at the inlets of all culverts reporting to the 72" bypass culvert for the Crandall Creek to minimize negative impacts to water quality. These structures include silt fences, rolled fiber (excelsior logs) and stone check dams, and hay bale barriers (see Plate 5-16). Two (2) rows of silt fences will be constructed within Crandall Creek below the outlet of the 72" culvert and extend a minimum of ten feet beyond the water's edge on either bank. The silt fences within Crandall Creek will be reinforced with chain-link fencing. These silt fences will be located in an area convenient for maintenance and cleanout. Silt fences will also be installed on each side of the Crandall Creek as the streambed is restored to prevent sediment from entering the creek. Rolled fiber and/or stone check dams will be installed within drainage ditches within the disturbed boundary area at intervals of not more than 50 feet. Sediment control structures will remain in place and maintained for a minimum of two (2) years after final reclamation has been completed, or until the new vegetation in the reclaimed areas has matured sufficiently to stop the flow of sediments into water channels; whichever is longer.

2. Demolition and Removal of Structures within the Disturbed Area Boundary

When mining operations are 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.

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

At the Portal Area, facilities to be removed are: underground bath house, mine fan, fan transformer (portable), belt transfer station, guard rail at top and along the Portal Access Road, water pipelines, the diversion culvert above portals, and fencing around the portal bench. The existing mine water discharge piping will remain. Coordinate with Appendix 5-30.

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

Loose combustible materials have been removed from the underground workings. Any structures that would interfere with sealing of the portals, such as beltline structure, will be

removed.

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. The termination structure for the mine power line will also be dismantled and removed from the site prior to completion of final reclamation.

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 (4) feet of backfill material.

Facilities to be removed from the Old Loadout Area include: the water treatment settling pond, storage/operations shed, and HDPE piping, except that which will remain after final reclamation. Coordinate with Appendix 5-30. 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. The sludge within the water treatment settling pond will be removed and disposed of at the Burma Pond prior to the removal of the water treatment pond.

The facilities to be removed from the Expansion Area are: overhead conveyors, stacking tube, reclaim vault and tunnel/escapeway tube, crusher building, MCC building, loadout conveyor, truck loadout and loading platform. 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.

3. Removal of Asphalt Paving within the Disturbed Area Boundary

All asphalt paving at the mine surface facilities site and along the Forest Service Road, from the bridge over Huntington Creek to the trail head/turnaround, will be removed and taken to an approved RCRA disposal site. As stipulated in the existing Forest Service special use permit (8/26/89) regarding the road, during final reclamation the asphalt paving and asphalt curbing for the entire roadway will be removed. Silt fences will be installed along the length of the Forest Service Road at the downslope side of the roadway prior to the removal of any asphalt paving or curbing to prevent any sediment from leaving the roadway area. The width of the road surface within the permit area will be reduced from a 27-foot subgrade and 24-foot wide running surface to a 20-foot subgrade and 14-foot wide running surface. For safety reasons, the northern boundary of the roadway, closest to the cliff faces and away from the downslope to Crandall Creek, will remain. Removal of road base and reclamation of the roadway outside of the new subgrade line will occur closest to the downslope to Crandall Creek. The 7-foot wide section of road base will be salvaged beyond the remaining 20-foot subgrade, and spread onto the remaining 14-foot wide running surface to create a 12-inch thick minimum road surface. The subsoil that remains beyond the new 20-foot subgrade boundary will be scarified, and twelve (12) inches of topsoil will be applied and feathered into the existing undisturbed soil. The topsoil

will be left rough and pitted to limit rilling and to provide for water retention to enhance seed germination. No topsoil will be spread when the subsoil or topsoil is frozen, wet or powdery. Interim seeding of the newly laid topsoil will be accomplished within one week of final grading, weather and soils conditions permitting. The seed will be of the approved mixture for interim seeding. If the soil surface is crusted, appropriate measures will be taken to break up crusted areas prior to seeding. Mulch will be applied over the newly applied topsoil and interim seeding. The newly topsoiled areas will receive final vegetation as described below in the fall.

No removed asphalt paving will be buried within the reclaimed areas of the mine site.

Asphalt paving will be removed utilizing the following equipment: trackhoe, backhoe, front ent loader, and highway end dump trucks. Similar equipment will be utilized to reclaim and spread the road base outside of the new required twenty (20) foot subgrade boundary. A road roller (road compactor) will be used to compact the length and width of the remaining roadway surface.

4. Expansion Area Fill Removal and Recontouring

After the removal of all structures from the Expansion Area, excess fill material from this area will be utilized as fill material to backfill, regrade and recontour areas within the disturbed boundary to the approximate origin contours of the mine site prior to any mining activities. Original contours of areas outside of the Expansion Area are not available. Therefore, these areas will be recontoured to blend with the existing landscape outside of the disturbed boundary.

Reclamation of the Expansion Area (which includes the south portal access ramp) is different from the other reclaimed areas because restoration to the approximate original contour (AOC) involves removal of fill material rather than placement of backfill material. As described in the following sections, fill material removed from the Expansion Area will be used to regrade and restore approximate original contour at the Portal 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 hauled to either the Burma Pond for reclamation of that site, or taken to another mine site owned by the Permittee to be utilized at that location.

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 below, 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, mulching, pocking in slopes of less than 2 horizontal units to 1 vertical unit, 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.

Equipment used in the Expansion Area fill removal and recontouring include: a front end loader, a backhoe, highway end dump trucks, a trackhoe, a crane, etc.

Cut and fill yardage calculations (see table on Plate 5-17a) were made utilizing the Reclamation Profiles shown on Plate 5-17a. The profiles were drawn using Autocad Map 3D 2017 by Autodesk and Carlson Software's Civil 2017 drafting software, based upon the existing contours lines shown on Plates 5-3 and 5-3a, as well as the reclaimed contours shown on Plate 5-17. At each section noted on Plate 5-17 and drawn on Plate 5-17a, the existing and reclaimed profiles were drawn using the same elevation grid for each station. Cut areas, where the reclaimed profile line lies below the existing surface line, are solid hatched (colored) in a pinkish color. Likewise, fill areas, where the reclaimed surface line lies above the existing surface line, are solid hatched a light blue color.

The Cut/Fill Tabulations table on Plate 5-17a is a Microsoft Excel spreadsheet that has been imported into the Autocad drawing. Within the table, each Station Number (Section Number) is listed on the left-hand side of the table. The cut and fill calculations are shown in similar colors for cuts and fills as are shown on the respective profile station numbers. The drafting program, Autocad Map 3D listed above, has the ability to calculated the area of complex shapes. Utilizing this tool, the Total Area of the pink cut and blue fill areas is listed on the respective row of the tabulation table to four (4) significant digits within the spreadsheet. These numbers are rounded within the spreadsheet to two (2) significant digits for clarity. However, the calculations within the spreadsheet itself still utilize the four (4) significant digits. The calculated area number, which is the total Area in square feet of the cut or fill area, is then multiplied by fifty (50) feet, which is the Distance Between Stations in feet, to achieve the Total Cubic Footage of each cut and fill area for each respective Station Number, or profile. The Total Cubic Footage number is then divided by twenty seven (27) cubic feet, which is the footage of one cubic yard (3' wide x 3' long x 3' tall) of volume. This calculation provides the Total Cubic Yardage for each cut and fill area for each Station Number. The Total Cubic Yardage numbers for cuts and fills are then added together to achieve the Subtotal numbers for cuts and fills across the mine site.

The Cut Subtotal number is then multiplied by 0.18 (18%) for a Swell Factor. As undisturbed or compacted soils are excavated, the particles of soil separate and the volume increases due to voids (air pockets) that form after excavation. This is known as the "Swell Factor." This is the reason that when one digs a hole, the excavated soil will not completely fit within the hole from where it just came. The Total Topsoil amount listed in Chapter 2 is then

listed under the Cut side of the table, because the topsoil will be removed (cut) from its current location within the stockpiles. Adding these numbers together (Subtotal, Swell Factor, and Topsoil yardages) provides the Total Cut (cubic yards) for the entire project.

The Fill Subtotal is the sum of the calculated cubic yardage numbers for each respective Station Number (profile number) shown on Plate 5-17a. The Topsoil for Crandall Canyon Road Reclamation is added to the fill Subtotal because this is fill material that will be utilized from the topsoil stockpiles. This yardage number is listed in Chapter 2 of the MRP. This topsoil cubic yardage is then added to the Fill Subtotal to achieve the Total Fill (cubic yards) number. The difference between the Total Cut (cubic yards) and the Total Fill (cubic yards) determines the remaining excess cut material.

Fill material, in excess of that needed for backfilling the Portal Area, Shop Area and Old Loadout Area (an estimated 57,991.06 loose cubic yards, see table on Plate 5-17a) will be loaded, and hauled to either the Burma Pond site for reclamation, or mine sites owned by the Permittee for use as needed at the respective mine site.

5. Backfill, Regrade and Recontour to Approximate Original Contours (AOC)

This work consists of backfilling the cuts to approximate original contour (AOC), less the forthcoming topsoil layer. Placing topsoil on the backfilled area and seeding the topsoiled area will be discussed below. Please see Plate 5-17 for new contours.

As 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 portal bench, 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.

With the Portal Area reclamation completed and a portion of the concrete retaining wall removed, work may continue at the Shop Area. Although this area is not as steep as the previous area, the same reclamation procedures will be used. The cut slope behind the shop/warehouse building 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 12 to 18 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.

The reclamation work at the Old Loadout Area will proceed generally using the same

reclamation procedures previously described. However, at the exposed sandstone face (high wall), a rock drainage system will be installed consisting of a rock layer installed against the rock face for its full height. Two perforated drain pipes will be installed to catch seepage from the rock face. One perforated pipe will be placed at and run along the top of the existing eight-foot tall concrete retaining wall. The second perforated pipe will be place at and run along the bottom of the existing concrete retaining wall. These drain pipes will connect to the mine water discharge piping described in Appendix 5-30. A layer of geotextile fabric will separate the fill material from the rock drainage system. See Appendix 5-28 for details of the drain system and the installation of the fill material.

The cut slope / rock face 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 / rock face. A dozer/loader will spread the material in lifts of a depth as detailed in Appendix 5-28. 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 as it is blended into the fill over the portal bench where needed. 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.

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. The lifts will be built up horizontally with a slight slope on each lift toward the highwall. Material will be spread into lifts of 12 to 18 inches deep, except for the Old Loadout Area which will be filled per Appendix 5-28. 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.

6. 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 disassembled 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.

Following the surface facility demolition activities, fill material will be removed from the Expansion Area in approximately 5'-10' lifts. Due to the Memorandum of Understanding (MOU) with Emery County (Appendix 5-27), 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 minimum 35-foot wide berm will be left intact at the culvert inlet to continue to serve as access to the memorial that exists to the west of the mine site. A new outlet structure and new stone riprap energy dissipater (to be constructed similarly to the existing structure at the existing outlet of the 72" culvert) will be installed at the new end of the 72" culvert. Please see Plate 5-17.

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).

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 covering the channel in situ with a geotextile fabric during the 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 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, leaving the memorial access in-place. At the intersection of the South Slope and the pad fill, the marker soil/geotextile fabric is located. The marker soil will be carefully removed from atop 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 existing 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 interim seeding per the approved seed mix will be applied 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 received interim seeding, wood fiber mulch will be applied (see below) and another lift (5-10 feet of fill) will be removed from the fill. Recontouring, interim seeding, and mulch work will continue on the next increment of hillside below the previous level. This work will be done in continued successive lifts, involving fill removal, peeling away the geotextile, revitalization of the in-place topsoil, interim seeding, and mulching of the newly exposed increment.

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 after soils samples have been taken for analysis, as described below, to determine if other nutrients are needed within the existing soil. 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).

It should be noted that approximate original contour of the North Slope of the Expansion Area will also be reestablished 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 as required.

By removing the fill in 5'-10' lifts, and simultaneously recontouring 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 activities. 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.

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 will be left intact during this phase of the fill retrieval process to prevent sediment from entering the stream.

7. Construction of the Fish Barrier within Crandall Creek

In order to protect upstream fish from whirling disease, the Division of Wildlife Resources is requiring a fish barrier to be installed within the Crandall Creek. The location of the fish barrier is shown on Plate 5-17. Details of the construction of the fish barrier are shown on Plate 5-21 of this MRP. The fish barrier will be a minimum of six feet high, with a concrete base to prevent pooling that will prevent fish from jumping high enough to breech the barrier.

The barrier will be constructed using large stones to create a retaining wall system. The top of the barrier will be armored with riprap and geotextile fabric to protect the structure from erosion. The base of the barrier will be a concrete slab, extending from the face of the foundation course of stones. The location of the barrier was selected due to the steepness of the original stream contours at that location, requiring less disturbance of the streambed. The stone barrier was selected over other types (concrete blocks, for example) in order to provide a more natural appearance that will blend into the surrounding landscape.

Construction of the fish barrier will take place during a low flow of period of the year, such as early July, prior to the flow of Crandall Creek's diversion into the underdrain system. Prior to construction of the fish barrier, the 72" bypass culvert will be completely uncovered. If necessary, the culvert will be lifted in-place to keep the flow of the stream within the culvert. The culvert will be braced so work can safely continue below it. These efforts will maintain the continuous flow of the stream within the culvert, as well as prevent sediment from entering Crandall Creek.

Temporary ditches will be constructed within the existing fill material of the Expansion Area above the work area to prevent potential storm water from entering the work area. These temporary ditches will report to the Sediment Pond. Temporary access roads to the work area will also be created within the Expansion Area fill material for equipment, workers and supplies. These access roads will be removed after the barrier is constructed, and the removal of fill materials continues.

Once the work area for the fish barrier is cleared to existing soil, including the removal of the underdrain system within the work area, two (2) silt fence rows, reinforced with galvanize chain link fence, will be installed just below the area required for construction of the fish barrier, and prior to the newly exposed end of the existing under drain system (see Plate 5-16). Once the water from Crandall Creek is diverted through the under drain system, water will flow out of the under drain system above the work area, pass over the new fish barrier, run through the silt fences to filter out all sediment, then re-enter the under drain system beyond the silt fences. The silt fences will remain intact and maintained until the entirety of the 72" culvert and the under drain have been removed (see below). Prior to removal of the silt fences, any silted sediment buildup will be removed to a location that will not pose an erosion or pollution hazard.

The contractor will clear the work area to approximate contours shown on Plate 5-21 and install the two silt fences noted above. Care will be taken to remove the existing marker soil, existing geotextile fabric and under drain system (see below) only as needed for the work area. Once rough contours are completed, the first new geotextile fabric layer will be installed. The geotextile fabric will preferably be in the form of a single sheet. If more than one sheet is needed, the downstream sheet will be installed first, with the next sheet overlapping the previous by a minimum of 24 inches.

The rockery will be installed per Plate 5-21, as well as the perforated pipe drain pipe and the drain rock behind the rock wall, with care taken to protect the geotextile fabric layer from

damage. The contractor will then continue the wall construction until the last row of rockery is ready for installation at the top of the barrier. At this point, a second layer of geotextile fabric will be installed similarly to the first layer. The second layer of geotextile fabric will extend to below the last rockery course. Riprap will placed over the fabrics as noted on Plate 5-21.

Once the rock wall is completed, the concrete slab can be poured. The slab will slope 2% minimum away from the base course of the rock wall. A curbed edge will be formed at the downstream edge of the slab for stability. Rock armor will be placed within the stream channel below the concrete slab as shown on the drawings to protect the stream bed from erosion.

The fish barrier will be monitored throughout the remainder of reclamation activities for any signs of weaknesses. Any issues encountered will be resolved immediately.

Equipment used to construct the fish barrier will include: trackhoe, backhoe, highway end dump trucks, and a vibrating compacting machine to compact fill material.

8. Removal and Disposal of the 72" Culvert

Fill removal (and South Slope recontouring and interim seeding) will proceed in vertical lifts until the 72" culvert has been exposed. Prior to removing any of the culvert below the memorial access area, the stream flow will be diverted into the 18" underdrain system that was constructed when the culvert was installed 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, after the construction of the fish barrier is complete. Once the stream flow has been successfully diverted into the underdrain system, removal of the 72" culvert can begin. Removal of the culvert will be done in 20-foot segments starting from the upstream end, that is below the memorial access, 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.

The 72" culvert will be removed, working downstream. However, stream flow will still continue to flow temporarily through the underdrain system at this time until the North Slope reclamation has been completed. All care will be taken to protect the newly installed fish barrier (see above) from damage during the removal of the culvert and under drain system. Any damage that occurs to the fish barrier during the removal of the 72" culvert and underdrain system will be repaired immediately.

Approximately 150 feet of culvert will be left in-place below the access to the memorial after final reclamation is complete. This culvert will be owned and maintained by Emery County as described in the Memorandum of Understanding (MOU) in Appendix 5-27 of this MRP after final reclamation is complete.

9. Removal of Sedimentation Pond

The U.S. Forest Service requires that the Crandall Canyon Mine sedimentation pond be removed concurrent with reclamation regrading of the disturbed area. To comply with this request from the land owner, and still preclude erosion of the reclaimed slopes and the contribution of sediment to Crandall Canyon Creek, Genwal will utilize deep gouging (pocking) techniques during regrading. This approach involves using a trackhoe or backhoe to gouge a regraded slope and create pockmarks that are approximately 3 to 6 feet in diameter and 1.5 to 3 feet deep. The gouges are constructed in a random, overlapping pattern at a sufficient frequency that typically makes walking difficult across the area following gouging. The gouges are designed to capture precipitation, thereby promoting infiltration, eliminating runoff and associated erosion, and enhancing vegetative growth. These protective measures prevent additional contributions of sediment to stream flow outside the reclaimed area, and will be used as a permanent control measure, in lieu of retaining the sedimentation pond throughout the post-reclamation, pre-bond release period.

Prior to any earthwork activity within the Pond Area, silt fences will be installed across the entire length of the east (down-canyon) end of the sediment pond embankment to filter any sediment resulting from removal of the pond from entering Crandall Creek. The silt fences previously installed in Crandall Creek below the culvert outlet to provide sediment control within the creek will be inspected and replaced if necessary. These silt fences will be maintained and remain in-place a minimum of 2 years after final reclamation is complete, or until the vegetation matures enough to prevent soil loss due to erosion; whichever is greater.

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 5' to 10' lifts down to the 72" pipe. Recontouring (grading, topsoiling and interim seeding) of the North and South Slopes will be done in the same manner as described for the Expansion Area reclamation. Stream flow will continue to 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 extracted, the geotextile fabric will be removed from the top of the underdrain system, beginning at the west end of the site, below the new 72" culvert outlet and rock energy dissipater, then working easterly (down-canyon). 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 exposed soil will be tested and nutrients added as described below for the south slope areas. The disturbed area will be revegetated in the manner described below.

Regrading of the disturbed area will be conducted starting in the upper reaches of the disturbed area and working down-canyon. After each section is graded and topsoiled, the area

will be covered with a weed-free hay or straw mulch at a rate of 2000 lb/acre. Once the mulch is evenly spread over the surface, the area will be deep gouged as described above and below. This will incorporate the mulch into the planting medium.

10. Topsoiling and Pocking - 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, except for near the fish barrier. Care will be taken to prevent damage to the fish barrier after its completion. 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, mulching, pocking and revegetation.

Topsoil to be reapplied to the North Slope area (see Figure 8c of Chapter 2) 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 (see below) 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 stockpiles 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.

A weed-free alfalfa hay mulch will then be applied over the newly laid topsoil at a rate of two tons per acre. Afterwards, a trackhoe or backhoe will pock the surface of the topsoil starting at the west end (up canyon) of the Expansion Area and working eastward (down canyon). Once pocking is completed, the area will be ready for revegetation.

11. Topsoiling - Recontoured Fill Areas

Topsoil to be applied to recontoured fill areas (Portal Area, Shop Area, and Old Loadout Area) 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 (see below) 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 stockpiles 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.

A weed-free alfalfa hay mulch will then be applied over the newly laid topsoil at a rate of two tons per acre. Afterwards, a trackhoe or backhoe will pock the surface of the topsoil starting at the higher elevations of the west end (up canyon) of the surface facilities and working eastward (down canyon). Once pocking is completed, the area will be ready for revegetation.

12. 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, the silt fences within Crandall Creek, downstream from the existing 72" culvert outlet location, will be inspected and replaced if necessary . 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 below the remaining portion of the 72" culvert, then working downstream. After the drain rock and drain pipe are removed, the lower layer of geotextile can be carefully peeled back, reestablishing 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 recontoured areas.

After the underdrain system has been removed and the stream channel reestablished downstream past each remaining culvert under the Forest Service Road, a rip rapped ditchway will be installed to carry drainage from the roadside culvert outlet, down the North Slope to the restored stream channel.

The silt fences at the fish barrier can be removed once the underdrain system has been completely removed. Prior to its removal, the sediment siltation that has collected at the silt fences will be removed.

13. Revegetation - South Slope of the Expansion Area

Revegetation procedures for the South Slope of the Expansion Area 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. Hydroseeding and mulching operations will be conducted as soon as an area's seed bed is prepared. These operations shall be coordinated to allow access to all areas for equipment. The plant containerized stock will be planted in the second year of reclamation. **Revegetation work will not be done until fall (September-October).**

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on existing topsoil samples taken as soil materials are exposed. The method used to ensure adequate and representative samples from different locations and depths within the existing topsoil layer include: taking two soil samples per lift 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 existing topsoil, prior to seeding, if a need is indicated by laboratory results. The fertilizer will be spread on the existing topsoil and hand-raked into the soil.

14. 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.

Genwal has committed to adding nutrients as determined by laboratory analysis conducted on existing topsoil samples taken as soil materials are exposed. The method used to ensure adequate and representative samples from different locations and depths within the existing topsoil layer include: taking two soil samples per lift and collecting samples with a soil

auger at two foot increments. Samples of the undisturbed soil adjacent to the regraded site at the south slope of the Expansion Area as previously described will be used as a baseline chemical reference. Fertilizer will be added to the existing topsoil, prior to seeding, if a need is indicated by laboratory results. The fertilizer will be spread on the existing topsoil and hand-raked into the soil.

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).

15. Revegetation - North Slope of the Expansion Area

Revegetation procedures for the North Slope of the Expansion Area 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. Hydroseeding and mulching operations will be conducted as soon as an area's seed bed is prepared. These operations shall be coordinated to allow access to all areas for equipment. The plant containerized stock will be planted in the second year of reclamation. **Revegetation work will not be done until fall (September-October).**

16. Revegetation - Recontoured Areas

Revegetation procedures for the recontoured areas (Portal Area, Shop Area and 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. Hydroseeding and mulching operations will be conducted as soon as an area's seed bed is prepared. These operations shall be coordinated to allow access to all areas

for equipment. The plant containerized stock will be planted in the second year of reclamation. **Revegetation work will not be done until fall (September-October).**

17. Completion of the Forest Service Road and Parking Area

Revegetation procedures for the reclaimed areas of the Forest Service Road 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. Hydroseeding and mulching operations will be conducted as soon as an area's seed bed is prepared. These operations shall be coordinated to allow access to all areas for equipment. The plant containerized stock will be planted in the second year of reclamation. **Revegetation work will not be done until fall (September-October).**

The Parking Area for the Forest Service trail head and the Memorial is located at the northwestern corner of the mine site. The existing gravel parking area will be regraded. New gravel to match the existing will be applied if necessary to provide a uniform surface from the end of the Forest Service Road.

18. Topsoil Stockpile Locations Reclamation

Following the removal of the topsoil stockpiles from the storage sites (during final reclamation retopsoiling activities), the topsoil pile locations will be reclaimed. 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).**

19. Maintenance and Monitoring of Reclaimed Areas

Once reclamation has been completed, maintenance and monitoring of the areas will be conducted using the following methods:

a) Signage will be placed at all newly vegetated areas to protect from human encroachment on these areas.

b) If noxious weeds become established in newly vegetated areas, they will be eliminated.

c) Reclaimed areas will be inspected for rodent damage periodically. Eradication methods will be employed in necessary to protect the areas from rodent damage.

d) Each spring, site visits will be scheduled to observe plant growth and inspect the site for rills and gullies. Any rills or gullies found will be filled and the area reseeded. Any such repairs will be recorded, then reported to the Division in the annual report.

APPENDIX 5-22

RECLAMATION TIME TABLE

APPENDIX 5-22
RECLAMATION TIME TABLE
CRANDALL CANYON MINE SURFACE FACILITIES

	RECLAMATION OPERATION	MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER			
		WK. 1	WK. 2	WK. 3	WK. 4	WK. 1	WK. 2	WK. 3	WK. 4	WK. 1	WK. 2	WK. 3	WK. 4	WK. 1	WK. 2	WK. 3	WK. 4	WK. 1	WK. 2	WK. 3	WK. 4	WK. 1	WK. 2	WK. 3	WK. 4
1	Installation of Temporary Sediment Control Structures in Preparation for Reclamation Operations																								
2	Demolition and Removal of Structures within the Disturbed Area																								
3	Removal of Asphalt Paving within the Disturbed Area																								
4	Expansion Area Fill Removal and Recontouring																								
5	Backfill, Regrade and Recontour to Approximate Original Contours (AOC)																								
6	Restoration of South and North Hillside Slopes - Expansion Area																								
7	Construction of the Fish Barrier in Crandall Creek																								
8	Removal and Disposal of the 72" Culvert																								
9	Removal of the Sediment Pond																								
10	Topsoiling and Pocking - North Slope of the Expansion Area																								
11	Topsoiling and Pocking - Recontoured Fill Areas																								
12	Restoration of the Stream Channel																								
13	Revegetation - South Slope of the Expansion Area																								
14	Revegetation of the Stream Channel																								
15	Revegetation - North Slope of the Expansion Area																								
16	Revegetation - Recontoured Areas																								
17	Completion of the Forest Service Road and Parking Area																								
18	Topsoil Stockpile Locations Reclamation																								

ATTACHMENT 1

JBR ENVIRONMENTAL CONSULTANTS, INC.
RECLAMATION RECOMMENDATION LETTER

jbr
environmental consultants, inc.
8160 South Highland Drive • Sandy, Utah 84093 • (801) 943-4144 • Fax (801) 942-1852

Jean M. Semborski
Andalex Resources Inc.
Project Engineer
P.O. Box 902
Price, UT 84501

May 22, 1997

RE: Crandall Canyon Culvert Reclamation Plan ACT/015/032

Dear Ms. Semborski:

This is to your request of May 16, 1997 regarding the reclamation plans for the site of Genwal's proposed fill and culvert in Crandall Canyon. Based on our discussions, and my review of your reclamation plan on May 15, 1997, I believe the main topics of interest in the proposed reclamation plan are:

1) The existing soil horizon in the canyon that would be covered by the fill will be removed from the surface environment for a number of years as well as being compacted to various degrees by the overlying fill. Extended burial of the soil may affect its density by compaction and may reduce the viability of the soil micro fauna by compaction and reduction of oxygen.

2) The north-facing slope under the fill is steep and erosion may be a problem if normal, mechanized seedbed preparation (scarifying and gouging) is conducted which disturbs the soil and may make it more prone to erosion.

3) Use of sewage sludge or chemical fertilizer to amend the soil must be done carefully or it may result in contamination of the adjacent stream.

4) Prevention of erosion of the soil after seeding is important because of the nearby stream channel.

My general recommendation is that Genwal should propose to reclaim the subject slope in sections as it is being exhumed from under the fill. It is my understanding that the fill will be removed in lifts to allow careful removal of the marker soil and geotextile. This will allow convenient access to all areas of the treated slope from the adjacent fill surface as the fill elevation is gradually reduced.

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

The seedbed preparation and seeding should be done with hand labor using hand rakes to lightly scarify the top inch or so of the soil surface, broadcast seed and fertilizer. This light hand work will produce a suitable seedbed for the seed and will thoroughly allow incorporation of the fertilizer into the seedbed. The hand raking should not be so deep as to destabilize the overall soil horizon.

Material such as polyacrylamide (PAM) can be added to the soil to chemically open up the soil for air and water penetration. However, I do not think that the compacted density of the soil immediately after it is exhumed should be much of a hindrance to long-term revegetation success. First of all, most of the soil will be buried under less than the full height of the fill thus the degree of compaction will not be uniform. The soil on the upper portions of the slope will be much less compacted than the soil at the bottom of the slope. Secondly, assuming that the reclamation and reseeding is done in the fall, the soil will be loosened over the winter and early spring by the effects of the weather before germination of the seeds. I would expect the combined effects of frost heave, moisture penetration, and burrowing animals during that first fall, winter, and early spring to naturally mitigate much of the original compacted density.

Erosion control material should be applied after preparation of the seedbed is completed. Hydraulically applied fiber mulch with tackifier and/or bonded fiber matrix should be effective in controlling erosion and may be more cost effective than stapled fiber matting.

With regard to the potential lack of viability of the soil because of its burial, I am not sure that this effect will materially affect the potential revegetation success, using the methods described above. I am familiar with successful revegetation of disturbed mining surfaces where there is no topsoil present. I am aware of materials such as mill tailings, waste rock, alluvium, road base, and heap leach waste that have been successfully revegetated without application of topsoil. These materials are typically enhanced with the use of fertilizer to help support the initial vegetation growth. In these cases, the material used as growth medium did not have the soil micro-fauna typically associated with topsoil, yet the vegetation became well established with chemical fertilizer addition. I have also observed many highway road cut sites where the seedbed was recently exhumed from its previous burial under significant overburden and these slopes have subsequently been revegetated.

In my experience, the main limitations to successful revegetation are lack of suitable soil texture, inadequate chemical nutrients in the growth material, and lack of moisture. In your case, the initial soil texture (gradation) should be unchanged by the burial. Lack of nutrients in the exhumed soil could be determined with sampling and mitigated with chemical fertilizer but its application would have to be carefully planned and carried out to reduce the potential for contamination of the nearby stream from the fertilizer. The location of the soil in question on a north-facing slope at higher elevations should indicate that sufficient moisture for vegetation growth is likely.

The micro-fauna of the topsoil in question at the Crandall Canyon site may be reduced in numbers and diversity by burial but the soil should still possess suitable gradation, chemical nutrient content and moisture for the above-described reasons. This material should therefore provide a suitable growth material for revegetation. The compacted soil may benefit from use of a mycorrhizal inoculum but even this may not be necessary for the initial establishment of a vegetation cover. The soil micro-fauna will eventually be naturally re-established by the affects of the growing vegetation and exposure to the surface environment. This may be accelerated up with use of a suitable cover crop.

I believe that future revegetation of the slope in question at the Crandall Canyon site should be readily feasible if the recommendations contained in this letter are followed.

Thank you for calling on JBR to assist you with this project. Please call if you have any questions on my recommendations.

Best Regards,

Brian W. Buck
Vice President

ATTACHMENT #2

JUSTIFICATION FOR DEEP GOUGING (POCKING) DURING FINAL RECLAMATION OF THE CRANDALL CANYON MINE SITE

Richard B. White, PE, PLLC
13441 South Lone Peak Lane • Draper, Utah 84020 • 801-673-6647

February 12, 2020

Karin Madsen
Genwal Resources, Inc.
P.O. Box 910
East Carbon, Utah 84520-0190

Subject: Justification for Removal of the Crandall Canyon Sedimentation Pond During Site Reclamation

Dear Karin:

The U.S. Forest Service has requested that Genwal concurrently remove the sedimentation pond from the Crandall Canyon Mine site during reclamation of that facility. However, Section R645-301-763.100 of the Utah Administrative Code requires that sedimentation ponds remain in place until at least 2 years after the last augmented revegetation of a reclaimed mine site. The purpose of this letter is to provide information showing that deep gouging (also known as pocking) is an appropriate sediment-control method that can be implemented during reclamation of the Crandall Canyon Mine while still allowing for the contemporaneous removal of the sedimentation pond.

Deep Gouging Design Standard

Deep gouging has been successfully applied during reclamation of several mine sites in Utah. As noted in "The Practical Guide to Reclamation in Utah" prepared by the Utah Division of Oil, Gas and Mining ("DOGM"),[1] "the process is repeated in a random and overlapping pattern, making it impossible for water to flow down slope." The gouges retain all precipitation, thereby precluding runoff and the generation of down-slope erosion. Gouging and the associated mulching also create a microenvironment that encourages rapid germination of seeds, thereby greatly enhancing revegetation success. In their comment letter of January 30, 2020 concerning the Crandall Canyon Mine reclamation plan, DOGM indicated that deep gouging "is the recognized best technology currently available" for stabilization of surface areas during mine reclamation.

Deep gouging is typically implemented in the field using a trackhoe to excavate multiple shallow pits into a regraded and topsoiled slope. Soil from each excavated gouge is placed around the rim of the pit. My experience has shown that individual pits have approximate surface diameters of 3 to 6 feet and approximate depths of 1.5 to 3 feet. Gouges are constructed in a random, overlapping pattern. Additional mulch is then added, often with a tackifier, during revegetation of the site. When completed, the area is typically difficult to walk across.

[1] Wright, M.A. and S. White (eds.). n.d. The Practical Guide to Reclamation in Utah. Utah Division of Oil, Gas and Mining. Salt Lake City, Utah. Downloaded from https://fs.ogm.utah.gov/pub/MINES/Coal_Related/RecMan/Reclamation_Manual.pdf.

Potential Inflow Volumes

Based on the formula for a truncated sphere, a uniform gouge with a surface diameter of 6 feet and a depth of 3 feet will have a volume of 56.5 cubic feet. Similarly, a uniform gouge with a surface area of 3 feet and a depth of 1.5 feet will have a volume of 7.1 cubic feet. This represents the typical volume range of deep gouges installed during reclamation of a disturbed area. Since the gouges are designed to retain all water, no overland flow will occur within the gouged area.

Data obtained from the National Weather Service Hydrometeorological Design Studies Center web site indicates that the 100-year, 24-hour storm at the Crandall Canyon Mine site produces 3.00 inches of precipitation[2] (see Attachment A). With a top surface area of 28.3 square feet, the 6-foot diameter deep gouge will capture 7.1 cubic feet of direct precipitation from a 3.00-inch precipitation event (assuming no infiltration). The smallest of the typical gouges (with a top diameter of 3 feet and a surface area of 7.1 square feet) will capture 1.8 cubic feet of direct precipitation during the same event (again assuming no infiltration). These volumes represent 12.5% and 25.0% of the capacity of the 6-foot and 3-foot diameter gouges, respectively (see Attachment B).

Data provided in Attachment A indicate that the estimated precipitation depth resulting from the 1000-year, 24-hour event is 4.08 inches. The typical 6-foot and 3-foot diameter gouges would capture 9.6 cubic feet and 2.4 cubic feet of direct precipitation, respectively, from this substantial event, representing 17.0% and 34.1%, respectively, of the capacity of the two typical gouge sizes. Thus, it is reasonable to assume that the typical gouges will have sufficient volume to retain all direct precipitation without discharging, even if no infiltration occurs during the storm.

As indicated previously, soil excavated during gouging is placed around the perimeter of the resulting pit. Thus, overland flow from undisturbed areas immediately adjacent to the reclaimed area will generally be captured behind the uppermost gouges. In the event that this does not occur, this overland flow would discharge into the uppermost gouges at the boundary between the reclaimed and undisturbed areas.

The quantity of overland flow that could discharge from the undisturbed area into an uppermost gouge was estimated by multiplying the overland flow quantity by the contributing area. The depth of runoff was calculated for the 100-year, 24-hour precipitation event using an estimated curve number of 73 for the undisturbed area (based on a pinyon-juniper vegetative type with a Hydrologic Soil Group of C and fair hydrologic condition[3]). The contributing area to a typical uppermost gouge was estimated based on gouge diameters of 3 to 6 feet and overland flow lengths of 50 to 100 feet (the typical flow distance before obstruction, based on field observation). The results of these calculations are presented in Attachment C. As indicated, the estimated maximum runoff and direct precipitation into a large gouge,

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[2] National Weather Service Hydrometeorological Design Studies Center data base accessed at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ut.
[3] See NRCS Technical Release 55, Table 2-2d, available at https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1044171.pdf.

based on the 100-year, 24-hour precipitation event, is 49.9 cubic feet, representing 88% of the large gouge capacity of 56.5 cubic feet. The maximum potential inflow into a small gouge (23.2 cubic feet) exceeds the capacity of a small gouge (7.1 cubic feet) by over 180%. Therefore, in order to ensure adequate holding capacity, I recommend that the row of gouges next to undisturbed areas have a capacity of at least 55 cubic feet each. Under this condition, the gouges will have a sufficient capacity to retain overland flow from the adjacent undisturbed area and direct precipitation from a 100-year, 24-hour event without discharging.

Predicted Sediment In-fill Rates

I estimated the rate of sediment in-fill to reclamation gouges at the Crandall Canyon Mine using the Universal Soil Loss Equation, as modified by Israelsen et al. (1984).[4] This approach was an outgrowth of the original Universal Soil Loss Equation modified specifically for application to disturbed areas in Utah. Under this approach, the average annual erosion expected from an area can be calculated as

$$A = R \cdot K \cdot LS \cdot VM$$

where

A = long-term average annual soil loss (tons/acre/yr)
R = rainfall-runoff erosivity factor
K = soil erodibility factor
LS = slope length and steepness factor
VM = erosion control factor

The resulting calculations are presented in Attachment D. The calculations are based on gouging of a reclaimed slope after backfilling, grading, and topsoiling. To estimate the time required before a gouge would fill with sediment, the largest typical gouge (with a surface diameter of 6 feet and a depth of 3 feet) was used to provide the greatest slope length. It was assumed that the interior slope of a gouge is 100% and that the area is mulched at a rate of 2 tons/acre following gouging. Since all sediment eroded from the interior of a gouge will be collected in the gouge, a sediment delivery of 1.0 was assumed.

According to Attachment D, it is predicted that sediment will accumulate at the bottom of a 6-foot diameter gouge at an average rate of 0.20 ton/ac/yr. The sediment eroded from the inside of a smaller diameter gouge will be less since the slope length is shorter. Furthermore, the rate at which sediment is eroded from the interior of a gouge will decrease with time as the slope length inside the gouge decreases. However, assuming that the erosion rate remains constant and that the unit weight of eroded sediment is 100 lb/ft^3, a period of over 11,000 years will be required for a small gouge to fill with

[4] Israelsen, C.E., J.E. Fletcher, F.W. Haws, and E.K. Israelsen, 1984. Erosion and Sedimentation in Utah: A Guide for Control. Hydraulics and Hydrology Series UWRL/H-84/03. Utah Water Research Laboratory, College of Engineering, Utah State University, Logan, Utah.

sediment and more than 22,000 years will be required for a large gouge to fill with sediment (see Attachment D).

Conclusions

It is my opinion that gouging of the regraded surface of the reclaimed Crandall Canyon Mine is an appropriate soil-stabilization method and will retain water and sediment within the gouges, thereby precluding impacts to adjacent water ways. My opinion is based on the following conclusions:

1. Deep gouging is effective at minimizing soil loss from reclaimed mine sites. When properly installed, the gouges retain all precipitation, thereby precluding runoff, precluding the generation of down-slope sediment, enhancing soil moisture retention, and enhancing revegetation success. As a result, even with removal of the Crandall Canyon Mine sedimentation pond during reclamation of the site, deep gouging will control erosion at the source and prevent contributions of sediment to adjacent streams.
2. Typical gouges with approximate surface diameters of 3 to 6 feet and approximate depths of 1.5 to 3 feet, constructed in a random, overlapping pattern, are effective at retaining all direct precipitation from storm events with return periods of 100 years and all runoff from uphill, undisturbed areas resulting from similar events.
3. The volume of typical indentations formed by deep gouging is sufficient that a period of at least 11,000 years is required before individual indentations will fill with sediment. During this time, vegetation will stabilize the gouge as it fills, thus resulting in an erosionally-stable site long before the gouges fill with sediment.

Given these factors, it is my opinion that the Crandall Canyon Mine sedimentation pond can be removed during the course of reclamation regrading without resulting in adverse impacts to local steams.

I have appreciated the opportunity to be of assistance in this matter. Please contact me if you have any questions.

Sincerely,

Richard B. White, P.E.
Consulting Civil and Environmental Engineer

Attachments

ATTACHMENT A

Depth-Duration-Frequency Data for the
Crandall Canyon Mine Area

NOAA Atlas 14, Volume 1, Version 5
Location name: Huntington, Utah, USA*
Latitude: 39.4599°, Longitude: -111.168°
Elevation: 7823.72 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.142 (0.123-0.168)	0.183 (0.159-0.216)	0.252 (0.217-0.297)	0.311 (0.264-0.367)	0.400 (0.333-0.473)	0.478 (0.390-0.567)	0.568 (0.454-0.677)	0.671 (0.522-0.807)	0.834 (0.621-1.02)	0.982 (0.705-1.23)
10-min	0.216 (0.188-0.255)	0.279 (0.242-0.330)	0.384 (0.330-0.451)	0.473 (0.403-0.558)	0.609 (0.507-0.720)	0.728 (0.594-0.864)	0.864 (0.692-1.03)	1.02 (0.794-1.23)	1.27 (0.945-1.56)	1.50 (1.07-1.87)
15-min	0.268 (0.233-0.317)	0.346 (0.301-0.409)	0.477 (0.410-0.560)	0.586 (0.499-0.692)	0.755 (0.628-0.892)	0.902 (0.737-1.07)	1.07 (0.857-1.28)	1.27 (0.985-1.52)	1.57 (1.17-1.93)	1.85 (1.33-2.31)
30-min	0.361 (0.314-0.427)	0.466 (0.405-0.550)	0.642 (0.552-0.754)	0.789 (0.672-0.931)	1.02 (0.846-1.20)	1.22 (0.992-1.44)	1.44 (1.16-1.72)	1.70 (1.33-2.05)	2.12 (1.58-2.60)	2.50 (1.79-3.11)
60-min	0.447 (0.388-0.528)	0.576 (0.501-0.681)	0.795 (0.683-0.933)	0.977 (0.832-1.15)	1.26 (1.05-1.49)	1.50 (1.23-1.79)	1.79 (1.43-2.13)	2.11 (1.64-2.54)	2.62 (1.95-3.22)	3.09 (2.22-3.85)
2-hr	0.553 (0.484-0.644)	0.701 (0.611-0.816)	0.928 (0.805-1.08)	1.13 (0.971-1.32)	1.45 (1.22-1.69)	1.72 (1.42-2.03)	2.04 (1.65-2.42)	2.41 (1.89-2.87)	2.99 (2.25-3.63)	3.53 (2.56-4.36)
3-hr	0.622 (0.551-0.716)	0.780 (0.690-0.898)	1.00 (0.883-1.16)	1.20 (1.05-1.38)	1.51 (1.30-1.74)	1.77 (1.50-2.06)	2.09 (1.73-2.44)	2.45 (1.99-2.90)	3.04 (2.38-3.66)	3.58 (2.71-4.38)
6-hr	0.810 (0.725-0.912)	1.00 (0.903-1.13)	1.24 (1.11-1.39)	1.44 (1.28-1.62)	1.72 (1.51-1.95)	1.97 (1.72-2.25)	2.27 (1.94-2.61)	2.61 (2.20-3.03)	3.19 (2.63-3.77)	3.72 (2.99-4.46)
12-hr	1.02 (0.931-1.14)	1.26 (1.15-1.40)	1.54 (1.39-1.71)	1.77 (1.59-1.97)	2.08 (1.85-2.33)	2.33 (2.06-2.62)	2.60 (2.27-2.93)	2.92 (2.52-3.33)	3.50 (2.97-4.04)	4.04 (3.37-4.72)
24-hr	1.21 (1.09-1.35)	1.50 (1.35-1.68)	1.83 (1.64-2.05)	2.09 (1.87-2.35)	2.45 (2.18-2.75)	2.72 (2.41-3.06)	3.00 (2.63-3.37)	3.28 (2.86-3.70)	3.65 (3.14-4.15)	4.08 (3.41-4.77)
2-day	1.44 (1.29-1.62)	1.79 (1.61-2.01)	2.19 (1.96-2.46)	2.51 (2.24-2.82)	2.95 (2.62-3.31)	3.29 (2.90-3.70)	3.64 (3.18-4.11)	3.99 (3.46-4.53)	4.47 (3.81-5.10)	4.84 (4.08-5.56)
3-day	1.62 (1.45-1.83)	2.01 (1.80-2.27)	2.47 (2.20-2.79)	2.84 (2.52-3.20)	3.34 (2.95-3.77)	3.73 (3.27-4.21)	4.13 (3.59-4.68)	4.53 (3.91-5.16)	5.08 (4.31-5.82)	5.51 (4.61-6.35)
4-day	1.80 (1.61-2.04)	2.23 (2.00-2.54)	2.75 (2.45-3.12)	3.16 (2.81-3.59)	3.72 (3.28-4.22)	4.16 (3.64-4.72)	4.61 (4.00-5.24)	5.07 (4.36-5.79)	5.70 (4.82-6.54)	6.18 (5.15-7.14)
7-day	2.19 (1.96-2.50)	2.73 (2.44-3.12)	3.37 (3.00-3.83)	3.89 (3.44-4.41)	4.60 (4.03-5.22)	5.15 (4.48-5.86)	5.71 (4.94-6.53)	6.29 (5.38-7.22)	7.07 (5.96-8.20)	7.69 (6.40-8.98)
10-day	2.53 (2.25-2.87)	3.15 (2.81-3.58)	3.88 (3.45-4.41)	4.47 (3.96-5.07)	5.25 (4.61-5.95)	5.84 (5.11-6.65)	6.45 (5.60-7.36)	7.07 (6.09-8.09)	7.89 (6.69-9.10)	8.53 (7.15-9.91)
20-day	3.46 (3.09-3.94)	4.33 (3.86-4.92)	5.37 (4.78-6.10)	6.19 (5.48-7.03)	7.29 (6.41-8.27)	8.13 (7.09-9.25)	8.99 (7.78-10.2)	9.86 (8.45-11.3)	11.0 (9.31-12.7)	11.9 (9.95-13.8)
30-day	4.24 (3.78-4.79)	5.30 (4.72-5.98)	6.51 (5.79-7.35)	7.45 (6.61-8.41)	8.69 (7.66-9.82)	9.63 (8.45-10.9)	10.6 (9.22-12.0)	11.5 (9.94-13.1)	12.7 (10.9-14.6)	13.7 (11.5-15.7)
45-day	5.24 (4.69-5.90)	6.54 (5.86-7.37)	8.03 (7.18-9.06)	9.20 (8.19-10.4)	10.7 (9.49-12.1)	11.9 (10.5-13.4)	13.1 (11.4-14.8)	14.3 (12.3-16.2)	15.8 (13.5-18.1)	17.0 (14.4-19.6)
60-day	6.28 (5.62-7.04)	7.86 (7.04-8.82)	9.68 (8.65-10.8)	11.1 (9.88-12.4)	12.9 (11.4-14.5)	14.3 (12.6-16.0)	15.6 (13.7-17.6)	17.0 (14.7-19.3)	18.8 (16.1-21.4)	20.2 (17.1-23.2)

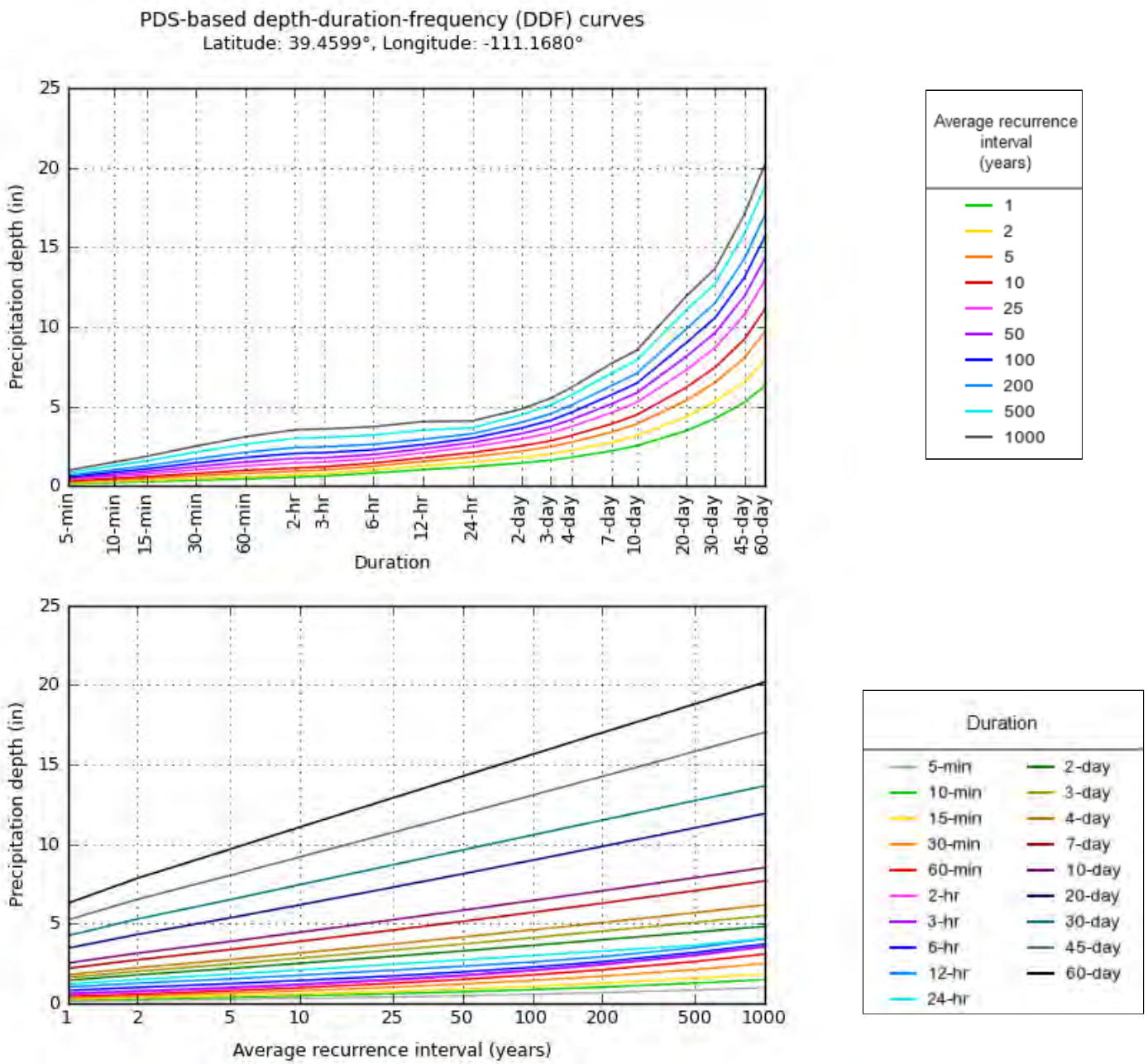
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



NOAA Atlas 14, Volume 1, Version 5

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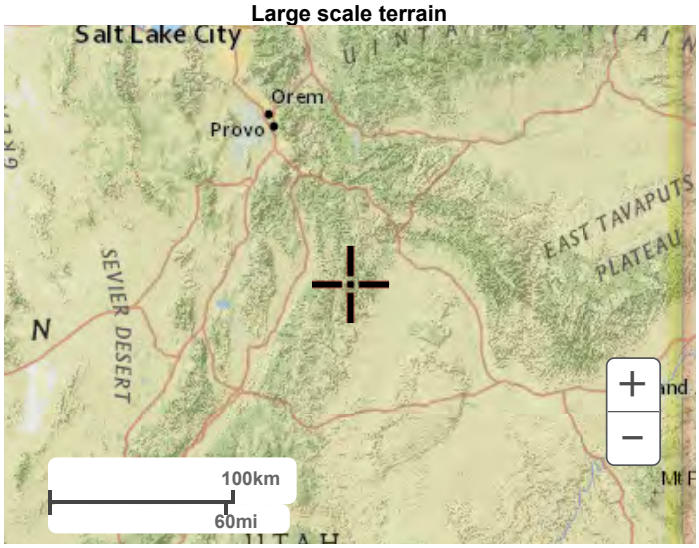
Back to Top

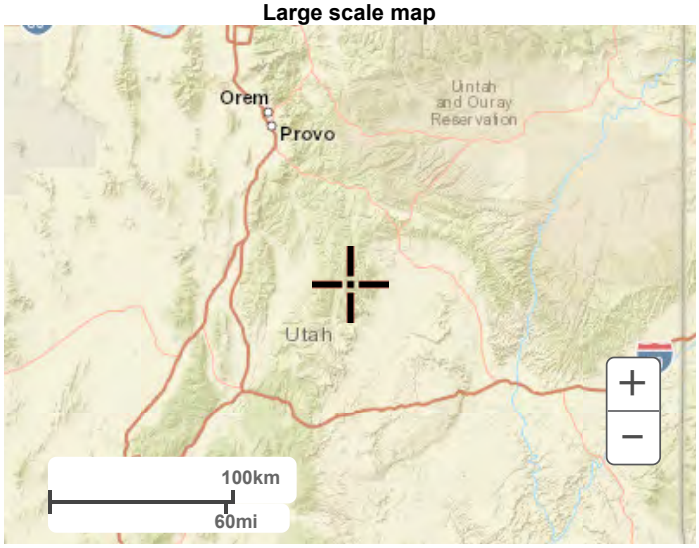
Maps & aerials

Small scale terrain

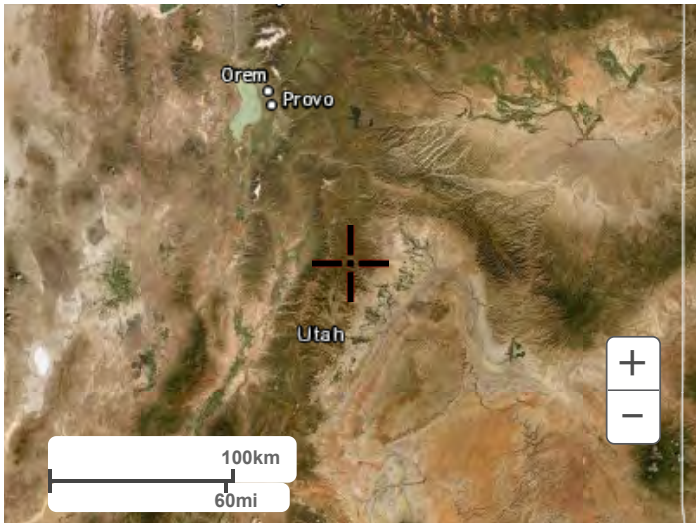
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT B

Calculation of Direct Precipitation Volumes
Into Individual Gouges

Percent of Typical Gouge Volume Filled by Direct Precipitation

Crandall Canyon Mine Reclaimed Site

Parameter	Large Gouge				Small Gouge			
	100-yr, 24-hr Precip		1000-yr, 24-hr Precip		100-yr, 24-hr Precip		1000-yr, 24-hr Precip	
Gouge diameter =	6	ft	6	ft	3	ft	3	ft
Gouge depth =	3	ft	3	ft	1.5	ft	1.5	ft
Gouge area =	28.3	sf	28.3	sf	7.1	sf	7.1	sf
Precip depth =	3.00	in	4.08	in	3.00	in	4.09	in
Precip volume =	7.07	cf	9.61	cf	1.77	cf	2.41	cf
Gouge volume =	56.5	cf	56.5	cf	7.1	cf	7.1	cf
Percent of capacity =	12.5	%	17.0	%	25.0	%	34.1	%

ATTACHMENT C

Calculation of Overland Flow Volumes
Into Individual Gouges

Estimated Flow Volume into Uppermost Gouges
Crandall Canyon Mine Reclaimed Site

Curve Number =	73		S =	3.70
Avg. overland flow length =	50	ft		
Max. overland flow length	100	ft		
Typical max. gouge dia. =	6	ft		
Typical min. gouge dia. =	3	ft		
Maximum contributing area =	600	ft^2		
Minimum contributing area =	150	ft^2		
100-yr, 24-hr precip depth =	3.00	in		
Runoff from above event =	0.86	in		
Large gouge volume =			56.55	ft^3
Small gouge volume =			7.07	ft^3
100-yr, 24-hr precip vol. in large gouge =			7.07	ft^3
100-yr, 24-hr precip vol. in small gouge =			1.77	ft^3

Potential uppermost gouge inflow volumes from adjacent undisturbed areas:

Condition	Runoff (ft^3)	Precip (ft^3)	Total (ft^3)
Max. input to uppermost large gouge =	42.87	7.07	49.94
Max. input to uppermost small gouge =	21.43	1.77	23.20
Avg. input to uppermost large gouge =	21.43	7.07	28.50
Avg. input to uppermost small gouge =	10.72	1.77	12.48

Conclusion: Place large gouges adjacent to undisturbed areas.

Notes:
1. Curve number based on Pinyon-juniper vegetative type (i.e., south-facing slope), Hydrologic Soil Group C, fair hydrologic condition (see NRCS Technical Release 55).
2. Flow lengths based on field observations.
3. Gouge diameters based on professional experience.

ATTACHMENT D

Results of Sediment Yield Calculations

Sediment Yield Calculations
Crandall Canyon Mine Reclamation
Genwal Resources, Inc.

Israelsen et al. (1984) developed a Modified Universal Soil Loss Equation for application specifically under Utah conditions. This equation was used to predict sediment yields from the area of the Crandall Canyon Mine immediately following completion of reclamation activities. Details regarding this methodology and the associated assumptions and references are provided below. Calculations were prepared for both north- and south-facing slopes since soils, which were graded to create the mine pad, differ between the slope aspects.

Calculations:

A = R K LS VM, where A is the average annual sediment yield (tons/acre/year). Terms are defined below.

Slope Aspect	R	K	LS	VM	A (t/ac/yr)
North	13.45	0.20	7.30	0.01	0.20
South	13.45	0.17	7.30	0.01	0.17

Definitions and Assumptions:

R = Rainfall-Runoff Erosivity Factor. Site-specific values determined using EPA's "Rainfall Erosivity Factor Calculator for Small Construction Sites", based on a construction season of May 15 through October 30 (see https://lew.epa.gov/).

K = Soil Erodibility Factor. According to Plate 2-6 of the MRP, soil on the north-facing slope adjacent to the disturbed area are part of the Bundo-Lucky Star-Adel Families Complex. Those on the south-facing slope are part of the Strych-Pathead-Podo Families Rubbleland Complex. Appendix 2-3A of the MRP indicates that K factors for the Bundo-Lucky Star-Adel Families Complex range from 0.15 to 0.17. The 1988 Soil Survey of Carbon Area, Utah indicates that K factors for the Strych, Pathead, and Podo Series soils range from 0.05 to 0.20. Since local soils were graded and used as fill during construction of the mine site and will be regraded during reclamation, the K factors for these soils were considered applicable to the post-reclamation conditions. In both case, the maximum K factor was selected for analysis to provide a conservatively high estimate of potential erosion.

LS = Combined length-slope factor, calculated below using the following equation presented by Israelsen et al. (1984):

$$LS = (65.41s^2/(s^2+10{,}000) + 4.56s/(s^2+10{,}000)^{0.5} + 0.065)(\lambda/72.6)^m$$

where s = slope angle (%). A slope of 100% was assumed for the inside of a gouge.

λ= slope length (ft). This value is defined as the distance from the origin of overland flow to the point of deposition or channelized flow. A slope length of 3 feet was used, which is the typical maximum distance from the top to the
m = a factor based on the steepness of the slope. For slopes steeper than 5%, m=0.5.

λ =	3	ft
s =	100	%
m =	0.5	
LS =	7.30	

VM = Erosion Control Factor (accounting for a combination of vegetative, chemical, and mechanical measures). For mulched soils, the value of this factor is a function of the rate at which surface much is applied and the product of the remaining erodibility factors. This relationship is shown on the following graph, from Israelsen et al. (1984) The planned rate of surface mulch ap[plication is 2 tons/acre. It was conservatively assumed that this mulch would not be anchored.

R K LS (North aspect) =	19.64
R K LS (South aspect) =	16.69

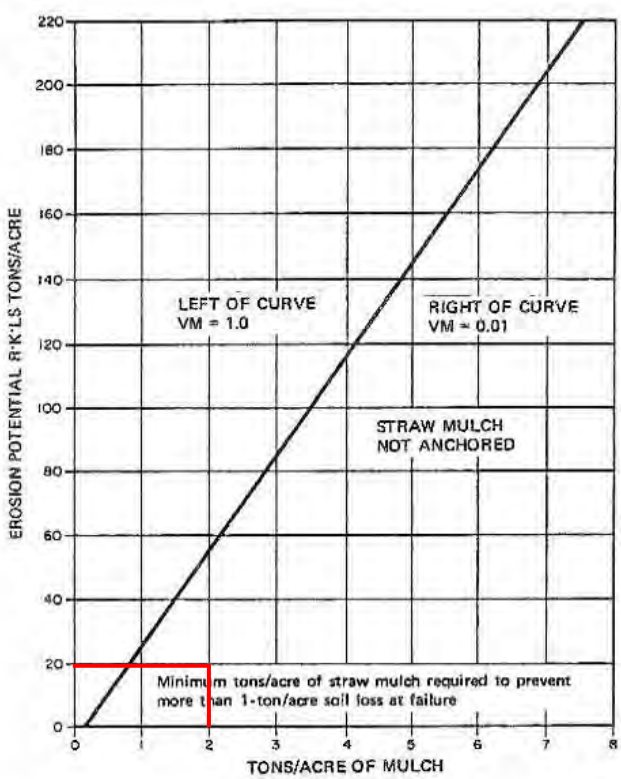


Figure 3. Straw mulch not anchored vs. R·K·LS.

Time Required to Fill Gouges With Sediment:

Maximum calculated sediment yield =	0.20	t/ac/yr
Assumed sediment unit weight =	100	lb/cf
Large gouge area =	28.3	sf
Large gouge volume =	56.5	cf
Time required to fill large gouge =	22,143	yr
Small gouge area =	7.1	sf
Small gouge volume =	7.1	cf
Time required to fill small gouge =	11,091	yr

Reference:

Israelsen, C. Earl, Joel E. Fletcher, Frank W. Haws, and Eugene K. Israelsen, 1984. *Erosion and Sedimentation in Utah: A Guide for Control* . Hydraulics and Hydrology Series UWRL/H-84/03. Utah Water Research Laboratory, College of Engineering, Utah State University, Logan, Utah.

Crandall Canyon Mine

<u>Appendix 5-27</u>

Crandall Canyon Memorial
Emery County Memorandum
of Agreement,
Quit-Claim 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

U.S. FOREST SERVICE

SECTION 6
SECTION 5
1/4 CORNER
235.13'
FOREST SERVICE
TRAILHEAD PARKING
SHOP
FOREST SERVICE
ROAD #50248
USFS TRAIL
"ROAD EASEMENT"
145.00'
152.75'
MINE STORAGE
AREA
PARKING AREA
DELINEATION FENCE
(APPROXIMATE LOCATION)
235.00'
UNDISTURBED DRAINAGE CULVERT
TRAIL
SOUTH CRANDALL
MINE PORTALS
MINE OPERATIONS AREA
MEMORIAL PARKING AREA
"DEEDED LAND"
(0.803 ACRES)
"CRANDALL CANYON
MEMORIAL"
PACIFICORP
EASEMENT
ANDALEX-IPA FEE
N

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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U.S. FOREST SERVICE

SECTION 6 SECTION 5

1/4 CORNER

"DEEDED LAND"

FOREST SERVICE TRAILHEAD PARKING

"ROAD EASEMENT"

USFS TRAIL

MEMORIAL PARKING AREA

UNDISTURBED DRAINAGE CULVERT REMAINING SEGMENT

TRAIL

"CRANDALL CANYON MEMORIAL"

ANDALEX-IPA FEE

N

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

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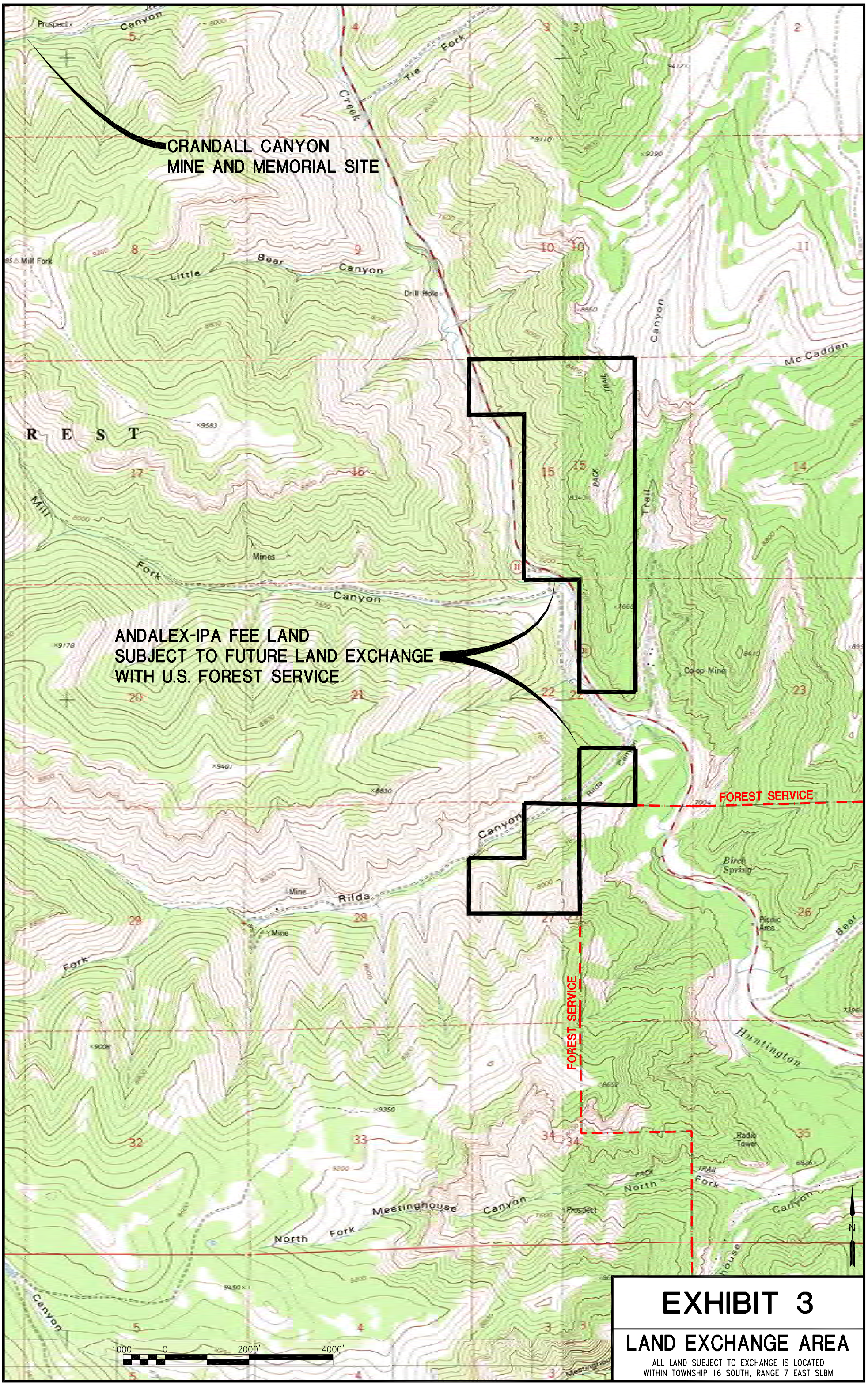

EXHIBIT 3

LAND EXCHANGE AREA

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

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Ent 397272 Page 1 of 5
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

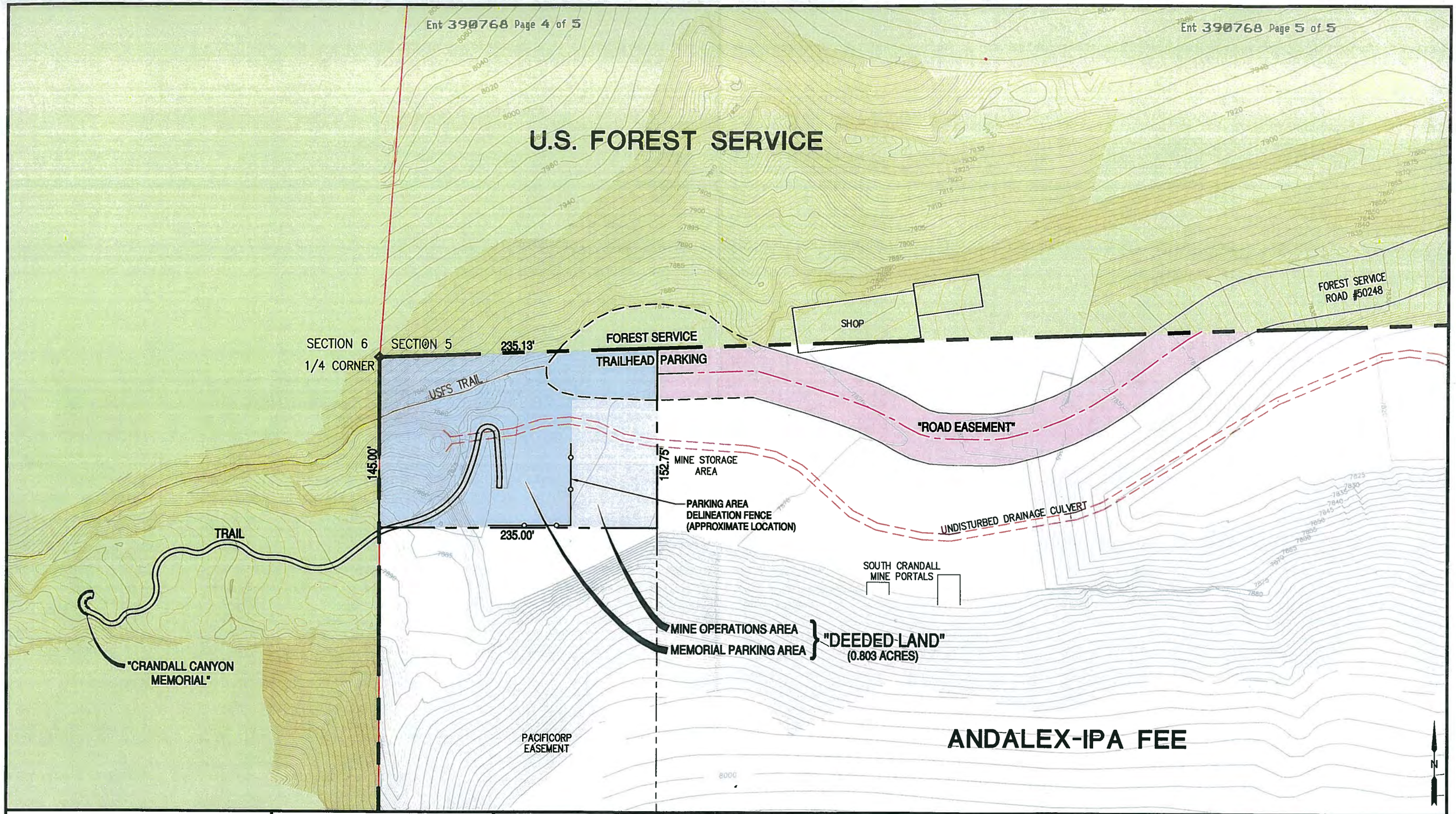
By: James A. Hewlett
Name: James A. Hewlett
Title: General Manager

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 General 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	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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Crandall Canyon Mine

Appendix 5-28

Geotechnical Stability Analysis

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.

1435 WEST 820 NORTH, PROVO, UTAH 84601-1343
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

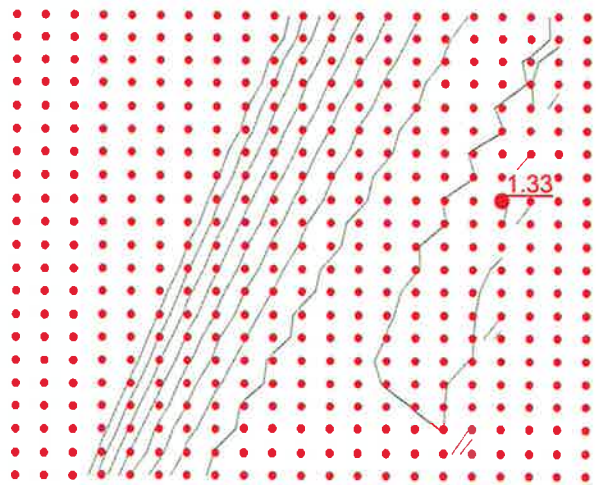
During the site visit, water was observed seeping from the existing slope. In order to prevent the fill materials from becoming saturated, it is recommended that a drainage layer be installed between the existing slope and the fill. The drainage layer should consist of clean well graded gravel and should 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.

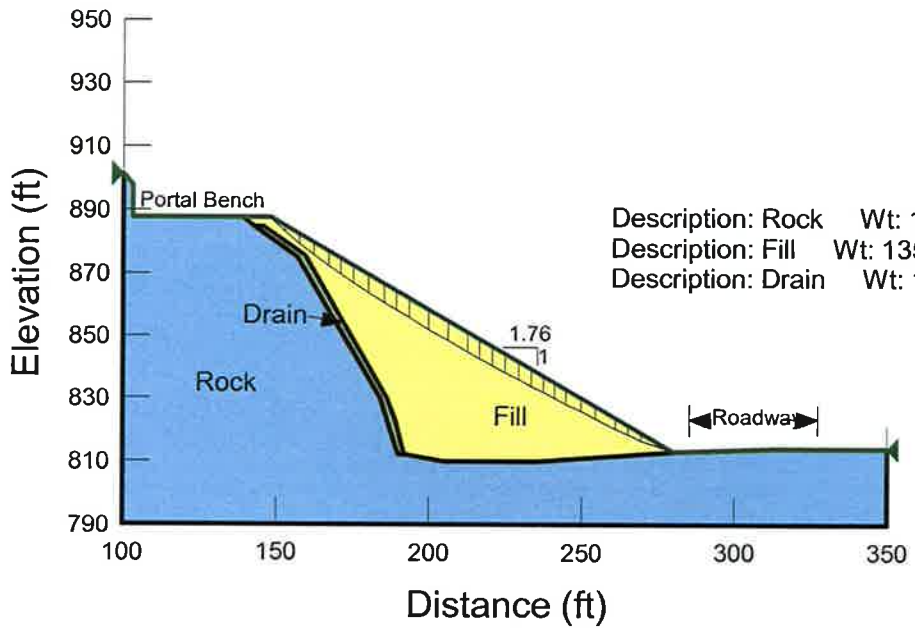
3. EMBANKMENT REQUIREMENTS

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.

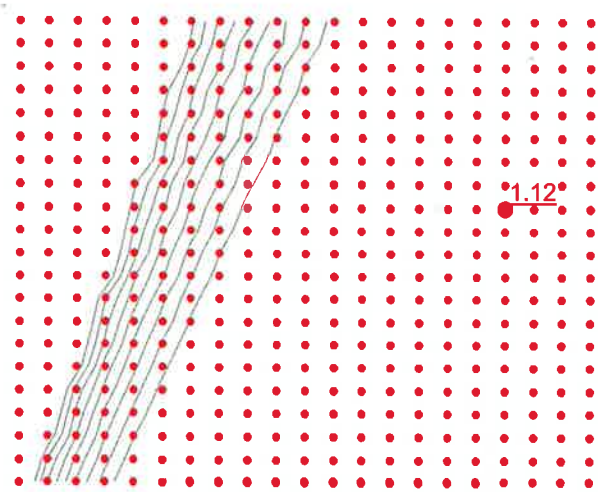
Gravel drain material used to construct the drainage system should be compacted. In order to compact against the existing slope, hand operated compaction equipment such as jumping jacks and/or walk behind rollers will likely be necessary. We recommend that gravel drain material to be compacted with hand 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.



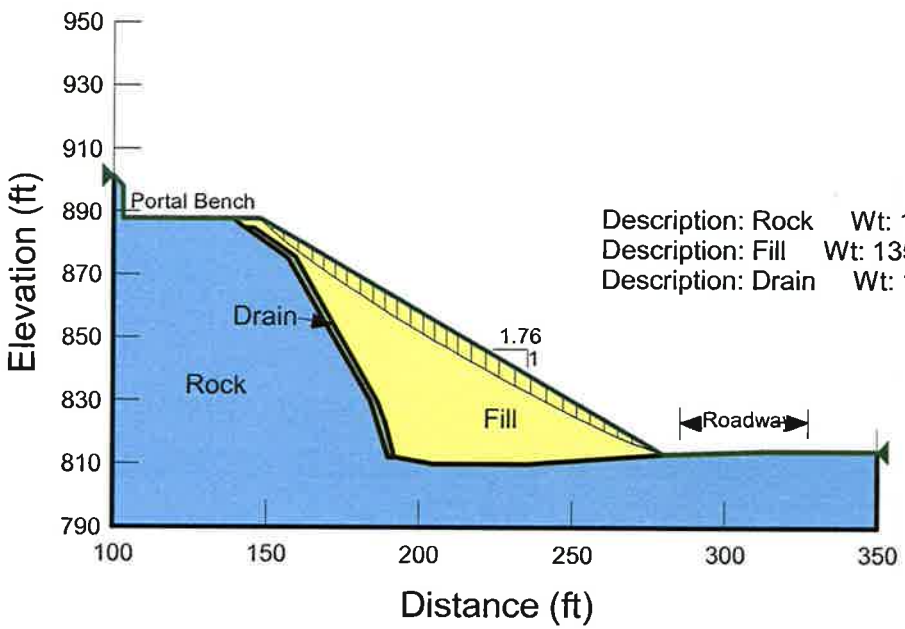
Crandall Canyon Mine Slope Stability
Static Condtions



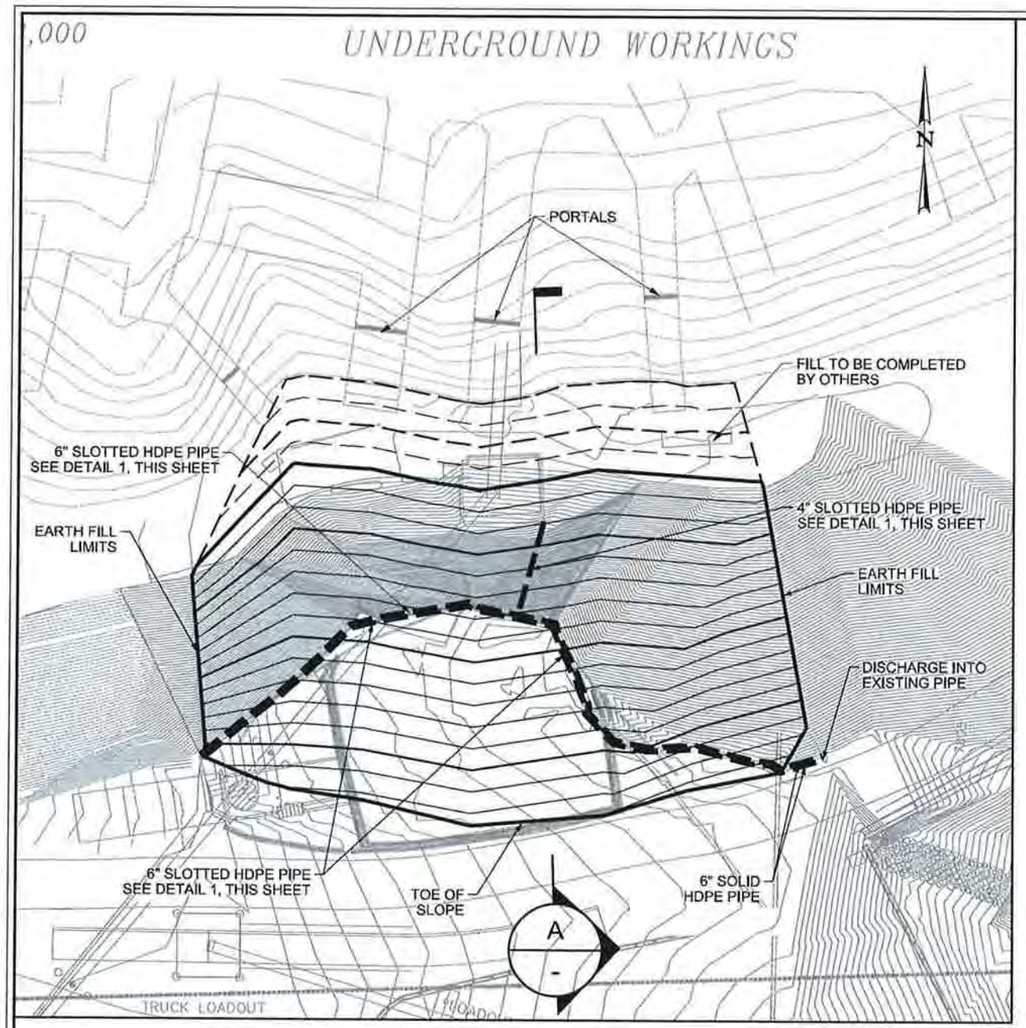
Description: Rock Wt: 150 Cohesion: 5000 Phi: 0
Description: Fill Wt: 135 Cohesion: 10 Phi: 36
Description: Drain Wt: 115 Cohesion: 0 Phi: 36



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



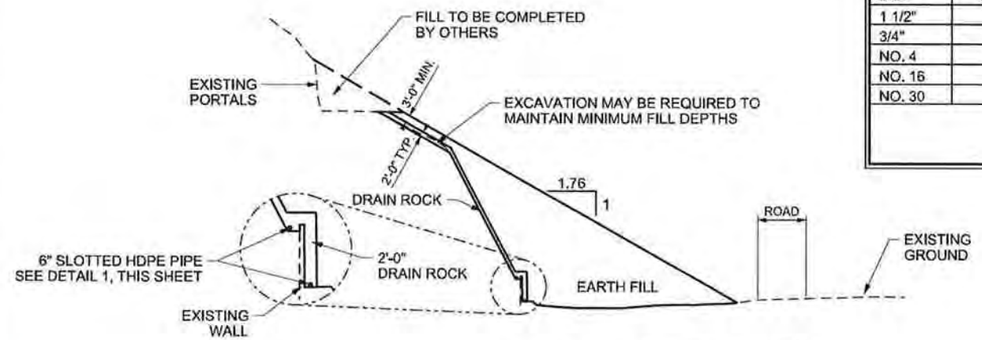
Description: Rock Wt: 150 Cohesion: 5000 Phi: 0
Description: Fill Wt: 135 Cohesion: 10 Phi: 36
Description: Drain Wt: 115 Cohesion: 0 Phi: 36



SITE PLAN OPTION 1

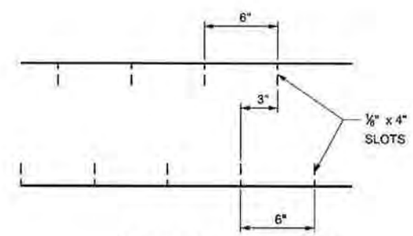
SCALE

0 30 60 90 120

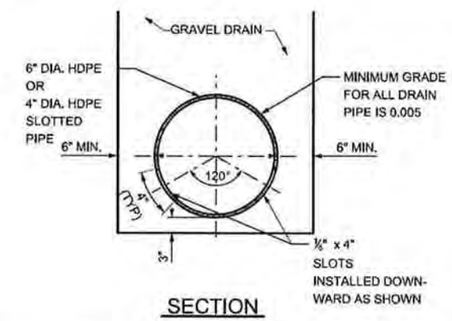


SECTION - TYPICAL (A / -)

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
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STATE OF UTAH

7/11/2011
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SCALE HORZ. VERT.
DATE JULY 2011

EMERY COUNTY, UTAH

CRANDALL CANYON MINE
SLOPE STABILITY

EARTHFILL

201001-006 PROJECT NO.
SEE FILE FILE DRAWING NO.
SHEET 1 OF ___ SHEETS

APPENDIX 5-30

RELOCATION OF UPDES OUTFALL #002 TO HUNTINGTON CREEK

(Revised April 2020)

APPENDIX 5-30

RELOCATION OF UPDES OUTFALL #002 TO HUNTINGTON CREEK

Index

Description and Narrative

Attachments:

Attachment #1:	Information and Recommendations for the Proposed Genwal Resources, Inc. Crandall Canyon Mine Water Pipeline
Attachment #2:	Sample Specifications for High Density Polyethylene Pipe, Fittings and Joining/Fusion
Attachment #3:	DWQ Letter to UDOGM Answering Questions Regarding Moving UPDES Outfall #002
Attachment #4:	Soils Report for New Pipeline Alignment
Attachment #5:	Wildlife Resources Report by the United States Forest Service
Attachment #6:	Biological Assessment and Biological Evaluation (BA/BE) by the United States Forest Service
Attachment #7:	Archeological Survey of the Crandall Canyon pipeline alignment by the United States Forest Service

Plates:

Plate #5-30-1a:	Mine Water Piping Schematic - Existing Piping Schema
Plate #5-30-1b:	Mine Water Piping Schematic - Piping Schema Prior to Final Reclamation
Plate #5-30-1c:	Mine Water Piping Schematic - Piping Schema at Final Reclamation
Plate #5-30-2a:	Crandall Canyon Road / Pipeline Sections
Plate #5-30-2b:	Crandall Canyon Road / Pipeline Sections
Plate #5-30-2c:	Crandall Canyon Road / Pipeline Sections
Plate #5-30-2d:	Crandall Canyon Road / Pipeline Sections and Details
Plate #5-30-3a:	Energy Dissipater and Outfall Plan and Sections
Plate #5-30-3b:	Energy Dissipater Details
Plate #5-30-3c:	Pipeline Sediment Control Plans and Details

DESCRIPTION AND NARRATIVE

Introduction

Mine water from behind the existing temporary seals within the Crandall Canyon Mine portals is currently discharged to the Crandall Creek at UPDES Outfall #002. Since December 2009, the mine water has been treated for iron levels above the permit compliance limits. Iron concentrations within the untreated mine water have steadily decreased over the past several years to a point where the pre-treatment water quality has been below permit compliance limits for several months. Due to the continued improved quality of the discharged mine water, Genwal Resources, Inc. proposes to relocate UPDES Outfall #002 from its current location at the main bypass culvert for the mine surface facilities to the western bank of Huntington Creek, near the existing bridge where the Crandall Canyon Road crosses Huntington Creek.

Moving the outfall location will require the mine water to be piped from the existing temporary portal seals to a location on the western bank of the Huntington Creek, where the discharge point would be above the high water level of the creek. Genwal Resources proposes to tie into the existing piping carrying the mine water from the portal bench with a new eight inch diameter high density polyethylene (HDPE) pipe. This new proposed pipeline would then run from the existing portal bench to the Crandall Canyon Road (Forest Service Road #0248). The pipe would be buried within the northern shoulder the roadway, averaging just over four (4) feet from the edge of the existing pavement, with right of access under a Forest Service Special Use Permit for the pipeline (see Appendix 1-19 of this MRP). Two (2) concrete manholes are proposed along the length of the pipeline for maintenance and venting purposes. The vented manhole covers would be a locking type to prevent unauthorized access. The pipeline would follow the Crandall Canyon Road to a point just below the location of the culvert that carries the Crandall Creek below the Crandall Canyon Road.

At this point, the pipeline would deviate from the roadway for a short distance through a currently disturbed area, then enter a concrete energy dissipater. The energy dissipater is required due to the expected high velocity of the water at the outfall location. The energy dissipater is essentially a cistern that slows the water velocity so it can flow to the bank of Huntington Creek under lower velocity to prevent erosion. The water would exit the energy dissipater and enter a premanufactured packaged metering manhole containing a Parshall Flume. The metering manhole will allow the quantity of the water to be measured and recorded. The energy dissipater and metering manhole are located a short distance away from the Crandall Canyon Road for protection from plowed snow in the winter months. Also, the energy dissipater and metering manhole areas would be covered with topsoil and vegetated to blend into the surrounding landscape. Vented access covers for the energy dissipater and the metering manhole would be lockable to prevent unauthorized access. After the metering manhole, the water would discharge to a short riprapped channel extending from the discharge location and extend to the existing large riprap on the bank of Huntington Creek in an area near the existing bridge that appears to be already disturbed. The water will then cascade through the existing large riprap and enter the creek at a slow velocity to prevent erosion of the bank.

Water will not be introduced into the new pipeline system until the pipeline is completed with an uninterrupted route from the portals to the new outfall location at the bank of Huntington Creek. Furthermore, before the removal of the water treatment system and facilities, a report will be submitted to the Division for approval that proves compliance with the UPDES standards.

Chapter 1: Legal

The new proposed UPDES outfall location and associated pipeline are located in Sections 4 and 5 of Township 16 South, Range 7 East of the Salt Lake Baseline and Meridian (SLBM), on lands located within the Manti-La Sal National Forest in Emery County, Utah, and owned by the United States government. The Unites States Forest Services administers said land. The legal description below is used to locate the proposed pipeline alignment, and is included in the permit area described in Chapter 1 of the MRP.

Township 16 South, Range 7 East; SLBM

Section 4:	Lot 3	37.35 acres
	Lot 4	37.36 acres
	NW1/4, SE1/4, NW 1/4	10.00 acres
	N1/2, SW1/4, NW1/4	20.00 acres
Section 5:	Lot 6	43.64 acres
	Lot 9	21.70 acres
	N1/2, S1/2, NE1/4	40.00 acres
	SW1/4, SW1/4, NE1/4	10.00 acres
Total Pipeline Permit Area:		220.05 acres

Right-of-entry to this land for the pipeline is established through a Special Use Permit obtained from the United States Forest Service (see Appendix 1-19). The final right-of-way will be 6.0' wide, centered on the pipeline along the existing roadway area, until the pipeline deviates from the road shoulder near the outfall location, where the right-of-way will expand to 20.0' wide, centered on the pipeline. The special use permit also includes a 30-foot x 250-foot area at the Crandall Canyon Mine portal bench to include the existing piping through the temporary portal seals. A temporary 20.0 foot wide right-of-way is included in the special use permit for the construction of the pipeline within the existing road right-of-way. This extra width will temporarily add approximately 2.12 acres to the area of the pipeline right-of-way, for a total of approximately 3.25 acres during construction. The right-of-way will revert to the 1.13 acres at the completion of construction, and reclamation of the pipeline alignment is complete. The disturbed area boundary for the pipeline discussed in Chapter 1 of this MRP is based upon the 20-foot temporary construction boundary to insure all disturbed areas are included within the disturbed boundary. A copy of the special use permit is included in Appendix 1-19 of the MRP.

Chapter 2: Soils

The majority of the proposed pipeline alignment and associated structures will be located on previously disturbed areas of the existing roadway, as well as a previously disturbed area near the proposed outfall location near the Huntington Creek. In all, the area of new disturbance will be approximately 2,735 square feet (0.06 acres).

The region of the proposed pipeline and associated structures historically has not been used as crop land. The steep walled canyons are not conducive to agricultural uses. No prime farmland exists within the proposed area. Please see Appendix 2-1 for further information.

A soils survey of the pipeline alignment was conducted by Environmental Industrial Services. I copy of the report from that survey is included as Attachment #4 to this appendix.

Topsoil for all construction areas will be salvaged to a minimum depth of six (6) inches. If topsoil depths are greater than six inches, the entire depth of topsoil will be salvaged. All temporarily stockpiled topsoil will be protected from erosion or other damage during operations. As the pipeline trench in backfilled and compacted, salvaged topsoil will be reapplied and the area reclaimed in accordance with the approved reclamation procedures. The salvaged topsoil in and around the area of the energy dissipater and the metering manhole will require storage, as the construction of these elements will take longer. The estimated amount of salvaged topsoil for the energy dissipater area will be approximately 120 cubic yards, using the approximate square footage noted above with a swell factor of 18%.

Any salvaged topsoil that will require storage will be stored at the "Truck Turn Around Area" at the mine surface facilities (see Plate 5-3a). This is currently a paved area, located west of the existing water treatment facilities, and will allow easy access. The stockpiled topsoil can be formed into a cone-shaped mound approximately 60 feet in diameter and approximately 15 feet high with side slopes of 2 horizontal units to 1 vertical unit. This size and shape of a stockpile will hold approximately 440 loose cubic yards of topsoil, which will allow for any excess storage that may be needed as the pipeline and manholes are installed. After installation of the energy dissipater and metering manhole, the topsoil will be returned to the disturbed area, then revegetated and reclaimed in accordance with the approved reclamation procedures.

After the pipeline has been installed, the trench will be backfilled and compacted as soon as possible. The surface will then be roughened using a trackhoe or backhoe. Topsoil will then be applied to the rough subsoil surface. The topsoil will be left rough and pitted to limit rilling and to provide for water retention to enhance seed germination. No topsoil will be spread when the subsoil or topsoil is frozen, wet or powdery. Mulch will be applied over the newly applied topsoil after seeding. Please see Appendix 5-22 for more information.

Interim seeding of the newly laid topsoil will be accomplished within one week of final grading, weather and soils conditions permitting. The seed will be of the approved mixture for interim

seeding. If the soil surface is crusted, appropriate measures will be taken to break up crusted areas prior to seeding.

Prior to beginning any construction operations for the pipeline or any of it's associated elements, a stream alteration permit will be attained by the Permittee from the State Engineer via the Utah Division of Water Rights. No work shall begin until this permit is obtained.

In order to prevent the introduction of sediment and silt into the Huntington Creek and the Crandall Canyon Creek, temporary sediment control structures (i.e., silt fences, excelsior logs and hay bales) will be installed below all construction areas prior to any ground disturbing activities. These structures will filter sediment from water prior to leaving a disturbed area (see Plate 5-16 of the MRP and Plate 5-30-3c of this appendix).

Within Huntington Creek, a turbidity curtain utilizing a flotation boom and weighted bottom will be installed within the creek to allow any sediment that might elude the silt fences or hay bales to settle to the stream bed, thus minimizing the impact of construction on the stream bed. The turbidity curtain will be installed prior to any other construction activities. In lieu of a turbidity curtain, a silt fence reinforced with chain-link fencing may be used at the discretion of the State Engineer. One or both structures may be utilized. The final determination will be made by the State Engineer when the stream alteration permit is issued.

All catch basins and inlets of all culverts reporting to the Crandall Creek along the pipeline alignment shall receive a silt trap immediately followed by a check dam to protect against silt from entering the culverts. These structures include silt fences, rolled fiber check dams (excelsior logs) and stone check dams (see Plated 5-16 and 5-30-3c). Rolled fiber and/or stone check dams will be installed at intervals of not less than 50 feet within roadside drainage ditches along Crandall Canyon Road below all construction activities within the project area.

All temporary sediment control structures will remain in place and maintained for a minimum of two (2) years after final reclamation of the pipeline has been completed, or until the new vegetation within the reclaimed areas has matured sufficiently to stop the flow of sediments into water channels, whichever is longer, to minimize any negative impacts to the water quality. Revegetation of all disturbed areas will proceed as quickly as is possible during and after pipeline construction. Reclamation procedures are detailed in Appendix 5-22.

All rock and subsoils excavated during the construction of the pipeline and its associated structures, not reused as backfill for the pipeline, will be either stored at the Crandall Canyon mine site for future backfill at final reclamation, or be removed from the site and transported for use at another mine site owned by the Permittee.

Chapter 3: Biology

The proposed pipeline and associated structures will create very little new surface disturbance.

The majority of the proposed pipeline will be located within the existing right-of-way for the Crandall Canyon Road. Thus, this portion of the pipeline will have very little to no impact on vegetation and wildlife, aside from disturbance during the construction phase of the project. A small portion of the pipeline will cross a previously undisturbed area of land along the western bank of the Huntington Creek.

The pipeline will extend from an elevation of approximately 7896' to approximately 7338' above sea level at the proposed outfall location, an elevation change of approximately 558' from the portal bench to the proposed outfall location. The area is year-round habitat for moose, summer habitat for elk, and winter habitat for deer. The dominant vegetative community for the undisturbed area is a mixed mountain shrub/conifer/aspen community. The alignment of the proposed pipeline through the undisturbed area will be done to avoid existing large trees and their respective root structures as much as is possible.

The Huntington Creek is home to several species of native and nonnative game and non-game fish. Flash flooding and debris flows from the Seely Fire in 2012 have caused damage to the habitat in the area of the undisturbed area. The area is slowly recovering from the damage. The installation of the pipeline and its associated structures should not impact the fish communities of the creek as no work is anticipated within the creek bed itself, except for the installation of the turbidity curtain or silt fence along the water's edge prior to construction activities.

The addition of the water from the proposed pipeline will increase the available water within the Huntington Creek for aquatic life. The Forest Service conducted wildlife investigations as part of the approval of the special use permit for the pipeline. A copy of the Wildlife Resources Report is included in this appendix as Attachment #5. A copy of the Biological Assessment and Biological Evaluation Report is also included in this appendix as Attachment #6.

The last raptor survey for the Crandall Canyon Mine was conducted in 2007. A new raptor inventory will be conducted prior to the construction of the pipeline and associated structures. The findings of that new raptor inventory will be provided to the Division.

Wildlife surveys were conducted by the U.S. Forest Service during the application process for the required special use permit for the pipeline. Copies of these reports accompany this appendix as attachments.

Chapter 4: Land Use

The current land uses for the proposed pipeline and associated structures are MMA (Leaseable Mineral Development Unit) for the Crandall Canyon Road, and UDM (Undeveloped Motorized Site) for the area to the southwest of the culvert carrying Crandall Creek below the roadway (currently undisturbed area). The area supports motorized traffic to and from the mine site

(Crandall Canyon Road) and along State Highway 31 east of Huntington Creek in the proposed area. Wildlife uses the general area for grazing and habitat.

The Crandall Canyon Road is expected to remain after final reclamation of the mine site for access to the existing memorial to those that perished in August 2007 due to a mining accident, as well as for access to the Forest Service hiking trail at the end of the Crandall Canyon Road. The proposed pipeline and associated structures will not change the land use, as the pipeline will be located within the existing road right-of-way. The small area outside of the road right-of-way will not alter the existing land use either, as it is currently used for vehicular traffic along Huntington Creek and its tributaries. The area will continue to provide grazing and habitat for local wildlife.

Cultural, Historic and Archeological inventories have been performed for the Crandall Canyon area from State Highway 31 to beyond the mine's surface facilities to the west. A more recent archeological survey was conducted by Forest Service as part of the permit approval process. A copy of that report is included in this appendix as Attachment #7. A single site was recorded in these inventories. The site (42EM722) is a rock shelter known as "Sherman's Shelter," located approximately 55 feet from the north edge of the existing Crandall Canyon Road paving, and approximately 900 feet due west of the Huntington Creek. The site is currently fenced. The proposed pipeline will remain at least 50 feet from the site at its closest point, and will not impact the site. All precautions will be taken during construction to not disturb the site. After construction, the pipeline will not affect the site. No other historic sites have been located within the pipeline project area.

Chapter 5: Engineering

Currently, water from behind the existing seals within the Crandall Canyon Mine is piped from the portal bench through 12" diameter HDPE pipes extending through the existing temporary seals to the water treatment facility below the portal bench. After treatment, the water is carried via ditches and culverts to the existing UPDES Outfall #002 location at the main bypass culvert that carries Crandall Creek below the mine site. The quality of the untreated mine water discharge has been steadily improving over time. It is currently at a point where treatment may not be necessary, based upon the requirements of the current UPDES permit. The Permittee therefore proposes to move the location of UPDES Outfall #002 from its current location at the main bypass culvert to the west bank of Huntington Creek, utilizing a pipeline to transport the mine water discharge to the new outfall location on the bank of the creek. The pipeline will mostly be constructed within the northern shoulder of the existing Crandall Canyon Road (Forest Service Road #50248). The pipeline is not anticipated to affect existing drainage patterns or topsoil piles located along the roadway.

The pipeline will be constructed in two phases. Phase 1 can be constructed while the surface facilities are in-use and operational. This phase will see the new pipeline tie into the existing piping just below the valves at the existing junction of the bypass piping (see Photograph #1),

and extend to the new outfall location near Huntington Creek (see Plate 5-3). The majority of the final pipeline configuration would be installed at this time including manholes and an energy dissipater near the outfall location. The existing water treatment facilities (i.e., maelstrom unit, settling pond, etc.) would remain intact. In the event that the raw mine water quality fell below the UPDES standards, treatment of the mine water could quickly be reimplemented until such time that the water quality came into compliance once again.

Phase 2 of the project would occur at the time of final reclamation of the mine's surface facilities. At this time, the water treatment facilities will be removed. A rock drainage system will be installed against the exposed sandstone highwall (see Appendix 5-28) and will be connected to the new proposed pipeline to accommodate seepage from the rock face. The new pipeline will be extended and connect to the existing piping on the portal bench, near the current location of belt transfer structure (see Plate 5-3a), utilizing an Alpha coupling manufactured by Romac Industries, Inc. (Or similar connector). The new pipe will be installed over the rock drainage, being buried a minimum of four feet within the reclaimed slope. The pipe extending to the existing valves seen in Photograph #1 will be cut and capped. This would be the final configuration of the pipeline and its associated structures.

Photograph #1: *Proposed Phase 1 tie-in location of new pipeline into existing piping.*

Photograph #2: *Previously disturbed area north of the Crandall Canyon Road, west of the Huntington Creek, and northwest of the traffic bridge crossing Huntington Creek. This is the proposed location of the energy dissipater and metering manhole. The outfall from the end of the pipeline will be exposed slightly above the existing riprap. Water will flow from the pipeline through a short riprapped channel and over the existing riprap to merge with Huntington Creek.*

The new proposed pipeline will be constructed using 8" diameter high-density polyethylene DR-17 (HDPE) pipe (see Attachment #1). The pipeline will utilize fused (welded) joints at all fittings and joints to create a strong, continuous pipe. A copy of a sample specifications for the HDPE pipe is included as Attachment #2. The pipe will be buried a minimum of five feet below the finished grades until the bank of Huntington Creek where it will breach the surface so the water may flow over the new and existing riprap to merge with the creek.

Phase 1 of the pipeline will generally be installed using the following steps. 1) Salvage, segregation and storage of topsoil. 2) Trenching for the pipeline. Excavated material will be temporarily stored alongside the pipeline trench. 3) Installation of imported bedding materials and pipeline. 4) Backfilling the trench in 12" lifts, with each lift compacted to 95% minimum proctor. 5) Redistribution of topsoil to disturbed area, feathering into undisturbed adjacent soils. 6) Seeding of the disturbed area using approved interim seed mix where needed, or application of riprap over geotextile fabric. 7) Final reclamation according to the approved reclamation plan in the MRP, including the application of approved final seed mix in areas without riprap, at the completion of construction of the pipeline. As trenching proceeds along the pipeline route, the pipe will be installed and the trench backfilled as soon as possible, topsoiled, and then seeded as quickly as possible. Trenches will be filled at the end of each work day for safety purposes. The pipeline system is intended to be a permanent installation and further reclamation activities beyond that noted above are not anticipated on the Phase 1 section of the project. Phase 2 of the pipeline will be reclaimed at the same time as final reclamation of the mine site per Appendix 5-22.

The above-mentioned construction steps will be implemented simultaneously as construction

progresses. Trenches will be filled at the end of each work day for safety purposes, and to reduce the amount of stored material on-site.

For maintenance purposes, two (2) reinforced concrete manholes will be installed along the pipeline's length. The upper manhole will be located near the existing sediment pond at the east end of the surface facilities (see Plate 5-3a, keyed note #28). The second manhole will be located approximately two-thirds down the pipeline route. The manholes will be used for maintenance of the pipeline and inspection of water flow. The manhole covers will be vented, and of a lockable type to prevent unauthorized access. Within the manholes, the pipeline will be interrupted so the vented manholes will allow venting of the pipeline.

Along the length of the pipeline, existing culverts will be encountered that run below the roadway. The new pipeline will be buried a minimum of 5'-0" below the existing culvert inlet elevation. When possible, the new pipe will be burrowed below the existing culvert. If burrowing is not an option, a portion of the existing culvert will be removed and reinstalled, or replaced with a new culvert of equal or greater diameter. The new pipeline will be installed above the existing culvert carrying the Crandall Creek. The culvert for Crandall Creek will not be disturbed.

An energy dissipater will be constructed to decrease the energy of the water and prevent erosion and damage to the bank of the Huntington Creek. The Permittee proposes a poured concrete energy dissipater be installed to absorb the energy of the water. The energy dissipater would be 10'-0" long x 6'-0" wide x 8'-0" tall, consisting of steel-reinforced, 4000 psi concrete. The height of the structure will allow the pipeline to buried at least 4'-0" below grade, which is below the frost line for this elevation. The top, bottom and walls of the structure will be 12 inches thick. A liner of ½" thick stainless steel plate will be installed on the sides and floor of the dissipater to protect the concrete from erosion. The reinforcing for the structure is based upon the Utah Department of Transportation's standard drawings for catchment structure of this size.

The pipeline will enter the concrete dissipater chamber at a height of 2'-0" above the floor slab, allowing the incoming water to exit the pipeline proper into the chamber that will act as a cistern and dissipate its energy. The water would then exit the chamber through the outflow that is located approximately 16 inches above the floor slab. This location will allow for the outlet to maintain flow at the same pace as the inlet, even in the event that the pipeline is completely full. One manhole will be installed above the energy dissipater for venting, inspection and maintenance purposes. The manhole cover will be of a vented and lockable type to prevent unauthorized access.

After exiting the energy dissipater, the water would enter a prefabricated packaged metering manhole. The manhole will be constructed of fiberglass with a vented, lockable access cover to prevent unauthorized access. Within the manhole will be a Parshall flume to monitor water flow. This location would also serve as a potential location for sample collection for water quality monitoring.

The water would then exit the manhole and flume to discharge into a short, riprapped channel that would lead to the bank of the Huntington Creek. The channel would be a maximum of 1'-6" across at the bottom, with banks sloping at a maximum slope of 2 horizontal units to 1 vertical unit to the existing grade. Geotextile fabric will then be laid along the bottom and sides of the channel prior to the riprap. Riprap will then be installed with a minimum of 9 inches thick at the bottom and the sides of the channel. The riprap would extend slightly beyond the edge of the channel to blend into the surrounding landscape and protect the edges of the channel. The new riprap would end at the existing riprap at the bank of the river, which would allow the water to merge with the Huntington Creek slowly to minimize erosion of the river channel. No new riprap will be placed within Huntington Creek.

Maintenance of the pipeline will be minimal to non-existent. The pipe is chemically inert, making mineral buildup within the pipe unlikely. Additionally, the pipe is nonmetallic, and thus eliminating concerns of rust. In the unlikely event of a clog within the pipe, the pipe can be cleaned out using low pressure water jets, or could be "pigged," if necessary, to remove any obstructions utilizing the concrete manholes and/or energy dissipater as access points. To date, the existing water discharge piping at the portals has not had problems with clogs or obstructions within the pipes. Due to the relative constant slope, the pipeline will be installed to prevent high points that could lead to air locks (vapor locks) within the pipe.

The pipeline is expected to generally operate partially full. The pipe has been sized to accommodate flows of more than 1,200 gallons per minute (see Attachment #1). The current flow rates are normally around 300 gallons per minute. This means that the pipe will not operate under pressure and will essentially act as a closed ditch.

Furthermore, the pipeline will be constructed of 8" nominal diameter DR17 HDPE pipe, with a pressure rating of 125 psi. The pipe will not flow full, and therefore will not operate under pressure. Burns et al (2005) present the results of an analysis of failure rates of 8-inch diameter Class 150 PVC in the United States. The lowest operation pressure that they evaluated was 105 psi. At this pressure, a failure rate of approximately one (1) failure per 100 kilometers per year was reported with pipe having an age of 100 years. At this rate, the approximate 6,550 feet (two kilometers) of pipeline from the Crandall Canyon Mine portals to the bank of Huntington Creek would experience 0.02 failures within 100 years.

After the concrete energy dissipater and metering manhole area has been reclaimed and seeded, a six-foot tall galvanized chain-link fence will be installed around the area, outside the sediment control structures, to protect the newly seeded area. A locked gate will be installed to provide access to the dissipater and metering manhole. The fence and sediment control structures will remain in-place until such time that the plant cover has matured enough to protect the soil from erosion. The fence and sediment control structures will be removed simultaneously.

A stream alteration permit is required for the work along the bank of the Huntington Creek. Due to the limited time of the permit duration, one year, a permit has not been attained at this time. A permit will be required prior to any work along the bank of the Huntington Creek. A copy of the

stream alteration permit will be provided to the Division when issued.

Signage delineating the boundaries of newly disturbed areas will be installed upon the completion of the pipeline construction. Also, signage will be placed at locations within one hundred (100) feet of the Huntington Creek and Crandall Canyon Creek to delineate the stream buffer zone.

Chapter 6: Geology

The majority of the new proposed pipeline will run within the existing right-of-way for the Crandall Canyon Road. The roadway traverses through the Star Point Sandstone Formation and into the Masuk Member Formation. Outcrops of the Star Point Sandstone are located along the alignment of the road. In these areas, hammer hoes will be required to break through the rock outcrop to the required depth. Some drilling and blasting may also be required as construction encounters the rock outcrops. The use of drilling and blasting will be used only when absolutely necessary.

Chapter 7: Hydrology

Water has been pumped and discharged from the Crandall Canyon Mine for many years. Flow rates have dropped over time, from more than 1,000 gallons per minute to the current approximate 300 gallons per minute. The mine water is currently discharged into the Crandall Creek. Moving the outfall location as proposed will remove this water inflow into the Crandall Creek. However, the discharged water will still enter the Huntington Creek, as it ultimately does now, only at a location slightly downstream from the Crandall Creek inflow into Huntington Creek.

Several seeps and springs are located in the general vicinity, and along the length of the Crandall Canyon Road (see Plate 7-12). The closest seeps and springs lie above the roadway and should not be affected by either moving the outfall location or the new proposed pipeline.

The closest groundwater rights to the proposed pipeline are located above the roadway and proposed alignment for the pipeline (see Plate 7-14). These groundwater rights should not be affected by either moving the outfall location or the new proposed pipeline.

The closest surface water right to the proposed pipeline is 93-188, which lies along Crandall Creek from the mine site to Huntington Creek. This water right will be affected because the mine discharge water will not flow into Crandall Creek after the current outfall location is relocated. However, Crandall Creek is a perennial stream, and the water flow for the creek will be restored to its original flow rate that existed prior to any mining operations within Crandall Canyon after the installation of the pipeline.

Please refer to Attachment 1: Information and Recommendations for the Proposed Genwal

Resources, Inc. Crandall Canyon Mine Water Pipeline prepared by Petersen Hydrologic, LLC for more hydrologic information regarding the proposed pipeline and associated structures.

The proposed pipeline and associated structures are intended to work with the existing drainage patterns. The new components should not significantly impact existing drainage patterns. All new excavations will be returned to approximate original contours (AOC) after the installation of the pipeline, meaning the current drainage patterns will be restored. The new location of the UPDES outfall is intended to appear to be a new "spring" to the casual observer that simply flows to the Huntington Creek.

Chapter 8: Bonding

Bonding for the proposed pipeline and associated structures is included in the latest submittal (April 2020).

ATTACHMENT #1:

INFORMATION AND RECOMMENDATIONS FOR THE PROPOSED GENWAL RESOURCES, INC. CRANDALL CANYON MINE WATER PIPELINE

ATTACHMENT #2:

**SAMPLE SPECIFICATIONS FOR
HIGH DENSITY POLYETHYLENE PIPE,
FITTINGS AND JOINING / FUSION**

ATTACHMENT #3:

DEPARTMENT OF WATER QUALITY (DWQ) LETTER TO THE DIVISION ANSWERING QUESTIONS REGARDING MOVING UPDES OUTFALL #002

ATTACHMENT #4:

SOILS SURVEY FOR NEW PIPELINE ALIGNMENT BY ENVIRONMENTAL INDUSTRIAL SERVICES (EIS)

ATTACHMENT #5:

WILDLIFE RESOURCES REPORT BY
THE UNITED STATES FOREST SERVICE

(PERFORMED DURING THE APPLICATION PROCESS FOR
THE SPECIAL USE PERMIT APPLICATION FOR
THE NEW WATER DISCHARGE PIPELINE)

ATTACHMENT #6:

BIOLOGICAL ASSESSMENT AND BIOLOGICAL EVALUATION (BA/BE)
BY THE UNITED STATES FOREST SERVICE

(PERFORMED DURING THE APPLICATION PROCESS FOR
THE SPECIAL USE PERMIT APPLICATION FOR
THE NEW WATER DISCHARGE PIPELINE)

ATTACHMENT #7:

ARCHEOLOGICAL SURVEY OF THE CRANDALL CANYON PIPELINE ALIGNMENT BY THE UNITED STATES FOREST SERVICE

(PERFORMED DURING THE APPLICATION PROCESS FOR THE SPECIAL USE PERMIT APPLICATION FOR THE NEW WATER DISCHARGE PIPELINE)

APPENDIX 5-30

RELOCATION OF UPDES OUTFALL #002 TO HUNTINGTON CREEK

PLATES

ATTACHMENT #1:

INFORMATION AND RECOMMENDATIONS FOR THE PROPOSED GENWAL RESOURCES, INC. CRANDALL CANYON MINE WATER PIPELINE

Information and Recommendations for The Proposed Genwal Resources, Inc. Crandall Canyon Mine Water Pipeline

29 March 2020

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Crandall Canyon Mine
East Carbon, Utah

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

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Table of Contents

Introduction …… .1
Proposed Pipeline Route …… .1
Mine-Water Discharge Rates and Pipeline Design Flows…..……. 3
Recommended Pipe Material ……. 5
Pipe Flow Dynamics Calculations ……. 5
Recommended Pipe Diameter ……..... 9
Air Venting ……. 9
Manholes ……10
Pipe outlet/energy diffuser ……..10
Water Quality Monitoring ……...12
Crandall Canyon Mine Discharge Water Quality ……12
Scaling Potential ……..14
Pipeline Area Geology and Morphology ……15
Potential Hydrologic Impacts……... 17
References Cited ……...…….…. 19

List of Figures

Figure 1 Location of the Genwal Resources, Inc. Crandall Canyon Mine.
Figure 2 Location of the proposed Crandall Canyon Mine discharge water pipeline.
Figure 3 Average yearly mine-water discharge from the Crandall Canyon Mine.
Figure 4 Monthly mine-water discharge rates for the Crandall Canyon Mine, 2016-2018.
Figure 5a Monthly TDS concentrations for the Crandall Canyon Mine discharge water.
Figure 5b Monthly TSS concentrations for the Crandall Canyon Mine discharge water.
Figure 5c Monthly pH values for the Crandall Canyon Mine discharge water.
Figure 5d Monthly total iron concentrations for the Crandall Canyon Mine discharge wat.
Figure 5e Monthly oil and grease concentrations for the Crandall Canyon Mine discharge.
Figure 6 Annotated photograph showing Quaternary alluvial sediments and Huntington Creek High water mark near the pipeline terminus location.

Calculations

Riprap stone sizing calculations

List of Drawings

Drawing 5-3 Engineering drawings of proposed Crandall Canyon Mine pipeline

Introduction

The Genwal Resources, Inc. Crandall Canyon Mine is located in Huntington Canyon approximately 15 miles northwest of the Town of Huntington, Utah (Figure 1). During the period of its operation, the underground mine produced low-sulfur bituminous coal using continuous miner and longwall mining techniques. The mine ceased operations in August of 2007. Beginning in early 2008, groundwater began to discharge as gravity flow from the mine portals. Historically, the Crandall Canyon Mine discharge water has been discharged to Crandall Creek under a UPDES permit (Permit No. UTU0024368) administered by the Utah Division of Water Quality. Genwal Resources, Inc. proposes to bypass mine-water discharge to Crandall Creek by piping the mine discharge water directly to Huntington Creek through a new buried pipeline in Crandall Canyon (Figure 2). The purpose of this report is to provide information and recommendations for the proposed buried pipeline project.

Proposed Pipeline Route

The general location of the proposed pipeline route is shown on a regional topographic base map in Figure 2. A detailed map that shows surveyed elevations and engineering details for the pipeline route is shown on Drawing 5-3. A cross-section view of the pipeline route that

shows surveyed ground elevations and the proposed buried pipeline locations is also shown on Drawing 5-3.

It is noted that based on ground conditions encountered during pipeline installation it may become necessary to deviate somewhat from the planned pipeline route as shown in Drawing 5-3. Notably, it is suspected that beneath some portions of the proposed pipeline route, hard siltstone and/or sandstone bedrock may be present at shallow depths beneath the asphalt pavement of Forest Service Road 0248.

The initial reach of the pipeline will extend approximately 130 feet from the mine-water intake areas at the Crandall Canyon Mine portals bench southward to the location of Forest Service Road 0248 (Drawing 5-3). The land surface in this initial pipeline reach exists entirely on previously disturbed land within the mine's existing permit area. The topographic gradient of the relatively short intake reach is steep (>0.50) as the pipeline crosses the near vertical cliff face.

The middle reach of the proposed pipeline location extends approximately 6,300 feet in an easterly/northeasterly direction down Crandall Canyon within the Forest Service Road 0248 right-of-way (Drawing 5-3). It is proposed that the pipeline in this reach be installed at a depth 5 feet beneath the existing paved road surface. Disturbance outside of the road right-of-way (i.e. the paved road surface and adjacent previously disturbed road shoulder) in this reach of the pipeline is not proposed. The topographic gradient of the middle reach of the

proposed pipeline, which essentially mirrors the topographic gradient of Road 0248, is approximately 0.075 (7.5%).

The lower reach of the proposed pipeline route extends approximately 200 feet from the lower extent of the middle reach within the Forest Service Road 0248 right of way to the proposed pipeline terminus adjacent to Huntington Creek (Drawing 5-3). The land surface in this short lower reach is situated outside of the existing Forest Road 0248 disturbance area. The final approximately 70 feet of the proposed pipeline route (0.3% of the total pipeline length) has a lower topographic gradient of about 0.02 (2%).

To prevent the discharge water from freezing during the cold winter months and to prevent damage from occurring to the buried pipeline within the roadway, it is recommended that the pipeline be buried to a depth of 5 feet.

Mine-Water Discharge Rates and Pipeline Design Flows

Mine-water discharge rates from the Crandall Canyon Mine are monitored monthly and reported to the Utah Division of Oil, Gas and Mining (UDOGM, 2019). Long-term discharge-rate trends from the Crandall Canyon Mine (2001-2018) are depicted as a bar graph in Figure 3. In Figure 3, the average yearly discharge rates for each year plotted. It is readily apparent from Figure 3 that mine-water discharge rates have trended generally downward during this 18-year period. After peaking at 1,016 gpm in 2001, the yearly discharge rates have declined to levels near 300 gpm in the past three years (UDOGM, 2019).

Monthly mine-water discharge-rate data for the most recent three-year period (2016-2018) are plotted in Figure 4. The average discharge rate for this period is 282 gpm, with a maximum monthly flow rate of 400 gpm and a minimum monthly flow rate of 211 gpm. We consider it likely that discharge rates will remain low and may continue to decline in the future.

Based on these considerations, a design mine-water discharge rate of 300 gpm is recommended for the normal operating condition at the proposed Crandall Canyon Mine pipeline. Periodically, short-lived surges in the mine discharge rates, commonly lasting from a few hours to a few days, have occurred intermittently over the period of mine discharge (Personal communication, Karin Madsen, 2019). The magnitudes of these short-term surges are commonly a few hundred gpm or less above the prevailing stable discharge level. Accordingly, for the purposes of pipeline design, a conservative value of 400% of the normal operating discharge level (1,200 gpm) is recommended to ensure adequate capacity in the pipeline to accommodate these short-term spike discharges or other upset conditions that may potentially occur. The 1,200 gpm recommended design level for the spike/upset conditions exceeds the maximum yearly discharge level of any of the past 18 years. This, in conjunction with the generally decreasing mine-water discharge rates observed over time suggest that the 1,200 gpm spike/upset condition is an appropriate value for design purposes. Additionally, the design specifications for the pipe to be utilized in the pipeline construction will be sized to provide additional capacity (above the 1,200 gpm level) to accommodate

additional flow to provide a margin of safety to the design (i.e. in the event of unanticipated surge flows, blockage, pipeline damage, or excessive scaling).

Recommended Pipe Material

We recommend the use of high density polyethylene (HDPE or PE) pipe for the construction of the Crandall Canyon Mine discharge-water pipeline. PE pipe has been utilized for many years in mining projects in the Utah mining industry and is generally known in the industry to perform satisfactorily.

A local supplier of PE pipe is ISCO Industries of West Jordan, Utah. Based on product information provided by ISCO, PE pipe is considered a good choice for the proposed pipeline construction based on the following characteristics of PE pipe:

- Low friction coefficient
- Low scaling potential
- Durable over long-term use
- Joints are readily formed by a heat welding process that results in strong joints
- Suitable pressure ratings for application

Pipe Flow Dynamics Calculations

To determine an appropriate pipe size that will accommodate the anticipated mine-water discharge rates, flow dynamics calculations were performed. Calculated discharges for gravity flow through partially filled pipelines were performed using the Manning Equation. The pipe flow dynamics calculations were performed to incorporate atmospheric pressures on the water surface of partially filled pipes.

Calculations were also performed to determine the pipe-full, maximum gravity flow capacity for the 8-inch PE pipe as it would be installed in the Crandall Canyon Mine discharge water pipeline. For pipe-full gravity-flow conditions, the calculations were performed using the Hazen-Williams Formula. It is noted that all of these calculations were based on a PE pipe of type DR17, rated for 125 psi. The inside diameters of the 8-inch DR17 pipe is 7.549 inches per the manufacturers specifications. The results of these calculations are presented below.

8-INCH PE PIPE CALCULATIONS

Normal conditions, 8-inch PE pipe at 300 gpm discharge rate

Pipe type: ISCO – PE4710 HDPE DR17 8-inch
Pipe diameter (I.D.): 7.549
Manning roughness, n: 0.009
Pressure slope/pipe slope, s: 0.075

Manning's Formula – Uniform pipe flow, partially full
Ratio of full depth: 0.274 of total diameter (2.07 inches deep in pipe)
Flow, Q: 300 gpm
Velocity, v: 9.72 ft./sec

Surge/upset conditions, 8-inch PE pipe at 1,200 gpm discharge rate

Pipe type: ISCO – PE4710 HDPE DR17 8-inch
Pipe diameter (I.D.): 7.549
Manning roughness, n: 0.009
Pressure slope/pipe slope, s: 0.075

Manning's Formula – Uniform pipe flow, partially full
Ratio of full depth: 0.59 (4.45 inches deep in pipe)
Flow, Q: 1,200 gpm
Velocity, v: 14.0 ft./sec

Maximum Pipe Flow Capacities
Hazen-Williams Formula – Gravity-Fed, Full Pipe
(Ambient temperature and turbulent flow)

Pipe type: ISCO – PE4710 HDPE DR17 8-inch

Pipe Diameter (I.D.): 7.549 inches
Roughness Coefficient: 150 (unitless)
Pipe Length (b): 6,500 feet
Drop (a): 550 feet

Hazen-Williams formula – full pipe
Velocity: 16.2 ft./sec
Discharge rate: 2,260 gpm

Recommended Pipe Diameter

Based on the calculations presented above and summarized here, it is apparent that 8-inch DR17 pipe would perform adequately at both the 300 gpm and 1,200 gpm flow design requirements. The calculated maximum flow capacity of the 8-inch PE pipe (2,260 gpm) considerably exceeds the maximum design flow rates.

8-inch PE pipe flow conditions	
300 gpm normal operation conditions	
Ratio of full depth	0.274
Water depth in inches	2.07
Water velocity (ft./sec)	9.72
1,200 gpm spike/upset conditions	
Ratio of full depth	0.59
Water depth in inches	4.45
Water velocity (ft./sec)	14.0
Maximum pipe-full flow capacity (gpm)	2,260
Water velocity at flow capacity (ft./sec)	16.2

Air Venting

To maintain atmospheric pressures on the water surface within the operating pipelines and promote smooth flow throughout the length of the buried pipeline, we recommend that air vents (open air type) be installed approximately every 1,000 linear feet along the entire length of the installed pipeline. Alternatively, air venting may be accomplished through manhole access points along the pipeline route (the pipeline in the manhole access points is open to the atmosphere for inspection and maintenance). It is noted that, under the design flow conditions described above, water theoretically flows through the pipeline under

partially-full conditions, resulting in free-flowing, atmospheric pressure conditions along the length the pipeline (under both normal operating and spike flow discharge rates).

Manholes

One or more manholes constructed at intervals along the Crandall Canyon Mine discharge water pipeline would facilitate access to the buried pipeline for inspection and possible maintenance/cleanout activities over the life of the pipeline. Such manholes should be locked and secured to prevent unauthorized access/vandalism.

Pipe Outlet/Energy Diffuser

We propose that the pipeline terminate into a suitably sized concrete vault that can be partially buried in the unconsolidated sediments near Huntington Creek. The concrete vault will anchor the pipeline to the ground surface and also facilitate energy dissipation of the swiftly flowing water discharging from the pipeline. Stone rip-rap (or similar) should be emplaced between the concrete vault outlet and the designated discharge point into Huntington Creek to minimize erosion potential. The outlet side of the vault opposite the inlet structure could contain multiple holes to allow water to flow outward from concrete vault under lower energy conditions (decreased velocity) toward Huntington Creek. Water flowing outward from the concrete vault will flow over the riprap material to prevent erosion of the unconsolidated sediments present in the area.

Sizing of stone riprap for the pipeline outlet location was performed using investigative techniques described in the National Engineering Handbook – Technical Supplement 14C.

Details of the sizing calculations are shown in the attached Riprap Stone Sizing Calculations sheet. Sizing results calculated using the US Bureau of Reclamation method, U.S. Geological Survey method, Abt and Johnson method, Isbash Technique, and the USACE Steep Slope method average 6.4 inches in diameter D_{50}, ranging from 4.6 to 8.4 inches in diameter. Using the average value of 6.4 inches with a safety factor of 1.4, a D_{50} size of 9 inches is recommended for use at the pipeline outlet location. The recommended riprap size exceeds that determined using any of the five individual methods used to calculate the stone riprap sizing (it is noted that the USACE method provides a D_{30} sizing). Geofabric installed beneath the placed riprap will increase the stability of the riprapped pipeline outflow area and minimize the erosion potential.

We also recommend the possibility of installing a suitably sized Parshall Flume at the pipeline terminus outlet structure for future use in monitoring mine water discharge rates. The Parshall Flume could potentially be enclosed within the concrete vault outlet structure so that the flume is protected from wintertime freezing conditions, disturbance from vandalism, and prevent the entry of foreign objects into the flume that could detrimentally influence the flow readings (e.g. rocks, sticks, leaves, litter, etc.). Such a flume structure could be constructed in place within the vault, or alternatively prefabricated flume units designed specifically for installation in a vault/manhole application are commercially available. A six-inch Parshall flume has good performance characteristics at flows ranging from a minimum flow of about 24 gpm (h = 0.10 feet) to a maximum flow of about 1,750 gpm (h = 1.50 feet). This range of flows spans the anticipated flow rates from the pipeline design specifications. Alternatively, a nine-inch Parshall flume could be utilized, although the 9-inch flume has a

somewhat lower minimum working limit of 41 gpm (h = 0.10 feet) but a higher maximum working range of about 2,560 gpm (h = 1.50 feet). Discharge measurements from the flume could be made by manually reading the stage levels at the flume a required. Alternatively, a continuous monitoring system could be set up using either a pressure transducer or ultrasonic distance sensor to measure the flume stage together with an electronic data logger to record the flume readings at the desired time intervals.

Water Quality Monitoring

Samples of the mine discharge water for required water quality monitoring could be collected from access locations at the pipeline terminus structure (concrete vault energy dissipater/Parshall Flume location).

Crandall Canyon Mine Discharge Water Quality

Water quality monitoring of the Crandall Canyon Mine discharge water is routinely performed by Genwal Resources personnel. Water quality information is submitted to the Utah Division of Oil, Gas and Mining. Previously, the water quality of the mine discharge water was elevated in total iron concentration and treatment of the water was necessary prior to its discharge to the Huntington Creek drainage (to Crandall Creek). More recently, the total iron concentrations of the untreated mine discharge water have naturally dissipated to levels such that treatment of the water is no longer necessary to be in compliance with the UPDES permit effluent limitation of 1.24 mg/L total iron.

Plots of important water quality parameters in the mine discharge water, including total dissolved solids, total suspended solids, pH, total iron, and oil and grease for the year 2018 (the most recent year for which data are available) are presented in Figure 5.

TDS

Total dissolved solids (TDS) concentrations measured in the Crandall Canyon Mine discharge water during 2018 averaged 536 mg/L with a general downward trend in the concentration during the year.

TSS

Total suspended solids (TSS) concentrations measured in the Crandall Canyon Mine discharge water during 2018 were continuously at or below 5 mg/L. These values indicate continuous compliance with the UPDES limits for TSS throughout 2018.

pH

The pH of the untreated Crandall Canyon Mine discharge water during 2018 was continuously between 7.1 and 8.8, which is within the effluent limitations of the mine's UPDES permit.

Total iron

The total iron concentrations of the untreated Crandall Canyon Mine discharge water during 2018 were in continuous compliance with the 1.24 mg/L effluent limitation

specified in the mine's UPDES permit. The average total iron concentration measured during 2018 was 1.055 mg/L.

Oil and Grease

Oil and Grease was measured in the Crandall Canyon Mine discharge water during each of the 12 months of 2018. No oil and grease was detected during any of the monthly sampling events.

Scaling Potential

Outgassing of dissolved CO_2 from the mine discharge water may potentially occur as the water comes into contact with the atmosphere. As a consequence of the loss of CO_2, pH levels increase and carbonate precipitation may occur. Under these conditions, there is the potential for carbonate deposition (scaling) to occur on the walls of the water-bearing pipes. Such scaling could over time reduce the flow capacity of the pipe. However, the manufacturers of PE pipe indicate that the pipe has a very low scaling potential on the smooth, non-porous surfaces of PE pipe. Additionally, because of the relatively rapid fluid flow rates anticipated in the pipeline, the total residence times for water traveling through the pipeline is low. Assuming a 9.5 ft./sec operating flow velocity in the pipeline and a 6,500-foot travel distance, the residence time for the water in the pipeline is only about 11.4 minutes. This allows only a limited time for geochemical evolution of the water to occur within the pipeline. Given the reported low scaling potential of the PE pipe material, the calculated rapid flow velocities and the brief residence time in the pipeline, the potential for

large amounts of scaling to occur in the pipeline seems low. Carbonate precipitation at the pipeline terminus location, however, could potentially occur.

Pipeline Area Geology and Morphology

The bedrock and surficial geology of the rocks and sediments present along the route of the proposed Crandall Canyon Mine discharge water pipeline are described briefly here. The Crandall Canyon Mine portals are situated within the Hiawatha coal seam, which sits near the base of the Cretaceous Blackhawk Formation. Underlying the mine portals area is the Cretaceous Star Point Sandstone. The Star Point Sandstone consists locally of three of tongues of gray or tan competent sandstone members interbedded with softer shale units of the Mancos Shale between the sandstone tongues. The uppermost of these tongues, the Spring Canyon sandstone member, forms the steep ledge that is present and exposed immediately beneath the mine portals location. The Spring Canyon Member is also exposed along the uppermost reaches of the pipeline route along Forest Service Road 0248. The other major sandstone members of the Star Point Sandstone, the Storrs Member and the Panther Member, outcrop at distances further down the canyon. The steep, south-facing slopes of the hillsides along the pipeline route may also locally contain a veneer of unconsolidated colluvial deposits in the shallow subsurface. In other areas, the bedrock sandstone units are at or very near the land surface. Considerable effort may be required to excavate the buried pipeline route in areas where the Star Point Sandstone members are present in the shallow subsurface along the proposed pipeline route.

In the area near the proposed pipeline terminus location, unconsolidated Quaternary alluvium and colluvium are present in the shallow subsurface. These sediments are well exposed in the incised Huntington Creek channel walls near the pipeline terminus location (Figure 6). The unconsolidated sediments exposed in the stream banks include sand, silt, gravel, and boulders. Some of the boulders in the alluvial/colluvial deposits are large, up to several feet in diameter.

As part of this investigation, a delineation of the high water mark on Huntington Creek near the proposed pipeline terminus was performed. In making this delineation, the location of a well-defined depositional horizon where sand and silty sediments along with woody debris were apparently deposited during the recent burn scar runoff flood events was utilized. There were no obvious indications of a high water mark at a higher level than that of the top of the flood-deposited sandy, silty, and woody observed at the site. The delineated high water mark for Huntington Creek is shown on Figure 6.

As a result of substantial erosion of the alluvial deposits adjacent to the Huntington Creek stream banks (including erosion likely associated with the burn scar runoff events) Huntington Creek near the pipe terminus is incised into the surrounding unconsolidated alluvial deposits. This has resulted in steep and even near-vertical stream banks in the area. A short distance upstream of the proposed pipeline terminus location, a near-vertical stream bank that rises about 14.5 feet above the current water level was observed (Figure 6). Because of the incised condition of the creek and the steep stream banks, there is no appreciable active flood plain present along the margins of the creek in this location. Rather,

stream flood flows are likely contained entirely within the deeply incised stream channel. A planar surface that appears to be an older, abandoned flood plain/terrace on the west side of the creek at an elevation that is substantially higher than the current creek level is present a short distance upstream of the pipeline terminus location.

Potential Hydrologic Impacts

Crandall Creek is a tributary to the much larger Huntington Creek drainage in Huntington Canyon (Figure 2). The Crandall Creek confluence with Huntington Creek is located approximately 1.25 miles east of the mine portals area (Figure 2). The proposed pipeline route/disturbance location lies within the Crandall Creek drainage (Figure 2). The surface-water drainage area in which the proposed buried pipeline construction activity will occur includes the relatively dry, south-facing hillsides that are situated between the ridgeline that divides the Crandall Canyon and Shingle Canyon drainages and the Crandall Creek stream channel. The surface-water drainages that drain precipitation waters from the south-facing slopes of Crandall Canyon that include the proposed pipeline route all appear to be ephemeral in nature. Springs and seeps have previously been identified in the surrounding areas (see Plate 7-12 in the Crandall Canyon Mine MRP for spring and seep locations). However, no springs or seeps or any appreciable groundwater discharge was observed within the pipeline construction/disturbance corridor during field reconnaissance visits during 2019. Further, no significant riparian resources were found within the Forest Service Road 0248 paved area or along the shoulder of the right-of-way within the pipeline disturbance area. Accordingly, impacts to springs and seeps and any associated riparian ecosystems within the Forest Service Road 0248 pipeline construction disturbance area are not anticipated.

During the pipeline construction activities, best management practices will be utilized to minimize the potential for contamination of surface-water resources in Crandall Creek.

The proposed pipeline route deviates from the Road 0248 right-of-way for the final approximately 200 feet of the proposed pipeline location to the proposed pipeline terminus near Huntington Creek. Increased vegetation is present along this final 200-foot reach of the proposed pipeline route.

Disturbance of the land in this reach will be done in compliance with all pertinent State and Federal regulations.

References Cited

National Engineering Handbook, Part 654, Technical Supplement 14C, 2007, Stone Sizing Criteria, 210-VI-NEH, August 2007, accessed March 2020, https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17812.wba

NRCS, Accessed 2019, Manning equation for pipe flow, open-channel flow, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_024957.xls

Hazen-Williams Equation, Full pipe gravity-fed flow, http://www.calctool.org/CALC/eng/civil/hazen-williams_g

Utah Division of Oil, Gas and Mining, 2019, on-line Coal Water Quality Database, https://www.ogm.utah.gov/coal/wqdb.php.

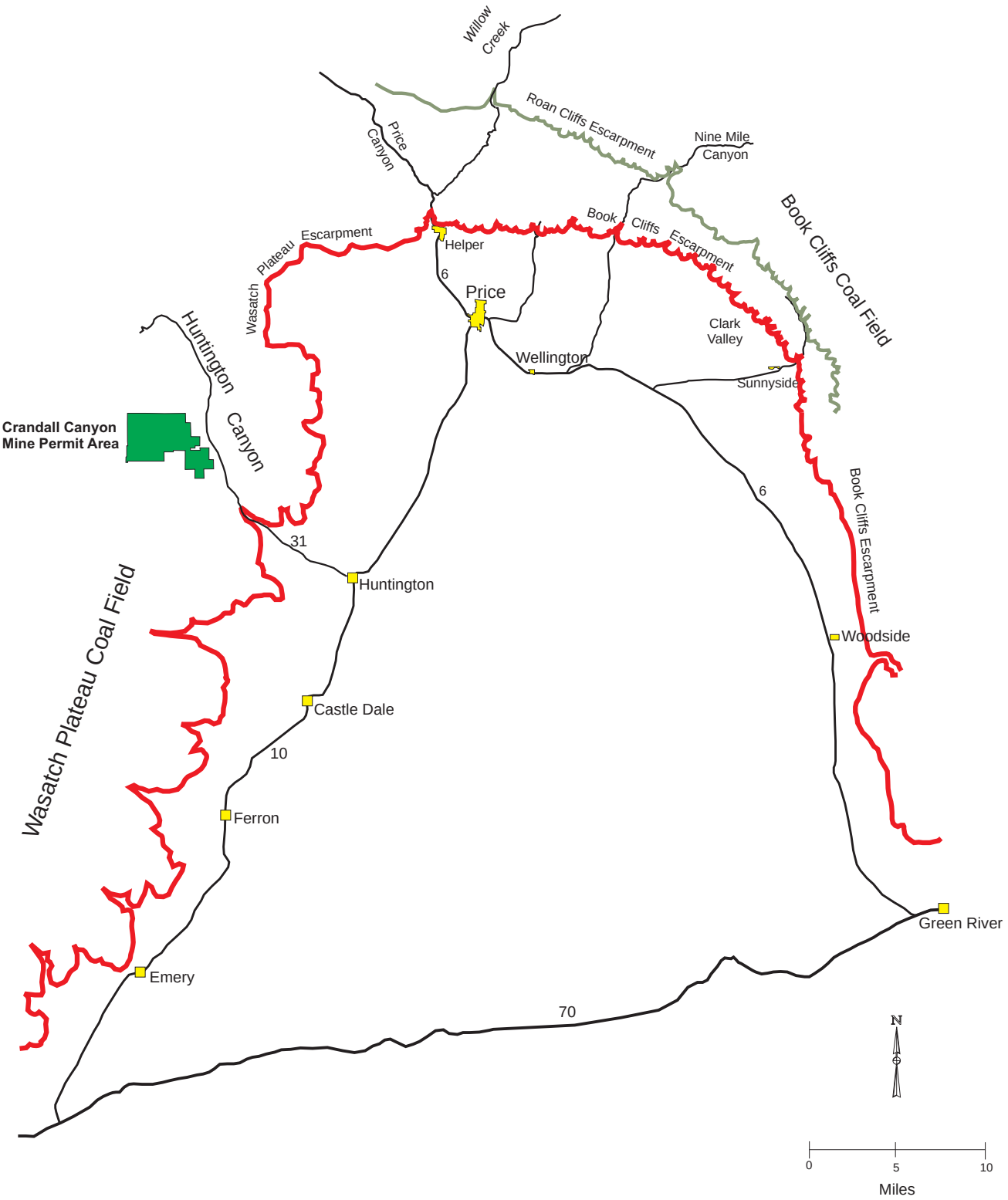


Figure 1 Location of the Genwal Resources, Inc. Crandall Canyon Mine.

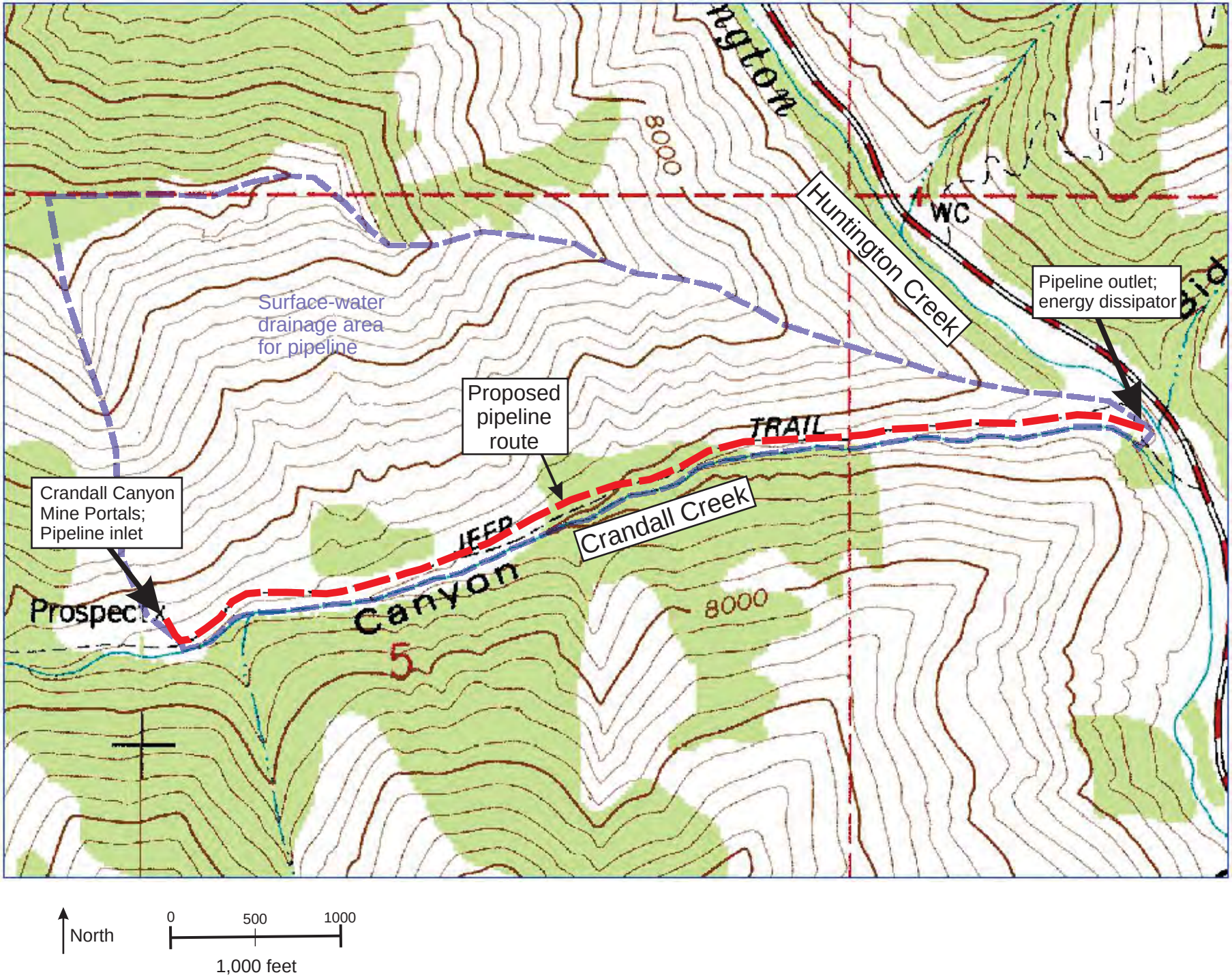
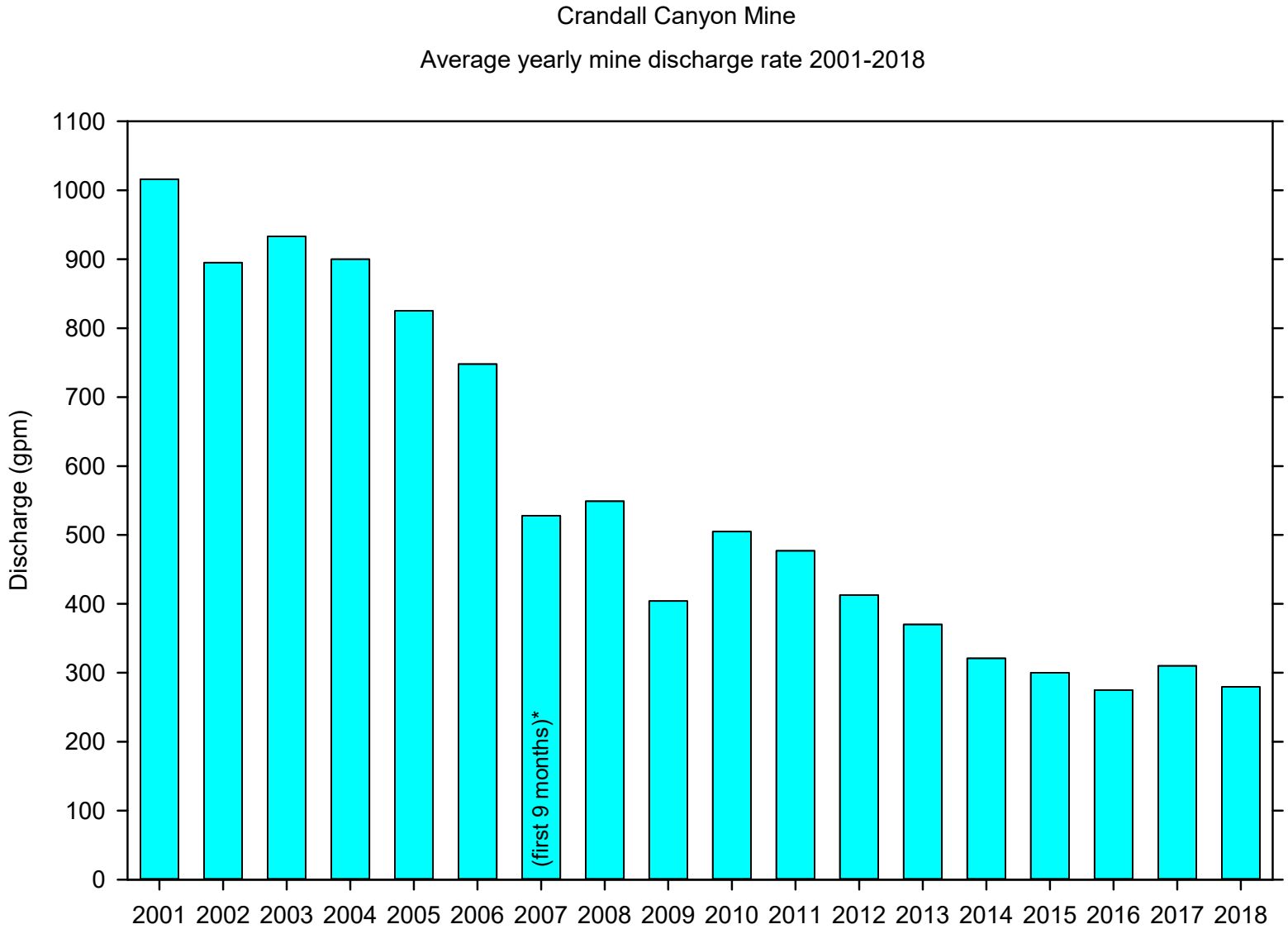


Figure 2 Location of the proposed Crandall Canyon Mine water discharge pipeline.



*The average discharge rate for the first 9 months of 2007 is plotted because during the last 3 months of 2007 the mine pumps had been shut off but gravity discharge of mine water to the surface had not yet occurred.

Figure 3 Average yearly mine-water discharge rates for the Crandall Canyon Mine.

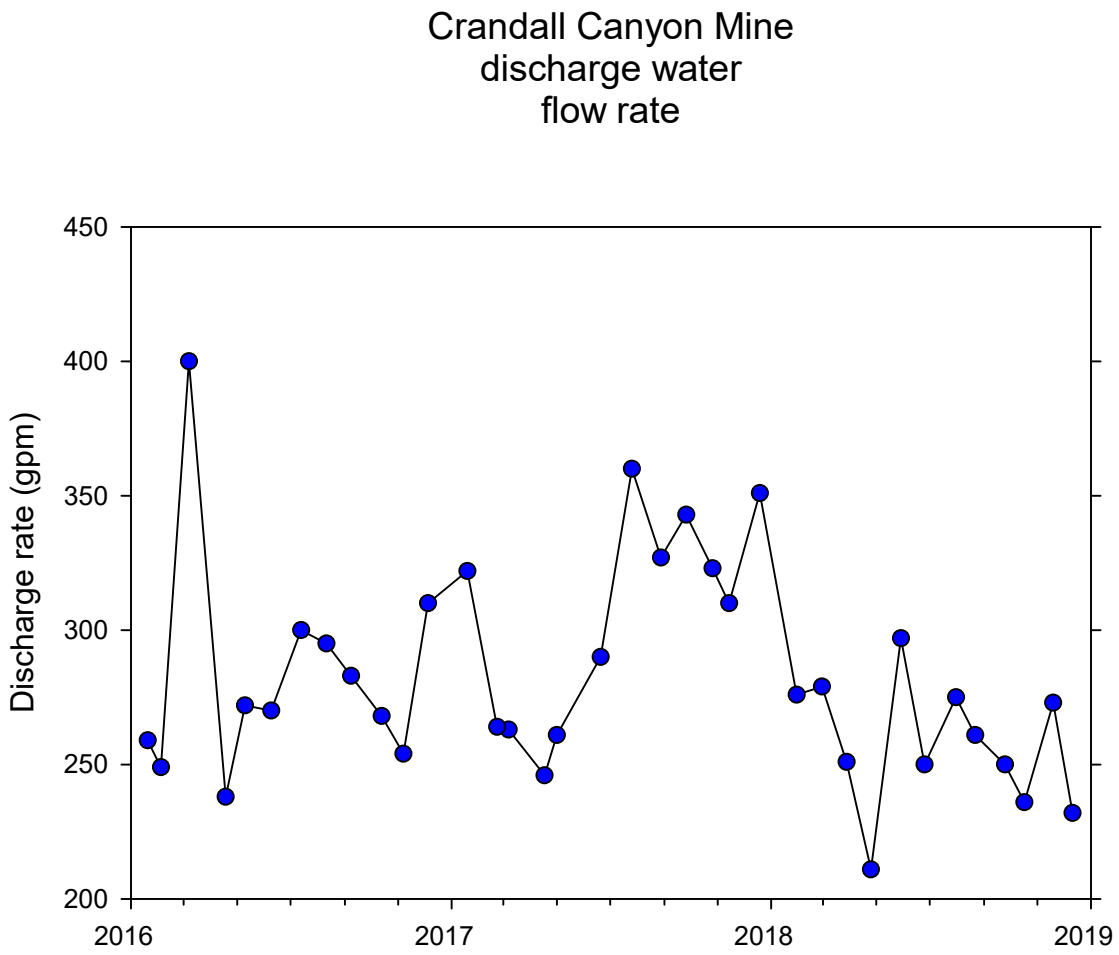


Figure 4 Monthly mine-water discharge rates for the Crandall Canyon Mine, 2016-2018

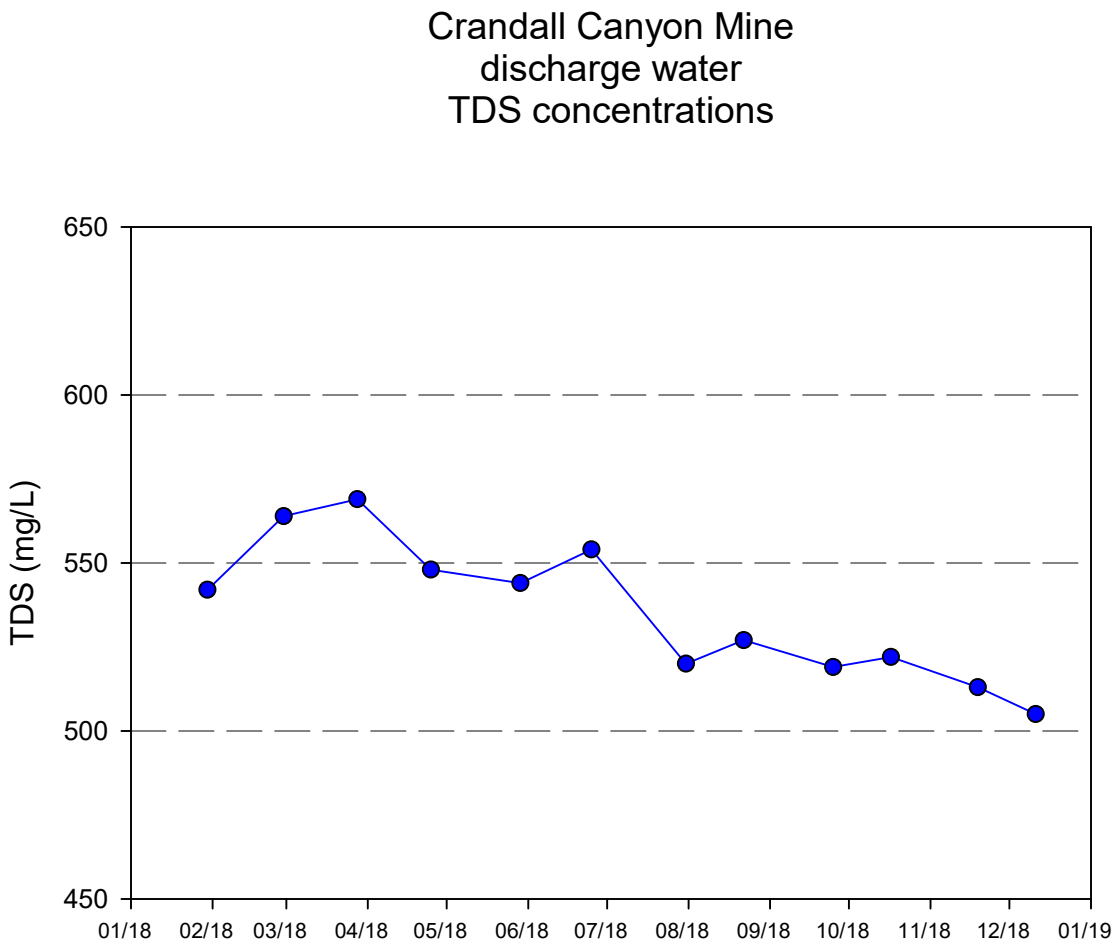
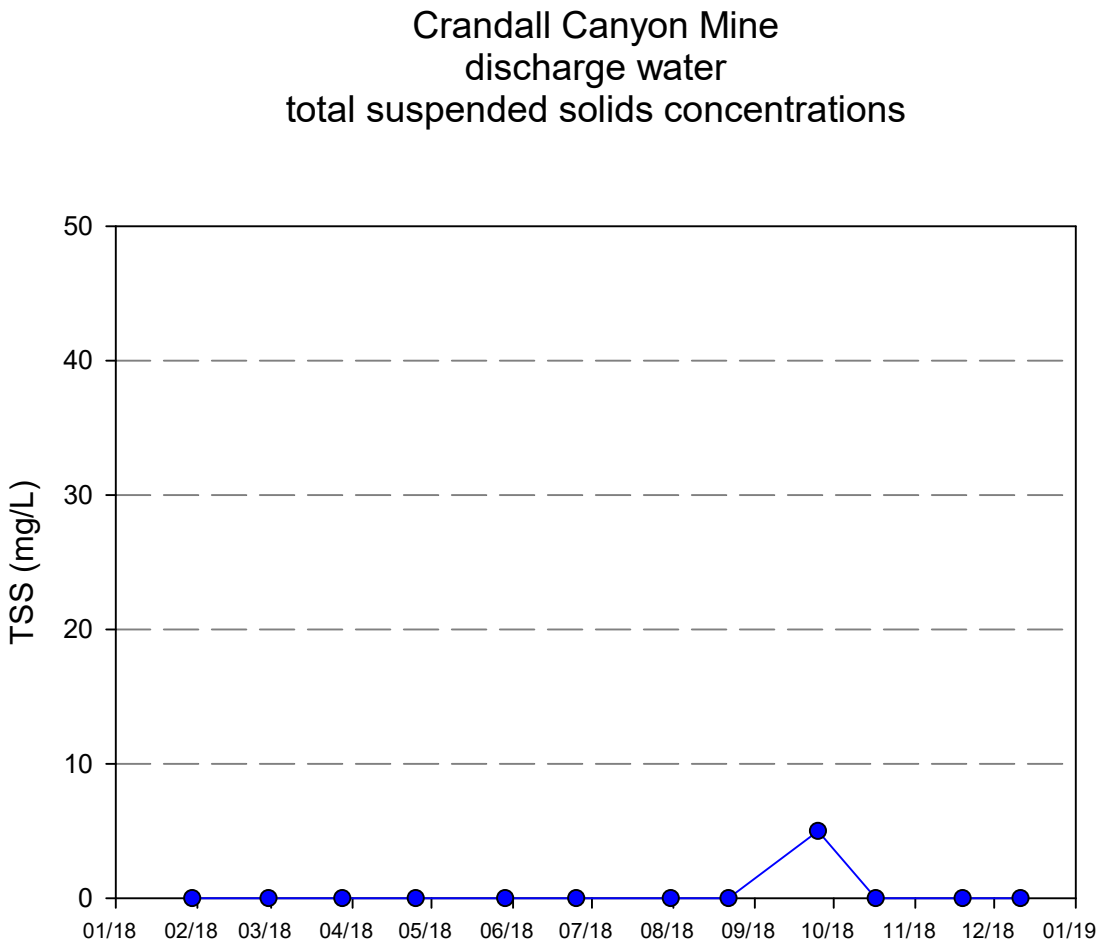


Figure 5a Monthly TDS concentrations for the Crandall Canyon Mine discharge water for 2018.



Note: When value is ND, a value of zero is plotted on this graph

Figure 5b Monthly TSS concentrations for the Crandall Canyon Mine discharge water for 2018.

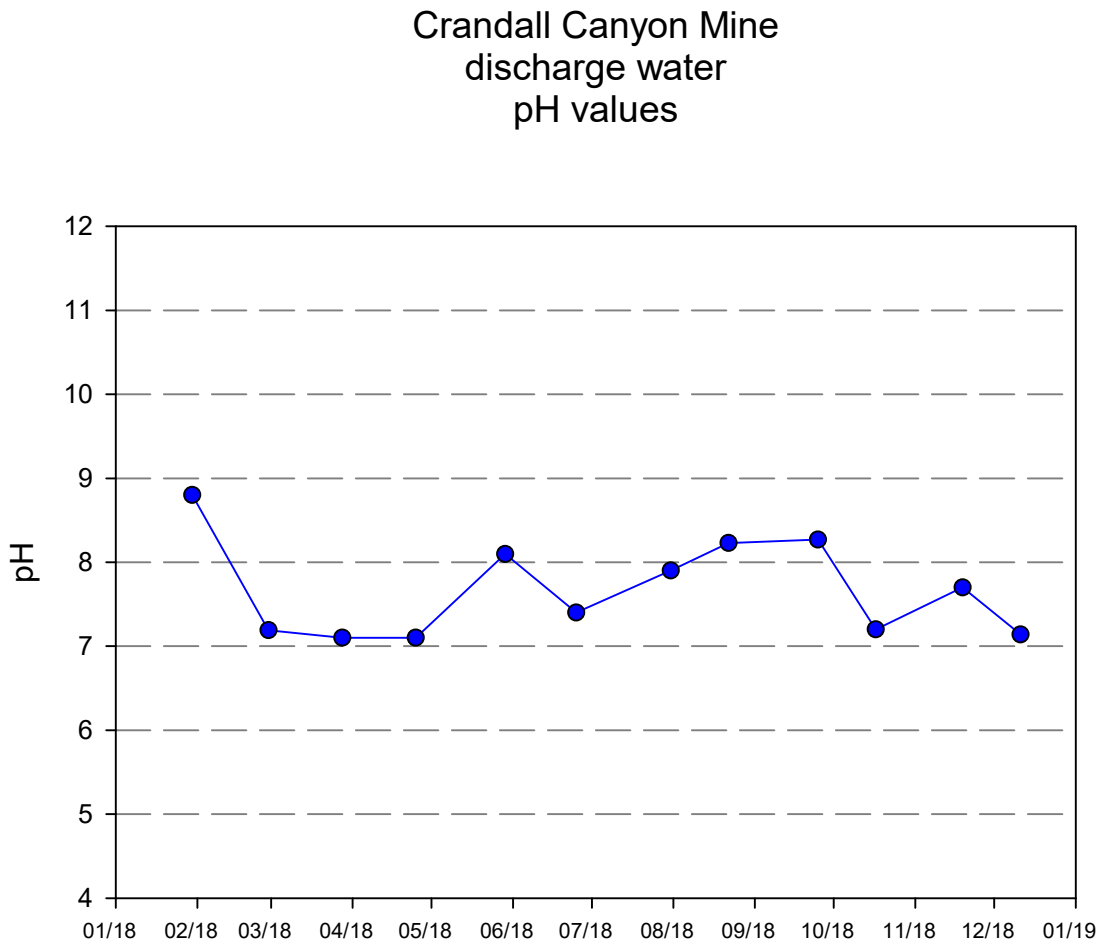


Figure 5c Monthly pH values for the Crandall Canyon Mine discharge water for 2018.

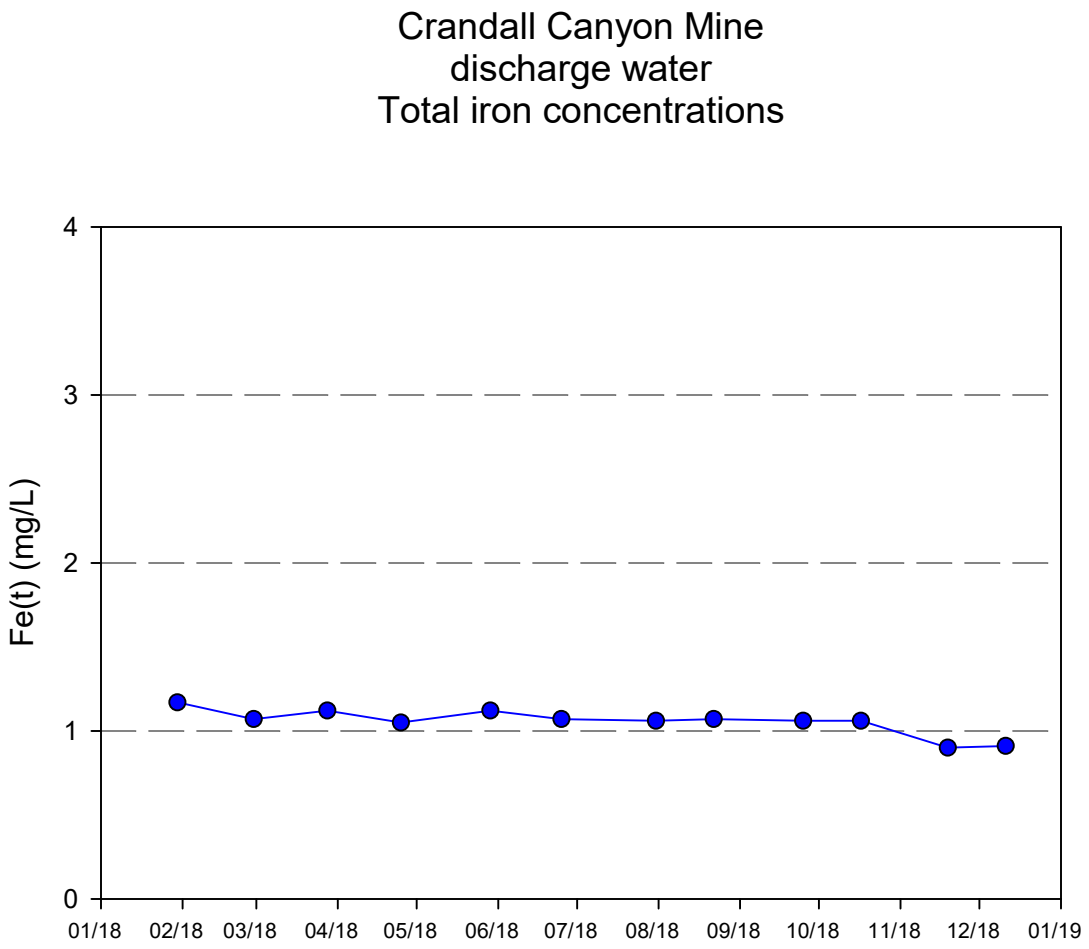
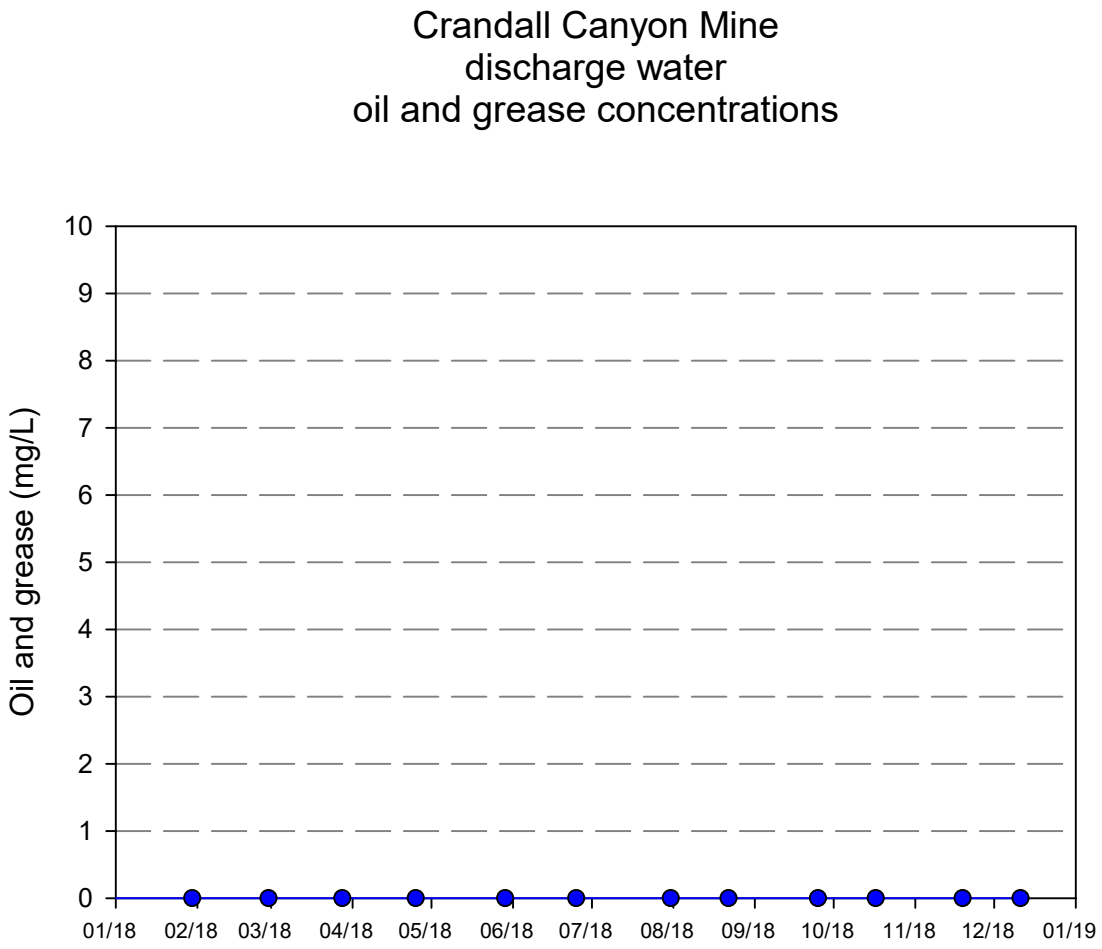


Figure 5d Monthly total iron concentrations for the Crandall Canyon Mine discharge water for 2018.



Note: When value is ND, a value of zero is plotted on this graph

Figure 5e Monthly oil and grease concentrations for the Crandall Canyon Mine discharge water for 2018.

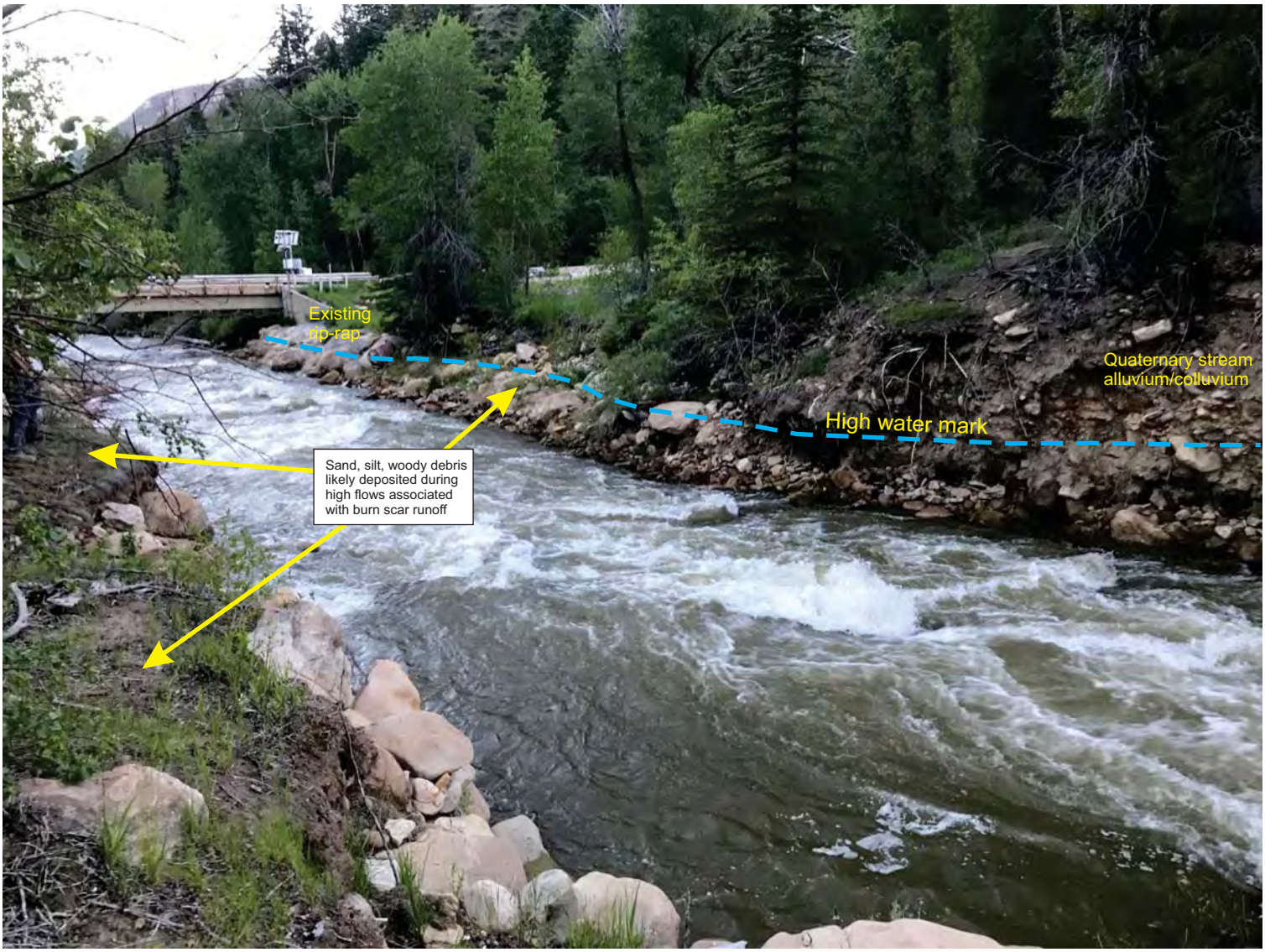


Figure 6 Annotated photograph showing Quaternary alluvial sediments and Huntington Creek high water mark near the pipeline terminus location.

Riprap Stone Sizing Calculations

Assumptions
Q - 2.67 cfs (1,200 gpm spike peak design flow)
b - Channel bottom width: 1.0 feet
Channel water depth (b): 0.5 feet
q - unit discharge (Q/b): 2.67 ft3/s/ft
S - channel slope: 0.30
V - Average channel velocity: 5.34 ft/sec
(1.0 ft width x 0.5 ft depth x 5.34 ft/sec = 2.67 cfs)
gravitational constant: 32.2 feet/sec^2

Method: U.S. Bureau of Reclamation (eq. TS14C-9)
$D_{50} = 0.0122V^{2.06}$
D_{50} = median stone diameter (feet)
V = average channel velocity (ft/s) = 5.34 ft/s
D_{50} = 0.39 feet (4.62 inches)

Method: U.S. Geological Survey Method (eq. TS14C-10)
$D_{50} = 0.01V^{2.44}$
D_{50} = median stone diameter (feet)
V = average channel velocity (ft/s) = 5.34 ft/s
D_{50} = 0.60 feet (7.15 inches)
Note: this method typically provides overly conservative results.

Method: Abt and Johnson (eq. TS14C-14)
$D_{50} = (q_{design})^{0.56} \times S^{0.43} \times 5.23$
D_{50} = median stone diameter (inches)
D_{50} = 0.45 feet (5.40 inches)
Note: rounded stone should be oversized by 40% to provide the same protection as angular stone.

Method: Isbash Technique (Figure TS14C-6)
$D_{50} = ((8W50)/(\pi\Upsilon_s))^{1/3}$
D_{50} = median stone diameter (feet)
Υ_s = specific stone weight (2.65x62.5 lbs) = 165 lbs/ft^3
W_{50} = 10 lbs
D_{50} = 0.54 feet (6.44 inches)

Method: USACE Steep Slope (eq. TS14C-12)
$D_{30} = (1.95S^{0.555} (Cq)^{2/3})/g^{1/3}$
C - flow concentration factor (1.25)
q - unit discharge (2.67 ft/s/ft)
D_{30} = 0.70 feet (8.42 inches)
Note: result is as D_{30} (m percent finer by weight).
Note: 0.30 slope exceeds 2 to 20 percent design range.
Note: This equation typically predicts conservative sizes.

ATTACHMENT #2:

**SAMPLE SPECIFICATIONS FOR
HIGH DENSITY POLYETHYLENE PIPE,
FITTINGS AND JOINING / FUSION**

SECTION 15XXX

HIGH DENSITY POLYETHYLENE (HDPE) PIPE, FITTINGS AND JOINING/FUSION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This specification covers the material (pipe and fittings), joining methods and general installation practice for high density polyethylene pipe (HDPE) piping systems for water and wastewater utility use as indicated on the Drawings.

1.02 SUBMITTALS

A. Submit product data to the Engineer for review in accordance with the Section XXXXX for all pipe, fittings, and appurtenances.

B. Contractor shall also submit the following to the Engineer for approval:

1. Certified dimensional as-built drawings/profile of all installed pipe, specials and fittings.

2. Details of fittings and specials such as elbows, tees, outlets, connections, test bulkheads, nozzles or other special items where shown on the Construction Drawings. All connections to jointed gasketed pipe materials, valves or fire hydrants must be restrained and supported independently to withstand the pressure transients, soil settlement, and external loading conditions.

3. The Supplier of the material shall submit, through the Contractor, a Certificate of Compliance that the HDPE pipe and fittings furnished for this project are FM approved materials that meet or exceed the standards set forth in this specification. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials.

4. Provide a statement that personnel responsible for fusing the pipe have been trained and qualified.

C. For items that do not meet all of the requirements of this specification, the bid/submittal shall include a written description of the deviations, along with data that show the magnitude and the justification for the deviation from the specification. The decision to accept material deviating from this specification shall be the responsibility of the specifying engineer and must be approved in writing.

1.03 REFERENCE DOCUMENTS AND STANDARDS

The standards and documents listed below may apply to the materials and practices in this specification. In the event of a conflict, the requirements of this specification prevail. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the project bid date.

ANSI/AWWA

- ANSI/AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
- ANSI/AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission
- ANSI/AWWA C651 Standard for Disinfecting Water Mains
- AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation

Plastics Pipe Institute, PPI

- PPI Handbook of Polyethylene Pipe – 2009 (2ndEdition)
- PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe
- PPI Material Handling Guide for HDPE Pipe and Fittings
- PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
- PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
- PPI TR-38 Bolt Torque for Polyethylene Flanged Joints
- PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects
- PPI TR-46 Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe

ASTM

- ASTM F 585 Standard Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers
- ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
- ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
- ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and
- ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
- ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings
- ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
- ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
- ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
- ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
- ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
- ASTM F 2880 Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3⁄4 in. to 65 in.
- ASTM F 3124 Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints
- ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- ASTM D 3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
- ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

PART 2 – PRODUCTS

2.01 HIGH DENSITY POLYETHYLENE MATERIALS

A. Resin and Material Requirements

1. All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D 3350 with a minimum cell classification of 445474C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

B. HDPE Pipe

1. Pipe shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black of not less than 2 percent. The manufacture of the HDPE resin shall certify the cell classification indicated.

2. Pipe sizes 3" and large shall have a manufacturing standard of ASTM F 714, while pipe smaller than 3" shall be manufactured to the dimensional requirements listed in ASTM D 3035. Dimension Ratio (DR) and Outside Diameter (IPS/DIPS) shall be as specified on plans.

3. Pipe shall meet AWWA C901 (1/2" to 3") or AWWA C906 (4" to 63"), and shall be listed as meeting NSF-61.

4. When required by the owner, pipe shall be color coded for the intended service. The color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe's manufacturing process. Color coding shall be as follows:
    a. Sewer – green
    b. Water – blue
    c. Reclaim – purple

C. HDPE Fittings

1. Butt Fusion Fittings- Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.01.A. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by owner/engineer. All fittings shall meet the requirements of AWWA C901 or C906.

    a. Molded fittings shall comply with the requirements of ASTM D 3261.

    b. All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F 2206, as manufactured by ISCO Industries, Inc or other approved manufacturer holding an ISO 9001 quality system certificate. Each fitting will be marked per ASTM F 2206 section 10 including the nominal size and fitting EDR, which will meet or exceed the pipe DR identified for the project. Fabricated fittings shall be manufactured using a McElroy DataLogger to record fusion pressure and temperature, and shall be stamped with unique joint number that corresponds to the joint report. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of 5 years as part of the quality control and will be available upon request of owner. Test results to validate ASTM F 2206 section 7.3 and 9 shall be provided to owner or owner's representative upon request.

    c. Socket fittings shall meet ASTM D 2683.

2. Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE 4710 and with a minimum Cell Classification as noted in 2.01.A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans. For potable water systems, all electrofusion fittings shall have AWWA approval.

3. Bolted Connections- Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe unless otherwise specified on the plans.

    a. Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (generically known as 150 pound patterns).

    b. Flange assemblies shall be assembled and torqued according to PPI TN-38, "Bolt Torque for Polyethylene Flanged Joints."

    c. Where shown on the drawings, 4" and larger transitions to mechanical joint fittings and valves shall be accomplished using a MJ Adapter with kit. The D.I./HDPE mechanical joint adaptor shall consist of an HDPE mechanical joint transition fitting, rubber gasket, a mechanical joint backup drive ring, and Corten mechanical joint tee bolts.

D. Mechanical Fittings: The use of mechanical coupling and saddles shall be approved by the owner or engineer prior to installation. Mechanical Fittings shall be designed for use and compatible with HDPE pipe, including SS stiffeners when required by manufacturer. Mechanical fittings shall have a pressure rating equal to or greater than the pipe.

E. Fusion Equipment Requirements

1. Butt fusion equipment must be in satisfactory working order and the hydraulic system must be leak free. Heater plates shall be free from scrapes, gouges, and have a consistent clean coated surface. The pressure gage and thermometer should be checked for accuracy. When requested by the owner, records showing a maintenance service/inspection within 3 months prior to use for this project shall be provided.

2. Rental Butt Fusion Equipment must be maintained by a McElroy Authorized Service and Repair Center with at least one McElroy Certified Master Mechanic on staff and inspected within 3 months prior to arrival at jobsite will be provided.

3. Electrofusion Processors shall be maintained and calibrated per manufacturer's requirements and recommendations.

F. Approved Suppliers

1. All Pipe, Fittings, and Fusion Equipment shall be provided by one supplier. Approved suppliers are ISCO Industries, Inc. or approved equal.

2.02 PIPELINE LOCATING MATERIALS

A. Detectable Marker Tape- Plastic marker tape shall be 5 mil minimum thickness with a solid aluminum core of .35mil minimum thickness and a minimum width of 2". The background of the tape shall be colored based on pipe service with black lettering continuously printed. Marker tape shall have a minimum 35 lbs./inch tensile strength. The installation of the tape shall be at 18 inches below finish grade.

B. Tracer Wire- All HDPE pipe 4" and greater shall be installed with an extra high-strength, copper clad steel tracer wire including 45 mil HDPE jacket that has a minimum average break load of at least 1150 lbs. The jacket shall be colored based on pipe service, with blue for potable water or green for sewer. Tracer wire gauge shall be 12 AWG, 10 AWG, or 8 AWG depending upon application and installation procedure. This wire shall to be continuous and brought up in the valve boxes at the ends of each line segment with splices made only by methods per the equipment manufacturer's recommendation. All miscellaneous splicing components shall be furnished and installed by the Contractor.

PART 3 – EXECUTION

3.01 GENERAL

A. All HDPE pipe and fittings shall be cut, joined, and installed in accordance with the manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe systems.

3.02 TRANSPORTATION, UNLOADING, HANDLING, AND STORAGE

A. The manufacturer shall package product in a manner designed to deliver the pipe and fittings to the project neatly, intact and without physical damage. During transportation each pipe shall rest on suitable pads, strips skids, or blocks securely wedged or tied in place.

B. During loading, transportation, and unloading, every precaution should be taken to prevent damage to the pipe. The handling of the pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Cuts or gouges that reduce the wall thickness by more than 10% are not acceptable and must be cut out and discarded.

C. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2. All pipe and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid.

D. Materials, if stored, shall be kept safe from damage and shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources. The contractor shall be responsible for all security, damage and loss of pipe, excluding Acts of God.

E. The interior of the pipe as well as all sealing surfaces of mating components (i.e. flange faces) shall be kept free from dirt or foreign matter at all times. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged to prevent insects, animals, or foreign material from entering the pipe line or pipe section. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted. Use waterproof nightcaps to prevent the entrance of any type of natural precipitation into the carrier or containment pipe and will be secured to the pipe in such a manner that the wind cannot blow them loose. Where possible, the pipe shall be raised and supported at a suitable distance from the open end such that the open end will be below the level of the pipe at the point of support.

3.03 RECEIPT INSPECTION

A. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are installed or lowered into the trench to be laid. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10% or more are not acceptable and must be removed and discarded.

3.04 FUSION AND JOINING

A. Fusion Joining Requirements:

1. All HDPE pipe shall be joined to itself by the heat fusion process which produces homogeneous, seal, leak tight joints. Tie-ins between sections of HDPE pipe shall be made by butt fusion whenever possible.

2. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F 2620. Considerations should be given to and provisions made for adverse weather conditions, such as temperatures below freezing, precipitation, or wind, which is accepted by the owner/engineer.

3. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F 1290, PPI TN 34, and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file. Qualification of the fusion technician shall be demonstrated by evidence electrofusion training within the past year on the equipment to be utilized for this project.

B. Fusion Operators:

1. The employer of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual. The employer is responsible for documenting all training and qualification records for that individual, including compliance to any code requirements for fusion/bonder operators.

2. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

3. For Projects with at least 5,000 feet or with pipe larger than 24 inches, operators or their supervisor must have a current McElroy Fusion Training Certificate for the equipment to be used on the project

C. Butt Fusion Equipment:

1. For 6” and larger pipe sizes, the pipe butt fusion machine shall be a hydraulic fusion machine capable of butt fusing HDPE pipe. The carriage must be removable from the chassis for in-ditch use. The machine must be compatible with an electronic data recording device, McElroy DataLogger or equal. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord of appropriate gauge (25' minimum), and hydraulic extension hoses (minimum of four). The butt fusion machine will be McElroy, or approved equivalent.

3.05 INSTALLATION

A. Direct Burial

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D 2321 or ASTM D 2774 for pressure systems and AWWA Manual of Water Supply Practices M55 Chapter 8. The Design Window identified in AWWA M55 Chapter 5 (page 65 of 2006 version) shall be considered acceptable design and installation conditions.

2. Unless required by the owner’s engineer, no thrust blocks shall be placed in the HDPE pipe system since the fused system is fully restrained.

B. Trenchless or Pull-in Installation Methods

1. For Horizontal Directional Drilling (HDD), refer to ASTM F1962, PPI TR-46, PPI PE Handbook (Chapter 12) and www.PPIBoreAid.com. See Section XXXXX of this Specification.

2. For sliplining, refer to ASTM F585, PPI PE Handbook (Chapter 11) and www.HDPEapp.com. See Section XXXXX of this Specification.

3. For pipe bursting, refer to PPI PE Handbook (Chapter 16)

C. Appurtenances

1. All appurtenances (tees, elbows, services, valves, air relief valves, fire hydrants, etc.), must be independently supported and shall not rely on the pipeline and its connections for this support. Excessive stresses may be encountered when appurtenances are inadequately supported.

2. Hydrant Assemblies shall be installed and field tested according to the requirements of AWWA M17.

3. Installation of Tracer Wire. When tracer wire is required, the Contractor shall install along the entire section of pipeline per local and manufacturer's requirements.. The tracer wire shall be installed simultaneously with the polyethylene piping system. Tracer wire shall be installed by the Contractor once backfill has been placed and compacted to at least 12 inches above the top of the pipe and not more than 18 inches above the top of the pipe. Tracer wire shall be properly spliced at each end connection and each service connection. Care should be taken to adequately wrap and protect wire at all splice locations. No bare tracer wire shall be accepted. Provide magnesium alloy anode for cathodic protection that conforms to the requirements of ASTM B843

3.06 FLUSHING, CLEANING, AND DISINFECTING

A. All mains shall be cleaned and flushed to remove all dirt, sand, debris and foreign matter.

B. Disinfection:

1. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). The disinfection chemicals should be limited to less than 12% active chlorine. The duration of the disinfection should not exceed 24 hours. Chlorine tablets and powders are not permitted. Upon completion, the system should be thoroughly flushed with fresh water, and sampled to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

3.07 TESTING AND LEAKAGE

A. The contractor shall insure testing can be accomplished in a safe manner, including protection of personnel, equipment, and public in the event of a failure during testing. The contractor shall restrain pipe, components, and test equipment as required. All pumps, valves, temporary connections, meters, gauges and other measuring devices shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Owner's Engineer.

B. The test pressure shall be 1.5 times the operating pressure, based on the lowest point in elevation in the test section.

C. Test pressures require consideration of thermal conditions. Polyethylene piping materials are typically pressure rated at 73°F (23°C) and PE piping at temperatures greater than 80°F (26°C) require reduced test pressures. (Note that higher pipe temperatures should consider both ambient temperatures and radiant solar heating of exposed black HDPE pipe) Guidance for elevated temperatures can be found in the appendix of Chapter 3 (Material Properties) of the PPI Handbook of PE Pipe.

D. Pressure Pipelines-Pressure testing shall be conducted in accordance with requirements and recommendations of ASTM F 2164 (Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure), AWWA M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

1. The section of pipe to be tested shall be filled with potable or generally clean water (uncontaminated river/lake water) approved by the Owner/Engineer. While the system is being filled with water, air shall be carefully and completely exhausted.

2. If the Contractor elects to perform hydrostatic testing against valves in an existing distribution system, it does so at his own risk and will bear the cost of any damages to the existing valve, piping system, private or public property, or the new pipeline under test.

3. The test procedure for HDPE pipe consists of two steps: 1) the initial phase or expansion phase and 2) the test phase. During the initial/expansion phase, sufficient make-up water shall be added hourly for 3 hours to return to the test pressure. During the test phase, the expansion phase pressure is reduced by 10 psi to test phase pressure and monitored for at least one hour (3 hours maximum).

4. Under no circumstances shall the total time under test exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section and permit the system to "relax" for eight (8) hours prior to the next testing sequence.

5. In accordance with section 9.8 of ASTM F 2164, the pipe shall pass if the final pressure is within 5% of the test phase pressure for the testing period (3 hours maximum). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the Owner.

END OF SECTION

ATTACHMENT #3:

DEPARTMENT OF WATER QUALITY (DWQ) LETTER TO THE DIVISION ANSWERING QUESTIONS REGARDING MOVING UPDES OUTFALL #002

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF WATER QUALITY
Erica Brown Gaddis, PhD
Director

November 13, 2018

Steve Christensen, Permit Supervisor
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 120
PO Box 145801
Salt Lake City, Utah 84114-5801
stevechristensen@utah.gov

Subject: UPDES Permit No. UT0024368 – Genwal Resources, Crandall Canyon Mine, Final Reclamation Plan

Dear Mr. Christensen:

On November 1, 2018 the Utah Division of Water Quality (DWQ) received your letter regarding the above referenced facility. Hopefully this correspondence will help answer the questions regarding the proposed pipeline discharge option as described in your letter. Your questions are presented below followed by DWQ's responses, respectively.

Question 1: *Can an existing outfall (in this case 002) be re-located or would it be considered a new outfall?*

DWQ Response: Yes, an existing outfall can be re-located without being considered a new outfall. As you know, the Crandall Canyon Mine is currently authorized to discharge mine water via Outfall 002 with geographic coordinates as specified in UPDES Permit No. UT0024368. Any change in the location of an outfall would need to be reflected in the respective UPDES permit.

Question 2: *Would the Permittee require a new UPDES Permit or could the existing permit be revised?*

DWQ Response: The existing UPDES Permit No. UT0024368 could be revised to reflect a proposed change in the discharging outfall coordinates. This type of revision would be accomplished through DWQ's permit modification procedures in Utah Administrative Code (UAC) R317-8-5.6.

Questions 3: *Would the Antidegradtion Policy outlined in (UAC) R317-2-3 preclude the pipeline construction and relocation of Outfall 002 from Crandall Creek to Huntington Creek?*

DWQ Response: No, the Antidegradtion Policy outlined in UAC R317-2-3 would not specifically preclude the pipeline construction and relocation of Outfall 002 from Crandall Canyon Creek to Huntington Creek. Once an outfall relocation request was made through the permit modification process as submitted to DWQ, an Antidegradation Review would be performed, following UAC R317-2-3, to ensure in-stream water quality standards are being met and that the beneficial uses of the receiving waters are protected as appropriate. In this case, Crandall Canyon Creek is a tributary to Huntington Creek, both of which are Category 3 waters having the same protected beneficial uses as per UAC R317-2-13.2(b).

Thanks for your coordination efforts with DWQ as the final reclamation plan options are considered for the Genwal Resources Crandall Canyon Mine. Your efforts to help protect Utah's Water Quality are appreciated.

If you have any further questions with regards to this matter, please contact Jeff Studenka at (801) 536-4395 or by e-mail at jstudenka@utah.gov.

Sincerely,

Matthew Garn, P.E., Manager
UPDES Surface Water Section

MG:JAS:lg

cc: Scott Hacking, DEQ District Engineer (email)
Orion Rogers, SE Utah Health Dept. (email)

DWQ-2018-012451

ATTACHMENT #4:

ENVIRONMENTAL INDUSTRIAL SERVICES SOILS SURVEY FOR NEW PIPELINE ALIGNMENT

Environmental Industrial Services
Environmental & Engineering Consulting
31 North Main Street * Helper, Utah 84526
Office – (435) 472-3814 * Toll free – (800) 641-2927 * Fax – (435) 472-8780
eisec@preciscom.net
www.eisenviro.com

March 4th, 2020

Please see the attached soils report for Crandall Canyon.

Mel Coonrod

Owner EIS

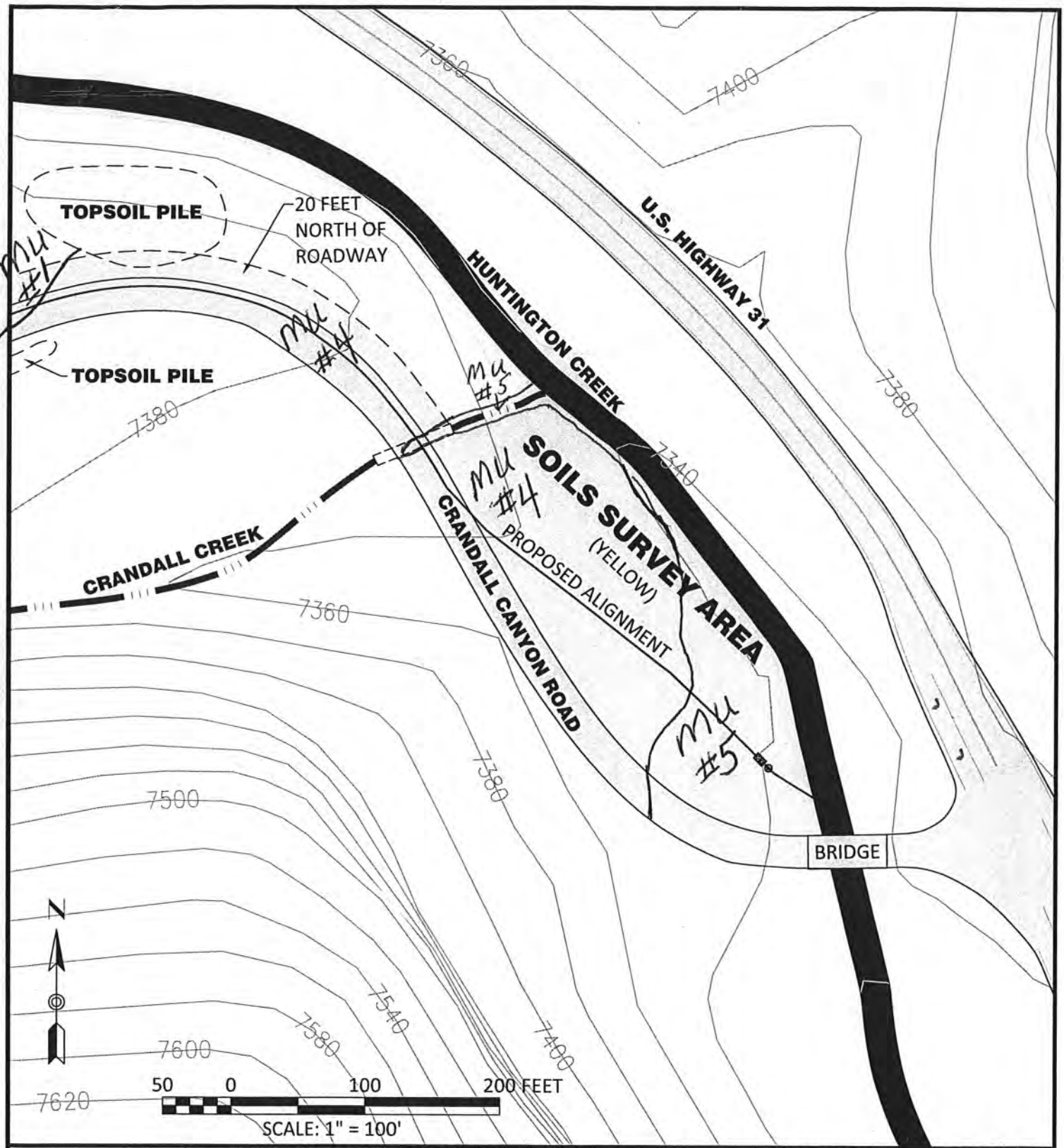
Crandall Canyon Soil Survey

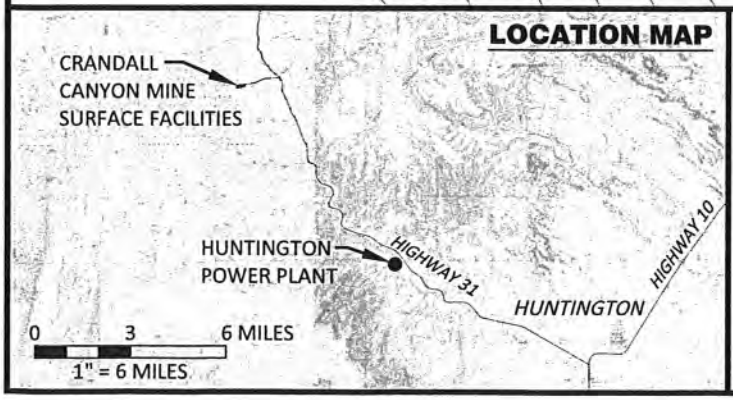
For UtahAmerican Energy, Inc

The area south of Huntington and Candle Creeks was soil checked and 4 major soils were described in the area, with small amounts of other soils. Some soils in the area have had prior disturbance, especially along the road. The soils of this area were separated into two map units, numbers 4 and 5.

Map unit number 4 is on mountain footslopes and a small bench area with slopes of 8 to 40 percent. The major soils are Datino and Snake John which contain 10 to 70 percent rock fragments and have dark topsoil from 7 to 15 inches thick, where not disturbed. The stream terrace with slopes 3 to 8 percent, map unit #5, is mostly the Dancehall soil which has 35 to 60 percent rock fragments of gravel to boulders and is stratified alluvium with a thin topsoil. There are areas of soil with less rock fragment, the Shupert soil which also has heavier texture and smaller areas with a coarser texture. These soils can be flooded during periods of high water. This map unit also includes the area along the stream called river wash which has little soil development and is frequently flooded, it is mainly rocks and water washed sands. Also included are eroded stream bank areas.

The area along the road up to the mine was separated into 3 map units. Map unit 1 is the moderately deep to very deep alluvial and colluvial areas with small rock outcrops and areas of shallow soils. Map unit 2 and 3 are shallow soils or rock cliffs with disturbed soils along the road.





UtahAmerican Energy, Inc.

794 NORTH "C" CANYON ROAD, EAST CARBON, UTAH 84520
P.O. BOX 1077, PRICE, UTAH 84501
PHONE: (435) 888-4000 FAX: (435) 888-4002

PIPELINE ALIGNMENT SOILS SURVEY SCOPE

Crandall Canyon Mines

Crandall Canyon
P.O. BOX 1077
PRICE, UTAH

MSHA ID #42-01715

DRAWN BY	PJJ	SCALE	AS SHOWN
APPROVED BY	--	DATE	30 SEPT. 2019
SHEET	PLATE #1 of 1		

G:\Current Drawings\MR Maps\Crandall Canyon\Pipe Line Water to Huntington Creek\Deficiencies Task 3\Maps\Support\Soils and Archeo Scoping Maps.dwg, Soils Scope, 9/30/2019 12:08:14 PM

Google Maps

Imagery ©2019 Google, Imagery ©2019 Maxar Technologies, State of Utah, USDA Farm Service Agency, Map data ©2019 500 ft

Mu # 1

Repp-Tosca- Gompers, 15 to 60 percent slopes

55 percent Repp very bouldery fine sandy loam soils and soils similar to Repp but have been disturbed on 15 to 60 percent slopes

20 percent Tosca very bouldery fine sandy loam soils with slopes of 20 to 50 percent in more concave positions

15 percent Gompers very stony fine sandy loam soils and soils similar to Gompers but have been disturbed with slopes of 15 to 60 percent

5 percent Rock outcrop mostly sandstone but some shale

5 percent other soils including coarse loamy soils, Wiggler soils and soils with a mollic epipedon more than 15 inches thick and moderately deep soils

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Basic Soils Course May-04

Series or Component Name: Repp like	Map Unit Symbol: 1	Photo #:	Classification: Frigid Calcic Haplustepts Loamy Skeletal mixed superactive	Soil Moist. Regime (Tax.): Ustic
Describer(s): L. Sasser	Date: Oct 28, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: Utah	County: Emery Pedon #:	Soil Survey Area: MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape: Mountains	Landform: Mtn slope	Microfeature:	Anthro:	Elevation: ≈ 7500'	Aspect: SSE	Slope (%): 58%	Slope Complexity: Complex	Slope Shape: (Up & Dn / Across) Convex / Rolling across	
Hillslope Profile Position: lower 1/3	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:		

Drainage: Well	Flooding: —	Ponding: —	Soil Moisture Status: Surface Moist to 3" dry below	Profile Saturated Hydraulic Conductivity Ksat:	Land Cover / Use: Grass and Trees
Parent Material: Slope alluvium & colluvium	Bedrock: Kind: Sandstone & Shale	Fract.:	Hard.:	Depth:	Lithostrat. Units: Group: Formation: Member: —
Erosion: Kind: Degree: Some small gullies	Runoff: rapid	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: Sandstone 12% 8 15 10 5 5			Diagnostic Horz. / Prop.: Kind: Ochric epipedon Depth: Calcic
P.S. Control Section: Ave. Clay %: Depth Range: 10-40" 12-15%	Ave. Rock Frag %: 45 to 55%				

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Wheat grass	
	Brome grass	
	Indian Rice grass	
	Mtn Big Sage	
	Douglas Fir	
	Ponderosa Pine	
	Rocky Mtn Juniper	
	Utah Juniper	
	Mtn. Mahogany	
	Pinyon Pine	
	Rabbit Brush	
	Service Berry	
	Oregon grape	
	Rye grass	

MISCELLANEOUS FIELD NOTES / SKETCH :

≈ 50% percent slope

Small less sloping area (concave)

8' To West South West (More grass here)

A 0-9" Mollic Epipedon SL fsl

BK1 9-15" } Calcic Horizon Vcob fsl

BK2 15-32" } Vgr fsl

BK3 32-62" Very stony fsl

BCK 62-80" Very Stony fsl

Tosca soil lacks bedrock

Disturbed soil along Road mixed surface

Component Name:					Map Unit Symbol:								Date:	
	Obser. Method	Depth (cm) (TOP) (BOT)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Sand %	Silt %	Clay %	pH	Mottles % Sz Cont. Col Mst Shp Loc
1	Small pit	0-2cm	Oi	As	Slightly decomposed				forest litter					None
2		1-4" 2-9cm	A	Aw	10YR5/2	10YR3/3	VBL fsl	20% gr 5% ST 10% cob 8% BL	2fgr			14%	7.6	
3		4-10" 9-25cm	E	CW	10YR7/2	10YR5/2	ST fsl	20% gr 7% ST 5% cob 1% BL	1fsbK			10%	7.6	
4		10-14" 25-35cm	E/Bw	CW	10YR6/3	10YR5/3	Vcob fsl	20% gr 2% ST 15% cob 1% BL	1fam sbK			13%	7.9	
5		14-22" 35-56cm	BK1	CW	10YR6/3	10YR4/4	Vcob fsl	20% gr 2% BL 12% cob 2% ST	2fam sbK			15%	8.1	
6		22-54" 56-138cm	BK2	GW	10YR8/3	10YR6/4	Vgr fsl	50% gr 1% BL 10% cob 3% ST	1fam sbK			13%	8.3	
7		54-62" 138-158cm	BCK	GW	10YR7/4	10YR5/6	VST fsl	20% gr 2% BL 15% cob 8% ST	sg			11	8.2	
8		62-79" 158-200cm	C		10YR6/6	10YR5/6	XBL lfs	20% gr 10% BL 15% cob 20% ST	sg			8	8.6	
9														
10														

	Redoximorphic Features Knd % Sz Cont. Col. Mst Shape	Concentrations Knd % Sz Cont. Col Mst Shp Loc	Ped / V. Surface Features Knd % Con Dst Loc Col Mst	Roots Qty Sz Loc	Pores Qty Sz Shp	Notes Ksat	Effer. Unified	Notes $CaCO_3$ equiv.
1	—	—	—				NE	0%
2	—	—	—				VSL	1%
3	—	—	—				VSL	1%
4	—	thin $CaCO_3$ coats BRF	—			80% Bw with 20% Ematerial	SL	4%
5	— mod	thick Coats $CaCO_3$ Bottom RF	—				ST	10%
6	—	mod thick Coats $CaCO_3$ Around RF	—				VE	15%
7	—	thin coats $CaCO_3$ ARF	—				VE	12%
8	—	—	—				ST	9%
9								
10								

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Draft

April, 2002

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):
Tosca	1		Lo-sk mixed s.a. frigid Typic Calciustoll	

Describer(s):	Date:	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum:	Location: Sec. T. R.
L. Sasser	Oct 21, 2019				

UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
Mountains	Mtn Slope			≈7375	SSE	38		Concave / Convex

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
Well	—	—		Moderate Ksat:	

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
Slope Alluvium	Sandstone 54"	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:
		10% 15 15 20 — 2%	Mollic 0-9" Calcic 9-54

P.S. Control Section: Ave.Clay %: Ave.Rock Frag %: Depth Range:	
10-40" 12-15 45 to 50%	

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Rky Mtn Juniper	
	Mtn Mahogany	
	Mtn Big Sage	
	Utah Serviceberry	
	Douglas Fir	
	Pinyon Pine	
	Wheat grass	
	Brome grass	
	Indian Rice grass	
	Bitter Brush	
	Oregon grape	
	Snowberry	
	Rabbit Brush	
	Buckwheat	

MISCELLANEOUS FIELD NOTES / SKETCH :

Taken NE of Sherman Shelter

Small area of Pachic soil ≈10' North
Non effevescent to 10 to 16"
Area is probably old Tree fall
concave area

Component Name: | Map Unit Symbol: | Date:

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1		0-2	0-4	A1	AW	10YR4/2	10YR3/2	VBL fsl	10% gr 10% st 15% cob 15% BL	2 f gr	so	vfr	ss	sp	
2		2-9	4-22	A2	CW	10YR5/3	10YR3/3	VST fsl	15% gr 10% st 15% cob 3% BL	1 f gr	sh	vfr	ss	sp	
3		9-28	22-72	BK1	GW	10YR6/3	10YR4/4	VST fsl	20% gr 10% st 10% cob 5% BL	1 f & m sbK	sh	vfr	ss	sp	
4		28-54	72-138	BK2	AS	10YR7/3	10YR5/3	VBL fsl	15% gr 10% st 15% cob 15% BL	1 f sbK	so	vfr	ss	sp	
5		54"		R		Sandstone									
6															
7															
8															
9															
10															

	Redoximorphic Features % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Concentrations % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Ped / V. Surface Features % Dst Cont Knd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CEC	Notes
1	—	—	—	3vf, 2f m&c		7.8	SL	14	2%	
2	—	—	—	3vf, 2f m&c		7.9	SL	12	3%	
3	—	mod thick $CaCO_3$ coats BRF	—	2vf, f m&c		8.1	ST	15	15	
4	—	mod thick $CaCO_3$ coats ARF	—	2vf, f m&c		8.4	VE	11	22	
5										
6										
7										
8										
9										
10										

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Basic Soils Course May-04

Series or Component Name: Gompers	Map Unit Symbol: 1	Photo #:	Classification: Frigid Aridic Lithic Ustorthents Loamy Skeletal mixed s.a. calc.	Soil Moist. Regime (Tax.): Aridic Ustic
Describer(s): Leland Sasser	Date: Oct. 29, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: UT County: Emery Pedon #:	Soil Survey Area:	MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape: Mountains	Landform: Mtn slope	Microfeature:	Anthro:	Elevation: ≈7500'	Aspect: SSE	Slope (%): 55%	Slope Complexity: Complex	Slope Shape: (Up & Dn / Across) Convex / Convex
Hillslope Profile Position: midslope to lower 1/3	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	

Drainage: Well	Flooding:	Ponding:	Soil Moisture Status:	Profile Saturated Hydraulic Conductivity Ksat:	Land Cover / Use: Trees & grass
Parent Material: Sandstone	Bedrock: Kind: Sandstone Fract.: Hard.: Depth: 16"			Lithostrat. Units: Group: Formation: Member:	
Erosion: Kind: Degree:	Runoff: rapid	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: 25 10 10 2 5 2			Diagnostic Horz. / Prop.: Kind: Ochric / Lithic Contact Depth: 16"
P.S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range: 10-16" 8-12% 45-55%					

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Mtn Mahogany	
	Indian Ricegrass	
	Wheatgrass	
	Doug Fir	
	Rky Mtn Juniper	
	Pinyon Pine	
	Utah Juniper	
	Rabbit brush	
	Brome grass	
	Oregon grape	
	Snowberry	
	Serviceberry	
	Mtn Big Sage	
	Rye grass	

MISCELLANEOUS FIELD NOTES / SKETCH :

Near Repp description

Along the Road the soil is disturbed similar to Gompers with no A horizon

some areas are moderately deep and disturbed

Component Name:							Map Unit Symbol:						Date:

	Obser. Method	Depth (cm) (TOP) (BOT)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Sand %	Silt %	Clay %	pH	Mottles % Sz Cont. Col Mst Shp Loc
1	small pit	0-4" 0-10cm	A	AW	10YR5/3	10YR4/3	VSL fsl	25% gr 2% BK 20% cob 10% SL	1fsbK	65		11	7.8	—
2	↓	4-14" 10-36cm	C1	CW	10YR6/3	10YR4/4	VSL fsl	20% gr 12% SL 15% cob 5% ch	1fsmsbK	70		12	7.8	—
3		14-16" 36-42cm	C2	AS	10YR6/4	10YR5/3	Vch fsl	30% ch 5% cob 15% gr 3% SL	sg	70		8	7.9	—
4		42cm	R.		Sandstone									
5														
6														
7														
8														
9														
10														

	Redoximorphic Features Knd % Sz Cont. Col. Mst Shape	Concentrations Knd % Sz Cont. Col Mst Shp Loc	Ped / V. Surface Features Knd % Con Dst Loc Col Mst	Roots Qty Sz Loc	Pores Qty Sz Shp	Notes Effervescence	Unified	Notes % $CaCO_3$
1	—	—	—			SL		15
2	—	—	—			SL		17
3	—	—	—			SL		15
4								
5								
6								
7								
8								
9								
10								

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Basic Soils Course May-04

Series or Component Name: Tosca like (No bedrock)	Map Unit Symbol: 1	Photo #:	Classification: Frigid Typic Calciustoll Loamy skeletal, mixed s.a.	Soil Moist. Regime (Tax.): Ustic
Describer(s): L. Sasser	Date: Oct 29, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: Utah County: Emery Pedon #:	Soil Survey Area: MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape: Mountains	Landform: Mtn Slope	Microfeature:	Anthro:	Elevation: ~7480	Aspect: SSE	Slope (%): 45	Slope Complexity:	Slope Shape: (Up & Dn / Across) Concave / convex
Hillslope Profile Position: lower 1/3	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	

Drainage: Well	Flooding: None	Ponding: None	Soil Moisture Status:	Profile Saturated Hydraulic Conductivity Ksat:	Land Cover / Use: Timber, grass
Parent Material: Colluvium slope alluvium	Bedrock: Kind: Fract.: Hard.: Depth:			Lithostrat. Units: Group: Formation: Member:	
Erosion: Kind: Degree:	Runoff: Modrapid-rapid	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: Sandstone 20 10 20 5 5 5		Diagnostic Horz. / Prop.: Mollic	Kind: Calcic Depth: 8-80"
P.S. Control Section: Depth Range: 10-40"	Ave. Clay %: 14-15	Ave. Rock Frag %: 35-45%			

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Doug Fir	
	Ponderosa Pine	
	Western Wheatgrass	
	Mtn Big Sage	
	Mtn Mahogany	
	Rocky Mtn Juniper	
	Indian Ricegrass	
	Utah Service Berry	
	Snowberry	
	Bitterbrush	
	Rabbit brush	
	Oregon grape	
	Brome grass	
	Pinyon Pine	

MISCELLANEOUS FIELD NOTES / SKETCH :

Disturbed soil downslope along road
surface is removed or mixed
Similar to Repp soil.

More rabbit brush along road

Component Name:							Map Unit Symbol:						Date:		
	Obser. Method	Depth (cm) (TOP) (BOT)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Sand %	Silt %	Clay %	pH	Mottles % Sz Cont. Col Mst Shp Loc
1	small pit	0-8 0-21	A	CW	10YR 5/2	10YR 3/2	VSL fsl	15gr 15cob 20SL 3BL	1fgr	56	30	14	7.9	—
2		8-15 21-38	BK1	CW	10YR 6/3	10YR 4/3	SL fsl	20gr 5r. 8SL cob	2fsbK	65	20	15	8.1	—
3		15-42 38-107	BK2	GW	10YR 6/4	10YR 4/3	Vcob fsl	25gr 10r. 21SL cob	1fsbK	70	15	15	8.2	—
4		42-65 107-165	BK3	GW	10YR 7/3	10YR 5/3	VSL fsl	20gr 15cob 15SL 2BL	1fsbK	70	17	13	8.4	—
5		65-80 165-202	BCK		10YR 6/4	10YR 5/4	Ex BL fsl	25gr 15cob 20SL 10BL	5g	75	15	10	8.4	—
6														
7														
8														
9														
10														

	Redoximorphic Features Knd % Sz Cont. Col. Mst Shape	Concentrations Knd % Sz Cont. Col Mst Shp Loc	Ped / V. Surface Features Knd % Con Dst Loc Col Mst	Roots Qty Sz Loc	Pores Qty Sz Shp	Notes ~~Kear~~ effervescence	Notes Unified
1	—	—	—			slight	
2	—	thin coats $CaCO_3$ BRF	—			Strong	
3	—	mod thick coats $CaCO_3$ ARF	—			Violent	
4	—	↓	—			Violent	
5	—	thin coats $CaCO_3$ ARF	—			Violent	
6							
7							
8							
9							
10							

LOCATION REPP MT+UT

Established Series
Rev. GLS-RJS
04/2013

REPP SERIES

The Repp series consists of very deep, well drained soils that formed in colluvium derived from argillite, quartzite, siltstone or limestone. These soils are on mountain slopes and hills. Slopes are 0 to 80 percent. Mean annual precipitation is about 480 mm, and mean annual air temperature is about 6.0 degrees C.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, frigid Calcic Haplustepts

TYPICAL PEDON: Repp very gravelly loam, forested (colors are for dry soil unless otherwise noted).

Oi--0 to 2 cm; slightly decomposed forest litter.

E1--2 to 15 cm; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, medium, and coarse roots; 40 percent gravel; slightly effervescent; slightly alkaline (pH 7.4); clear smooth boundary.

E2--15 to 33 cm; light brownish gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; 45 percent gravel; slightly effervescent; slightly alkaline (pH 7.4); clear smooth boundary. (combined thickness of the E horizons is 15 to 40 cm)

Bw--33 to 64 cm; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; few lime coatings on gravel, mainly on underside; 50 percent gravel; disseminated lime; violently effervescent; moderately alkaline (pH 8.4); gradual wavy boundary. (18 to 45 cm thick)

Bk1--64 to 104 cm; very pale brown (10YR 7/3) extremely gravelly loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; thin lime coatings on gravel, mainly on underside; 70 percent gravel; disseminated lime; violently effervescent; moderately alkaline (pH 8.4); gradual wavy boundary. (20 to 90 cm thick)

Bk2--104 to 152 cm; very pale brown (10YR 7/3) extremely gravelly loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; lime coating on gravel, mainly on underside; 65 percent gravel; disseminated lime; violently effervescent; moderately alkaline (pH 8.2).

TYPE LOCATION: Missoula County, Montana; 91 meters north and 122 meters east of the S 1/4 corner of Sec. 8, T14N, R21W.

RANGE IN CHARACTERISTICS:

Soil temperature - 6.5 to 8.0 degrees C.
Depth to calcic horizon - 33 to 90 cm

Note: Some pedons may have a E/Bw horizon.

E horizon
Hue: 10YR or 2.5Y; dry or moist
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 or 3; dry or moist
Clay content: 10 to 20 percent
Rock fragments: 20 to 50 percent--20 to 50 percent gravel, 0 to 10 percent cobbles and stones
Reaction: pH 6.1 to 7.6

Bw horizon
Hue: 10YR or 2.5Y; dry or moist
Value: 5 to 7 dry; 4 or 5 moist
Chroma: 2 to 4; dry or moist
Clay content: 10 to 20 percent
Rock fragments: 35 to 60 percent--35 to 50 percent gravel, 0 to 10 percent cobbles
Reaction: pH 7.4 to 8.4

Bk horizons
Hue: 10YR or 2.5Y; dry or moist
Value: 6 to 8 dry; 4 to 6 moist
Chroma: 2 or 3; dry or moist
Clay content: 10 to 18 percent
Rock fragments: 60 to 85 percent--55 to 75 gravel, 0 to 10 percent cobbles
Calcium carbonate equivalent: 10 to 15 percent
Reaction: pH 7.8 to 8.4

COMPETING SERIES:
Lamedeer (MT) - have rock fragments that are channers and flagstones
Redfist (MT) - are moderately deep to a lithic contact

GEOGRAPHIC SETTING:

Landform - mountain slopes and hills
Elevation - 880 to 1,725 meters
Slope - 0 to 80 percent
Parent material - colluvium derived from argillite, quartzite, siltstone or limestone
Climate - long, cold winters; moist springs; warm summers
Mean annual precipitation - 430 to 650 mm
Mean annual temperature - 3.8 to 7.2 degrees C.
Frost-free period - 70 to 105 days

GEOGRAPHICALLY ASSOCIATED SOILS: None listed.

DRAINAGE AND PERMEABILITY: Well drained; moderate permeability.

USE AND VEGETATION: Repp soils are used mainly for timber production and understory grazing. Potential native vegetation is mainly Douglas-fir and ponderosa pine with an understory of bluebunch wheatgrass, elk sedge, pinegrass, common snowberry, and mallow ninebark.

DISTRIBUTION AND EXTENT: Repp soils are of small extent in western Montana and parts of Utah. MLRAs - 43A, 44A and 46.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana.

SERIES ESTABLISHED: Missoula County, Montana, 1970.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon - 0 to 33 cm (Oi, E1, E2 horizons);
Cambic horizon - 33 to 64 inches (Bw horizon);
Calcic horizon - 64 to 152 cm (Bk1, Bk2 horizon); and
Particle-size control section from 25 to 100 cm (part of E2, Bw, part of Bk1 horizons).

Repp soils have a frigid temperature regime and an ustic moisture regime.

ADDITIONAL DATA: Soil Interpretation Records - MT0155, MT8124.

This description reflects a change in classification from Loamy-skeletal, mixed, superactive, frigid Typic Haplustepts to Loamy-skeletal, mixed, superactive, frigid Calcic Haplustepts (10/03/2008).

National Cooperative Soil Survey
U.S.A.

'J'

LOCAT.ON TOSCA UT

Established Series
Rev. GWL/CSW/JWB
08/2008

TOSCA SERIES

The Tosca series consists of deep, well drained, moderately permeable soils that formed in slope alluvium and colluvium from sandstone and shale. Tosca soils are on mountain back slopes, sideslopes, and shoulders with slopes ranging from 20 to 80 percent. Average annual precipitation is about 18 inches and the mean annual air temperature is about 42 degrees F.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, frigid Typic Calciustolls

TYPICAL PEDON: Tosca gravelly sandy loam, rangeland (Colors are for air-dry soil unless otherwise noted). The surface is covered by 20 percent gravel, cobbles, and stones.

0i--0 to 2 inches; slightly decomposed leaves, twigs and litter.

A1--2 to 5 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (7.5YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; few coarse and many very fine roots; common very fine and fine tubular pores; 10 percent gravel, 5 percent cobbles in horizon; slightly effervescent, (8 percent calcium carbonate equivalent); carbonates are disseminated; moderately alkaline (pH 8.0); clear smooth boundary. (3 to 9 inches thick)

A2--5 to 11 inches; dark yellowish brown (10YR 4/4) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few coarse medium and fine and common very fine roots; few medium and common very fine and fine tubular pores; 10 percent angular gravel, 5 percent cobbles; slightly effervescent, (13 percent calcium carbonate equivalent), carbonates are disseminated and thin coatings on rock fragments; moderately alkaline (pH 8.0); clear wavy boundary. (0 to 7 inches thick)

Bk1--11 to 19 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; weak medium and fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few coarse medium fine and common very fine roots; few fine and very fine tubular pores; 25 percent angular gravel and 15 percent cobbles; strongly effervescent, (37 percent calcium carbonate equivalent), carbonates are disseminated and thin coatings on rock fragments; moderately alkaline (pH 8.2); gradual smooth boundary. (7 to 19 inches thick)

Bk2--19 to 39 inches; light gray (10YR 7/2) very cobbly sandy loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine, fine and medium roots; common fine, many very fine tubular pores; 25 percent cobbles, 10 percent stones, 25 percent angular gravel; strongly effervescent, (26 percent calcium carbonate equivalent), carbonates are disseminated

and thin coatings on rock fragments; moderately alkaline (pH 8.4); clear wavy boundary. (7 to 25 inches thick)

Bk3--39 to 53 inches; light gray (10YR 7/2) extremely stony sandy loam, brown (10YR 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine, fine and medium roots; common very fine and fine tubular pores; 50 percent stones, 20 percent channery fragments, 10 percent cobbles; strongly effervescent, (22 percent calcium carbonate equivalent); carbonates are disseminated and thin coatings on rock fragments; moderately alkaline (pH 8.4); clear irregular boundary. (0 to 14 inches thick)

C--53 to 60 inches; pale brown (10YR 6/3) extremely stony sandy loam, brown (7.5YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; 40 percent stones, 20 percent cobbles, 10 percent angular gravel; slightly effervescent, (20 percent calcium carbonate equivalent), carbonates are disseminated; moderately alkaline (pH 8.4); abrupt wavy boundary. (0 to 22 inches thick)

R--60 inches; sandstone.

TYPE LOCATION: Grand County, Utah; about 40 miles southwest of Bonanza, 1,700 feet east and 2,000 feet north of the southwest corner of sec. 34, T. 15 1/2 S., R. 24 E SLBM; P R Springs, Utah USGS quadrangle; 39 degrees, 27 minutes, 38 seconds north latitude and 109 degrees, 15 minutes, 10 seconds west longitude. NAD 27.

RANGE IN CHARACTERISTICS: Depths are measured from the top of the mineral soil surface.

Soil moisture: It is moist in all parts of the moisture control section 40 to 45 percent of the time the soil temperature exceeds 41 degrees F. The soil moisture control section is usually moist in some part during late spring to early fall, and intermittently dry in late fall; typic ustic soil moisture regime.
Mean annual soil temperature: 40 to 45 degrees F.
Mean summer soil temperature: 61 to 65 degrees F.
Depth to calcic horizon: 7 to 15 inches
Depth to lithic contact: 40 to 60 inches to sandstone bedrock
Some pedons have a lithologic discontinuity at 14 to 51 inches
Mollic epipedon: 7 to 15 inches thick

Particle-size control section: 10 to 18 percent clay and 35 to 65 percent rock fragments

A horizon:
Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 3 or 4 moist
Chroma: 2 through 4 dry or moist
Calcium carbonate equivalent: 2 to 15 percent
Reaction: slightly alkaline or moderately alkaline

Bk horizon:
Hue: 7.5YR to 2.5Y

Photo 1 shows a break between map unit 1 on the left of the photo and map unit 2 on the right side of the photo. With interbedded shale and sandstone.

The thicker trees are on Tosca Soil in concave area in the center of the photo with Repp above the shallow gompers above the bedrock on the far left of the photo.

Mu#2

Gompers-Wiggler-Rock outcrop 15 to 80 percent slopes

50 percent Gompers very channery loam soils and similar disturbed soils along the road

30 percent Wiggler gravelly loam soils and similar disturbed soils along the road

15 percent Rock outcrop

5 percent other soils including moderately deep disturbed soils along the road

USDA-NRCS **PEDON DESCRIPTION** **PEDON ID#:**

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:
Gompers	2		Frigid Aridic Lo-sK mixed s.a. Calc. Lithic Ustorthents

Describer(s):	Date:	Weather:	Temp.: Air: Soil: Depth:	Latitude: ° ' " N	Geodetic Dat
L. Sassev	Oct. 22, 2019			Longitude: ° ' " W	

UTM: Zone: mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:	MLRA/LR
		Utah Emery		

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shap
Mountain	Mtn Slope			≈7600	SE	40		Convex

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physi
Lower 1/3						

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	K_{sat}:
Well	—	—	dry	

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formati
Sandstone/shale	Sandstone 14"	

Erosion: Kind: Degree:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	P.S. Control Section: Rock frag Ave. Clay Depth Range:
	1 10 2% 2% — 25 5	0-14" 50-55% 16-19

Diagnostic Horz. / Prop.: Kind: Depth:

Ochric horizon, Lithic Contact

VEGETATION:

SYMBOL	COMMON NAME	% GD COVER
	Mtn Mahogany	
	Utah Juniper	
	Rky Mtn Juniper	
	Wheatgrass	
	Brome grass	
	Indian Ricegrass	
	Douglas Fir	
	Rabbit Brush	
	rye grass	

MISCELLANEOUS FIELD NOTES / SKETCH:

Along road just below disturbed similar soil.

Component Name:									Map Unit Symbol:						Date:
	Obser. Method	Horizon	Depth (in) (cm)	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Kind % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Notes
1		A	0-3" 0-8	AW	10YR 6/2	10YR 4/3	vch L	25% ch 5% FL 10% qr 2% cob	1f sbk	sh	vfr	ss	sp	
2		C1	3-8" 8-20	CW	10YR 6/4	10YR 4/4	vch fsl	25% ch 2% FL 10% qr 2% cob	1f sbk	sh	fr	ss	sp	
3		C2	8-14 20-36	AS	2.5Y 5/2	2.5Y 4/2	exch L	10% qr 50% ch 7% FL	m	h	fr	s	sp	
4		R	14" 36	Sandstone interbedded with shale										
5														
6														
7														
8														
9														
10														

	Redoximorphic Features % Sz Co Hd Sp Kd Loc Bd Col	Concentrations % Sz Co Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cou Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH method	Effer (agent)	Clay %	Sand %	Notes % $CaCO_3$
1	—	—	—			8.1	ST	18	50	18
2	—	—	—			8.1	ST	15	60	20
3	—	few thin $CaCO_3$ coats	—			8.3	ST	22	45	21
4										
5										
6										
7										
8										
9										
10										

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Basic Soils Course May-04

Series or Component Name: Gompers	Map Unit Symbol: 2	Photo #:	Classification: Frigid, Aridic Lithic Ustorthents Loamy-skeletal mixed sa calcareous	Soil Moist. Regime (Tax.):
Describer(s): L. Sasser	Date: Oct 28, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area: MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape: Mountains	Landform: Mtn slope	Microfeature:	Anthro:	Elevation: ≈ 7480	Aspect: SSE	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across) Convex / Convex
Hillslope Profile Position: lower 1/3	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:		State Physio. Area:	Local Physio. Area:

Drainage: Well	Flooding: —	Ponding: —	Soil Moisture Status: dry	Profile Saturated Hydraulic Conductivity Ksat:	Land Cover / Use: Trees / grass
Parent Material: Sandstone / Shale	Bedrock: Kind: Fract.: Hard.: Depth: Sandstone / shale 39cm			Lithostrat. Units: Group: Formation: Member:	
Erosion: Kind: Degree:	Runoff: rapid	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: 5 2 — — 40 2		Diagnostic Horz. / Prop.: Kind: Depth: Ochric / Lithic 39cm	
P.S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range: 10-15" 17-20% 40-48%					

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Mtn Mahogany	
	Rocky Mtn Juniper	
	Utah Juniper	
	Pinyon Pine	
	Wheatgrass	
	Bromegrass	
	Indian Rice grass	
	Doug Fir	

MISCELLANEOUS FIELD NOTES / SKETCH :

5% Mod deep soil

3% R.O.

This area Gompers 55%
Wiggler 20%
R.O. 20%
Mod deep 5%

Component Name:								Map Unit Symbol:						Date:

	Obser. Method	Depth (cm) (TOP) (BOT)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Sand %	Silt %	Clay %	LEP	Mottles % Sz Cont. Col Mst Shp Loc
1	Small Pit	0-3" 0-8cm	A	cw	10YR6/3	10YR4/3	vchL	35%ch 2cob 5gr 2FL	1fsbK			19		
2		3-12 8-31cm	C1	cw	10YR6/3	10YR4/4	chfsl	20%ch 2cob 8gr 1FL	1fsbK			16		
3		12-15" 31-39cm	C2	AS	2.5Y5/2	2.5Y4/2	vchL	40ch 10gr 2FL	1thpl			25		
4		15" 39cm	R		Sandstone		interbedded		with Shale					
5														
6														
7														
8														
9														
10														

	Redoximorphic Features Knd % Sz Cont. Col. Mst Shape	Concentrations Knd % Sz Cont. Col Mst Shp Loc	Ped / V. Surface Features Knd % Con Dst Loc Col Mst	Roots Qty Sz Loc	Pores Qty Sz Shp	Notes Ksat	Notes Unified
1	—	—	—				
2	—	—	—				
3	—	—	—				
4							
5							
6							
7							
8							
9							
10							

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Draft

April, 2002

Series or Component Name: Wiggler	Map Unit Symbol: MU#2	Photo #:	Classification:	Soil Moist. Regime (Tax.):
Describer(s): L. Sasser	Date: Oct 22, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum: Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape: Mountains	Landform: MInslope	Microfeature:	Anthro:	Elevation: ≈7380	Aspect: SSE	Slope (%): 40%	Slope Complexity:	Slope Shape: (Up & Dn / Across)
Hillslope Profile Position: lower 1/3	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	

Drainage: Well	Flooding: None	Ponding: None	Soil Moisture Status:	Permeability: moderately slow Ksat:	Land Cover / Use:
Parent Material: Colluvium & residuum	Bedrock: Kind: Shale Fract.: highly Hard.: Hard Depth: 10-20"			Lithostrat. Units: Group: Formation: Member:	
Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: 20% CB: 1% ST: 1% BD: CN: FL: 2% Kind:		Diagnostic Horz. / Prop.: Kind: Ochric epipedon Depth:	
P.S. Control Section: Ave.Clay %: Ave.Rock Frag %: Depth Range: 10-15" 25-28 15-25%					

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Rky Moutain Juniper	
	Utah Juniper	
	MIn Mahogany	
	Serviceberry	
	Pinyon Pine	
	Douglas Fir	
	Western Wheat grass	
	Brome grass	
	Indian Rice grass	
	Rabbit Brush	

MISCELLANEOUS FIELD NOTES / SKETCH :

Disturbed soil soil few feet nearer road.

To North R.O. is 5 to 6' from Road
R.O. is almost verticle Cliff.

Rabbit Brush is a predominate plant
in disturbed areas.

Component Name:	Wiggler	Map Unit Symbol:		Date:

	Obser. Method	Horizon	Depth (in)	Depth (cm)	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Notes
1		A	0-4	0-9	AW	2.5Y6/3	2.5Y4/3	grL	20% gr 5% 2-3 sl ch	2msbk 2mgr	sh	fr	ss	p	
2		C1	4-12	9-30	CS	2.5Y5/2	2.5Y4/1	Para ChL	25% parach 10% ch	2fplaty	sh	fr	ss	p	
3		C2	12-15	30-39	AS	2.5Y6/1	2.5Y4/1	VchCL	30% ch 80% parach	2fine platy	sh	fr	ss	p	
4		Cr	15"	Weathered		5Y6/2		shale							
5															
6															
7															
8															
9															
10															

	Redoximorphic Features % Sz Co Hd Sp Kd Loc Bd Col	Concentrations % Sz Co Hd Sp Kd Loc Bd Col	Ped / V. Surface Features % Dst Cont Kd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH method	Effer (agent)	Clay %	Sand %	Notes
1	—	—	—	2vf, f 1m+c		8.2	ST	22	50	
2	—	few $CaCO_3$ coats BRF	—	2vf, f 1m+c		8.4	ST	25	40	
3	—	few to common salt crystals	—	2vf, 1fem		8.8	ST	28	40	
4										
5										
6										
7										
8										
9										
10										

Waggler (note)

USDA-NRCS **PEDON DESCRIPTION** **PEDON ID#:** **2/2012**

Series or Component Name:	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):
Describer(s): L. Sagger	Date: Oct 29, 2019	Weather:	Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Geodetic Datum:
Location: Sec. T. R.	UTM: Zone: mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:
MLRA/LRU:	Transect: ID: Stop#: Interval:	Landscape:	Landform:	Microfeature:
Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:
Slope Shape: (Up & Dn / Across)	Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:
Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	Drainage:
Flooding:	Ponding:	Soil Moisture Status:	K_{sat}:	Land Cover / Use:
Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:	Erosion: Kind: Degree:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:
P.S. Control Section: Depth Range:	Ave. Clay%:	Ave. Rock Frag %:	Diagnostic Horz. / Prop.: Kind: Depth:	

VEGETATION:

SYMBOL	COMMON NAME	% GD COVER
	rabbitbrush	
	Wheatgrass	
	Bromegrass	
	Indian Ricegrass	

MISCELLANEOUS FIELD NOTES / SKETCH:

H

A0-4 0-5 cm grL 2.5Y4/3 2.5Y4/3 dry 2m sbk 2m gr

C1-17 5-28cm vpanachL 2.5Y5/2 2.5Y4/1 moist

C2 17 vch a panach shale 2.5Y4/2 2.5Y4/2 with salt crystals

Cr

(To north R.O. is 546' from road)

disturbed soil

16' then R.O.

~~Sandstone & Shale~~ interbedded

on R.O. is shale with Juniper Rky Mtn " Serviceberry Bouteloua Mtn Mahogany (Wheatgrass)

Established Series
Rev. RJL/MJD/SSP
06/1999

GOMPERS SERIES

The Gompers series consists of very shallow and shallow, well drained, moderately rapidly permeable soils formed in slope alluvium and colluvium over residuum derived from sandstone and shale. Gompers soils are on hillslopes. Slopes are 4 to 80 percent. The mean annual precipitation is about 14 inches and the mean annual temperature is about 44 degrees F.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, calcareous, frigid Aridic Lithic Ustorthents

TYPICAL PEDON: Gompers very channery silt loam on a north facing 12 percent slope under pinyon pine and Utah Juniper at an elevation of 6,520 feet. (Colors are for air-dry soil unless otherwise stated.)

The surface is covered by 45 percent channers and 5 percent flagstones.

A--0 to 3 inches; brown (10YR 5/3) very channery silt loam, dark yellowish brown (10YR 3/4) moist; moderate thin platy structure parting to moderate very fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine, few medium roots; common very fine and fine, few medium vesicular pores; 25 percent channers; slightly effervescent, (24 percent calcium carbonate equivalent), carbonates are disseminated; moderately alkaline (pH 8.2); clear smooth boundary. (1 to 5 inches thick)

C1--3 to 8 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 5/3) moist; weak very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine, few medium roots; common very fine, fine, and medium tubular pores; 35 percent channers, 5 percent flagstones; slightly effervescent, (28 percent calcium carbonate equivalent), carbonates are disseminated; moderately alkaline (pH 8.4); clear wavy boundary.

C2--8 to 18 inches; pale yellow (2.5Y 7/4) extremely channery loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine and fine, common medium roots; few very fine and fine tubular pores; 70 percent channers, 5 percent flagstones; slightly effervescent, (30 percent calcium carbonate equivalent), carbonates are disseminated; strongly alkaline (pH 8.6); clear wavy boundary. (combined thickness of C horizons is 7 to 15 inches)

R--18 inches; fractured shale bedrock.

TYPE LOCATION: Uintah County, Utah; along the southeast portion of Indian Ridge on the USGS

Bates Knoll, Utah Quadrangle; about 2,100 feet west and 3,800 feet south of the northeast corner of sec. 6, T.14S., R.23E., SLBM; 39 degrees, 37 minutes, 32 seconds north latitude and 109 degrees, 22 minutes, 59 seconds west longitude. NAD 27.

RANGE IN CHARACTERISTICS:
Soil moisture: The soil moisture control section is affected by precipitation that is evenly distributed throughout the year with a slight increase in late summer and fall. The soil moisture regime is ustic bordering on aridic.
Mean annual soil temperature: 44 to 47 degrees F.
Depth to lithic contact: 5 to 20 inches to fractured shale or sandstone bedrock

Particle-size control section: 8 to 18 percent clay and 35 to 80 percent rock fragments (channers and flagstones from shale and sandstone lithology)

A horizon:
Value: 5 to 7 dry, 3 to 5 moist
Chroma: 2 to 4 dry or moist
Calcium carbonate equivalent: 15 to 30 percent

C horizon:
Hue: 10YR or 2.5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: extremely channery loam, extremely channery sandy loam, very channery loam, or extremely channery sandy loam
Rock fragments are in horizontal beds of shale and sandstone that have soil material between the rock fragments and in cracks.
Calcium carbonate equivalent: 15 to 30 percent
Reaction: moderately alkaline or strongly alkaline.

COMPETING SERIES: There are no current competitors. A competitor prior to the Eighth Edition, 1998 Keys to Soil Taxonomy is the Reva series. Reva soils have soil moisture control sections affected by peak periods of precipitation in the spring and early summer.

GEOGRAPHIC SETTING:
Parent material: slope alluvium and colluvium over residuum derived from calcareous shale and sandstone
Landform: hillslopes
Slopes: 4 to 80 percent
Elevation: 6,500 to 8,000 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 42 to 45 degrees F.
Frost-free period: 90 to 110 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Bigpack, Iceslew, Pherson, Towave,

and Whetrock soils.
Bigpack soils are on alluvial flats and are very deep.
Whetrock soils have mollic epipedons.
Iceslew soils are fine-loamy with a high water table and are on floodplains.
Pherson soils are very deep and are on drainageways.
Towave soils are on hillslopes and are very deep.

DRAINAGE AND PERMEABILITY: Well drained; low to high runoff; moderately rapid and moderately permeability.

USE AND VEGETATION: These soils are used principally for rangeland, wildlife habitat, and recreation. Potential vegetation consists of pinyon pine, Utah juniper, bluebunch wheatgrass, Salina wildrye, Indian ricegrass, and birchleaf mountainmahogany. This soil has been correlated to Upland Shallow Loam (Pinyon-Utah Juniper) - 034XY322UT range site in Utah.

DISTRIBUTION AND EXTENT: Northeastern Utah. LRR D, MLRA 34. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Uintah County (Uintah Area Soil Survey) Utah, 1998.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Particle-size control section: The zone from 10 to 18 inches. (C2 horizon)
Ochric epipedon: The zone from 0 to 3 inches. (A horizon)
Lithic contact: The contact with fractured shale at 18 inches. (R layer)

NSSL Sample No. S80UT047-1

The cation exchange activity class was inferred from laboratory data from similar soils in the Uintah Area Soil Survey.

The surface texture modifier was determined following the guidelines outlined in the Utah document, "Procedures for Distributing Rock Fragments on the Surface Layer into the Upper 6 inches of Soil and Subsequent Naming of Map Units, April 1979."

Taxonomic version: Eighth Edition, 1998.

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. DWH/RLM/JPP/TWH
07/2002

WIGGLER SERIES

The Wiggler series consists of very shallow or shallow, well drained soils that formed in residuum and colluvium derived from sandstone and shale. These soils are on mountain slopes. Slopes range from 15 to 70 percent. Mean annual precipitation is about 15 inches. and the mean annual temperature is about 40 degrees F.

TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, frigid, shallow Typic Ustorthents

TYPICAL PEDON: Wiggler very cobbly loam - on a 35 percent north facing slope in woodland. (Colors are for air-dry soil unless otherwise noted.)

A--0 to 7 inches; gray (10YR 6/1) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft; friable, slightly sticky and slightly plastic; common fine and medium, and few coarse roots; common fine and medium, and few coarse pores; 20 percent gravel, 15 percent cobbles and 5 percent stones; strongly calcareous, carbonates are disseminated; moderately alkaline (pH 8.4); gradual wavy boundary. (4 to 12 inches thick)

C1--7 to 12 inches; light gray (10YR 7/1) loam, grayish brown (10YR 5/2) moist; moderate medium granular structure; slightly hard, friable, moderately sticky and moderately plastic, common fine and medium, and few coarse roots; few fine, medium and coarse pores; strongly calcareous, carbonates are disseminated; moderately alkaline (pH 8.4); gradual wavy boundary. (0 to 5 inches thick)

C2--12 to 19 inches; light gray (10YR 7/1) clay loam, grayish brown (10YR 5/2) moist; weak fine angular blocky structure; slightly hard, firm, moderately sticky and moderately plastic; few fine and medium and coarse roots; few fine and medium pores; and 10 percent hard shale fragment; strongly calcareous, carbonates are disseminated; moderately alkaline (pH 8.4); gradual wavy boundary.

Cr--19 inches; weathered shale.

TYPE LOCATION: Garfield County, Utah; 3 1/2 miles northwest of Hatch; 900 feet north and 2250 feet east of the SW Corner of Section 14, T. 36 S., R. 6 W.

RANGE IN CHARACTERISTICS:
Soil moisture regime: ustic. The soils are dry in parts of the moisture control section for 60 to 75 days during the winter months, but are moist for 50 to 55 percent of the time when the soil temperature at 20 inches depth is more than 41 degrees F.
Mean annual soil temperature: 40 to 45 degrees F.

Mean summer temperature: 59 to 62 degrees F.
Depth to paralithic contact: 8 to 20 inches.

Particle-size control section:
Clay content: 18 to 32 percent
Rock fragment content: 0 to 35 percent shale fragments throughout the soil; up to 10 percent additional shale fragments will slake in water.

A horizon:
Hue: 10YR or 2.5Y
Value: 4 to 7 dry, 2 to 6 moist
Chroma: 1 to 4, dry or moist
Calcium carbonate equivalent: moderately calcareous to strongly calcareous.
Reaction: moderately alkaline to strongly alkaline

C horizon:
Hue: 10YR or 2.5Y
Value: 5 to 7 dry, 3 to 7 moist
Chroma: 1 to 6, dry or moist
Texture: mainly loam and clay loam but include channery clay loam and channery silty clay loam
Rock fragment content: 0 to 35 percent
Calcium carbonate equivalent: moderately calcareous to strongly calcareous
Reaction: moderately alkaline to strongly alkaline

COMPETING SERIES: These are the Abac, Cabba and Cohagen series. All of these series occur in climatic setting that receives three-fourths of the precipitation between April and September with May and June being the wettest months. In addition the Abac soils have hue of 5YR or redder.

GEOGRAPHIC SETTING:
Parent material: residuum and colluvium from shale.
Landform: mountain slopes and rolling hills.
Slopes: 15 to 70 percent.
Elevation: 7,800 to 8,200 feet
Mean annual temperature: 38 to 43 degrees F.
Mean annual precipitation: 14 to 18 inches.
The precipitation is distributed fairly evenly throughout the year with 55 to 65 falling between April and September. Wettest months: July, August and September
Driest months: December and January.
Frost-free period: 60 to 100 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Guben, Podo and Ruko series. Guben soils are more than 60 inches deep and have a calcic horizon. Podo soils are 14 to 20 inches deep over hard sandstone. Ruko soils are in a clayey family.

DRAINAGE AND PERMEABILITY: Well drained. Runoff is medium to rapid. Permeability is

moderate.

USE AND VEGETATION: The Wiggler soils are used for woodland, rangeland and wildlife habitat. Potential native vegetation is pinyon, Utah Juniper, ponderosa pine, Nevada bluegrass and Muttongrass.

DISTRIBUTION AND EXTENT: Wiggler soils are of small extent. They are mapped in the Canaan Peak area of Garfield County and Carbon County. LRR D, MLRA 34 and 35

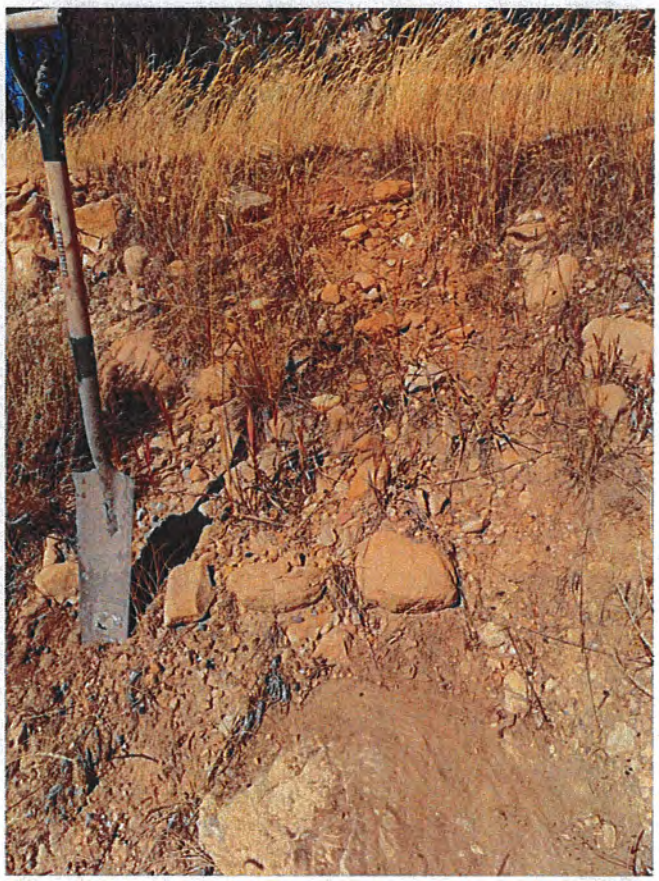
MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Panguitch Soil Survey Area, Garfield County, Utah 1983. The name is that of a nearby stream.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon: The zone from 0 to 7 inches. (A horizon)
Paralithic contact: Shale bedrock at 19 inches. (Cr horizon)
Particle-size control section: The zone from 10 to 19 inches. (Part of the C1 horizon and the C2 horizon)

Keys to Soil Taxonomy: classified according to the Eighth Edition, 1998.

National Cooperative Soil Survey
U.S.A.



Photo's 2 & 3 Show landscapes and soil photos of this map unit.

Behind the spade shows Datine to the right and SnakeJohn with the brown subsoil with an area of bedrock in the center. The surface is eroded or disturbed in this area.

Mu # 3

Rock Cliffs and Gompers soil on 50 to 80 percent slopes

70 percent Cliffs

20 percent Gompers very shallow, very flaggy loamy fine sand and disturbed soils similar to Gompers that have been disturbed. These soils have slopes of 40 to 80 percent except for areas along the road

10 percent other soils including moderately deep disturbed areas along the road

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Basic Soils Course May-04

Series or Component Name: Gompers	Map Unit Symbol: 3	Photo #:	Classification: Frigid Aridic Lithic Ustorthents Loamy skeletal mixed s.a. Calcic	Soil Moist. Regime (Tax.): Aridic Ustic
Describer(s): L. Sasser	Date: Oct. 29, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape: Mountains	Landform: Mtn Slope	Microfeature:	Anthro:	Elevation: ≈ 7400	Aspect: SSE	Slope (%): 60%	Slope Complexity: Simple	Slope Shape: (Up & Dn / Across) Convex / Convex
Hillslope Profile Position: Mid Slope	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:	
Drainage: Well	Flooding: —	Ponding: —	Soil Moisture Status:	Profile Saturated Hydraulic Conductivity Ksat:	Land Cover / Use:			
Parent Material: Sandstone	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:						
Erosion: Kind: Degree:	Runoff: Very Rapid	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth: Ochric epipedon lithic contact 7"					
P.S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range: 0-7" 8-12 40-55%								

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Mtn Mahogany	
	Indian Rice grass	
	Wheat grass	
	Rabbit brush	

MISCELLANEOUS FIELD NOTES / SKETCH :

Cliff below

This Gompers soil is typically shallower than in other areas

Component Name:		Map Unit Symbol:		Date:

	Obser. Method	Depth (cm) (TOP)	(BOT)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frag Knd % Rnd Sz	Structure Grade Sz Type	Sand %	Silt %	Clay %	LEP pH	Mottles % Sz Cont. Col Mst Shp Loc
1	Small pit	0-2" 0-5cm		A	cw	10YR5/3	10YR4/2	VFL lfs	25% ch 5% gr 10% FL	1fgr	82	8	10	7.9	—
2	↓	2-7" 5-18cm		C	As	10YR6/3	10YR4/3	Vchfsl	35% ch 2% 5% gr FL	1Thin pl	75	17	8	8.0	—
3		7" 18cm		R		Sandstone									
4															
5															
6															
7															
8															
9															
10															

	Redoximorphic Features Knd % Sz Cont. Col. Mst Shape	Concentrations Knd % Sz Cont. Col Mst Shp Loc	Ped / V. Surface Features Knd % Con Dst Loc Col Mst	Roots Qty Sz Loc	Pores Qty Sz Shp	Notes ~~Ksat~~ effevescence	Notes Unified
1	—	—	—	2vf, 1f m&c		SL	
2	—	—	—	2vf, 1f m&c		SL	
3							
4							
5							
6							
7							
8							
9							
10							

Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: very gravelly sandy loam, very gravelly loam, cobbly loam, very cobbly sandy loam, very cobbly fine sandy loam, very stony loam, extremely stony loam, very flaggy loam
Rock fragments: 15 to 80 percent
Calcium carbonate equivalent: 15 to 40 percent; up to 45 percent below 40 inches

C horizons:
Hue: 7.5YR to 2.5Y
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: extremely stony sandy loam, very cobbly sandy loam, very channery loam, and very stony loam
Calcium carbonate equivalent: 10 to 20 percent
Rock fragments: 50 to 75 percent
Reaction: moderately alkaline or strongly alkaline

The Bw horizon, where present, has colors similar to the Bk horizons. It is too thin for a cambic horizon.

The 2C horizon, where present, has colors similar to the C horizons.

COMPETING SERIES: Current competitors are the Bigsheep, Eager, Saddlehorse and Winspect series.

Bigsheep, Winspect and Saddlehorse soils contain more than 18 percent clay in the control section. Bigsheep, Eager and Winspect soils are very deep.
Saddlehorse soils have a paralithic contact with shale at 20 to 40 inches.

GEOGRAPHIC SETTING:
Parent material: slope alluvium and colluvium derived from sandstone and shale
Landform: backslopes of mountains
Elevation: 6,500 to 9,400 feet
Slope: 20 to 80 percent
Mean annual temperature: 38 to 46 degrees F.
Average annual precipitation: 16 to 22 inches
Precipitation Pattern: Wettest months are May to Ootober and driest months are February to April.Mean annual temperature: 38 to 46 degrees F.
Freeze-free period: 60 to 90 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Utso, Sowcan, Pathead, Seeprid, and Veatch soils. Sowcan, Seeprid and Utso soils have mollic epipedons thicker than 16 inches. Pathead and Veatch soils are 20 to 40 inches deep.

DRAINAGE AND PERMEABILITY: Well drained, medium and high runoff, moderately rapid or moderate permeability.

USE AND VEGETATION: These soils are used for rangeland, recreation and wildlife habitat. Present vegetation is mountain big sagebrush, Utah serviceberry, birchleaf mountainmahogany, antelope bitterbrush and Gambel oak. This soil has been correlated to the Mountain Very Steep Stony Loam 048AY473UT range site at the type location in Utah.

DISTRIBUTION AND EXTENT: Northeastern and central Utah and northwestern Colorado. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Douglas Plateau Area, Parts of Garfield and Mesa Counties, Colorado, 1988.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Mollic epipedon: The zone from 2 to 11 inches. (A1, A2)
Calcic horizon - the zone from 11 to 53 inches. (Bk1, Bk2, Bk3)
Lithic contact: The contact with sandstone bedrock at 60 inches. (R layer)

The classification was changed from Typic Calciborolls to frigid Typic Calciustolls 12/98.

Taxonomic version: Tenth Edition, 2006.

ADDITIONAL DATA: NSSL number 80P2759-2764 and 80P2788-2795 sample analysis October 1981.

National Cooperative Soil Survey
U.S.A.

Cliff face with shallow soil

Mu # 4

Datino-Snake John 10 to 40 percent slopes

On footslopes of mountains, mostly north aspects

65 percent Datino gravelly loam on more convex and steeper areas, 20 to 40 percent slopes

25 percent Snake John stony loam on more gentle slopes on benches, 10 to 20 percent slopes

5 to 10 percent disturbed soils lacking mollic epipedons along the road and other disturbed areas. Also included are small loamy areas with over thickened A horizons. Plus small areas of coarse loamy soils, rock outcrop and soils less than 60 inches to bedrock.

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Draft

April, 2002

ries or Component Name: Datino	Map Unit Symbol: MU# 4	Photo #:	Classification: Lo-sk, mixed s.a. frigid Haplustoll Entic		Soil Moist. Regime (Tax.):
scriber(s): L. Sasser	Date: Oct. 21, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum:	Location: Sec. T. R.
M: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:

ndscape: Mountain	Landform: Mtn slope	Microfeature: Footslope	Anthro:	Elevation: 7348	Aspect: ENE	Slope (%): 32%	Slope Complexity:	Slope Shape: (Up & Dn / Across) Convex / Concave	
llslope Profile Position: lower 1/3	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:		
ainage: Well	Flooding: None	Ponding: None	Soil Moisture Status: Top 3" moist	Permeability: moderately rapid Ksat:	Land Cover / Use:				
rent Material: Slope Alluvium	Bedrock: Kind: Fract.: Hard.: Depth:		Lithostrat. Units: Group: Formation: Member:						
osion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: 15% 2 1 2			Diagnostic Horz. / Prop.: Kind: Depth: Mollic, Cambic, Calcic				
S. Control Section: Ave.Clay %: Ave.Rock Frag %: Depth Range: 10-40" 16-18 55-65%									

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Douglas Fir	
	Rocky Mtn. Juniper	
	Mtn. Big Sage	
	Aspen	
	Wildrose	
	Wheatgrass	
	Serviceberry	
	Oregon Grape	
	snowberry	
	Mtn Mahogany	
	Indian Ricegrass	
	rye grass	

MISCELLANEOUS FIELD NOTES / SKETCH :

North side of unit above Hunting Creek has steep eroded bank about 40' high.

Some areas have disturbed soil especially along road

Map Unit Symbol: Date:

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1		0-3	0-7	A1	AW	10YR4/2	10YR3/2	gr L	15% gr 2% Ch 2% cob	2f gr	sh	vfr	ss	sp	—
2		3-8	7-20	A2	AW	10YR5/3	10YR3/3	vgr fsl	25% gr 3% 8% cob 5%	1f gr	sh	vfr	ss	sp	—
3		8-14	20-36	BW	CW	10YR5/4	7.5YR4/3	vst fsl	20% gr 10% st 15% cob 2% BL	2m sbk	h	fr	ss	sp	—
4		14-29	36-74	BK1	GW	10YR6/3	10YR4/3	vst fsl	20% gr 20% st 15% cob 2% BL	1m vfsbk	sh	vfr	ss	sp	—
5		29-62	74-158	BK2	GW	10YR7/3	10YR5/3	Exst fsl	20% gr 20% cob 25% st 3% BL	1fsbk	sh	vfr	ss	sp	—
6		62-74	158-188	C		10YR6/4	10YR5/4	Exst fsl	20% gr 20% cob 30% st 5% BL	sg	lo	lo	ns	np	
7															
8															
9															
0															

	Redoximorphic Features % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Concentrations % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Ped / V. Surface Features % Dst Cont Knd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CEC	Notes
1	—	—	—	3vf, 2f m+c		7.4	NE	19	0	
2	—	—	—	2vf, f m+c		7.5	NE	16	0	
3	—	very few very thin CaCO3 coats BRF	—	↓		7.8	SL	18	3	
4	—	common fine threads CaCO3 & coats BRF	—	↓		8.0	ST	16	16	
5	—	common fine threads CaCO3 & coats ARF	—	2vf+f 1m 2c		8.0	VE	16	20	
6	—	few very thin CaCO3 coats	—	1vf+f m+c		7.9	ST	11	7	
7										
8										
9										
0										

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Draft April, 2002

Series or Component Name: Snake John	Map Unit Symbol: MU #4	Photo #:	Classification: Fi-ly mixed s.a. frigid Typic Argiustolls	Soil Moist. Regime (Tax.):
Describer(s): L. Sasser	Date: Oct. 22, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape: Mountain	Landform: Footslope	Microfeature:	Anthro:	Elevation: 7380	Aspect: NNW	Slope (%): 14	Slope Complexity:	Slope Shape: (Up & Dn / Across) Convex / linear	
Hillslope Profile Position: Footslope ridge	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:		

Drainage: Well	Flooding: None	Ponding: None	Soil Moisture Status: Moist upper 3" dry below	Permeability: Ksat:	Land Cover / Use:
Parent Material: Alluvium	Bedrock: Kind: Fract.: Hard.: Depth:			Lithostrat. Units: Group: Formation: Member:	
Erosion: Kind: Degree:	Runoff:		Surface Frag %: GR: CB: ST: BD: CN: FL: Kind: 15 5 10	Diagnostic Horz. / Prop.: Kind: Depth: Mollic, Argillic, Calcic	
P.S. Control Section: Ave.Clay %: Ave.Rock Frag %: Depth Range:					

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Mtn Mahogany	
	Mtn Big Sage brush	
	snowberry	
	Utah Serviceberry	
	wheat grass	
	Indian Ricegrass	
	Douglas Fir	
	wild rose bushes	
	Rky Mtn Juniper	
	Brome grass	

MISCELLANEOUS FIELD NOTES / SKETCH :

Along road disturbed, lacks Mollic & argillic

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1		0-6	0-15	A	CW	10YR5/3	10YR3/2	SiL	10% St 15% gr 3% cob	2 m gr	so	vfr	ss	sp	—
2		6-9	15-22	BE1	AW	7.5YR5/3	7.5YR3/2	grL	15% gr 5% cob 2% St	2m sbK	sh	fr	ss	p	—
3		9-22	22-56	BE2	CW	7.5YR6/3	7.5YR4/3	cob CL	15% gr 10% cob 2% St	2m sbK	h	fi	s	p	—
4		22-27	56-68	BK1	CW	7.5YR6/4	7.5YR5/4	Vcob fsl	20% gr 15% cob 2% St	2f sbK	sh	fi	ss	sp	—
5		27-54		BK2	GW	10YR7/3	10YR5/3	VSt fsl	20% gr 15% cob 15% St 2% BL	1 fsbK	sh	fr	ss	sp	—
6		54-65		BK3		10YR7/4	10YR5/4	ExSt fsl	15% gr 25% cob 20% St 7% BL	1f sbK	sh	vfr	ss	sp	—
7															
8															
9															
10															

	Redoximorphic Features % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Concentrations % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Ped / V. Surface Features % Dst Cont Knd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CEC	% Sand	Notes
1	—	—	—			7.4	NE	18	0	50%	
2	—	—	mod thick clay films common distinct			7.6	NE	22	0	48	
3	—	—	mod thick clay films common distinct			7.7	NE	26	0	44	
4	—	mod thick $CaCO_3$ coats BRF	—			7.8	St	17	15%	60	
5	—	mod thick $CaCO_3$ coats ARF	—			8.2	VE	16	24%	74	
6	—	thin $CaCO_3$ coats ARF	—			8.0	St	12	16%	75	
7											
8											
9											
10											

Established Series
Rev. WRM/RJL/JWB
05/2008

DATINO SERIES

The Datino series consists of very deep, well drained soils that formed in colluvium and slope alluvium over residuum derived from calcareous sandstone and shale. Datino soils are on mountain slopes. Slopes range from 30 to 80 percent. Mean annual precipitation is about 480 mm and the mean annual temperature is about 4.5 degrees C.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, frigid Entic Haplustolls

TYPICAL PEDON: Datino extremely stony fine sandy loam, on a northeast facing, convex, 70 percent slope in Douglas-fir at an elevation of 2,195 meters. (Colors are for dry soil unless otherwise noted.) The surface is covered by about 33 percent stones and boulders.

A--0 to 25 cm; brown (10YR 4/3) extremely stony fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; few coarse and medium and common fine and very fine roots; few very fine pores; 25 percent stones, 25 percent cobbles and 15 percent gravel; noneffervescent; moderately alkaline (pH 7.9); clear smooth boundary. (18 to 30 cm thick)

Bw--25 to 41 cm; brown (10YR 5/3) very stony loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few coarse, medium, fine and very fine roots; few medium and common fine and very fine pores; 10 percent stones, 15 percent cobbles and 15 percent gravel; very slightly effervescent (2 percent calcium carbonate equivalent); moderately alkaline (pH 7.9); gradual wavy boundary. (15 to 20 cm thick)

Bk--41 to 104 cm; pale brown (10YR 6/3) extremely stony fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few coarse, medium, fine and very fine roots; common fine and very fine pores; 25 percent stones, 20 percent cobbles and 15 percent gravel; violently effervescent (22 percent calcium carbonate equivalent), common soft powdery carbonate segregations, carbonate coats on bottom of rock fragments; moderately alkaline (pH 8.0); gradual smooth boundary. (63 to 127 cm thick)

C--104 to 152 cm; pale brown (10YR 6/3) extremely stony fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few coarse, medium, fine and very fine roots; few very fine pores; 25 percent stones, 20 percent cobbles and 15 percent gravel; strongly effervescent (16 percent calcium carbonate equivalent), carbonates are finely disseminated; moderately alkaline (pH 7.9).

TYPE LOCATION: Carbon County, Utah; [TWCI1]about 0.16 kilometers (0.1 mile) west of the Soldier Creek Mine; located about 2,500 feet west and 900 feet south of the NE corner section 18, T 13 S., R 12 E.; Pine Canyon USGS quad; lat. 39 degrees 42 minutes 00 seconds north and 110 degrees 36 minutes 58 seconds west., NAD 83

RANGE IN CHARACTERISTICS:

Soil moisture: Soil moisture control section is usually moist in some part during late spring to early fall, and intermittently dry in late fall. Ustic moisture regime.
Mean annual soil temperature: 4.4 to 6.7 degrees C.
Mean summer soil temperature: 16 to 19 degrees C.
Depth to the cambic horizon: 18 to 30 cm
Depth to the calcic horizon: 38 to 56 cm
Thickness of the mollic epipedon: 18 to 38 cm
Thickness of the cambic horizon: 15 to 20 cm
Thickness of the calcic horizon: 63 to 127 cm

Particle-size control section (weighted average):
Clay content: 16 to 27 percent
Fine sand and coarser sand content: greater than 15 percent
Rock fragment content: 35 to 70 percent

A horizon:
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4 dry or moist
Texture: loam, gravelly loam, very cobbly loam, extremely stony fine sandy loam
Clay content: 15 to 25 percent
Rock fragments: 2 to 80 percent total; 0 to 35 percent stones, 0 to 30 percent cobbles, 0 to 35 percent gravel
Calcium carbonate equivalent: 0 percent in the upper 18 cm; 0 to 5 percent below that depth
Reaction: neutral or slightly alkaline

AB horizon (present in some pedons):
Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4 dry or moist
Texture: very cobbly loam
Clay content: 18 to 25 percent
Rock fragments: 35 to 60 percent total; 0 to 15 percent stones, 15 to 35 percent cobbles, 15 to 35 percent gravel
Calcium carbonate equivalent: 0 percent above a depth of 18 cm
Reaction: neutral or slightly alkaline

Bw horizon:

Hue: 10YR or 7.5YR
Value: 5 or 6 dry; 4 or 5 moist
Chroma: 2 to 4 dry or moist
Texture: gravelly loam, cobbly loam, very stony loam
Clay content: 18 to 27 percent
Rock fragments: 15 to 60 percent total; 0 to 30 percent stones, 0 to 20 percent cobbles, 5 to 30 percent gravel
Calcium carbonate equivalent: 1 to 10 percent
EC (mmhos/cm): 0 to 2
Reaction: neutral to moderately alkaline

Bk horizons, (BCk horizons present in some pedons):
Hue: 10YR or 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: gravelly loam, gravelly clay loam, very gravelly loam, very cobbly loam, very stony loam, extremely stony fine sandy loam
Clay content: 16 to 30 percent
Rock fragments: 15 to 80 percent total; 0 to 35 percent stones, 0 to 35 percent cobbles, 10 to 50 percent gravel
Calcium carbonate equivalent: 5 to 30 percent
EC (mmhos/cm): 0 to 4
Reaction: slightly alkaline to strongly alkaline

C or BC horizon:
Hue: 2.5Y to 7.5YR
Value: 5 to 7 dry; 4 to 6 moist
Chroma: 2 to 6 dry or moist
Texture: very cobbly fine sandy loam, extremely stony fine sandy loam
Clay content: 3 to 20 percent
Rock fragments: 35 to 80 percent total; 0 to 30 percent stones, 15 to 35 percent cobbles, 15 to 35 percent gravel
Calcium carbonate equivalent: 5 to 20 percent
EC (mmhos/cm): 0 to 2
Reaction: slightly alkaline or moderately alkaline

COMPETING SERIES: These are the Anceney, Baahish, Bitton, Debeque and Syrett series. Anceney, Baahish, Debeque and Syrett soils do not have a cambic horizon. Baahish soils also have a lithologic discontinuity over very gravelly outwash. Bitton, Debeque and Syrett soils do not have a calcic horizon. Syrett soils have a lithic contact between a depth of 51 and 102 cm.

GEOGRAPHIC SETTING:
Parent material: colluvium and slope alluvium over residuum from calcareous sandstone and shale
Landform: mountain slopes
Slopes: 30 to 80 percent

Elevation: 2,042 to 2,865 meters
Mean annual temperature: 3.3 to 5.6 degrees C
Average summer temperature: 15 to 17.8 degrees C
Mean annual precipitation: 40 to 56 cm
Precipitation pattern: Wettest months are May to October and driest months are February to April.
Frost-free period: 60 to 90 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Comodore, Minnimaud and Tosca series. Comodore soils are shallow to bedrock and are on mountain ridgetops. Minnimaud and Tosca soils are calcareous to the soil surface, deep to bedrock and are intermixed with the Datino soils.

DRAINAGE AND PERMEABILITY: Well drained; high runoff; moderate permeability.

USE AND VEGETATION: Used for rangeland, wildlife habitat and watershed. Native vegetation is Douglas-fir, pinyon pine, Rocky Mountain juniper, Gambel oak, snowberry, mountain big sagebrush, birchleaf mountainmahogany, serviceberry, salina wildrye, Indian ricegrass, needleandthread, wheatgrass, and bluegrass.

DISTRIBUTION AND EXTENT: Eastern Utah, Southern Rocky Mountains, Carbon and Emery Counties; LRR E, MLRA 48A; small extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Garfield County (Paunsaugunt Area), Utah, 1969.

REMARKS:
Diagnostic horizons and features recognized in this pedon are:
Series control section: The zone from 0 to 200 cm.
Particle-size control section: The zone from 25 to 100 cm. (Bw and part of Bk horizons)
Mollic epipedon: The zone from 0 to 25 cm. (A horizon)
Cambic horizon: The zone from 25 to 41 cm. (Bw horizon)
Calcic horizon: The zone from 41 to 104 cm. (Bk horizon)
Entic feature: These soils are noneffervescent in the upper 18 to 25 cm and increase to strongly or violently effervescent in the calcic horizon. They have free carbonates throughout the cambic horizon or in all parts of the mollic epipedon below a depth of 25 cm from the mineral soil surface.

The assignment of the cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

Taxonomic Version: Classified according to Keys to Soil Taxonomy, Tenth Edition, 2006.

In October 2000, taxonomic classification was converted to the closest match found in Soil Taxonomy, Second Edition 1999. Some update was made to horizon nomenclature, competing series section, etc. Other placements may be more appropriate after a complete update.

In May 2008, the type location was moved to Carbon County, Utah, and the series concept was

LOCATION SNAKEJOHN UT

Established Series
Rev. RJL/MJD/SSP
11/2001

SNAKEJOHN SERIES

The Snakejohn series consists of deep, well drained soils that formed in loamy slope alluvium derived from shale and sandstone. Snakejohn soils are on hillslopes. Slopes range from 3 to 15 percent. Mean annual precipitation is about 19 inches and the mean annual temperature is about 42 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, frigid Typic Argiustolls

TYPICAL PEDON: Snakejohn loam, on a northwest facing, convex-concave, 4 percent slope in birchleaf mountainmahogany and Utah serviceberry browse at an elevation of 8,320 feet. (Colors are for dry soil unless otherwise noted.)

A--0 to 2 inches; brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) moist; moderate very fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine, common medium, few coarse roots; many very fine, common fine tubular pores; 10 percent gravel; neutral (pH 7.2); abrupt smooth boundary.

AB--2 to 5 inches; brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine, common medium, few coarse roots; common very fine and fine, few medium tubular pores; 10 percent gravel; slightly alkaline (pH 7.6); clear smooth boundary. (combined thickness of A horizons is 3 to 6 inches)

Bt1--5 to 10 inches; brown (7.5YR 5/3) clay loam, dark brown (7.5YR 3/2) moist; moderate medium prismatic structure parting to moderate very fine and fine subangular blocky; hard, firm, sticky and plastic; common very fine and fine, few medium and coarse roots; common very fine and fine, few medium tubular pores; common discontinuous distinct clay films on faces of peds; 10 percent gravel; slightly alkaline (pH 7.8); clear smooth boundary.

Bt2--10 to 15 inches; brown (7.5YR 5/3) gravelly clay loam, dark brown (7.5YR 3/2) moist; moderate medium prismatic structure parting to moderate very fine and fine subangular blocky; hard, firm, sticky and plastic; common very fine and fine, few medium and coarse tubular pores; common continuous distinct clay films on faces of peds; 20 percent gravel; slightly alkaline (pH 7.8); abrupt wavy boundary. (combined thickness of Bt horizons ranges from 9 to 15 inches thick)

Bk1--15 to 32 inches; pale brown (10YR 6/3) gravelly clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate very fine and fine subangular blocky; slightly hard, firm, sticky and plastic; common very fine and fine, few medium roots; common very fine and fine, few medium and coarse tubular pores; 15 percent gravel, 15 percent channers; strongly effervescent (33 percent calcium carbonate equivalent), carbonates are disseminated and segregated as common fine rounded masses and nodules; moderately alkaline (pH 8.4); abrupt irregular boundary. (13 to 19 inches thick)

Bk2--32 to 41 inches; very pale brown (10YR 8/2) very gravelly loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; common very fine and fine, few medium tubular pores; 25 percent gravel, 25 percent channers; violently effervescent (55 percent calcium carbonate equivalent), carbonates are disseminated and segregated as many fine and medium masses; strongly alkaline (pH 8.8); clear wavy boundary. (13 to 25 inches thick)

R--41 inches; unweathered sandstone bedrock

TYPE LOCATION: Uintah County, Utah; about 31 miles south southeast of Bonanza, Utah; .5 miles northwest of Lone Spring; located about 1,500 feet east and 1,600 feet north of the southwest corner of sec. 18, T.14S., R.26E., SLBM; Rat Hole Ridge, Utah USGS quad; lat. 39 degrees 35 minutes 49 seconds N. and long. 109 degrees 3 minutes 5 seconds W., NAD 27.

RANGE IN CHARACTERISTICS:

Soil moisture: The soil moisture control section is affected by precipitation evenly distributed throughout the year with a slight increase in late summer and early fall. Typic Ustic moisture regime.
Mean annual soil temperature: 42 to 45 degrees F.
Depth to lithic contact: 40 to 60 inches to sandstone bedrock
Depth to calcic horizon: 15 to 30 inches
Thickness of the mollic epipedon: 7 to 15 inches

Particle-size control section: 27 to 35 percent clay; 10 to 35 percent rock fragments (predominantly gravel from shale and sandstone)

A and AB horizon:
Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 2 or 3 moist
Chroma: 2 or 3
Texture: loam and clay loam
Reaction: neutral or slightly alkaline

Bt and A/Bt (when present) horizon:
Hue: 7.5YR or 10YR
Value: 4 to 6 dry, 3 to 5 moist
Chroma: 2 or 3
Texture: clay loam or gravelly clay loam
Rock fragments: 10 to 35 percent (predominantly gravel)
Reaction: neutral or slightly alkaline

Bk horizon:
Value: 4 or 5 moist, 6 to 8 dry
Chroma: 2 or 3
Rock fragments: 35 to 60 percent gravel and channers
Calcium carbonate equivalent: 15 to 55 percent
Reaction: moderately alkaline or strongly alkaline

COMPETING SERIES: Current and potential competitors are the Absarook, Beartooth, Beeno, Bielenberg, Bookcliff, Bullflat, Burtoner, Clancy, Clasoil, Dooley, Empedrado, Fairfield, Farnuf,

Felor, Greenway, Gurney, Hangdo, Hoppers, Hyalite, Jeffcity, Kokoruda, Lininger, Livona, Martinsdale, Maudlin, Meagher, Moen, Pianohill, Placerton, Reeder, Reedwest, Sponseller, Trag, Tragmon, Trazuni, Tschicoma, Ulrant, Vida, Watne, Watrous, Williams, and Yegen series.

Absarook, Burtoner, Gurney, Maudlin, Moen, Pianohill, and Watrous: have a lithic contact at depths of 20 to 40 inches.

Beartooth, Bielenberg, Bullflat, Clasoil, Dooley, Empedrado, Fairfield, Farnuf, Felor, Greenway, Hangdo, Hyalite, Kokorudu, Livona, Martinsdale, Meagher, Trag, Tragmon, Trazuni, Vida, Watne, Williams, and Yegan: do not have bedrock within a depth of 60 inches.

Beeno, Clancy, Hoppers, Jeffcity, Lininger, Placerton, Reeder, and Reedwest: have a paralithic contact at depths of 20 to 40 inches.

Bookcliff: does not have a calcic horizon.

Sponsellor: have pyroclastic and basalt parent material and includes hue redder than 7.5YR.

Tschicoma: is noncalcareous to a depth of 40 inches or more and have clay minerals of volcanic origin.

Ulrant: have granitic rock fragments.

GEOGRAPHIC SETTING:
Parent material: loamy slope alluvium derived from shale and sandstone
Landform: hillslopes
Slopes: 3 to 15 percent
Elevation: 7,800 to 8,500 feet
Mean annual air temperature: 40 to 43 degrees F.
Mean annual precipitation: 16 to 22 inches
Frost-free period: 70 to 90 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Gompers, Moonset, Utso, Whetrock series.

Gompers and Moonset soils occur on hillslopes and are shallow to shale bedrock.

Utso soils occur on hillslopes and have no argillic horizon.

Whetrock soils occur on hillslopes and are moderately deep to weathered shale.

DRAINAGE AND PERMEABILITY: Well drained, medium runoff, moderately slow permeability.

USE AND VEGETATION: The major uses are rangeland, wildlife habitat, and recreation. The potential native plant community consists of birchleaf mountainmahogany, Utah serviceberry, mountain big sagebrush, bluegrass, snowberry, elk sedge, and Gambel's oak. This soil has been correlated to Mountain Stony Loam (Browse) - 048AY451UT range site in Utah.

DISTRIBUTION AND EXTENT: Northeastern Utah. LRR E, MLRA 48A. This series is of small extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Uintah County, Uintah Area Soil Survey, Utah. 1998. The name is taken from a nearby geographic location.

REMARKS: Diagnostic horizons and features recognized in this pedon are:

Particle-size control section: The zone from 5 to 16 inches. (Bt1 and Bt2 horizons)
Mollic epipedon: The zone from 0 to 15 inches. (A, A/Bt, Bt1, Bt2 horizons)
Argillic horizon: The zone from 5 to 16 inches. (Bt1, Bt2 horizons)
Calcic horizon: The zone from 16 to 41 inches. (Bk1, Bk2 horizons)

Classification changed from Typic Argiborolls to frigid Typic Argiustolls 12/98.

Taxonomic version: Eighth Edition, 1998.

The assignment of the superactive cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

National Cooperative Soil Survey
U.S.A.

An eroded side slope of map unit #4 Datino- SnakeJohn soils. Shows nice mollic epidedon, with area on the left side of the photo where it is over thickened. Just to the right of this soil is brown subsoil with less rock fragments. This is the SnakeJohn Soil. More Rocky Datino soil is on the far right and far left side of the photo.

Mu # 5

Dancehall-Shupert 3 to 8 percent slopes

On stream terraces

70 percent Dancehall very gravelly fine sandy loam

20 percent Shupert gravelly loam in more concave positions

10 percent stream wash, mostly loose cobbles and stones that are flooded during high stream flows and more poorly drained soils along stream channels.

Plus small amounts of coarse loamy soils

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Draft

April, 2002

Series or Component Name: Dancehall	Map Unit Symbol:	Photo #:	Classification: Aridic Lo-sK mixed, sa.cale.frigid/LsT.fluvent	Soil Moist. Regime (Tax.):
Describer(s): L. Sasser	Date: Oct. 21, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum: Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
Mtn Valley Floodplain	Stream Terrace			≈7345	ENE	4%	Simple	Convex

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability:	Land Cover / Use:
Well	rare	—	dry	moderately rapid	

Parent Material:	Bedrock:	Lithostrat. Units:
Sedimentary Alluvium Rocks	Kind: None Fract.: Hard.: Depth:	Group: Formation: Member:

Erosion:	Runoff:	Surface Frag %:	Diagnostic Horz. / Prop.:
Kind: Degree:		GR: 30% CB: 5% ST: 3% BD: CN: FL: Kind:	Kind: Ochric epipedon Depth:

P.S. Control Section: Ave.Clay %: Ave.Rock Frag %:
Depth Range: 15-17% 50-55%

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Western Wheatgrass	
	Bromegrass	
	Cottonwood Trees	
	Mtn. Big Sagebrush	
	Rocky Mtn. Juniper	
	Common Juniper	
	Willows	
	Douglas Fir	
	Rose bushes	
	Indian Ricegrass	
	Rye grass	
	Rabbitbrush	

MISCELLANEOUS FIELD NOTES / SKETCH :

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1		0-3	0-8	A	AS	10YR5/3	10YR 4/3	vgr fsl	30% gr 3% SL 5% cob	1fgr	vfr	so	ss	sp	—
2		3-21	8-54	C1	AS	10YR 6/3	10YR5/3	vSL fsl	25% gr 15% SL 15% cob	1fsbK	vfr	sh	ss	sp	—
3		21-26	54-65	C2	CS	10YR5/3	10YR4/2	vSL L	20% gr 15% SL 20% cob 2% BL	1fgm sbK	vfr	sh	ss	sp	—
4		26-38	65-96	C3	AW	10YR 6/3	10YR4/3	vSL fsl	25% gr 20% SL 15% cob 3% BL	1fsbK	vfr	sh	ss	sp	—
5		38-42	96-106	Ab	AW	10YR5/2	10YR4/2	Vcob L	20% gr 5% SL 20% cob	1fsbK	vfr	sh	ss	sp	—
6		42-74	106-188	Cb1	GW	10YR6/3	10YR4/3	ExSL fSL	25% gr 3% BL 20% cob 20% SL	sg	lo	lo	ns	sp	—
7		74-80	188-202	Cb2		10YR7/2	10YR5/2	VBL SL	20% gr 10% BL 15% cob 15% SL	sg	lo	lo	ns	np	few vf 7.5YR 4/3
8															
9															
10															

	Redoximorphic Features % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Concentrations % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Ped / V. Surface Features % Dst Cont Knd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CEC	Notes
1	—	—	—	3vf 2f, m+c		7.5	sl	16	3%	
2	—	—	—	2vf, f m+c		7.6	sl	14	2%	
3	—	—	—	2vf, f m+c		8.1	sE	21	6%	
4	—	—	—	2vf, f m+c		8.2	sE	17	9%	
5	—	—	—	3vf, 2f 1m+c		8.0	sE	19	8%	
6	—	—	—	2vf, f 1m+c		8.2	sE	11	5%	
7	few vf	—	—	1vf, f m+c		8.0	sl	9	2%	
8										
9										
10										

USDA-NRCS

PEDON DESCRIPTION

Pedon ID # :

Draft

April, 2002

Series or Component Name: Shupert	Map Unit Symbol:	Photo #:	Classification: Aridic Fi-ly, mixed, s.a. calc frigid ustifluvent	Soil Moist. Regime (Tax.):
Describer(s): L. Sasser	Date: Oct. 21, 2019	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W Datum:	Location: Sec. T. R.
UTM: Zone: mE: mN:	Topo Quad.:	Site ID: YR: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU: Transect: ID: Stop #: Interval:

Landscape:	Landform:	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%):	Slope Complexity:	Slope Shape: (Up & Dn / Across)
Mtn valley Flood plain	Stream Terrace			≈ 7345	ENE	3%	Simple	Concave

Hillslope Profile Position:	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage:	Flooding:	Ponding:	Soil Moisture Status:	Permeability: Ksat:	Land Cover / Use:
Well	rare	—	dry		

Parent Material:	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:
Alluvium Sedimentary Rocks	None	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:
		25% 2%	Ochric epipedon

P.S. Control Section: Ave.Clay %: Ave.Rock Frag %: Depth Range:
24-28 30-35%

VEGETATION :

SYMBOL	COMMON NAME	%GD COVER
	Western Wheatgrass	
	Brome grass	
	Cottonwood Trees	
	Willows	
	Douglas Fir	
	Rose bushes	
	Rye grass	
	Rabbit brush	
	Mountain Big sage	
	Indian Ricegrass	

MISCELLANEOUS FIELD NOTES / SKETCH :

Component Name: | Map Unit Symbol: | Date:

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd % Rnd Sz	Structure Grade Sz Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles % Sz Cont. Col Mst Shp Loc
1		0-4	0-10	A	AS	10YR 5/2	10YR 4/2	gr L	25% g 2% cob	1fgr	vfr				
2		4-10	10-25	C1	AW	10YR 5/3	10YR 4/3	gr fsl	20% gr 3% cob	1fsbk	vfr				
3		10-14	25-36	C2	CW	10YR 6/2	10YR 4/3	gr CL	15% gr 2% cob	2mABK	fi				
4		14-28	36-72	C3	AW	10YR 5/3	10YR 4/3	gr L	3% cob 1% 20% gr ST	2msbk	fr				
5		28-49	72-125	C4	CW	10YR 6/3	10YR 4/2	Vcob fsl	20% cob 3% 20% gr ST	1vfsbk	vfr				
6		49-72	125-184	C5	AW	10YR 6/3	10YR 5/3	VST fsl	25% gr 2% BL 15% cob 20% ST	sg	lo				
7		72-80	184-202	C6		10YR 7/2	10YR 5/3	Ex ST SL	20% gr 5% BL 25% cob 20% ST	sg	lo				few vf 7.5YR 4/3 moist 5/3 dry
8															
9															
10															

	Redoximorphic Features % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Concentrations % Sz Cont. Hrd. Shp Knd Loc Bnd Col	Ped / V. Surface Features % Dst Cont Knd Loc Col	Roots Qty Sz Loc	Pores Qty Sz Shp	pH (meth)	Effer. (agent)	Clay %	CEC	Notes
1	—	—	—	3vf 2f,moc		7.6	sl	19	3%	
2	—	—	—	2vf,f moc		8.1	sl	14	2%	
3	—	—	—	2vf,f moc		8.2	st	33	8%	
4	—	—	—	2vf,f 1moc		8.4	st	26	9%	
5	—	—	—	2vf,f 1moc		8.1	st	18	10%	
6	—	—	—	2vf,f 1moc		8.2	st	11	5%	
7	2-4% vf 7.5YR 5/3 4/3	—	—	1vf,f moc		8.0	sl	9	3%	
8										
9										
10										

LOCATION DANCEHALL UT

Established Series
Rev. LDS/CW/JWB
03/2011

DANCEHALL SERIES

The Dancehall series consists of very deep, well drained soils that formed in alluvium derived from sedimentary rock. Dancehall soils are on valley and canyon floors, drainageways, flood plains and stream terraces. Slopes range from 1 to 8 percent. Mean annual precipitation is about 35 cm and the mean annual temperature is about 5.3 degrees C.

TAXONOMIC CLASS: Loamy-skeletal, mixed, superactive, calcareous, frigid Aridic Ustifluvents

TYPICAL PEDON: Dancehall bouldery sandy loam, on a southwest facing, concave, 3 percent slope in rangeland at an elevation of 2,176 meters. (Colors are for dry soil unless otherwise noted.)

A--0 to 15 cm; grayish brown (10YR 5/2) bouldery sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; very friable, soft; few coarse and common medium, fine and very fine roots; 10 percent boulders, 10 percent stones and 4 percent cobbles; very slightly effervescent, carbonates are finely disseminated; slightly alkaline (pH 7.6); abrupt smooth boundary. (10 to 15 cm thick)

C1--15 to 28 cm; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common medium, fine and very fine roots; common fine pores; 10 percent gravel; strongly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.2); clear wavy boundary.

C2--28 to 66 cm; pale brown (10YR 6/3) very bouldery loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; few fine and very fine roots; common fine pores; 15 percent boulders, 10 percent stones, 5 percent cobbles and 10 percent gravel; strongly effervescent, carbonate coats on rock fragments, carbonates are finely disseminated in matrix; moderately alkaline (pH 8.4); abrupt smooth boundary.

C3--66 to 86 cm; brown (10YR 5/3) very bouldery loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; few fine and very fine roots; common fine pores; 15 percent boulders, 10 percent stones, 5 percent cobbles and 10 percent gravel; strongly effervescent, carbonate coats on rock fragments, carbonates are finely disseminated in matrix; moderately alkaline (pH 8.4); abrupt smooth boundary.

C4--86 to 152 cm; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; single grain; very friable, loose, slightly sticky; few fine and very fine roots; 5 percent boulders, 5 percent cobbles and 40 percent gravel; strongly effervescent, carbonate coats on rock fragments, carbonates are finely disseminated in matrix; moderately alkaline (pH 8.4).

TYPE LOCATION: Carbon County, Utah; about 4 kilometers (2.5 miles) north of the Sunnyside Mine; located about 1,800 feet south and 2,500 feet west of the northeast corner of sec. 20, T. 14 S., R. 14 E.; Patmos Head USGS quad; lat. 39 degrees 35 minutes 42 seconds N. and long. 110 degrees 22 minutes 24 seconds W., NAD 83

RANGE IN CHARACTERISTICS:
Soil moisture: The soil moisture control section is affected by precipitation that peaks from July to October and falls evenly throughout the remainder of the year; ustic moisture regime bordering on aridic.
Mean annual soil temperature: 4.4 to 8 degrees C
Mean summer soil temperature: 15 to 17 degrees C
Thickness of the ochric epipedon: 10 to 15 cm

Particle-size control section (weighted averages):
Clay content: 10 to 18 percent
Fine sand and coarser sand content: 30 to 50 percent
Rock fragment content: 35 to 60 percent boulders, stones, cobbles and gravel

A horizon:
Hue: 10YR or 7.5YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 2 to 4 dry or moist
Texture: bouldery sandy loam, very stony fine sandy loam
Clay content: 8 to 18 percent
Rock fragments: 1 to 15 percent boulders, 1 to 25 percent stones, 0 to 25 percent cobbles, 0 to 35 percent gravel
Calcium carbonate equivalent: 1 to 20 percent
EC (mmhos/cm): 0 to 2
Reaction: slightly alkaline or moderately alkaline

C horizon:
Hue: 10YR or 7.5YR
Value: 5 to 7 dry, 4 to 6 moist
Chroma: 2 to 4 dry or moist
Texture: loam, stony loam, very bouldery loam, gravelly fine sandy loam, very gravelly sandy loam; thin layers of very bouldery sandy clay loam in some pedons
Clay content: 8 to 22 percent
Rock fragments: 0 to 40 percent stones and boulders, 0 to 30 percent cobbles, 0 to 50 percent gravel

Calcium carbonate equivalent: 1 to 20 percent
EC (mmhos/cm): 0 to 2
SAR: 0 to 1
Reaction: moderately alkaline

COMPETING SERIES: There are no competitors in this family. Series in similar families are the Pherson, Rapidcreek and Winetti series. Pherson soils have a mean annual soil temperature of 8.9 degrees C. to 10.5 degrees C.and an aridic moisture regime bordering on ustic. Rapidcreek soils have an ustic moisture regime bordering on udic. Winetti soils have a typic ustic soil moisture regime.

GEOGRAPHIC SETTING:
Parent material: alluvium derived from sedimentary rock, dominantly calcareous sandstone and shale
Landform: Canyon and valley floors, drainageways, flood plains, stream terraces
Slopes: 1 to 8 percent
Elevation: 1,950 to 2,316 meters
Mean annual temperature: 3.3 to 7.2 degrees C
Mean annual precipitation: 30 to 41 cm
Precipitation pattern: Peaks from July to October and falls evenly throughout the remainder of the year
Frost-free period: 80 to 120 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Neto, Podo, Rabbitex and Shupert series. The Neto soils occur in drainageways at higher elevations and have a typic ustic moisture regime. The shallow Podo soils are on canyon walls and mountainsides under pinyon and Utah juniper. Rabbitex soils have a mollic epipedon and a calcic horizon and are on mountain toeslopes and fans under Wyoming big sagebrush. The Shupert soils are fine-loamy and are on stream terraces on slightly higher elevations under basin big sagebrush.

DRAINAGE AND PERMEABILITY: well, low to medium runoff, moderate or moderately rapid permeability, rarely flooded for brief periods during the months of March to October from snowmelt and summer thunderstorms.

USE AND VEGETATION: Grazing and wildlife habitat. Native vegetation consists of Great Basin wildrye, basin big sagebrush, rubber rabbitbrush, fourwing saltbush, muttongrass, western wheatgrass, needleandthread, Indian ricegrass, and pepperweed.

DISTRIBUTION AND EXTENT: Northeastern and central Utah mountains, Warm Central Desertic Basins, Mountains and Plateaus; LRR D, MLRA 34B; small extent. About 4,000 acres (1,600 hectares) in Carbon, Emery, and Sevier Counties, Utah.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Carbon County, Utah, Carbon Area, Utah, Parts of Carbon and Emery Counties soil survey area, 2011. The name is that of a spring in upper Whitmore Canyon near the type location.

REMARKS:

Diagnostic horizons and features recognized in this pedon are:
Series control section: The zone from 0 to 200 cm.
Particle-size control section: The zone from 25 to 102 cm. (parts of the C horizons)
Ochric epipedon: The zone from 0 to 15 cm. (A horizon)
Fluvent feature: Irregular decrease of organic carbon from a depth of 25 to 125 cm; or at least 0.2 percent organic carbon of Holocene age at a depth of 125 cm below the soil surface

The type location was previously classified as the Winetti series in the Carbon Area soil survey.

The assignment of the cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

Taxonomic Version: Classified according to Keys to Soil Taxonomy, Eleventh Edition, 2010.

ADDITIONAL DATA:

National Cooperative Soil Survey
U.S.A.

LOCATION SHUPERT UT

Established Series
REV: LDS/CW/JWB
04/2008

SHUPERT SERIES

The Shupert series consists of very deep, well drained, moderately slowly permeable soils that formed in sedimentary alluvium on stream terraces, valley floors and narrow canyon floors. Slopes are 1 to 8 percent. The average annual precipitation is about 36 cm and mean annual temperature is about 5 degrees C.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, calcareous, frigid Aridic Ustifluvents

TYPICAL PEDON: Shupert loam, on an east facing, slightly concave, 4 percent slope in rangeland at an elevation of 2,001 meters. (Colors are for air-dry soil unless otherwise noted.) When described on February 23, 1995, the soil was moist to 46 cm and slightly moist below this depth. The surface is covered by 2 percent cobbles and 10 percent gravel.

A--0 to 10 cm; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; 19 percent clay; weak fine granular structure; very friable, soft, slightly sticky, slightly plastic; common coarse and medium and many fine and very fine roots; 1 percent stones, 2 percent cobbles, 10 percent gravel; slightly effervescent, carbonates are finely disseminated, carbonates are finely disseminated; slightly alkaline (pH 7.8); abrupt smooth boundary. (8 to 10 cm thick)

C1--10 to 30 cm; light yellowish brown (10YR 6/4) fine sandy loam, brown (10YR 4/3) moist; 17 percent clay; weak fine subangular blocky structure; very friable, slightly hard, slightly sticky, slightly plastic; common coarse, medium, fine and very fine roots; 3 percent gravel; slightly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.3); abrupt smooth boundary.

C2--30 to 72 cm; pale brown (10YR 6/3) clay loam, dark grayish brown (10YR 4/2) moist; 31 percent clay; moderate medium and fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; common coarse, medium, fine and very fine roots; 5 percent cobbles, 8 percent gravel; strongly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.2); clear wavy boundary.

C3--72 to 92 cm; light brownish gray (10YR 6/2) cobbly clay loam, dark grayish brown (10YR 4/2) moist; 33 percent clay; weak medium and fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; common coarse, medium, fine and very fine roots; 3 percent stones, 15 percent cobbles, 15 percent gravel; strongly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.4); clear wavy boundary.

C4--92 to 104 cm; light yellowish brown (10YR 6/4) very cobbly sandy loam, brown (10YR 5/3)

moist; 19 percent clay; single grain; loose, slightly sticky, slightly plastic; common coarse, medium, fine and very fine roots; 3 percent stones, 15 percent cobbles, 30 percent gravel; strongly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.2); clear wavy boundary.

C5--104 to 160 cm; pale brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) moist; 21 percent clay; massive; friable, slightly hard, slightly sticky, slightly plastic; few coarse and common medium, fine and very fine roots; 3 percent stones, 15 percent cobbles, 25 percent gravel; strongly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.4); gradual wavy boundary.

C6--160 to 188 cm; pale brown (10YR 6/3) very cobbly loam, grayish brown (10YR 5/2) moist; 20 percent clay; massive; friable, slightly hard, slightly sticky, slightly plastic; few coarse and medium, common fine and very fine roots; common brown (7.5YR 5/4) moist, masses of oxidized iron throughout; 3 percent stones, 20 percent cobbles, 25 percent gravel; strongly effervescent, carbonates are finely disseminated; moderately alkaline (pH 8.4).

TYPE LOCATION: Emery County, Utah; about 14.5 kilometers (9 miles) west-northwest of Huntington along Huntington Creek; 1,950 feet west and 700 feet south of the northeast corner of sec. 35, T. 16 S., R. 7 E.; Hiawatha USGS quad; lat. 39 degrees, 23 minutes, 36.00 seconds north latitude, 111 degrees, 6 minutes, 10.00 seconds west longitude, NAD 83.

RANGE IN CHARACTERISTICS:
Soil moisture: The soil moisture control section is affected by precipitation that has peak periods in December to March and July to October and falls evenly throughout the remainder of the year; ustic moisture regime bordering on aridic.
Mean annual soil temperature: 4.4 to 8 degrees C.
Mean summer soil temperature: 15 to 17.8 degrees C.
Depth to redoximorphic features: greater than 152 cm
Thickness of the ochric epipedon: 8 to 10 cm

Particle-size control section:
Clay content: 27 to 35 percent
Fine sand and coarser sand content: 20 to 50 percent
Rock fragment content: 0 to 35 percent

A horizon:
Hue: 10YR or 2.5Y
Value: 5 or 6 dry, 3 to 5 moist
Chroma: 2 or 3 dry or moist
Texture: loam, gravelly loam
Clay content: 15 to 25 percent
Rock fragments: 0 to 5 percent stones and boulders, 0 to 8 percent cobbles, 0 to 25 percent gravel
Calcium carbonate equivalent: 3 to 20 percent
EC (mmhos/cm): 0 to 2
Reaction: slightly alkaline or moderately alkaline

C horizon:
Hue: 10YR or 2.5Y
Value: 5 to 7 dry, 4 or 5 moist
Chroma: 2 to 4 dry or moist
Texture: fine sandy loam, clay loam, cobbly clay loam, very cobbly sandy loam, very cobbly loam
Clay content: 13 to 35 percent
Rock fragments: 0 to 5 percent stones, 0 to 40 percent cobbles, 0 to 25 percent gravel in any one stratum; most rock fragments occur below the particle-size control section
Calcium carbonate equivalent: 1 to 20 percent
Gypsum content: 0 to 1 percent
EC (mmhos/cm): 0 to 2
SAR: 0 to 1
Reaction: moderately alkaline

COMPETING SERIES: These are the Bullhook and Havre series. Bullhook soils have EC 4-16 and SAR 13-20 in the C horizon. . Havre soils have soil moisture that peaks in spring and early summer.

GEOGRAPHIC SETTING:
Parent material: mixed alluvium from sedimentary rocks, dominantly calcareous sandstone and shale
Landform: stream terraces and narrow canyon and valley floors
Slopes: 1 to 8 percent
Elevation: 1,951 to 2,316 meters
Mean annual temperature: 3.3 to 7.2 degrees C.
Mean annual precipitation: 30 to 41 cm
Precipitation pattern: Peaks from July to October and falls evenly throughout the remainder of the year
Frost-free period: 80 to 120 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Dancehall (T), Neto, Podo, and Rabbitex soils. Dancehall soils are loamy-skeletal and are intermixed with the Shupert soils. Neto soils occur in drainageways at higher elevations, are coarse-loamy and have a typic ustic moisture regime. Podo soils are shallow to bedrock and are on canyon walls under pinyon and Utah juniper. Rabbitex soils have a mollic epipedon and a calcic horizon and are on mountain toeslopes and fans under Wyoming big sagebrush.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderately slow permeability, seasonal high water table may be present from April to August below a depth of 180 centimeters, rarely flooded for brief periods from March to October due to snowmelt and late summer thunderstorms.

USE AND VEGETATION: Used for rangeland and wildlife habitat. Native vegetation consists of Great Basin wildrye, basin big sagebrush, rubber rabbitbrush, fourwing saltbush, muttongrass, western wheatgrass, needleandthread, Indian ricegrass, and pepperweed.

DISTRIBUTION AND EXTENT: Northeastern and central Utah mountains, Warm Central Desertic Basins, Mountains and Plateaus; LRR D, MLRA 34B; small extent. About 4,300 acres (1,700

hectares) in Carbon, Emery, and Sevier Counties, Utah.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Paunsaugunt Area, Utah, 1969.

REMARKS:
Diagnostic horizons and features recognized in this pedon are:
Series control section: The zone from 0 to 200 cm.
Particle-size control section: The zone from 25 to 102 cm. (parts of the C1, C2 and C3 horizons)
Ochric epipedon: The zone from 0 to 10 cm. (A horizon)
Redoximorphic features: masses of oxidized iron from 160 to 188 cm (C6 horizon)
Fluvent feature: Irregular decrease of organic carbon from a depth of 25 to 125 cm; or at least 0.2 percent organic carbon of Holocene age at a depth of 125 cm below the soil surface

These soils were formerly classified as Typic Ustifluvents, loamy-skeletal, mixed, superactive, calcareous, frigid. The type location was moved to Emery County and the soil moisture regime was changed from typic ustic in April 2008 since the original type location is no longer mapped Shupert.

Capillary rise may occur below a depth of 152 cm which may account for masses of oxidized iron in horizons below this depth.

The assignment of the cation-exchange activity class is inferred from lab data from similar soils in the surrounding area.

Taxonomic Version: Classified according to Keys to Soil Taxonomy, Tenth Edition, 2006.

National Cooperative Soil Survey
U.S.A.

<u>ATTACHMENT #5:</u>

WILDLIFE RESOURCES REPORT BY
THE UNITED STATES FOREST SERVICE

(PERFORMED DURING THE APPLICATION PROCESS FOR
THE SPECIAL USE PERMIT APPLICATION FOR
THE NEW WATER DISCHARGE PIPELINE)

2020 CRANDALL CANYON MINE CLOSURE WATER PIPELINE WILDLIFE RESOURCES REPORT

MANTI-LA SAL NATIONAL FOREST

FERRON/PRICE & SANPETE RANGER DISTRICTS

Prepared by: Jeff Jewkes Date: 1-24-2020

Jeff Jewkes, Wildlife Biologist

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Table of Contents

INTRODUCTION *1*

APPLICABLE LAWS AND REGULATORY REQUIREMENTS *1*

Forest Plan Consistency **3**

Goals 3

Desired Future Condition 3

General Management Direction 4

DESCRIPTION OF THE PROPOSAL *4*

Project Location **4**

Proposed Action **4**

Purpose and Need **5**

Purpose 5

Need 5

Scope and Timeframe **5**

Proposed Project Area/Action Area Existing Condition Description **5**

Wildlife Design Features **7**

Golden Eagle 8

EVALUATED SPECIES INFORMATION *8*

Management Indicator Species (MIS) **8**

Migratory Birds **9**

SPECIES DESCRIPTIONS AND ANALYSIS OF EFFECTS *10*

Management Indicator Species **10**

Golden Eagle 10

Macroinvertebrates 13

Big Game – Mule Deer and Rocky Mountain Elk 15

Mule Deer 16

Rocky Mountain Elk 18

Northern Goshawk 22

Migratory Birds **25**

LITERATURE CITED ***26***

Crandall Canyon Mine Closure Water Pipeline Wildlife Resources Report

INTRODUCTION

The purpose of this Wildlife Resources Report is to review the potential impacts of the Crandall Canyon Mine Closure Water Pipeline on species identified as Management Indicator Species (MIS) by the Manti-La Sal National Forest (MLNF) (USDA, Forest Service 1986); and priority migratory bird species identified by the US Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BOCC).

APPLICABLE LAWS AND REGULATORY REQUIREMENTS

The National Forest Management Act of 1976

The National Forest Management Act reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

Under the 1982 Planning Rule, the Act states "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 C.F.R. § 219.19). A viable population is defined as, "[a population] which has the estimated numbers and distribution of reproductive individuals to ensure its continued existence is well distributed in the planning area". In order to ensure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.

A requirement under this Act was the development of MIS which states “In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as MIS and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities” (36 C.F.R. § 219.19 (1)). “Population trends of the MIS will be monitored and relationships to habitat changes determined” (36 C.F.R. § 219.19 (6)).

Migratory Bird Treaty Act

Migratory Bird Treaty Act (as amended 1998) implements Conventions between the United States and four neighboring countries (Canada, Mexico, Japan, and Russia) for the protection of migratory birds and has specific provisions in the statute that includes: Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." (16 U.S.C. 703)

Bald and Golden Eagle Protection Act (Eagle Act)

The Eagle Act, originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a);50CFR 22). “Take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb” a bald or golden eagle. The term “disturb” under the Eagle Act was recently defined via a final rule published in the Federal Register on June 5, 2007 (72 FR 31332). “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Manti-La Sal National Forest Land Management Plan (as amended)

The 1986 (MLNF) Land and Resource Management Plan (LRMP) (USDA, Forest Service 1986) developed components (goals, objectives, standards, and guidelines) for management activities on Forest System Lands.

The following wildlife and/or fisheries goals, desired conditions, and management direction (among others) apply to this proposed action (Manti-La Sal National Forest Land and Resource Management Plan [1986 as amended]):

Forest Plan Consistency

Goals

Wildlife and Fish (III-3)

- Maintain or improve fisheries habitat.
- Protect habitat for viable populations of the existing vertebrate and invertebrate species found on the Forest.

Soil and Water (III-4)

- Maintain satisfactory watershed conditions
- Provide favorable condition of water flow (quality, quantity, and timing)
- Protect National Forest System lands or resources from unacceptable damage caused by the development of water uses.
- Protect soil and water productivity so that neither will be significantly or permanently impaired.

Desired Future Condition

Soil and Water(III-11)

- Water quality and soil productivity would be maintained or improved.
- Future resource uses or activities would be executed so as to minimize impacts to soil and water quality.

Wildlife and Fish (III-10)

- Habitats of threatened and endangered species would be maintained.

General Management Direction

Wildlife Habitat Improvement and Management (III-21)

- Provide habitat needs, as appropriate for management indicator species
- Manage habitat for recovery of endangered and threatened species.
- Manager habitat of sensitive species to keep them from becoming threatened or endangered.

DESCRIPTION OF THE PROPOSAL

Project Location

The proposed project is located in the Miller Fork Canyon-Huntington Creek 6th level watershed, approximately 13 miles northwest of Huntington, Utah. The legal description is Salt Lake Meridian, Utah T. 16 S., R. 7 E., sec. 4 and 5.

Proposed Action

The proposal would allow Genwal Resources, Inc. to construct approximately 2 miles of buried 8-inch diameter high density polyethylene (HDPE) pipeline to gravity flow intercepted groundwater from the North Crandall Canyon Mine portals to Huntington Creek. With an energy dissipater to be installed near the outfall location, prior to the water's discharge from the pipeline, in order to prevent erosion of the existing bank. The proposed pipeline would be constructed within the northern portion of the existing right-of-way for the Crandall Canyon Road (Forest Service Road #50248), and the western bank of the Huntington Creek, near the existing roadway bridge for the Crandall Canyon Road.

The proposed pipeline right-of-way width is 6 feet within the roadway, then 20 feet wide within the currently undisturbed area near Huntington Creek as a short portion at the end of the pipeline would deviate from the existing roadway. An additional 20-foot-wide temporary right-of-way is requested within the roadway during construction. Access covers for all manholes will be a lockable type to prevent unauthorized access. The proposed outfall location and proposed channel connecting the

pipeline to Huntington Creek will be riprapped, with the new rock blending into the existing landscape to create as aesthetically pleasing of a site as possible.

The total acreage is estimated to be less than 2 acres on FS lands after construction with less than .25 acres to be new disturbance. After the construction of the pipeline, all previously undisturbed areas will be revegetated and reclaimed. The proposed location of the discharge point appears to be already disturbed. This area will be seeded at the same time as the newly disturbed area. Any asphalt paving that will be removed for the project will be replaced. Any culverts damaged by the project will be repaired or replaced as required. The culvert carrying the Crandall Creek will not be disturbed.

Purpose and Need

Purpose

To install 8″ HDPE pipe along FS Road #50248,and the western bank of the Huntington Creek near the existing roadway bridge to convey groundwater from Crandall Canyon Mine to be dispersed into Huntington Creek. The total estimated acres on FS land would be less than 2 acres, with less than .25 acres being new disturbance.

Need

To construct and maintain a new mine water discharge pipeline within the right-of-way for the Crandall Canyon Road (FS Road #50248), and the western banks for the Huntington Creek near the existing roadway bridge for the Crandall Canyon Mine.

Scope and Timeframe

The anticipated implementation would be the fall of 2020 with disturbance estimated at less than 2 acres. Construction is expected to take between 120-160 days.

Proposed Project Area/Action Area Existing Condition Description

The North Crandall Canyon Mine has completed active coal mining and is undergoing mine closure procedures. As part of the closure procedures the mine must address the management of intercepted groundwater. At present, UEI is discharging groundwater from the North Mine portals into Crandall Creek under a Utah Pollutant Discharge Elimination System UPDES permit (UTU0024368).

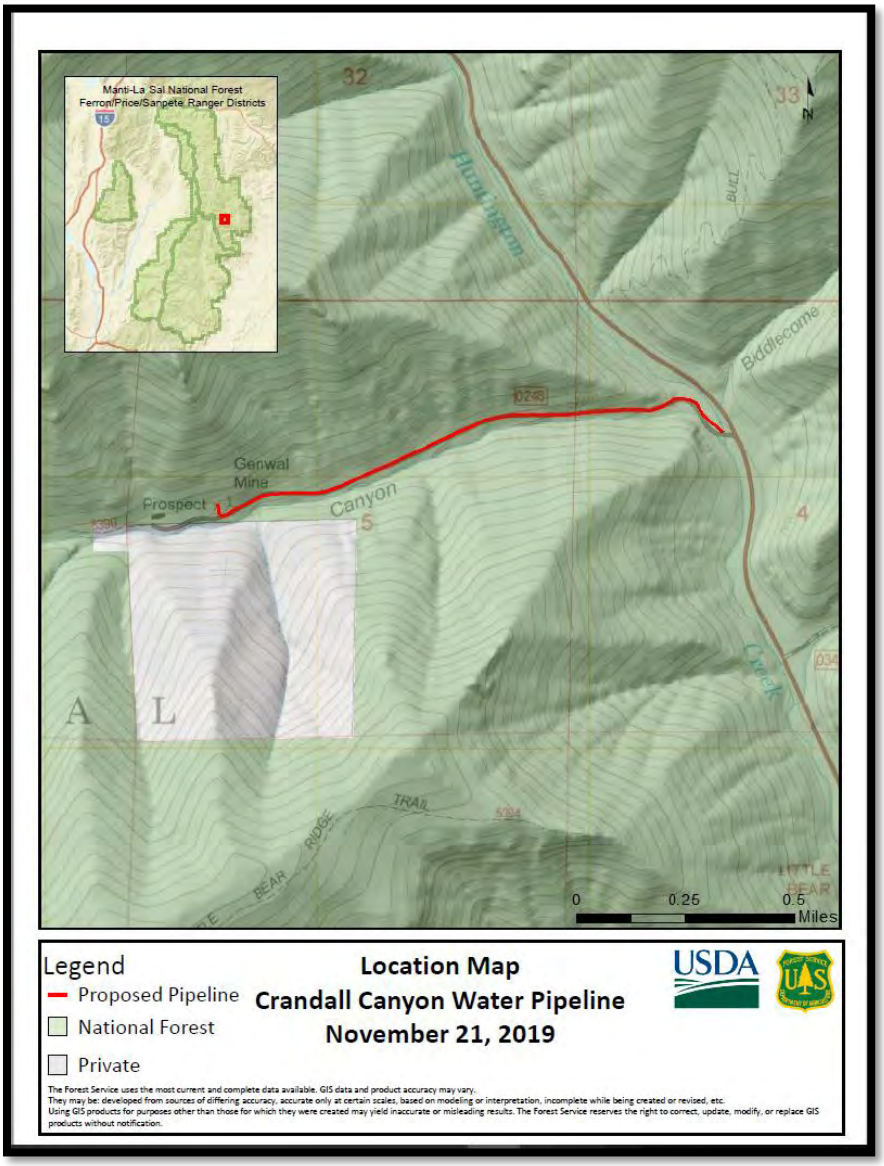
Groundwater must meet designated use water quality standards set by State of Utah Division of Water Quality (UDWQ) prior to its discharge into Crandall Creek. If the water is out of compliance with water quality standards it must be treated prior to being discharged. UEI is currently treating groundwater discharging from the North Crandall portals for elevated levels of iron when not in compliance, prior to discharging into Crandall Creek.

The proposed Crandall Canyon Mine Closure and Water Pipeline project area would be constructed within the northern portion of the existing right-of-way for the Crandall Canyon Road (Forest Service Road #50248), and the western bank of the Huntington Creek, near the existing roadway bridge for the Crandall Canyon Road. This area is within the previously disturbed area of the Crandall Canyon mine.

The vegetation within the project area varies slightly, as a result of topography and elevation; however, the majority of the area within the disturbance area is classified as developed and adjacent areas are classified as Douglas fir, pinyon/juniper, upland herbaceous, and riparian woody, as described by the Vegetation Classification, Mapping, and Quantitative Inventory (VCMQ) (USDA, Forest Service 2017). The proposed project is outside of big game General Winter Range (GWR) and there are no known raptor nests within ½ mile of the site.

Recreational activities are low within Crandall Canyon and most of the use is a result of visitors to the Crandall Canyon Miners Memorial. Huntington Creek is a popular fishing destination and held status as a blue-ribbon fishery; however, it was damaged by debris flows and flooding as a result of the 2012 Seeley Fire.

Map 1. Crandall Canyon Mine Closure Water Pipeline.



Wildlife Design Features

The wildlife design features are integrated into the proposed action and are to be carried forward into the development of unit specific treatment plans or sales. Treatment plans for each unit will have the most updated information based on pre-project monitoring and inventories. The effects analysis assumes all described design criteria are applied and followed.

Golden Eagle

- No proposed treatment related activities will be allowed within ½ mile of active nests from January 1 – August 31, unless it is determined by a Wildlife Biologist that activities will not cause nest abandonment. Determinations may be related to direct line of sight, position of cliff, topography, etc...

EVALUATED SPECIES INFORMATION

Management Indicator Species (MIS)

Table 1. (MIS) designated by the (MLNF LRMP), their occurrence within the proposed project area, and brief habitat description.

SPECIES	SPECIES OCCURRENCE
Golden Eagle *(Aquila chrysaetos)*	Golden eagles breed in open and semi-open habitats from near sea level to 12,000 ft. They occur primarily in mountainous canyon land, rim-rock terrain of open desert, and grassland areas of the western United States (Kochert et al. 2002) and in eastern Utah, valley bottoms, aspen, conifer, and pinyon/juniper habitats as expected based on availability and talus habitat less than expected (Bates and Moretti 1994). They generally nest on cliffs, but they may also nest in trees. Golden eagles hunt over open country for small mammals, snakes, birds and carrion. There is suitable nesting and foraging habitat within the proposed project area.
Macroinvertebrates (Aquatic Insects)	Macro-invertebrates (aquatic insects) are ecological indicator species in aquatic habitats. Habitat requirements for aquatic macroinvertebrates vary with species; habitat requirements for any one species are very specific. Many macro-invertebrates are the larval form of flying insects such as mayflies, stoneflies, and caddisflies. Macroinvertebrates are found within Huntington Creek.

SPECIES	SPECIES OCCURRENCE
Mule Deer *(Odocoileus hemionus)*	Mule deer use a wide array of habitat types and exhibit seasonal movement (elevational migration) in response to snow cover. The proposed project is outside of General Winter Range (GWR) identified by the MLNF LRMP (USDA, Forest Service 1986).
Northern Goshawk *(Accipiter gentilis)*	In Utah, most nests can be found in mid-elevation sites occupied by quaking aspen or coniferous forest (Graham et al. 1999). There is no suitable nesting or foraging habitat within the proposed project area.
Rocky Mountain Elk *(Cervus canadensis)*	Elk tend to occupy the higher elevation aspen and mixed conifer habitats from spring through early fall, and move to lower elevation mixed shrub, pinyon/juniper, and sagebrush habitats for winter. The proposed project is outside of General Winter Range (GWR) identified by the MLNF LRMP (USDA, Forest Service 1986).

Migratory Birds

The Migratory Bird Treaty Act (MBTA) and Executive Order 13186 contain direction to promote the conservation and reduce the take of migratory birds. The Executive Order directs agencies to take certain actions to further comply with the migratory bird conventions, the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and other pertinent statutes. A Memorandum of Understanding (MOU) was signed between the USFWS and the USFS to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration.

As part of the MOU, the USFS agreed to evaluate the effects of agency actions on migratory birds, focusing on birds of management concern along with their priority habitats and key risk factors. Species lists consulted for this analysis include the IPAC resource list of USFWS Birds of Conservation Concern, which was received specifically for this project, (BOCC) (USDI, U.S. Fish and Wildlife Service 2020). No USFWS Migratory Birds of Conservation Concern were on the list and do not occur within the vicinity of the proposed project area. This proposed project is of minimal

concern to migratory birds because of the work occurring within the road right-of-way which is already disturbed.

SPECIES DESCRIPTIONS AND ANALYSIS OF EFFECTS

This analysis of effects reviews the potential "direct and indirect effects" of the proposed project on MIS and migratory bird species of conservation concern within the project area, along with the expected "cumulative effects" that could potentially accrue to these species if project activities add cumulatively to other past, present or reasonably foreseeable future actions to impact the species of concern. Cumulative effects are only addressed if project related activities lead to measurable direct or indirect effects/impacts and add cumulatively to other past, present, or reasonably foreseeable future actions. Cumulative effects will not be addressed if there are no disclosed direct or indirect effects/impacts or if the impacts are minimal (unmeasurable) or discountable (extremely unlikely to occur).

Management Indicator Species

Golden Eagle

Golden eagles typically nest on cliffs overlooking large open expanses of grass-shrub, shrub steppe, and pinyon/juniper habitat, but tree nesting occurs in portions of their breeding range, including Utah. Nesting and brooding season generally extends from mid-February to mid-July. There is extensive cliff habitat along the eastern margin of the Wasatch Plateau and in canyons incising the Plateau. There are also extensive grassland and mountain brush habitats for foraging. Golden eagles primarily prey on small mammals including ground squirrels, prairie dogs, jack rabbits and cottontails; however, local populations rely heavily on jack rabbits and cottontails. Nest site selection and young productivity correlates strongly with rabbit population cycles (Bates and Moretti 1994). Preferred golden eagle prey habitat includes edge along high mountain brush habitat, high/mid elevation perennial forb habitat, and high elevation perennial grassland habitat. Preferred golden eagle winter habitat includes large expanses of sagebrush.

Conservation efforts for golden eagles have focused on the anthropogenic causes of mortality, particularly electrocution from power distribution lines, wind energy, contaminants (lead poisoning), collisions with vehicles, and illegal shooting since these factors are responsible for more than half of the annual golden eagle mortality across all age classes (USDI, U.S. Fish and Wildlife Service 2016).

There are two identified golden eagle nests in the vicinity of the project area, both of which, were impacted by the Trail Mountain Fire. These nests are outside of the ½ mile spatial protection buffer. Golden eagle monitoring occurs annually and any active nests within ½ mile will be avoided during implementation (See wildlife design features).

Population Trends

Golden eagles are widely distributed throughout the Northern Hemisphere. Golden eagle populations have been estimated from 50,000 to 100,000 individuals in North America. A population level survey in the western U.S. conducted by (Good et al. 2004), estimated a total late summer population of 4,998 golden eagles in the region, out of an interior west population of 27,392 golden eagles. This survey gave a summary of known and estimated breeding pairs, which is illustrated in table 2.

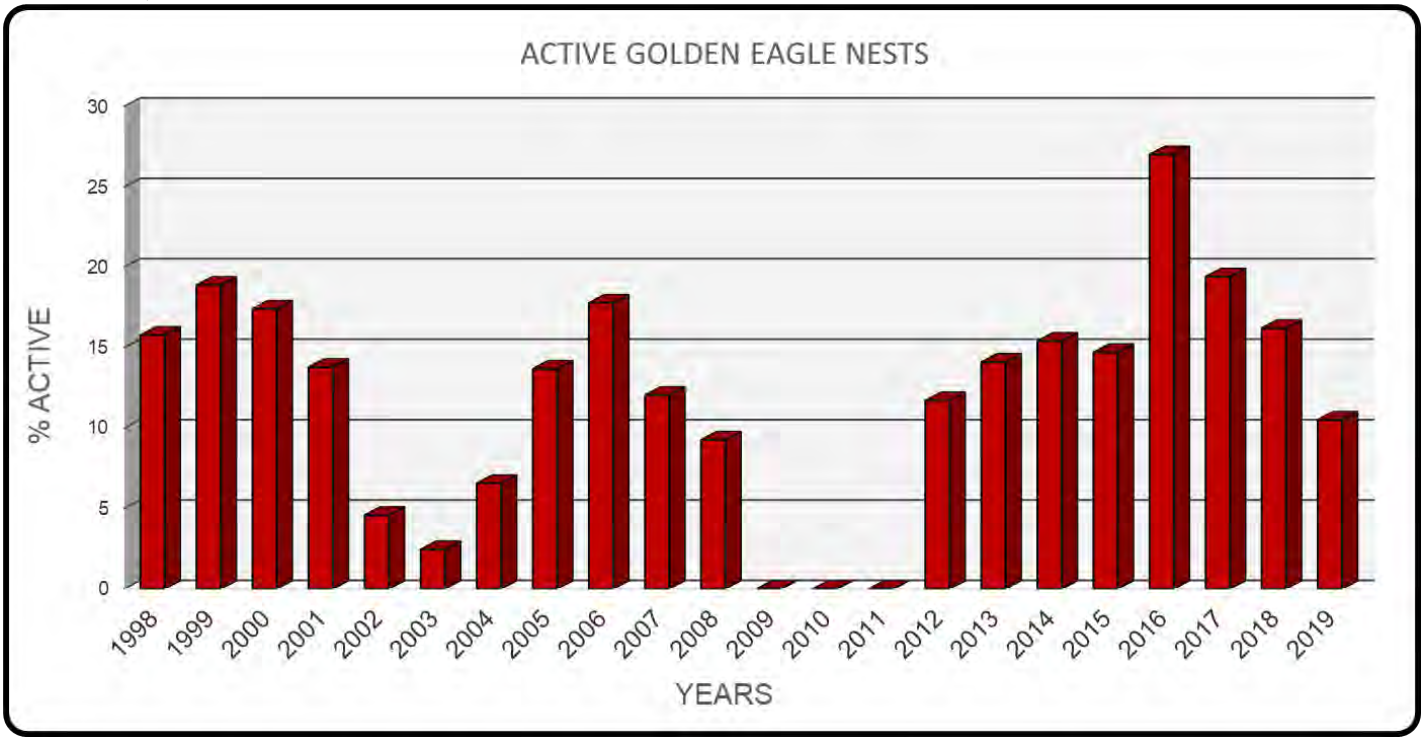
Golden eagles in Eastern Utah (Carbon and Emery Counties), show significant correlations with rabbit populations, data demonstrates that golden eagles produce more young in the same year that rabbit populations increase, but a higher proportion of territories are active the year following an increase in rabbits (Bates and Moretti 1994). Breeding success and local population fluctuations are more the result of prey availability and not forest management actions. The optimum number of golden eagles on the forest was estimated using the fact that a breeding pair requires a territory up to 30 square miles which provides habitat for a maximum of 69 breeding pairs (USDA, U.S. Forest Service 1986). The forest has partnered with HawkWatch Int. to get a more accurate data on the number of territories and interactions within the local golden eagle population. The data shows a very high nest density, with perhaps a smaller territory size based on the quality of the nesting habitat and available prey selection and foraging area. The number of nesting territories is closer to 82 on the Manti-La Sal National Forest (HawkWatch 2019). On the Manti-La Sal National Forest, the number of known golden eagle nests on the Forest has increased over the years as new nests are found. Therefore, looking at the number of known active nests each year would not give an accurate impression of changes in the golden eagle population on the Forest. A better indication of golden eagle population change on the Forest would be the percent of monitored nest territories that were occupied each year, and the nesting success of those occupied territories, shown below in graph 1.

Table 2. *A summary of known and estimated breeding golden eagle pairs in Utah and neighboring states.*

State	Eagle Pairs
Utah	1,885 pairs
Nevada	1,200 pairs
Colorado	500 pairs

Wyoming	4,174 pairs
Idaho	400-500 pairs

Graph 1. The percentage of active golden eagle nests which were monitored from 1998 through 2019 (USDA, Forest Service 2019).



Direct and Indirect Effects

No direct impacts to nesting activities would occur because no proposed treatment related activities would be allowed within ½ mile of active nests from January 1 – August 31. Any impacts to eagles would most likely be caused from project related noise to foraging individuals; however, these impacts would be minimal due to the large territory size of golden eagles and the available foraging habitat. This proposed project is in close proximity of State Highway 31 which receives a good volume of traffic, so these golden eagles are habituated to noise. Golden eagles have nested near mining operations in Southeastern Utah for many years with some of these nests having been there for many decades, which would indicate that there is some habituation to noise. The proposed project includes no activities that would cause abandonment of a nesting territory and would have no impacts to golden eagle population trends. Local population trend fluctuations are driven by prey availability, more specifically, jack rabbit population cycles.

Cumulative Effects

Since the proposed project would not have measurable direct or indirect impacts on the golden eagle or its habitat, no cumulative impacts would accrue to this species as a result of the proposed project.

Macroinvertebrates

Macroinvertebrates are benthic organisms including aquatic insects (mayflies, caddis flies, daphnia, cyclops, stoneflies and others), mollusks and worms. The 1986 Forest Plan's monitoring and evaluation program includes aquatic macroinvertebrates as a management indicator species and calls for monitoring at baseline stations or as needed for select project activities (page IV-6). Aquatic habitat is to be monitored and evaluated under the Forest Plan. Macroinvertebrates serve as natural indicators of management activities undertaken within each watershed. The Forest Plan on page E-9, in defining macroinvertebrates states that "the composition of the [macroinvertebrate] community is an indication of the quality of the aquatic habitat and reflects the condition of the entire drainage". Representative baseline locations were selected for sampling.

Most monitoring locations are near the Forest boundary and are designed to reflect the overall water quality and aquatic habitat quality of the stream system and watershed above the monitoring point. The sampling locations are not designed to monitor the effects of a single land use or activity. These locations are not suitable for project-level monitoring or evaluation.

Freshwater macroinvertebrate communities are highly variable. In a stream system, many physical, chemical, and biotic factors interact to affect macroinvertebrate communities in ways that are not fully understood. The effects of landslides, wildfires, floods and droughts may take several years to affect these communities. The effects may persist for several years and may outweigh the effects of human activities in the watershed. "Cause and effect are often separated in time and space, concealing linkages in a complex series of physical and biological interactions. Consequently, it is often difficult to: 1) clearly link land use or management effects to environmental impacts and 2) separate man caused impacts from those that result from natural phenomena" (Larsen, 1998).

The monitoring techniques of the 1986 Forest Plan were the Biotic Condition Index (BCI), a macroinvertebrate community index, and the Habitat Condition Index (HCI); the measurement frequency was 5 years (USDA, Forest Service 1986). The BCI data indicated highly variable communities across the Forest; probably in response to droughts, floods, and landslides in addition to land management activities. There were no statistically significant trends in the data. There revealed no apparent upward trend in the number of streams that did not meet the Forest Plan standard, nor was there an apparent downward trend in the number of streams that surpassed the

standard. Over the entire period of record, only 5% of the samples did not meet the Forest Plan BCI standard (USDA, Forest Service 2006). The indices currently used by the Forest to monitor Aquatic Habitat, as listed in the Land and Resource Management Plan are obsolete.

The Forest Plan was amended in 2006 to update the protocols used to collect macroinvertebrate data and to change the method used to analyze the data. The 2006 amendment did not alter the language regarding macroinvertebrate monitoring as an optional technique for selected projects. The Manti-La Sal National Forest will continue monitoring aquatic habitat using macroinvertebrate sampling but change the type of appraisal method used. The methodology is similar to that being used by the Utah Division of Water Quality for macroinvertebrate monitoring. The State program has selected relatively unimpaired representative streams as reference sites for different stream types. Monitoring will continue at baseline stations to characterize Forest-wide conditions; data analysis will be in cooperation with the Utah Division of Water Quality.

This project will not impact streams or springs. 36 CFR 219.14(f) states that site-specific monitoring [for management indicator species] or surveying of a proposed project or activity area is not required but may be conducted at the discretion of the Responsible Official. The Forest Plan, as amended, is consistent with this direction.

Trends

Only two sites have not met standards since the 2006 amendment where protocols used to collect macroinvertebrate data were changed, Johnson Creek in 2007 and Muddy Creek in 2009. Both of these sites were re-read and met standards in the follow up monitoring. Since the macroinvertebrate monitoring was designed to reflect forest wide conditions, no project-based monitoring is required; however, as part of the permitted actions through Utah Division of Oil Gas and Mining (UDOGM), the water from the mine has been treated and water quality testing has been ongoing .

Table 3. *Macroinvertebrate monitoring trends (USDA, Forest Service 2014).*

NAME	SITE CODE	YEARS SAMPLED	MEETING STANDARDS
Huntington Creek (Main)	4930770	2007	Yes
Left Fork of Huntington Creek	4930780	2007	Yes
Pack Creek	4956485	2009, 2011	Yes, Yes
Oak Creek (Spring City)	4946785	2009	Yes
Oak Creek (Fairview)	4946565	2009	Yes
Ferron Creek	5931760	2009, 2011	Yes, Yes

South Eccles Creek	4933070	2009	Yes
Manti Creek	4946370	2009,2011	Yes
Fish Creek	5931650	2009	Yes
Twelve-mile	5989110	2009	Yes
Chicken Creek	5989100	2009,2011	Yes, Yes
Lowry Water (Upper)	4931105	2009	Yes
Lowry Water (Lower)	4931100	2009,2014	Yes
Johnson Creek	4953462	2007, 2012	No, Yes
Indian Creek	4955800	2007, 2012	Yes
Pigeon Creek	4942085	2009, 2011	Yes
Muddy Creek	4955590	2009, 2011	No, Yes
Mill Creek	4956435	2009, 2011	Yes
Upper Huntington Creek	4931250	2011	Yes
Additional Sites Monitored Located Within Canyons Project Area			
Booth's Canyon	4931123	2014	Yes
Potter's Canyon	4931120	2014	Yes
Miller's Flat Creek	5932021	2013	Yes
Paradise Creek	5932024	2013	Yes

Direct and Indirect Effects

Direct impacts amount to approximately .25 acres of disturbance within vicinity of Huntington Creek. The proposed outfall location and proposed channel connecting the pipeline to Huntington Creek will be riprapped to prevent erosion. This small area of disturbance will have minimal impacts to macroinvertebrates. The water, which does contain elevated amounts of iron, is not expected to impact aquatic species once it is diluted with the high volume of water in Huntington Creek. Water will be continually tested.

Cumulative Effects

Since the proposed project is not anticipated to have measurable direct or indirect impacts on macroinvertebrates, no cumulative impacts would accrue as a result of the proposed pipeline project.

Big Game – Mule Deer and Rocky Mountain Elk

Because the effects to both mule deer and Rocky Mountain elk would be similar, they are addressed together under the big game direct and indirect effects section.

Mule Deer

Mule deer occupy several habitat types throughout the west and are very adaptable in their ability to live in diverse habitats such as coastal rain forests, icy mountains, prairie grasslands, Yukon River valleys, and deserts (Devos et al. 2003). Mule deer prefer a mosaic of various aged vegetation that provides woody cover, meadow and shrubby openings, and free water. Vegetation cover is critical for thermal regulation in winter and summer, and to provide escape cover. Mule deer are concentrate selectors, diets contain a much higher shrub component than compared to elk, although dietary composition of forage classes vary among locations and seasons and depend on their availability (Devos et al. 2003).

Rutting season occurs in late fall through early winter. Gestation is between 195 and 212 days, and fawns are born from early April to mid-summer, with some geographic variation. Fawning peaks generally occur from late April through mid-June. Fawning occurs in moderately dense shrub lands and forests, dense herbaceous stands, and mid to high elevation riparian and mountain shrub habitats that have available water and abundant forage.

There is no Key Winter Range (KWR) or General Winter Range (GWR) designated by the USFS (USDA, Forest Service 1986) within the proposed treatment units under the proposed action.

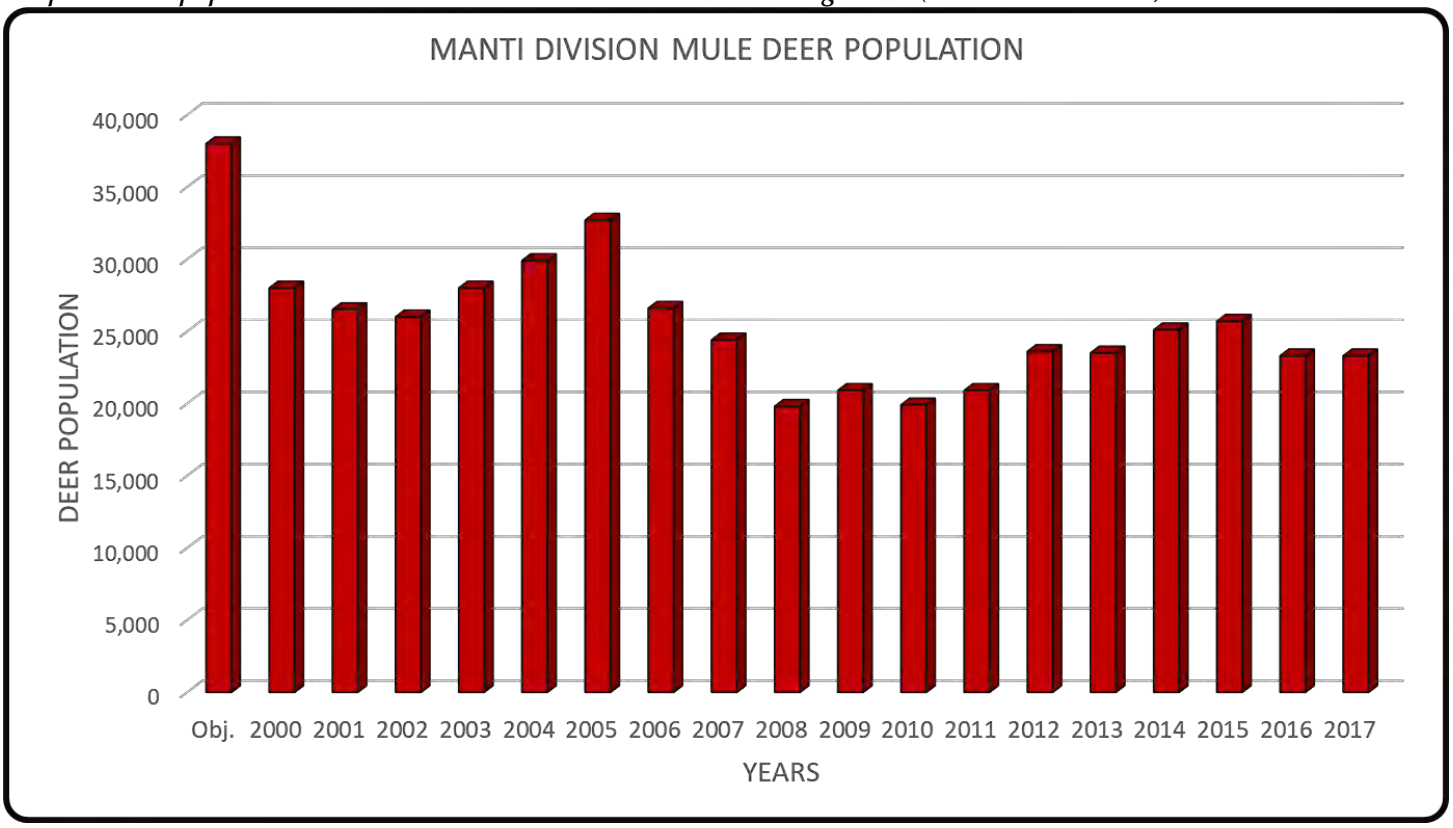
Population Trends

Mule deer occur throughout the mountains and valleys of eastern Utah. Their populations throughout Utah have historically fluctuated, periodically affected by drought and severe winter weather. Populations in eastern Utah declined in the early to mid-1990s but showed signs of recovery in the late 1990s. The decline was attributed to severe drought conditions from 1988 through 1992, which was followed by a severe winter in 1992-93. The most current mule deer population in the state of Utah, as of 2017 is estimated at 363,650 animals which is below the objective of 440,100 (Bernales et al. 2017). The current mule deer population on the Central Mountains Manti Management Unit is estimated at 23,300 animals, which is well below the objective of 38,000 (Bernales et al. 2017). The population has increased considerably since the 1990's, however, the population if still well below objective and is reflective of the low fawn recruitment. There is growing concern in the state of Utah for the decline in mule deer populations. There are many factors involved in mule deer population dynamics including degraded habitat, predation, hunting permits, highway mortality, Off Highway Vehicles (OHV's), and habitat fragmentation. The deer population on the (MLSNF), for the most part, is dependent on the number and type of tags issued by the UDWR each

year, and on weather cycles and patterns. Several past, present and future habitat restoration projects have and will take place on the Manti-La Sal National Forest. Graph 2 illustrates the mule deer population estimates from 2000 - 2017.

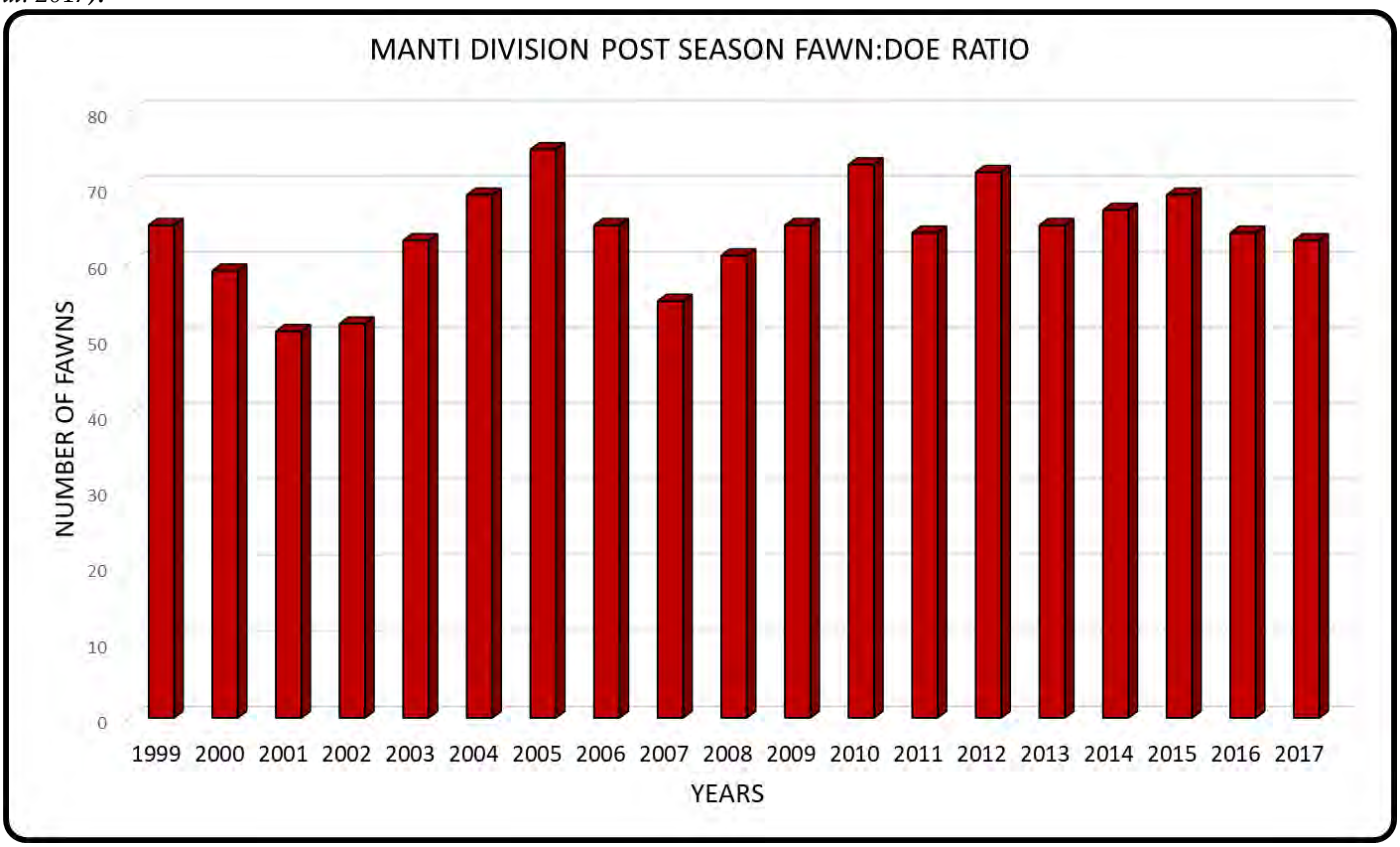
For mule deer, the Forest Plan (USDA Forest Service 1986) considered a minimum viable population for the Manti-La Sal National Forest to be 19,820. The current winter population estimate for herd units dominated by Manti-La Sal National Forest lands is 44,200 deer with 23,300 on the Manti Division (Bernales et al. 2017).

Graph 2. Deer population estimate on the Manti Division 2000 through 2017 (Bernales et al. 2017)



Fawn production is closely tied to the abundance of succulent, green forage during the spring and summer months, predation, and overall fitness of the does following the winter months. Fawn production was very low in the dry 2001-2002 seasons, increased until 2005, decreased until 2007, and has increased until 2010.

Graph 3. *Mule deer fawn post season fawn to doe ratio (fawns:100 does) on the Manti Division from 1999 through 2017 (Bernales et al. 2017)***.**



Rocky Mountain Elk

Elk habitat includes semi-open forest and mountain meadows in the summer. They move to foothills, plains and valleys in winter. Rocky Mountain elk use uneven-aged, mature forest stands that include old growth characteristics, herbaceous openings, and water. Dense brush under-story is used for escape and thermal cover. They are herbivorous, and feed in riparian areas, meadows, and on herbaceous and brush stages of forest habitats. They graze and browse, eating grasses, forbs, tender twigs, and leaves of shrubs and trees, fungi, some mast, and aquatic vegetation.

On the Wasatch Plateau, elk tend to occupy the higher elevation aspen and mixed conifer habitats from spring through early fall, and then move to lower elevation mixed shrub, pinyon/juniper, and sagebrush habitats for winter range. The rut occurs from late August to November. Elk generally occupy winter range from about the beginning of December through mid-April, but this varies depending on the severity of the winter. On the Plateau, parturition (calving) takes place roughly

from the first part of May through early July, generally in aspen dominated habitat. Protection of winter range and calving habitat is considered a key factor in the maintenance of elk populations. It is important that higher nutritional demands during calving be met to improve the chances of calving success, cow recovery, and early calf growth. Therefore, available forage within calving habitat is especially important. Available forage within winter range is also important to increase chances of survival during this harsh season.

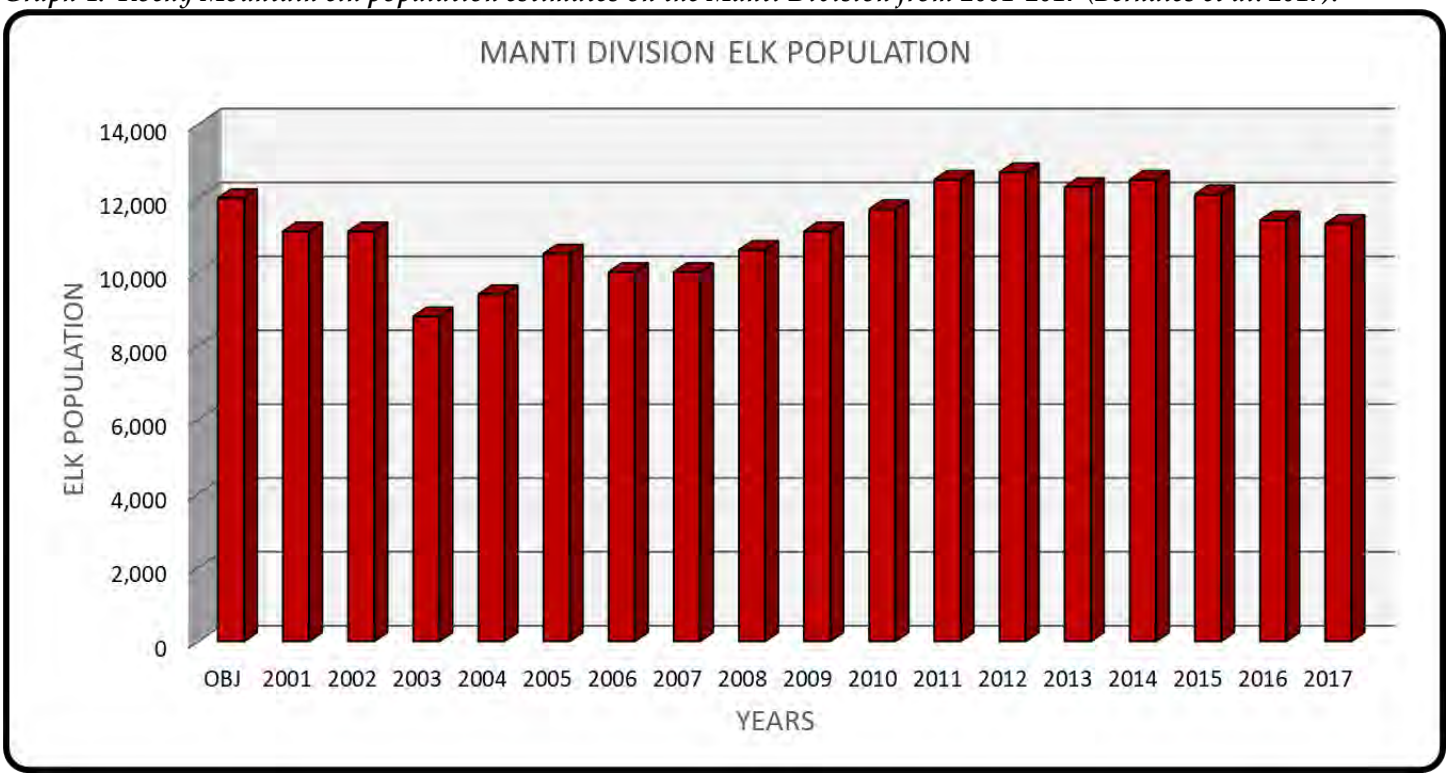
There are approximately 30 acres of GWR designated by the USFS (USDA, Forest Service 1986) within the proposed treatment units under the proposed action.

Population Trends

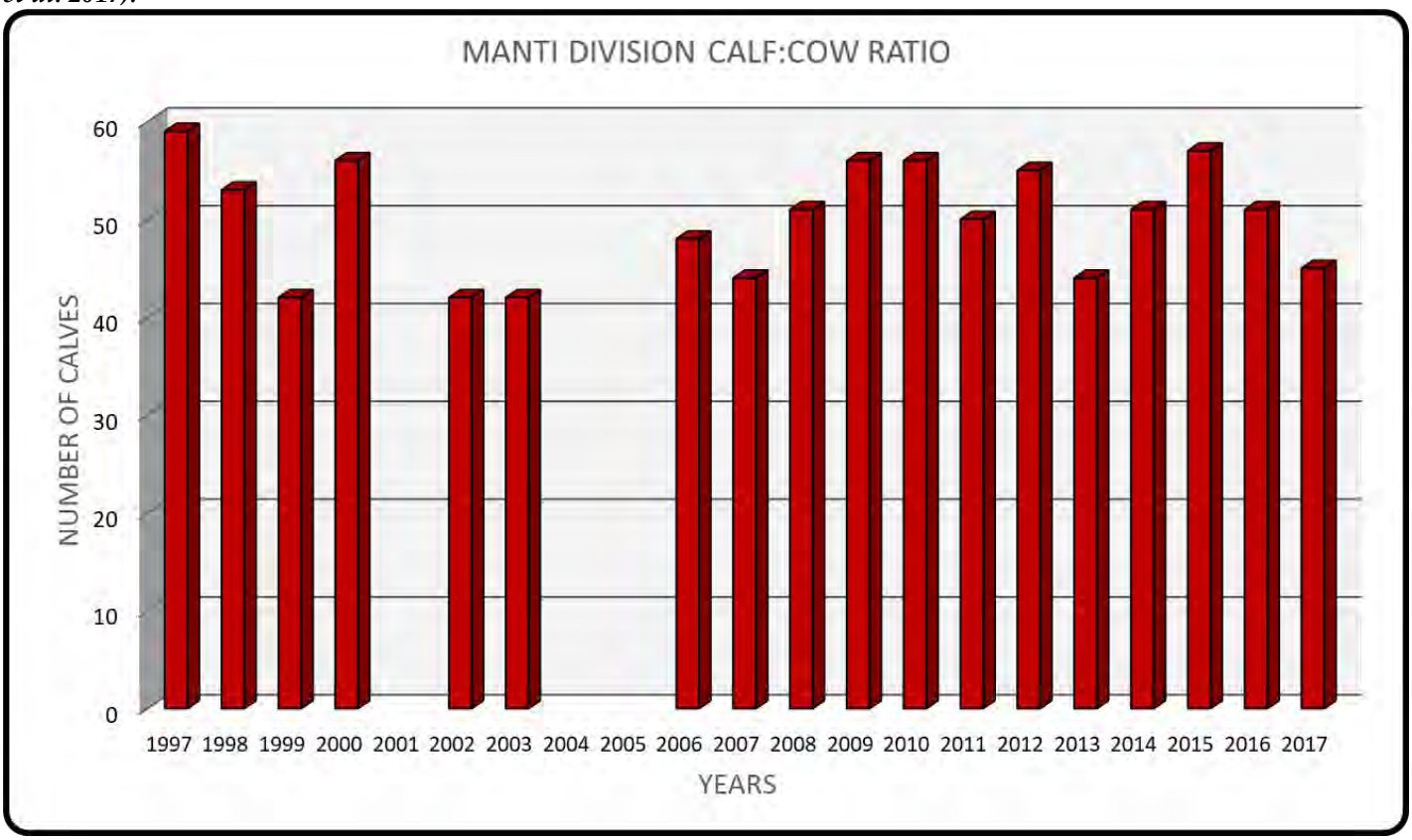
The elk population within the state of Utah has grown dramatically over the last 30+ years. The current elk population in the state of Utah is estimated at 80,955 which is above the objective of 78,215 (Bernales et al. 2017). The elk population on the Manti Division of the MLSNF is estimated at 11,300 which is below the objective of 12,000 (Bernales et al. 2017). The population has remained relatively stable over the last 10 years, although the elk population was intentionally reduced from 2000-2003 due to the persistent drought. The elk population on the (MLSNF), for the most part, is dependent on the number and type of tags issued by the UDWR each year, and on weather cycles and patterns. Graph 4 illustrates the elk population estimates from 2001-2017. Graph 5 illustrates pre-season calf: cow ratios from 1997 through 2017.

The Forest Plan (USDA Forest Service 1986) has a minimum viable population for elk of 2,125. The current population estimate for elk on herd units dominated by Manti-La Sal National Forest lands is 15,200 elk, with 11,300 elk on the Manti Division (Bernales et al. 2017).

Graph 4. Rocky Mountain elk population estimates on the Manti Division from 2001-2017 (Bernales et al. 2017).



Graph 5. Rocky Mountain elk pre-season calf to cow ratio (calves per 100 cows) on the Manti from 1997-2017 (Bernales et al. 2017).



Cover: Forage Ratio

Big game cover to forage ratios will not be addressed because this project will not have any impacts to forage or cover. The disturbance is within the existing right-of-way.

Calving/Fawning Habitat

Small trees, shrubs and down logs provide security to newborn fawns and calves. Calving/fawning habitat on the forest includes patches of tall plants, shrubs, and small trees away from development and roads. A large elk nursery band was detected at the head of Seeley Canyon where several hundred cows were using large patches of false hellebore (Veratrum californicum) to drop their calves. Elk calves and deer fawns have also been observed in taller sage brush, snowberry, other shrub vegetation types and aspen stands. The proposed project are does not contain any quality calving/fawning habitat for big game; therefore, no calving or fawning habitat will be disturbed.

Big Game Direct and Indirect Effects

There will be no direct impacts to big game calving/fawning habitat, cover, or quality foraging habitat from the proposed project because most of disturbance will be within the existing road right-of-way and is within close proximity to Highway 31. Indirect impacts would most likely be from avoidance by individual animals; however, this will be minimal to unmeasurable based on the low-quality habitat of this site for big game.

Cumulative Effects

Since the proposed project is not anticipated to have measurable direct or indirect impacts on mule deer or Rocky Mountain elk, no cumulative impacts would accrue as a result of the proposed pipeline project.

Northern Goshawk

Goshawks have been found in a variety of forest ecosystems including lodgepole pine, aspen, ponderosa pine, Douglas-fir, and mixed forests throughout much of the northern hemisphere. Goshawk nest sites are usually located in dense mature forests with relatively large trees, near water, and on benches of relatively little slope (Graham et al. 1999). Closed canopies are important for protection and thermal cover, and relatively open under-stories are important to allow maneuverability during foraging. Data (district records) collected from the Wasatch Plateau between 1989 and 2013 show that over 80 percent of goshawk nests are in stands with a mixture of aspen and conifer species, with the remaining nest stands comprised of mixed conifer (primarily Engelmann spruce/sub-alpine fir) without aspen. Nearly 70 percent of all known nests have been in aspen trees, with proportionally fewer in Douglas-fir and spruce. Nests are often used year after year, but nest stands usually contain a number of alternate nests. Aspen regeneration is an important component in the life history of northern goshawks on the Manti-La Sal National Forest. The loss of aspen is concerning as well as the acreage of beetle killed spruce. Many nests have been lost due to wind or snow load causing dead spruce to fall over onto nest trees.

Suitable goshawk habitat is often heterogeneous, which supports a broad range of prey species; particularly those preferred by the goshawk: small mammals and birds including rabbits, squirrels, chipmunks, grouse, woodpeckers, jays and robins. Important forest components in Utah include snags, multiple canopies, and down woody debris (Graham et al. 1999).

Vegetation structural stages (VSS) are stages of forest growth and maturity and are used in defining the components of goshawk habitat. VSS 1 is classified as grass/forb with 0-1" dbh trees, VSS 2 is

seedling/sapling with 1-5″ dbh trees; VSS 3 is young forest with 5-12″ dbh trees, VSS 4 is mid-age forest with 12-18″ dbh trees, VSS 5 is mature forest with 18-24″ dbh trees, and VSS 6 is old forest with 24″+ trees. There are no VSS 6 within the treatment units, which could be a result of historic logging in this area.

There are three components to a northern goshawk nesting home range (6,000 acres). The **nest area** is approximately 30 acres and is the center for all activities and movements associated with breeding, including courtship, nesting, and fledging (Reynolds et al. 1992). Goshawks usually have anywhere from two to four alternate nests within their home range. Nest areas are associated with one or more stands of large old or mature trees with dense canopy cover. If a goshawk nest area is found to be active, management activities should be restricted during the active nesting period which normally occurs between March 1st and September 30th.

The **Post Fledging Area** (PFA) is approximately 420 acres and surrounds the nest area and includes a variety of forest types and conditions (Reynolds et al. 1992). The PFA is the defended area of the territory and is the primary center for movement from the time the young leave the nest until they are no longer dependent on the adults.

The last component, the **foraging area**, is approximately 5,400 acres and surrounds the PFA. It is area for hunting and is usually tied to prey availability more so than forest structure.

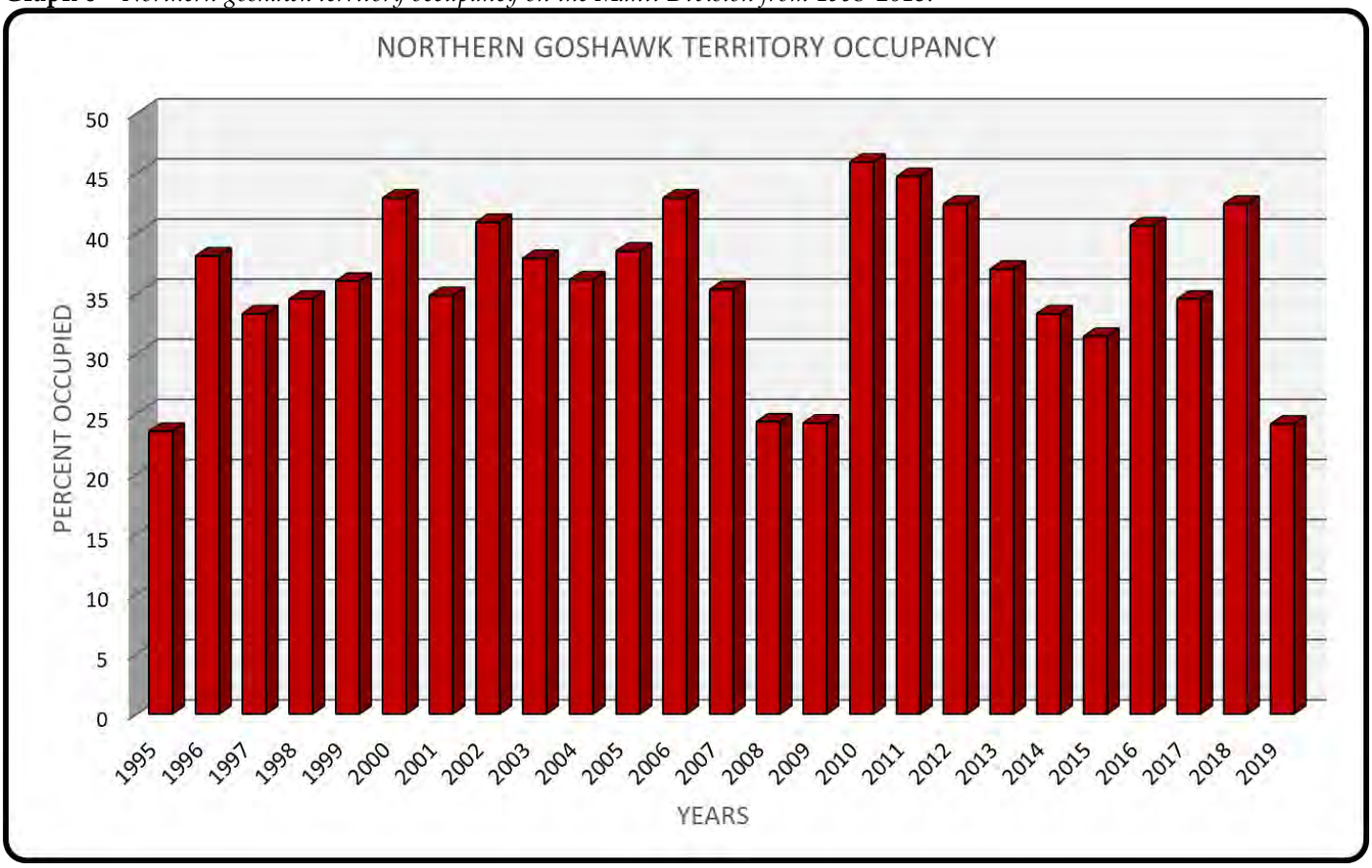
The Manti-La Sal LRMP calls for the delineation of an active nest area, two alternate nest areas, and three replacement nests areas for all known territories (USDA, Forest Service 1986). It states that each nest area (active, alternate and replacement) should be approximately 30 acres (total of approximately 180 acres) in size when sufficient suitable habitat exists (USDA, Forest Service 1986). It also calls to identify a PFA which encompasses the active, alternate and replacement nest areas and additional habitat needed to raise fledglings. A PFA should be approximately 420 acres in size (exclusive of nest area acres) when sufficient (USDA, Forest Service 1986). Forest vegetative manipulation within the PFAs should be designed to maintain or improve the same habitat features as the goshawk home range (i.e., stand structure, snags, down logs, nest trees important in the life histories of the goshawk (See wildlife design features).

Population Trends

The goshawk population on the Manti-La Sal National Forest has remained relatively stable, although occupancy declined from 2002 - 2004. Looking at the number of active nests over the years would give the impression that the goshawk population on the Forest has steadily increased since the late 80s. A better indication of how the goshawk population is doing on the Forest would be the

percent of monitored nests that were occupied each year, which is illustrated in graph 6 below. The Manti-La Sal National Forest Plan Goshawk Amendment (USDA, Forest Service 1986) states that a 20% decline in occupancy over a 3-year period is an acceptable range. We are currently within that range.

Graph 6 – *Northern goshawk territory occupancy on the Manti Division from 1995-2018.*



Direct and Indirect Effects

No direct or indirect impacts will occur to northern goshawks because there is no suitable nesting or foraging habitat found within the proposed project area.

Cumulative Effects

Since the proposed project will have no direct or indirect impacts on northern goshawks, no cumulative impacts would accrue as a result of the proposed pipeline project.

Migratory Birds

There are no migratory bird Species of Conservation Concern within this project area. Most of the work is within existing disturbed areas; therefore, no impacts would occur to migratory birds from this proposed project.

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ATTACHMENT #6:

BIOLOGICAL ASSESSMENT AND BIOLOGICAL EVALUATION (BA/BE)
BY THE UNITED STATES FOREST SERVICE

(PERFORMED DURING THE APPLICATION PROCESS FOR
THE SPECIAL USE PERMIT APPLICATION FOR
THE NEW WATER DISCHARGE PIPELINE)

2020 CRANDALL CANYON MINE CLOSURE WATER PIPELINE BIOLOGICAL ASSESSMENT

&

BIOLOGICAL EVALUATION (BA/BE)

MANTI-LA SAL NATIONAL FOREST

FERRON/PRICE & SANPETE RANGER DISTRICTS

Prepared by: Jeff Jewkes Date: 1/17/2020
Jeff Jewkes, Wildlife Biologist

Reviewed by: _____ Date 21 Jan 2020
Kim Anderson, Ecologist

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Table of Contents

INTRODUCTION *1*

APPLICABLE LAWS AND REGULATORY REQUIREMENTS *1*

Forest Plan Consistency **3**
GOALS 3
DESIRED FUTURE CONDITION 3
GENERAL MANAGEMENT DIRECTION 4

DESCRIPTION OF THE PROPOSAL *4*

Project Location **4**

Proposed Action **4**

Purpose and Need **5**
Purpose 5
Need 5

Scope and Timeframe **5**

Proposed Project Area/Action Area Existing Condition Description **5**

Wildlife Design Features **7**
Golden Eagle 7

EVALUATED SPECIES INFORMATION *7*

Threatened, Endangered, Proposed and Candidate Species **7**

Sensitive Plant, Wildlife and Fish Species **12**

SPECIES DESCRIPTIONS AND ANALYSIS OF EFFECTS *18*

Threatened, Endangered, Proposed and Candidate Species **18**

Sensitive Plant, Wildlife and Fish Species **18**
Canyon sweetvetch and Link Trail columbine 18

LITERATURE CITED *20*

Crandall Canyon Mine Closure Water Pipeline

INTRODUCTION

The purpose of this Biological Assessment/Biological Evaluation (BA/BE) is to review the potential effects of the Crandall Canyon Mine Closure Water Pipeline Project on threatened, endangered, or proposed plant and animal species (TEP). The Endangered Species Act of 1973 (PL 93-205, as amended) requires federal agencies to ensure that any activities they authorize, fund, or carry out, do not jeopardize the continued existence of any wildlife species federally listed as Threatened or Endangered (Section 7). Consultation with the USFWS is required if threatened or endangered (T&E) species, or their critical habitat may be affected by proposed actions. This BA/BE is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)), and follows standards established in the Forest Service Manual (FSM 2671.2 and 2672.4).

The USDA, Forest Service has developed policy regarding the designation of sensitive plant and animal species (FSM 2670.32). A sensitive species is defined (FSM 2670.5) as those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: 1) significant current or predicted downward trends in population numbers or density or 2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. The Biological Evaluation is an analysis of which sensitive species may occur in the project area and whether any impacts on these species or their habitat are anticipated which will adversely affect their viability.

APPLICABLE LAWS AND REGULATORY REQUIREMENTS

The National Forest Management Act of 1976

The National Forest Management Act reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

Under the 1982 Planning Rule, the Act states “Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area” (36 C.F.R. § 219.19). A viable population is defined as, “[a population] which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well

distributed in the planning area". In order to ensure that viable populations will be maintained, habitat must be provided to support, at least, a minimum number of reproductive individuals and that habitat must be well distributed so that those individuals can interact with others in the planning area.

A requirement under this Act was the development of MIS which states "In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as MIS and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities" (36 C.F.R. § 219.19 (1)). "Population trends of the MIS will be monitored and relationships to habitat changes determined" (36 C.F.R. § 219.19 (6)).

Migratory Bird Treaty Act

Migratory Bird Treaty Act (as amended 1998) implements Conventions between the United States and four neighboring countries (Canada, Mexico, Japan, and Russia) for the protection of migratory birds and has specific provisions in the statute that includes: Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." (16 U.S.C. 703)

Bald and Golden Eagle Protection Act (Eagle Act)

The Eagle Act, originally passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a);50CFR 22). "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" a bald or golden eagle. The term "disturb" under the Eagle Act was recently defined via a final rule published in the Federal Register on June 5, 2007 (72 FR 31332). "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

Manti-La Sal National Forest Land Management Plan (as amended)

The 1986 (MLNF) Land and Resource Management Plan (LRMP) (USDA, 1986) developed components (goals, objectives, standards, and guidelines) for management activities on Forest System Lands.

The following wildlife and/or fisheries goals, desired conditions, and management direction (among others) apply to this proposed action (Manti-La Sal National Forest Land and Resource Management Plan [1986 as amended]):

Forest Plan Consistency

GOALS

Wildlife and Fish (III-3)

- Maintain or improve fisheries habitat.
- Protect habitat for viable populations of the existing vertebrate and invertebrate species found on the Forest.

Soil and Water (III-4)

- Maintain satisfactory watershed conditions
- Provide favorable condition of water flow (quality, quantity, and timing)
- Protect National Forest System lands or resources from unacceptable damage caused by the development of water uses.
- Protect soil and water productivity so that neither will be significantly or permanently impaired.

DESIRED FUTURE CONDITION

Soil and Water(III-11)

- Water quality and soil productivity would be maintained or improved.
- Future resource uses or activities would be executed so as to minimize impacts to soil and water quality.

Wildlife and Fish (III-10)

- Habitats of threatened and endangered species would be maintained.

GENERAL MANAGEMENT DIRECTION

Wildlife Habitat Improvement and Management (III-21)

- Provide habitat needs, as appropriate for management indicator species
- Manage habitat for recovery of endangered and threatened species.
- Manager habitat of sensitive species to keep them from becoming threatened or endangered.

DESCRIPTION OF THE PROPOSAL

Project Location

The proposed project is located in the Miller Fork Canyon-Huntington Creek 6th level watershed, approximately 13 miles northwest of Huntington, Utah. The legal description is Salt Lake Meridian, Utah T. 16 S., R. 7 E., sec. 4 and 5.

Proposed Action

The proposal would allow Genwal Resources, Inc. to construct approximately 2 miles of buried 8-inch diameter high density polyethylene (HDPE) pipeline to gravity flow intercepted groundwater from the North Crandall Canyon Mine portals to Huntington Creek. With an energy dissipater to be installed near the outfall location, prior to the water's discharge from the pipeline, in order to prevent erosion of the existing bank. The proposed pipeline would be constructed within the northern portion of the existing right-of-way for the Crandall Canyon Road (Forest Service Road #50248), and the western bank of the Huntington Creek, near the existing roadway bridge for the Crandall Canyon Road.

The proposed pipeline right-of-way width is 6 feet within the roadway, then 20 feet wide within the currently undisturbed area near Huntington Creek as a short portion at the end of the pipeline would deviate from the existing roadway. An additional 20-foot-wide temporary right-of-way is requested within the roadway during construction. Access covers for all manholes will be a lockable type to prevent unauthorized access. The proposed outfall location and proposed channel connecting the pipeline to Huntington Creek will be riprapped, with the new rock blending into the existing landscape to create as aesthetically pleasing of a site as possible.

The total acreage is estimated to be less than 2 acres on FS lands after construction with less than .25 acres to be new disturbance. After the construction of the pipeline, all previously undisturbed areas will be revegetated and reclaimed. The proposed location of the discharge point appears to be already disturbed. This area will be seeded at the same time as the newly disturbed area. Any

asphalt paving that will be removed for the project will be replaced. Any culverts damaged by the project will be repaired or replaced as required. The culvert carrying the Crandall Creek will not be disturbed.

Purpose and Need

Purpose

To install 8″ HDPE pipe along FS Road #50248,and the western bank of the Huntington Creek near the existing roadway bridge to convey groundwater from Crandall Canyon Mine to be dispersed into Huntington Creek. The total estimated acres on FS land would be less than 2 acres, with less than .25 acres being new disturbance.

Need

To construct and maintain a new mine water discharge pipeline within the right-of-way for the Crandall Canyon Road (FS Road #50248), and the western banks for the Huntington Creek near the existing roadway bridge for the Crandall Canyon Mine.

Scope and Timeframe

The anticipated implementation would be the fall of 2020 with disturbance estimated at less than 2 acres. Construction is expected to take between 120-160 days.

Proposed Project Area/Action Area Existing Condition Description

The North Crandall Canyon Mine has completed active coal mining and is undergoing mine closure procedures. As part of the closure procedures the mine must address the management of intercepted groundwater. At present, UEI is discharging groundwater from the North Mine portals into Crandall Creek under a Utah Pollutant Discharge Elimination System UPDES permit (UTU0024368).

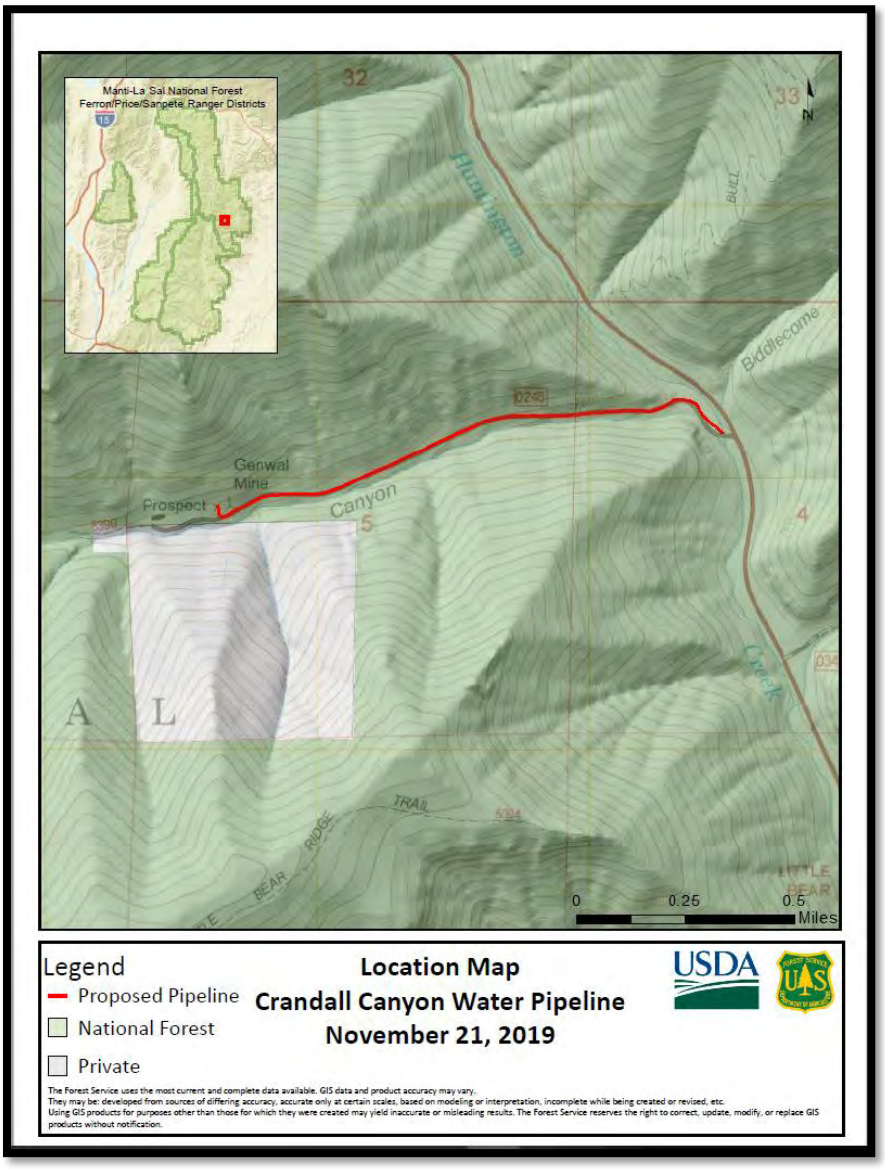
Groundwater must meet designated use water quality standards set by State of Utah Division of Water Quality (UDWQ) prior to its discharge into Crandall Creek. If the water is out of compliance with water quality standards it must be treated prior to being discharged. UEI is currently treating groundwater discharging from the North Crandall portals for elevated levels of iron when not in compliance, prior to discharging into Crandall Creek.

The proposed Crandall Canyon Mine Closure and Water Pipeline project area would be constructed within the northern portion of the existing right-of-way for the Crandall Canyon Road (Forest Service Road #50248), and the western bank of the Huntington Creek, near the existing roadway bridge for the Crandall Canyon Road. This area is within the previously disturbed area of the Crandall Canyon mine.

The vegetation within the project area varies slightly, as a result of topography and elevation; however, the majority of the area within the disturbance area is classified as developed and adjacent areas are classified as Douglas fir, pinyon/juniper, upland herbaceous, and riparian woody, as described by the Vegetation Classification, Mapping, and Quantitative Inventory (VCMQ) (USDA, Forest Service 2017). The proposed project is outside of big game General Winter Range (GWR) and there are no known raptor nests within ½ mile of the site.

Recreational activities are low within Crandall Canyon and most of the use is a result of visitors to the Crandall Canyon Miners Memorial. Huntington Creek is a popular fishing destination and held status as a blue-ribbon fishery; however, it was damaged by debris flows and flooding as a result of the 2012 Seeley Fire.

Map 1. *Crandall Canyon Mine Closure Water Pipeline.*



Wildlife Design Features

The wildlife design features are integrated into the proposed action and are to be carried forward into the development of unit specific treatment plans or sales. Treatment plans for each unit will have the most updated information based on pre-project monitoring and inventories. The effects analysis assumes all described design criteria are applied and followed.

Golden Eagle

- No proposed treatment related activities will be allowed within ½ mile of active nests from January 1 – August 31, unless it is determined by a Wildlife Biologist that activities will not cause nest abandonment. Determinations may be related to direct line of sight, position of cliff, topography, etc...

EVALUATED SPECIES INFORMATION

Threatened, Endangered, Proposed and Candidate Species

A list of threatened and endangered species, as well as candidate and those proposed for listing was generated via the IPAC system from the USFWS (USFS, 2019). The list is specific to the project area and identifies those species potentially affected by the proposed project. These species are in Table 1 below. No candidate or species proposed for listing were on the list and there is no designated critical habitat within the project area.

Table 1. *Threatened and endangered plants and terrestrial and aquatic wildlife identified by the IPAC system that could potentially be affected by the proposed project, species status, and occurrence in the project area. Species that are not known or suspected to occur in the project area, and for which no suitable habitat is present will not be evaluated further in this document.*

SPECIES	STATUS	SPECIES OCCURRENCE WITHIN THE PROJECT AREA
Plant Species		
No threatened or endangered plants were on the list generated via the IPAC system from the USFWS.		
Terrestrial Wildlife Species		
California Condor *(Gymnogyps californianus)*	Endangered (Experimental Population)	(No Occurrence). The analysis area is not within the designated experimental population area, where all released condors and their progeny are expected to remain (USDI, U.S. Fish and Wildlife Service 1996). The analysis area is not suitable habitat and the distance from areas of known foraging

		would make even transient use very unlikely. Therefore, it is my determination that the proposed project will have **No Effect** on the California condor or its habitat and it will not be evaluated in further analysis.
Mexican Spotted Owl *(Strix occidentalis lucida)*	Threatened	(No Occurrence). In Utah, the Mexican spotted owl nests in steep-walled, complex rock canyons at relatively low elevations (USDI, U.S. Fish and Wildlife Service 2004). A habitat evaluation and field surveys were conducted in Huntington Canyon in 2002-2003 (Buys and Associates 2003). North facing canyons were deemed most suitable for nesting; however, most of these areas did not meet the criteria for foraging habitat, which the species requires. Only a few areas met both criteria for suitable habitat in their evaluation which were surveyed. No Mexican spotted owls were detected during those surveys in 2002-2003 (Buys and Associates 2003). The proposed project area does not contain any Protected or Restricted Areas as described in the Recovery Plan (USDI, U.S. Fish and Wildlife Service 2012) or canyon habitat that matches the primary constituent elements (physical and biological features necessary for the species' survival) as described in the Final Designation of Critical Habitat (USDI, U.S. Fish and Wildlife Service 2004). The analysis area is more than 45 miles from designated critical habitat and approximately 120 miles from the nearest designated MSO PAC and the proposed project will not impact MSO habitat; therefore, it is my determination that the proposed project will have **No Effect** on the Mexican spotted owl or its habitat and it will not be evaluated in further analysis.
Southwestern Willow Flycatcher	Endangered	(No Occurrence). The southwestern willow

(Empidonax traillii extimus)		flycatcher is a riparian obligate, nesting in areas with high shrub densities interspersed with openings or meadows; they nest in cottonwood/willow habitats and structurally similar riparian vegetation such as alder and aspen (Sedgwick 2000). Potential SW willow flycatcher habitat in Huntington Canyon was inventoried and no willow flycatchers were detected. The nearest critical habitat is located approximately 140 miles from the proposed analysis area; therefore, it is my determination that the proposed project will have **No Effect** on the Southwestern willow flycatcher or its habitat and it will not be evaluated in further analysis.
AQUATIC WILDLIFE SPECIES		
Bonytail *(Gila elegans)*	Endangered	(No Occurrence). Historically, the bonytail existed in warm water reaches of larger rivers in the Colorado River Basin; it is considered to be adapted to pools and eddies of mainstream rivers. It has been extirpated from most of its historic range. Currently, a small number of wild adults exist in Lake Mohave in the Lower Colorado River Basin, and there are small numbers of wild individuals in the Green River and in sub basins of the Upper Colorado River Basin (USDI, U.S. Fish and Wildlife Service 2002). There is no suitable habitat within the project area and Implementation of the proposed project would not adversely affect water quality in the long-term, nor contribute to the existing water quality impairments defined by the Utah Department of Environmental Quality (UDEQ) (USDA, Forest Service 2017). Therefore, it is my determination that the proposed project will have **No Effect** on the bonytail, or its habitat and it will not be evaluated in further analysis.

Colorado Pikeminnow *(Ptychocheilus Lucius)*	Endangered	(No Occurrence). The Colorado pikeminnow is endemic to the Colorado River Basin, and it historically extended from the Green River in Wyoming, to the Gulf of California; it was widespread and abundant in warm-water rivers and tributaries. It is a long-distance migrator (hundreds of kilometers to and from spawning areas). Adults require deep pool and eddy habitats in streams that have high spring flows. Currently, in Utah this species occurs in the Green River from Lodore Canyon to the confluence of the Colorado River (USDI, U.S. Fish and Wildlife Service 2002a). There is no suitable habitat within the project area and the nearest population is found over 80 miles from the proposed pipeline. Implementation of the proposed project would not adversely affect water quality, nor contribute to the existing water quality impairments defined by the Utah Department of Environmental Quality (UDEQ). Therefore, it is my determination that the proposed project will have **No Effect** on the Colorado pikeminnow or its habitat and it will not be evaluated in further analysis.
Humpback Chub *(Gila cypha)*	Endangered	(No Occurrence). The humpback chub is restricted to deep, swift mainstream and large tributaries in relatively inaccessible canyons of the Colorado River Basin. Adults require eddies and sheltered shorelines in streams that maintain high spring flows that flush sediments from spawning areas and form gravel deposits used for spawning. Young require low-velocity shoreline habitats. Currently, there are six known extant populations, which are located in the Upper Colorado River, Yampa River and Little Colorado River (USDI, U.S. Fish and Wildlife

		Service 2002b). There is no suitable habitat within the project area, with the nearest population located over 87 miles from the proposed pipeline. Implementation of the proposed project would not adversely affect water quality, nor contribute to the existing water quality impairments defined by the (UDEQ). Therefore, it is my determination that the proposed project will have **No Effect** on the humpback chub, or its habitat and it will not be evaluated in further analysis.
Razorback Sucker *(Xyrauchen texanus)*	Endangered	(No Occurrence). Historically the razorback sucker was widely distributed in warm-water reaches of the Colorado River and its tributaries from Wyoming to Mexico. Adults require deep pools, eddies and backwaters in spring; shallow water associated with sandbars in summer; and low velocity pools and eddies in winter. Young require quiet, warm, shallow water found at tributary mouths, and in coves or shorelines in reservoirs. Currently, within the Upper Colorado River Basin this species is only found in small numbers in the middle Green River, between the confluence of the Duchesne and Yampa rivers, and in the lower reaches of those two tributaries (USDI, U.S. Fish and Wildlife Service 2002c). There is no suitable habitat within the project area, with the nearest population located over 87 miles from the proposed pipeline. Implementation of the proposed project would not adversely affect water quality in the long-term, nor contribute to the existing water quality impairments defined by the (UDEQ). Therefore, it is my determination that the proposed project will have **No Effect** on the razorback sucker, or its habitat and it will not be evaluated in further analysis.

Sensitive Plant, Wildlife and Fish Species

Table 2 lists the USFS Intermountain Regional Forester's list of sensitive plant, wildlife, and fish species that could occur on the Manti Division of the Manti-La Sal National Forest (MLNF) and the proposed project's potential effects on these species (USDA, Forest Service 2016). Sensitive plant, wildlife, and fish species that do not occur or have suitable habitat in the project area are identified in Table 2 and will not be evaluated further in this BA/BE.

Table 2. *FS Sensitive Species*

SPECIES	SPECIES OCCURRENCE AND EVALUATION
Plant Species	
Abajo daisy (*Erigeron abajoensis*)	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the Abajo Daisy or its habitat and this species will not be evaluated further.
Abajo peak draba (*Draba abajoensis*)	**(No Occurrence).** There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the Abajo Peak draba or its habitat and this species will not be evaluated further.
Arizona Willow *(Salix arizonica)*	**(No Occurrence).** *Salix arizonica* occurs in wet meadows along perennial streams from 8366 – 10,629 ft. in Garfield, Iron, Sanpete and Sevier counties. Occurs only in Sanpete and Sevier counties on the Manti - La Sal N. F. in the Muddy Creek drainage and there are no occurrences of this species within the project area and no suitable habitat (NatureServe 2020, Utah Native Plant Society 2003-2016, and USDA, NRCS 2017). Therefore, it is my determination that the proposed project will have **No Impact** on the Arizona willow or its habitat and this species will not be evaluated further.
Canyonlands lomatium (*Lomatium latilobum*)	**(No Occurrence).** There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the

	Canyonlands lomatium or its habitat and this species will not be evaluated further.
Canyon sweetvetch (*Hedysarum occidentale var. canone*)	**(May Occur).** *Hedysarum occidentale var. canone* is endemic to Carbon, Duchesne and Emery counties found in pinyon-Juniper, serviceberry, maple, mountain mahogany, and sagebrush communities from 6,400-8,317 ft. This plant, though often found at moderate elevations, is mainly a plant adapted to dry open slopes in pinyon-juniper and mountain brush communities on or below the coal measures of the Mesa Verde group. Main area of distribution is below the coal cliffs in Carbon and Emery counties (NatureServe 2020, Utah Native Plant Society 2003-2016, and USDA, NRCS 2017). There is one recorded occurrence of this species within proximity of the project area. The canyon sweetvetch will be evaluated further.
Indian Canyon Fleabane (*Erigeron untermanii*)	**(No Occurrence)**. *Erigeron untermanii* [synonym *E. carringtoniae*, ITIS 2016, Barkley *et al*. 1997, and USDA 2016] found in the Uinta basin (Welsh *et al.* 2015) to the "margins of the high Wasatch Plateau in Emery, Sanpete, and Sevier counties (Franklin 2005). On the MLNF it occurs in limestone outcrops and escarpments in the sub-alpine vegetation type on windblown ridge tops and snowdrift sites at high elevations from 10,000 to 11,000 ft. (Utah Native Plant Society 2003-2016, and USDA, NRCS 2017). There are no known occurrences of this species within the project area. Suitable habitat is found within the project area. However, this represents only about 0.0000044% of the total potential habitat on this Forest. Surveys prior to implementation will be conducted to verify presence/absence of species; however, it is my determination that the proposed project will have **No Impact** on the Indian Canyon Fleabane or its habitat. This species will not be evaluated further.
Chatterley Onion (*Allium geyeri var. chatterleyi*)	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the Chatterley onion or its habitat and this species will not be evaluated further.

Creutzfeldt-flower cryptanth (*Cryptantha creutzfeldtii*)	**(No Occurrence)**. *Cryptantha creutzfeldtii* an east-central Utah endemic known from widely scattered locations along the base of the Book Cliffs and Wasatch Plateau escarpments as they flank Castle Valley on its north and west edges, in Carbon, Emery and Sevier counties. It occurs on silty-clay soils of the Mancos Shale where the soil is occasionally covered by a veneer of fragments from the overlying Emery Sandstone. It grows in scattered pinyon-juniper communities with an understory of black sagebrush and/or atriplex from 5,250 – 6,500 ft. (Franklin 2005, NatureServe 2020, Utah Rare Plant Society 2003-2016, and USDA, NRCS 2017). There are no occurrences of this species and no suitable habitat within the project area; therefore, it is my determination that the proposed project will have **No Impact** on the Creutzfeldt-flower cryptanth or its habitat and this species will not be evaluated further.
Isely's milkvetch (*Astragalus iselyi*)	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the Isely's milkvetch, or its habitat and this species will not be evaluated further.
Kachina daisy (*Erigeron kachinensis*)	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the Kachina daisy, or its habitat and this species will not be evaluated further.
La Sal daisy (*Erigeron mancus)*	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the La Sal daisy or its habitat and this species will not be evaluated further.
Link Trail columbine (*Aquilegia flavescens var. rubicunda*)	**(May Occur)**. *Aquilegia flavescens rubicunda* is endemic to Emery and Sevier counties in ponderosa pine, aspen, and spruce-fir communities, generally associated with seeps at the base of the Mesa Verde Group sandstones adjacent to the coal measures from 6,900 – 8,513 ft. (Welsh et al. 2015). Occurs near spring seeps and perennial wetland sites on the east side of the Wasatch Plateau (NatureServe 2020, Utah Rare Plant Society

	2003-2016, and USDA, NRCS 2017). There is one recorded occurrence of this species within 2 miles of the project area and there is suitable habitat within the project area. Link Trail columbine will be evaluated further.
Maguire campion (*Silene petersonii*)	**(No Occurrence)**. *Silene petersonii* is endemic to Garfield, Iron and Sanpete counties in ponderosa pine, aspen, and spruce-fir communities on Flagstaff Limestone and Claron Formation, mainly at plateau margins from 7,000 - 11,300 ft. Occurs at high elevations on open calcareous and igneous soils (NatureServe 2019, Utah Rare Plant Society 2003-2016, and USDA, NRCS 2017). There are no occurrences of this species and no suitable habitat within the project area; therefore, it is my determination that the proposed project will have **No Impact** on the Maguire campion or its habitat and this species will not be evaluated further.
Musinea groundsel (Senecio musiniensis)	**(No Occurrence).** *Senecio musiniensis* is endemic to Sanpete county on ridge tops of Flagstaff Limestone, barrens and talus slopes at Musinea Peak and on the margins of the Wasatch Plateau from 9,700 -10,800 ft. (Welsh et al. 2015, NatureServe 2020, Utah Rare Plant Society 2003-2016, USDA, NRCS 2017). There are no occurrences of this species and no suitable habitat within the project area; therefore, it is my determination that the proposed project will have **No Impact** on the Musinea groundsel, or its habitat and this species will not be evaluated further.
Pinnate spring-parsley (*Cymopterus beckii*)	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the pinnate spring-parsley, or its habitat and this species will not be evaluated further.
Sweet-flowered rock jasmine (*Androsace chamaejasme ssp. carinata*)	**(No Occurrence)**. There is no suitable habitat within the project area. This species is only found on the south zone of the Manti-La Sal National Forest; therefore, it is my determination that the proposed project will have **No Impact** on the sweet-flowered rock jasmine, or its habitat and this species will not be evaluated further.

TERRESTRIAL WILDLIFE SPECIES	
Bald Eagle *(Haliaeetus leucocephalus)*	**(May Occur)**. There is suitable winter habitat along Huntington Creek for bald eagles. These winter migrants tend to forage in the lower valleys and are only present during the winter months. No nesting bald eagles have ever been detected on the Forest. No impacts to suitable habitat would occur because no perching or potential nesting habitat would be removed as a result of this project. Any impacts that could potentially occur would be from displacing forging individuals as a result of project related noise and activity. These impacts would be minimal at best, simply because of the expected number of eagles at any one time compared to the overall foraging area available. Therefore, it is my determination that the proposed project will have **No Impact** on the bald eagle, or its habitat and this species will not be evaluated further.
Bighorn sheep (*Ovis canadensis*)	**(No Occurrence).** The proposed project area is outside the UDWR-mapped range of desert bighorn and Rocky Mountain bighorn sheep; therefore, it is my determination that the proposed project will have **No Impact** on the bighorn sheep, or its habitat and this species will not be evaluated further.
Flammulated owl (Otus flammeolus)	**(No Occurrence).** There is no suitable nesting or foraging within the project area. Therefore, it is my determination that the proposed project will have **No Impact** on the flammulated owl, or its habitat and this species will not be evaluated further.
Greater Sage Grouse (*Centrocercus urophasianus)*	**(No Occurrence).** There is no greater sage grouse priority or general habitat management areas within the proposed project area and no seasonal use habitat designated by the Manti-La Sal National Forest. Therefore, it is my determination that the proposed project will have **No Impact** on the greater sage grouse, or its habitat and this species will not be evaluated further.
Northern Goshawk (*Accipiter gentllis*)	**(No Occurrence).** There is no suitable nesting or foraging habitat within the proposed project area. Therefore, it is my determination that the proposed project will have **No Impact** on the northern goshawk, or its habitat and this species will not be evaluated further.

Peregrine Falcon (*Falco peregrinus*)	**(May Occur).** There is suitable nesting and foraging habitat adjacent to the proposed project area. No impacts to suitable habitat would occur because no nesting or foraging habitat would be removed as a result of this project. Any impacts that could potentially occur would be from displacing forging individuals as a result of project related noise and activity. These impacts would be minimal at best, simply because of the expected number of individuals foraging at any one time compared to the overall foraging area available. Therefore, it is my determination that the proposed project will have **No Impact** on the peregrine falcon, or its habitat and this species will not be evaluated further.
Spotted Bat (*Euderma maculatum*)	**(May Occur).** There is roosting and foraging habitat adjacent to the proposed project area; however, work would occur in the fall and winter while bats are hibernating. Therefore, it is my determination that the proposed project will have **No Impact** on the spotted bat, or its habitat and this species will not be evaluated further.
Three-toed woodpecker (*Picoides dorsalis*)	**(No Occurrence).** There is no suitable habitat within the proposed project area. Therefore, it is my determination that the proposed project will have **No Impact** on the three-toed woodpecker, or its habitat and this species will not be evaluated further.
Townsend's big-eared bat (*Corynorhinus townsendii*)	**(May Occur).** There is roosting and foraging habitat adjacent to the proposed project area; however, work would occur in the fall and winter while bats are hibernating. Therefore, it is my determination that the proposed project will have **No Impact** on the Townsend's big-eared bat or its habitat and this species will not be evaluated further.
AQUATIC WILDLIFE SPECIES	
Bonneville cutthroat trout (*Oncorhynchus clarki Utah*)	**(No Occurrence).** Bonneville cutthroat trout do not occur within any drainages near the proposed project; therefore, it is my determination that the proposed project will have **No Impact** on the Bonneville cutthroat trout or its habitat and this species will not be evaluated further.

Colorado River Cutthroat Trout *(Oncorhynchus clarki pleuriticus)*	**(No Occurrence)**. Colorado River cutthroat trout do not occur within the drainages where the proposed project will occur; therefore, it is my determination that the proposed project will have **No Impact** on the Colorado River cutthroat trout or its habitat and this species will not be evaluated further.
Columbia River Spotted Frog *(Rana luteiuentris)*	**(No Occurrence).** There is no suitable habitat within the project area and no known occurrences on the Manti-La Sal National Forest (Crockett et al. 2006); therefore, it is my determination that the proposed project will have **No Impact** on the Columbia River spotted frog or its habitat and this species will not be evaluated further.
Southern leatherside chub (*Lepidomeda aliciae*)	**(No Occurrence).** This species is not found in any streams near the proposed project; therefore, it is my determination that the proposed project will have **No Impact** on the southern leatherside chub, or its habitat and this species will not be evaluated further.
Western Boreal Toad (*Bufo boreas boreas*)	**(No Occurrence)**. Only 1 breeding population of boreal toad has been detected on the Manti-La Sal National Forest, despite a large survey effort in what was assumed to be suitable habitat. This breeding population is located approximately 4 miles from the proposed water pipeline. The pipeline will be placed within the existing road corridor. No existing springs or suitable habitat will be removed. Therefore, it is my determination that the proposed project will have **No Impact** on the Western boreal toad or its habitat and this species will not be evaluated further.

SPECIES DESCRIPTIONS AND ANALYSIS OF EFFECTS

Threatened, Endangered, Proposed and Candidate Species

There are no listed species, candidate, or species proposed for listing that occur in or have suitable within the proposed project area. No species were carried forward for analysis (see table 1).

Sensitive Plant, Wildlife and Fish Species

Canyon sweetvetch and Link Trail columbine

Direct and Indirect Effects

There may be direct impacts to individual plants if they happen to occur; however, construction of the pipeline will be within the existing, previously disturbed road right-of-way, reducing the likelihood of impacts. Surveys will be conducted prior to implementation to determine presence or absence of the two plant species in the proposed project area. If the plants are found, mitigation efforts will be assessed. Regardless, any potential impacts would occur to individuals and would not be detrimental to overall populations. Therefore, it is my determination that the Crandall Canyon Mine Closure Water Pipeline project **May Impact** individuals but is not likely to cause a trend to federal listing or loss of viability.

Cumulative Effects

Since the proposed project would not have measurable direct or indirect impacts on either the Canyon sweetvetch or the Link Trail columbine, no cumulative impacts would accrue to these species as a result of the proposed project.

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ATTACHMENT #7:

ARCHEOLOGICAL SURVEY OF THE CRANDALL CANYON PIPELINE ALIGNMENT BY THE UNITED STATES FOREST SERVICE

(PERFORMED DURING THE APPLICATION PROCESS FOR THE SPECIAL USE PERMIT APPLICATION FOR THE NEW WATER DISCHARGE PIPELINE)

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Jill Remington Love
Executive Director
Department of
Heritage & Arts

Utah Division of
State History

Don Hartley
Director
State Historic Preservation Officer

November 29, 2019

Darren Olsen
District Ranger
Ferron Ranger District
Manti-La Sal National Forest
115 West Canyon Road
Ferron, Utah 84523

RE: Crandall Canyon Pipeline, Manti-La Sal National Forest

For future correspondence, please reference Case No. 19-2675

Dear Darren,

The Utah State Historic Preservation Office received your request for our comment on the above-referenced undertaking on November 25, 2019.

We concur with your determinations of eligibility and effect for this undertaking.

This letter serves as our comment on the determinations you have made within the consultation process specified in §36CFR800.4. If you have questions, please contact me at 801-245-7263 or by email at cmerritt@utah.gov.

Sincerely,

Christopher W. Merritt, Ph.D.
Deputy State Historic Preservation Officer

COVER PAGE
Must Accompany All Project Reports
Submitted to the Utah SHPO

Report Title: Crandall Canyon Pipeline, Manti-La Sal National Forest
UDSH Project Number: U19FS0853
Org. Project Number: ML-20-1739
Report Date: Nov 20, 2019
County(ies): Emery
Report Author(s): Sarah Herrera
Principal Investigator: Sarah Herrera
Record Search Date(s): 11/18/2019
Field Supervisor(s): Sarah Herrera
Intensive Acres Surveyed (<15m intervals): 16
Recon/Intuitive Acres Surveyed (<15m intervals): 0
USGS 7.5' Series Map Reference(s): Rilda Canyon, UT

Sites Reported	Count	Smithsonian Trinomials
Revisits (no updated site forms)	0	
Updates (updated site forms provided)	1	42EM722
New recordings (site forms provided)	1	42EM5326
Total Count of Archaeological Sites in APE	2	42EM722, 42EM5326
Historic Structures (structures forms provided)	0	
Total National Register Eligible Sites	29	42EM722

*Please list all site numbers per category. Number strings are acceptable (e.g. "42TO1-13; 42TO15"). Cells should expand to accommodate extensive lists.

Checklist of Required Items for Submittal to SHPO

- ☒ "Born Digital" Report in a PDF/A format
  - ☒ SHPO Cover Sheet
  - ☒ File Name is the UDSH Project Number with no hyphens or landowner suffixes
- ☒ "Born Digital" Site forms in PDF/A format
  - ☒ UASF with embedded maps and photos
  - ☒ File name is Smithsonian Trinomial without leading zeros (e.g. 42TO13 not 42TO00013)
  - ☒ Photo requirements (including size and quality)
- ☒ Archaeological Site Tabular Data
  - ☒ Single spreadsheet for each project
  - ☒ Follows UTSHPO template (info here: https://goo.gl/7SLMqj)
- ☒ GIS data
  - ☒ Zipped polygon shapefile or geodatabase of survey (if different from APE) or other activity area with required field names and variable intensity denoted
  - ☒ Zipped polygon shapefile or geodatabase of site boundaries with a the required field name

Crandall Canyon Pipeline
Manti-La Sal National Forest

State Project Number: U19FS0853
Forest Project Number: ML-20-1739

Sarah Herrera, Manti-La Sal National Forest
Nov. 20, 2019

Project Summary

Location: T 16 S, R 7 E, Sec. 4,5 (SLM)
Quad: Rilda Canyon, UT 7.5 Min.
Total New Survey Area: 16 acres
Survey Results: 1 new site
Project Effect: No Adverse Effect

Project Description

The Manti-La Sal National Forest, Ferron-Price Ranger District, in conjunction with Genwal Resources Inc. propose to construct a water pipeline. The proposed pipeline will be located in Crandall Canyon northwest of Huntington in Emery county (see figure 1). The purpose of the pipeline is to deal with long-term water discharge from the mine portals as part of the reclamation of the Crandall Canyon Mine surface facilities. The project is located along Crandall Canyon in elevations ranging from roughly 7,350 feet to 7,950 feet. Vegetation in Crandall Canyon includes areas of sagebrush and Pinyon-Juniper near the bottom, as well as aspen, mixed conifers, and curl leaf mahogany.

This proposal would place approximately 1.3 miles of underground pipeline along the north side of the road from the mine to eventually discharge into Huntington Creek (see included Project Map). The water will be gravity fed through an 8-inch diameter HDPE pipe that will remain primarily within the disturbance created by the previous construction and re-contouring of the road right of way for Crandall Canyon Road (FS road 0248). An energy dissipater and rip rap channel will be placed near the area where the pipe will discharge into Huntington Creek to prevent erosion. The area of potential effect includes up to 20 foot wide corridor the length of the pipeline from the mine water seepage area to follow along the north side of the road to Huntington Creek. The trench for the pipeline will be six feet deep and eight feet wide at the top of the trench. The lowest two feet in which the pipe will be placed will only be four feet wide. The top of the trench will be one foot away from the current asphalt on the road, causing a direct potential of ground disturbance up to 12 feet on the north side of the road. Air vents will also be installed above the pipe about every 1,000 feet along the length of the pipeline, but these will be within the disturbed footprint made for the pipeline trench. A specific location to dump excess subsoil has not been identified as of yet, but will be consulted on prior to construction, if not covered within the footprint of this report.

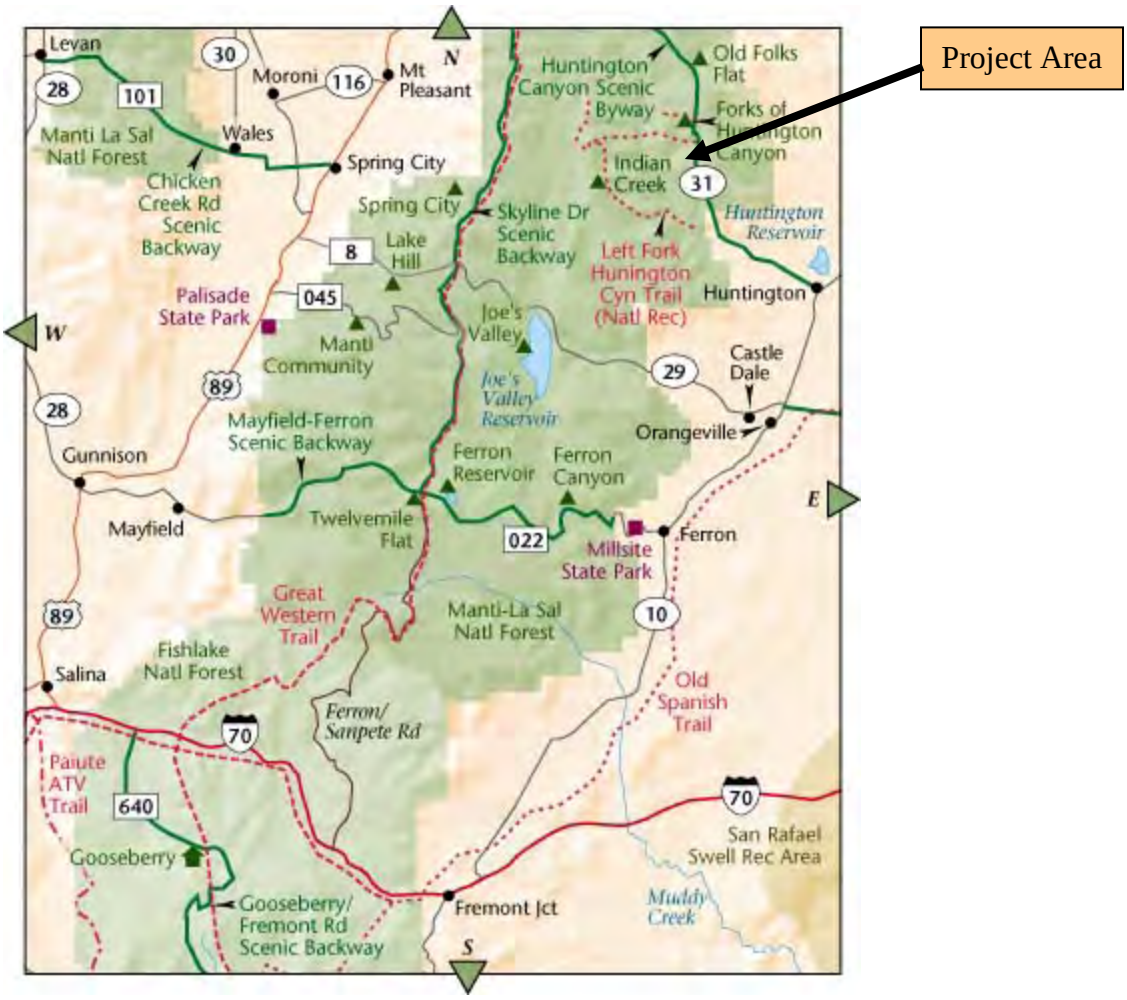


Figure 1. General Project Location (http://www.publiclands.org/explore/quadrant_map.php?plicstate=UT)

Previous Research

Cultural resource surveys have been completed for the entire APE of the project along Crandall Canyon; however, most of them were completed over 20 years ago. Most of the projects had to do with the expansion and explorations of mining and mine access in Crandall Canyon. Other small projects included riparian restoration and fishery structures. All nine of these projects only recorded one prehistoric site within Crandall Canyon.

Table 1. Previous cultural resource surveys within and around the proposed project area.

Project Number(s)	**Project Name**	**Results**
ML-75	Archaeological Survey of Crandall Canyon Mine Road.	1 new site
ML-97-844 U97FS0449	Huntington Canyon Restoration Project	150 acres: 3 new sites
ML-80-228	Crandall Canyon Vicinity Road Access Genwal Coal	100 acres: 0 new sites
ML-96-939	UDOT Improvements to Genwal Mine Access	6 acres: 0 new sites

ML-97-845 U97FS-0531f	Crandall Canyon Fish Structures	2 acres: No Sites
ML-95-753 U95AF410f	Class II Survey East Mountain	405 acres: 1 New Site
ML-11-1351 U11FS0488f	Crandall Canyon Land Exchange	10 acres: No Sites
ML-94-947 U94SC424P	Survey of Proposed Genwal Mine Expansion	10 acres: 0 New Site
ML-89-491	Crandall Canyon Coal Lease Survey #U-54762. Cultural Resource Report	32 acres: 0 new sites

Table 2 summarizes the one previously recorded historic property found within .25 miles of the project area. 42EM722 (ML-2200) is an NRHP eligible prehistoric rock shelter with several pictographs on the back of the rockshelter wall. The pictographs contain four clearly visible figures including one Fremont Indian style anthropomorph, two zoomorphs, and a fourth arched figure. There are an additional 10 other figures in various stages of fading including three handprints and one zoomorph. When originally recorded in 1975 small amounts of lithic materials, two metates, ceramics, basketry, burned bone, and charcoal were identified on the surface of the site in addition to looters holes. Subsequent visits have recorded additional looter holes, and a lack of the aforementioned artifacts. The site was also subject to more looting in early 2018, which revealed a profile showing at least 3 occupational layers, with some intact buried deposits remaining. A damage assessment for this episode of looting is being completed along with a research plan for mitigation. Due to these remaining buried deposits and potential for more information, the site is still considered to be Eligible for the NRHP under Criterion D.

Table 2. Previously recorded sites located in or adjacent to the APE.

Site No(s)	**Forest #**	**Site Class**	**Site Type/Name**	**National Register Eligibility**	**Potential Effect and Design Features**
42EM722	ML2200	Prehistoric	Rock Shelter / Rock Art	Eligible	No Adverse Effect: Avoid and Monitor

Survey Strategy

The project APE and a buffer when possible was surveyed November 19, 2019 by Sarah Herrera in 15 meter or tighter transects. That area included the direct path for the pipeline along the roadway, on the slopes above the roadway when accessible, and the entire riparian area where the pipeline will discharge into Huntington Creek. That wider area near the discharge location into the creek was surveyed in a tight zigzag pattern. The top 140 feet of the pipeline was not surveyed as it was behind the Crandall Canyon Mine's property fence, from the mine portal opening down a very steep slope leading into a water treatment pool, thus resulting in very low site potential.

Survey Results

The entire APE for this project was inventoried for cultural resources plus a buffer when possible. One new site 42EM5326/ ML-5487 was identified in the area near Huntington Creek and 42EM722 / ML-2200 the rockshelter and rock art site was revisited with an updated site

form and GIS shapes being produced. One isolated find was located on a ledge above Huntington Creek. It is a 12" tall by 10.5" diameter Schaeffer's Specialized Lubricants 5 gallon metal bucket.

42EM5326/ ML-5487 is a 50 foot road segment that remains from one of the original roads to access Crandall Canyon. This iteration of the road is marked as an unnamed dirt road in 1923 Hiawatha Quad and was used as such until rerouting and surfacing of the current roadway occurred in 1980. This historic roadway currently appears as a slightly cleared path from old trees with overgrown brush, young trees, and a thick layer of duff. Although it retains its location and setting, it does not retain the design, workmanship, materials, feeling or appearance of a historic road, and thus does not retain integrity. It also does not fulfill any criteria of significance and therefore is Not Eligible for the NRHP.

Project Effect

The proposed pipeline will cross through 42EM5326, the historic road segment that is not eligible for the NRHP. As the site is not eligible for the National Register, it is not considered a historic property that is affected under the law, thus the Forest Service determines "No Historic Properties" affected for this property.

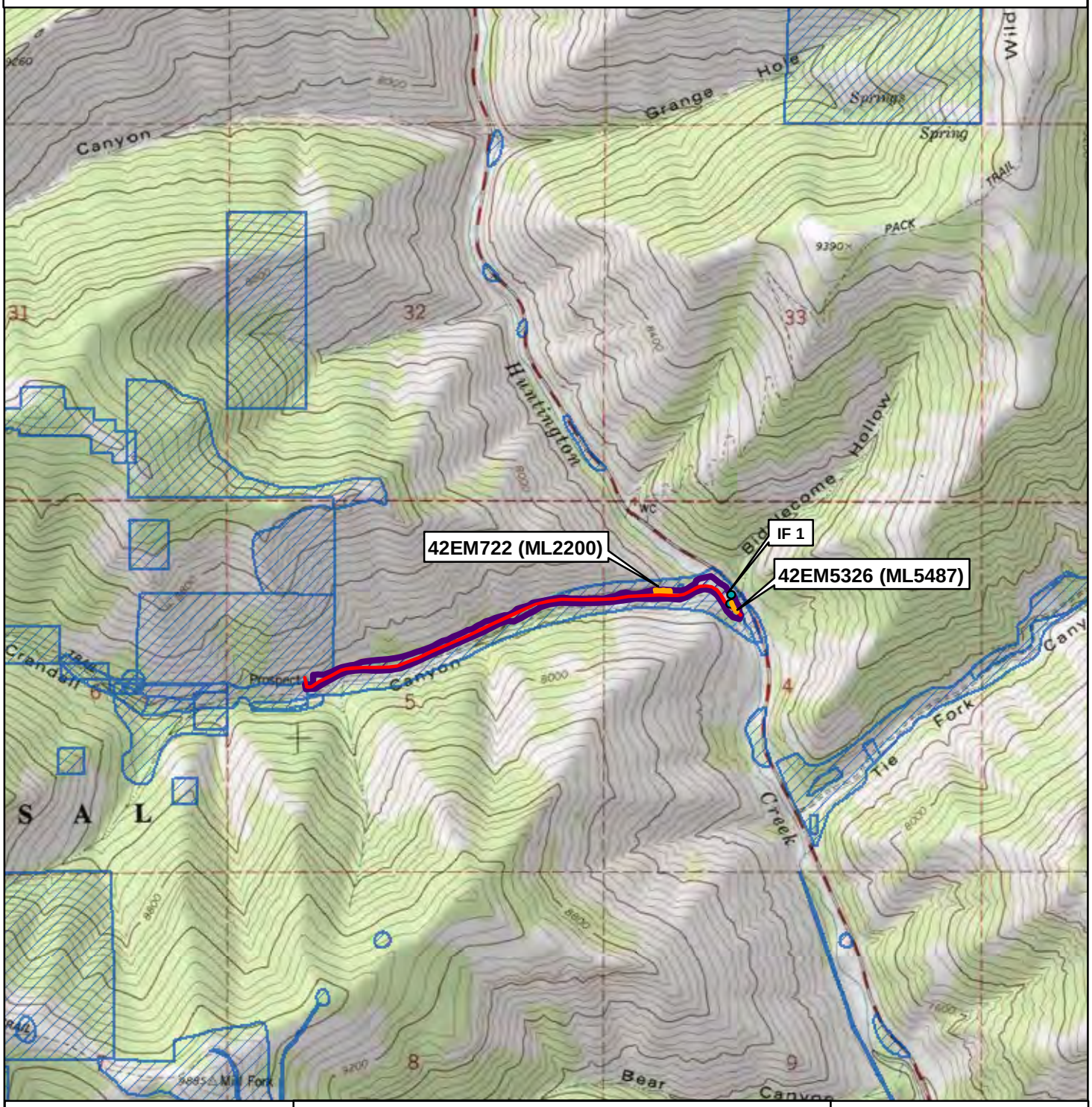
The pipeline will skirt the road downslope from 42EM722, a prehistoric rockshelter with rock art. The APE is approximately 12 feet downslope of the fence around the site, with the shelter itself another 30 feet away from the fence. As this is in fairly close proximity to 42EM722, a few design features will be included in the project to mitigate the potential effects of the project and ensure no adverse effect to this cultural resource. Primarily, construction of the 300 feet of pipeline downslope of the site will be restricted to be placed as close to the roadway as possible. This will limit the ground disturbance to the previously disturbed area created by the previous construction and re-contouring of the slope by the road right of way. Additionally, a monitoring plan will be developed and included in the contract for the construction of this pipeline. This plan will include a requirement for formal monitoring by a federally permitted archaeologist while work is being performed downslope of this site. The monitoring plan will also include a clause in the contract for unanticipated discoveries that would cause construction to stop in order for the archaeologist to profile and assess the sediments, contact SHPO, and develop a plan for mitigation beyond the documentation of the exposed sediments or artifacts. As the proposed pipeline should not significantly affect the character defining features of the property, nor diminish its eligibility for the National Register, the Forest Service determines "No Adverse Effect" for this property.

We conclude that a determination of "No Adverse Effect" pursuant to 36CFR800.5(b) is appropriate for the Crandall Canyon Pipeline, as the project will not alter those characteristics of the cultural resources that qualify them for the National Register.

Manti-La Sal National Forest
Ferron Ranger District

Project Map

Crandall Canyon Pipeline
U19FS0853 / ML-20-1739



County: Emery
Topo Quad: Rilda Canyon, UT
7.5 Minute Series, NAD83,
Zone 12

Date: 22 Nov 2019

Legend

- Pipeline APE
- Sites
- New Survey
- Previous Survey
- IF 1

0 0.5 1 mi
0 0.5 1 Km

Scale = 1:24,000

T 16 S R 7 E:
SEC 4, 5
Salt Lake Meridian

N

ITEM 5-4

Cultural Resource Report, Sherman Shelter

CULTURAL RESOURCE REPORT

81-1

Crandall Canyon (Genwall Coal Company) Road Proposal

Manti-LaSal National Forest

INTRODUCTION

On December 17, 1980, an investigation of archeological site ML-2200 (42EM722, or Sherman Shelter) was conducted by Les Wikle, Monticello District Archeologist, and Walt Nowak, of the Price District, for the purpose of assessing scientific potential of the site as well as possible impacts on it by a proposed road upgrading by Genwall Coal Company.

Two previous investigations had been conducted on the existing road and its immediate environs. The first (Gillio 1975) described the site and noted a projectile point fragment in the roadway, probably washed down the slope from the site above. The second report (Howell 1980) expanded on the earlier work, surveying a considerable area around the proposed mine facility, as well as covering the entire canyon bottom where the proposed access road is located.

As a result of previously unanswered questions in the reports and new project proposals, the Price Ranger District requested a reanalysis of the situation. The result was the December visit and the present report.

PREHISTORY OF THE AREA

Although a few isolated, uncontrolled finds may date to an earlier time, people of the Archaic period are apparently the first to use this general area of Utah. The Archaic period dates approximately from 6500 B.C. to A.D. 200. Subsistence techniques were basically of a small game hunting and wild plant gathering nature. Some camping and habitation was done at open sites, but our best Archaic information comes from rockshelters and caves where preservation is better.

The Fremont culture dating between A.D. 450-1250 probably was present at Sherman Shelter for at least a short time during this period. This was a time of a more settled life, corn agriculture, and some trade with contemporaneous Anasazis to the south (Madsen and Lindsay 1977).

SITE ENVIRONMENT

Sherman Shelter is located near the junction of Crandall Canyon and Huntington Canyon at 7460 feet elevation. The alcove faces south, being on the north side of the east-west running Crandall Canyon. The existing dirt road is 25-30 meters to the south, down a steep slope which varies from about 18% to 35%.

The canyon is very narrow and steep, limiting the options available for road improvement and relocation. Pinyon and juniper are in the the immediate site area, although aspen and coniferous trees are also found in the nearby area. Crandall Creek provides a permanent water supply.

SITE TESTING

Due to time and work load constrictions, only very limited testing could be done. Two small test pits were dug on the west side of the site on the edge of the extensive pothunting area (See site map).

Surface pottery had been reported by earlier investigations, but none was found on this trip. Much bone material was scattered on the surface, but almost all of it was of a very fragmentary nature. The pieces intact enough for identification were not human bone. No surface collection was taken.

Test Pit I was dug towards the southwest corner of the site, near the expected edge of the cultural deposits. The pit was 0.3 meters square and was dug to a depth of one meter. The first 0.1 meter consisted of soil from a large pothole to the north, under which was the recent sod level. Under this was a deep deposit of yellowish sandy loam with occasional charcoal bits.

Artifactual material from Test Pit I consisted of two bone fragments and a piece of glass at the recent sod level (under the pot hole dump), a bone fragment and small piece of wood at the contact of the sod level and the yellowish sandy loam, and two bone fragments and a sherd between the yellowish level and the darker level below. The sherd is a body fragment from a very roughly formed corrugated vessel. Many confusions surround ceramic typology in the general Fremont area (Madsen and Lindsay 1977:52). For this reason, the sherd has not yet been classed pending later laboratory analysis. However, its general style and material relate to a sherd found at Backhoe Village (Madsen and Lindsay 1977:56) which dated to about A.D. 900-1100, which relates well in time to Mancos Corrugated in the Anasazi area.

Test Pit II was dug not long before darkness came, and so was not deep. Its purpose was to assess the depth of cultural material existing below the potted depths. In this it was not too sucessful, as time allowed going only a few tenths of a meter below that level. Six bone fragments and a corn cob were recovered from this test pit.

No pollen or soil samples were collected in this limited test, and the amount of charcoal present did not allow for collecting a sample for C-14 dating. No building stone material was seen either on the surface or in the test pits. The bone fragments seen on the surface and found in the test pits were apparently of animal origin as far as field analysis could identify.

CULTURAL CONCLUSIONS

Although no diagnostic Archaic materials were found in the limited depth test pits probably such a time period is represented at Sherman Shelter, based on nearby isolated finds of Archaic-like projectile point fragments. Such a fragment found just downstream from the site (Howell 1980) has morphological similarities to either Pinto or Humbolt points according to Holmer's (1979) typology.

The corn cob and corrugated sherd indicate a later Fremont occupation. There were no materials to indicate a post-Fremont, non-Anglo occupation or use.

The alcove, being small, shallow, and having some problems with shelter from inclement weather, probably had limited, seasonal use. The small amount of trash on the slopes would support this.

Notwithstanding the relative smallness of the site, coupled with the rather severe existing pothunting, a great deal of important scientific information exists on the site and needs to be protected or extracted through careful excavation. The presumed subsistence base of the adjacent Sevier Culture has recently been questioned (Madsen and Lindsay 1977:87-89) and a reanalysis of the Fremont culture on this same basis would be warranted. Sherman Shelter can aid us in providing new data on this subject. Also needed is more information that will help us find the relationships between small "field house" sites, larger villages, and alcoves in Fremont times.

ALTERNATIVES

Six major alternatives are considered here that span the whole range of possible options. Each alternative is described by approximate cost, effect on the site, viability, and procedures needed and completed (See Table 1).

Alternative A: Reroute the road that is now in the site area to the other side of the creek.

Alternative B: Move the present roadway slightly to the south, avoiding extensive cut and fill in the bank, but requiring some rerouting of the creek. Fence the site.

Alternative C: Keep the road where it is, with cut and fill where necessary. Fence the site.

Alternative D: Move the road upslope toward the site to avoid problems with the existing creek bank. Fence the site.

Alternative E: Completely salvage the site, allowing any road option to be completed without any effects on the site.

Alternative F: Allow any road proposal to go through without worrying about complete destruction of the site through natural causes or illegal digging.

Some concern has been voiced by some Forest Service personnel regarding soil stability in the area: there is a worry that any cutting into the steep slope near the site would lead to heavy erosion that would ultimately destroy the site. This is not an item that can be directly addressed in an archeology report, though it of course would have an effect on the site itself unless Alternative F were chosen. The possible erosion problem is one which must be addressed by the appropriate soil scientists. Genwall Coal Company has proposed putting in five or more study trenches for soil stability. Unless Alternative A, E, or F is chosen it must be required that one of the trenches be in the slope below the archeology site.

Concerns about resultant soil erosion, types of retaining walls needed if the slope is cut into, and so forth, must be taken care of by engineers, soil scientists, and other specialists. In this paper we can only address the archeology issues. And the crux of that is that, again unless Alternative F is considered viable and is chosen, the site's informational integrity must be maintained or properly salvaged.

The definition of where a site begins and ends is sometimes a difficult subjective judgement: any reasonable boundary-drawing most likely will exlude at least one or two sherds, flakes, etc. But in this case, a reasonable arbitrary boundary that effectively contains virtually all the site's information value, while not unduly hampering other proposed projects is as follows: make an east-west line 10 meters (33 feet) south of the datum point (the highest point on the large boulder in the central part of the site) and terminate it 25 meters (82.5 feet) west of datum and 40 meters (132 feet) east of datum, going north into the cliff from these points.

As long as the integrity of this bounded area is preserved, proposed projects can be considered having "no effect" upon the archeological site. It must be left up to other specialists to design road cuts, etc. to maintain this integrity.

RECOMMENDATIONS

From a purely archeological standpoint Alternatives A and E are the most acceptable. Alternative A would preserve the data for future excavators with better techniques. Alternative E would provide some very essential information we need now to better understand the Fremont culture and better assess the significance of the other sites known and to be discovered in the area. However, because of financial, administrative, and time constraints these two alternatives are probably not very acceptable in a general sense.

Alternative B and C are the next most acceptable, with C taking priority. Alternative D is the one most recently proposed by Genwall Coal Company and is archeologically acceptable as long as soil stability tests indicate there will be no danger to the site.

Alternative F is simply not acceptable within the framework of our Agency responsibilities set out in laws and regulations. Acceptance of this alternative could lead us into serious lawsuits as well as possibly allowing great loss of scientific information.

In summary, the preferred archeological rankings of the alternatives are first A, down through E, C, B, D and ending with F.

If alternative B, C, or D is chosen, certain basic requirements for the fence must be met. The fence must not intrude into the site area as defined earlier in this section and as shown on the site map attached. The fence must be of chain link material, properly installed, at least six feet high above ground level at the point of installation, and have a locking gate with a Forest Service lock. The fence must be painted with an outdoor paint that blends well with the surrounding ground and vegetation, so as to not detract from the natural surroundings and not be easily visible from the road. At least two metal antiquity signs must be posted, each slightly inside the fence line, easily visible from outside the fence but not the road. In addition, a small engraved wooden sign very briefly describing the reasons for the protection of the site and the site's nature must be posted slightly inside the fence line and near the center of the longer axis.

It will probably be noticed that the recommendations found in this report are basically the same as those in the two earlier reports, only some more detail and discussion of alternatives being added.

LES WIKLE
Monticello District Archeologist

REFERENCES

Gillio, David
1975 "Archeological Survey of Crandall Canyon Mine Road". Letter to the Forest Supervisor, Manti-LaSal National Forest. September 5, 1975

Holmer, Richard
1979 "A Mathematical Typology for Archaic Projectile Points of the Eastern Great Basin". Phd Dissertation, Department of Anthropology, University of Utah.

Howell, Wayne
1980 "Archeological Reconnaissance in the Crandall Canyon Vicinity, Emery County, Utah". A survey report of Utah Archaeological Research Corporation, Provo.

Madsen, David and LaMar Lindsay
1977 "Backhoe Village". Antiquities Section Selected Papers, Number 12. Utah State Historical Society.

TABLE I

Altern-atives	Approximate Cost above Present Plan	Effect on Site	Viability	Procedures Necessary	Procedures Completed
A	Several $10,000's	No Effect	Arch: Excellent Eng: Poor Other: Fair	SHPO Concurrance	
B	$10,000 + (?) Road building, Fence, Administration	No Effect	Arch: Good Eng: Fair Other: Poor	SHPO Concurrance Build Fence	SHPO Concurrance
C	$1,00-2,000 (Fence) $500-800 (Administration)	No Effect	Arch:Good Eng:Good Other:Good	SHPO Concurrance Build Fence	SHPO Concurrance
D	$1,000-2,000 (Fence) $500-800 (Administration)	No Effect	Arch:Fair Eng:Good Other:Fair	SHPO Concurrance Build Fence	SHPO Concurrance
E	$5,000-10,000 (Bidding Range) $1,500-2,500 (Administration)	No Adverse Effect	Arch:Excellent Eng:Excellent Other:Excellent	SHPO Concurrance National Register Eligi-bility, Advisory Council concurrance. Contract, bidding, etc. Excavation permit. Supervise Excavation + Report	
F		Adverse Effect	Arch:Not Acceptable Eng:Excellent Other:Excellent	SHPO Concurrance (would not be given) or prepare for legal action	

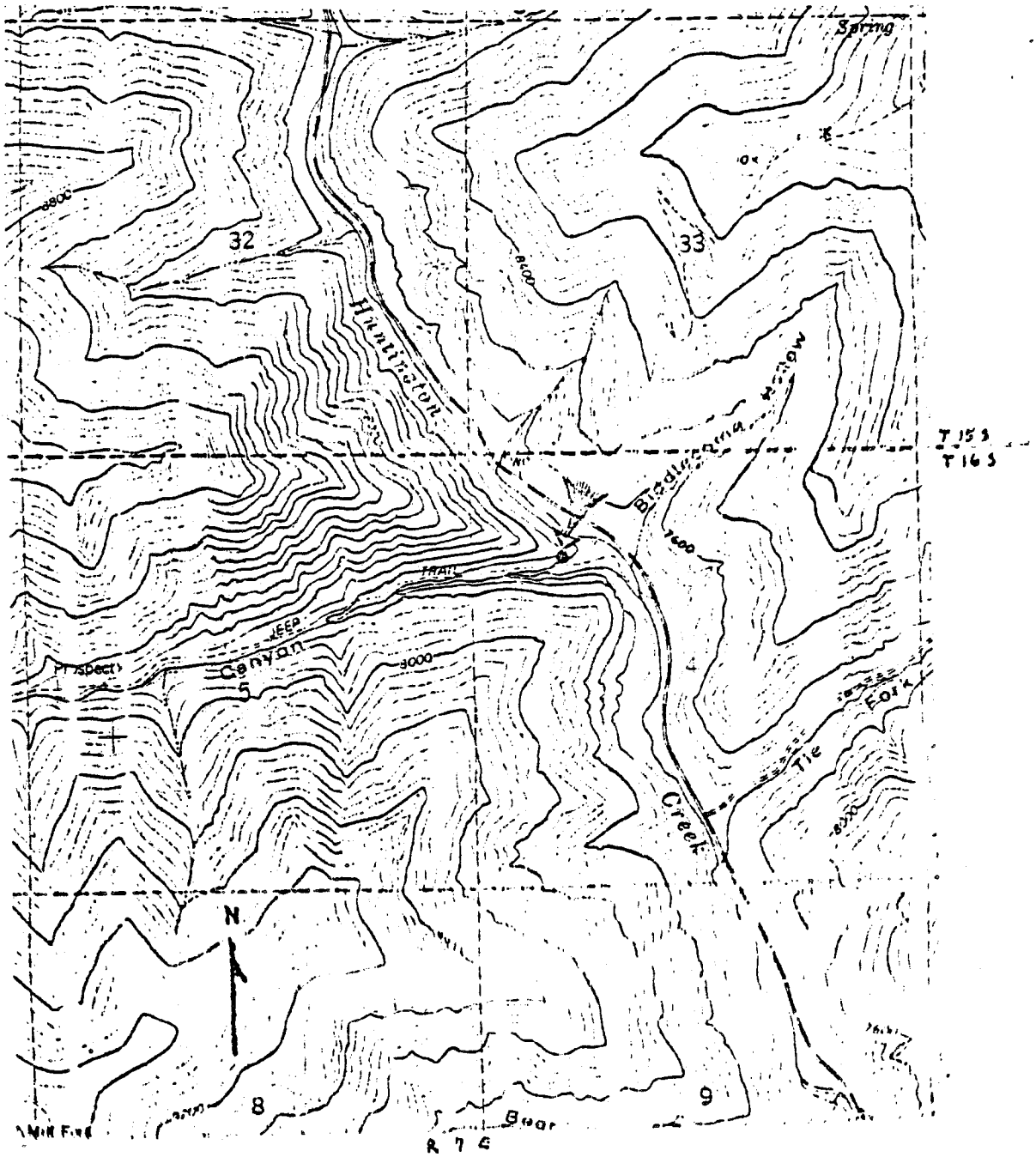


Fig. 1

Source: Rilda Canyon, Utah (USGS 7½')
Scale: 1:24,000 Contours: 80 feet

Arrow marks site location (ML-3300)

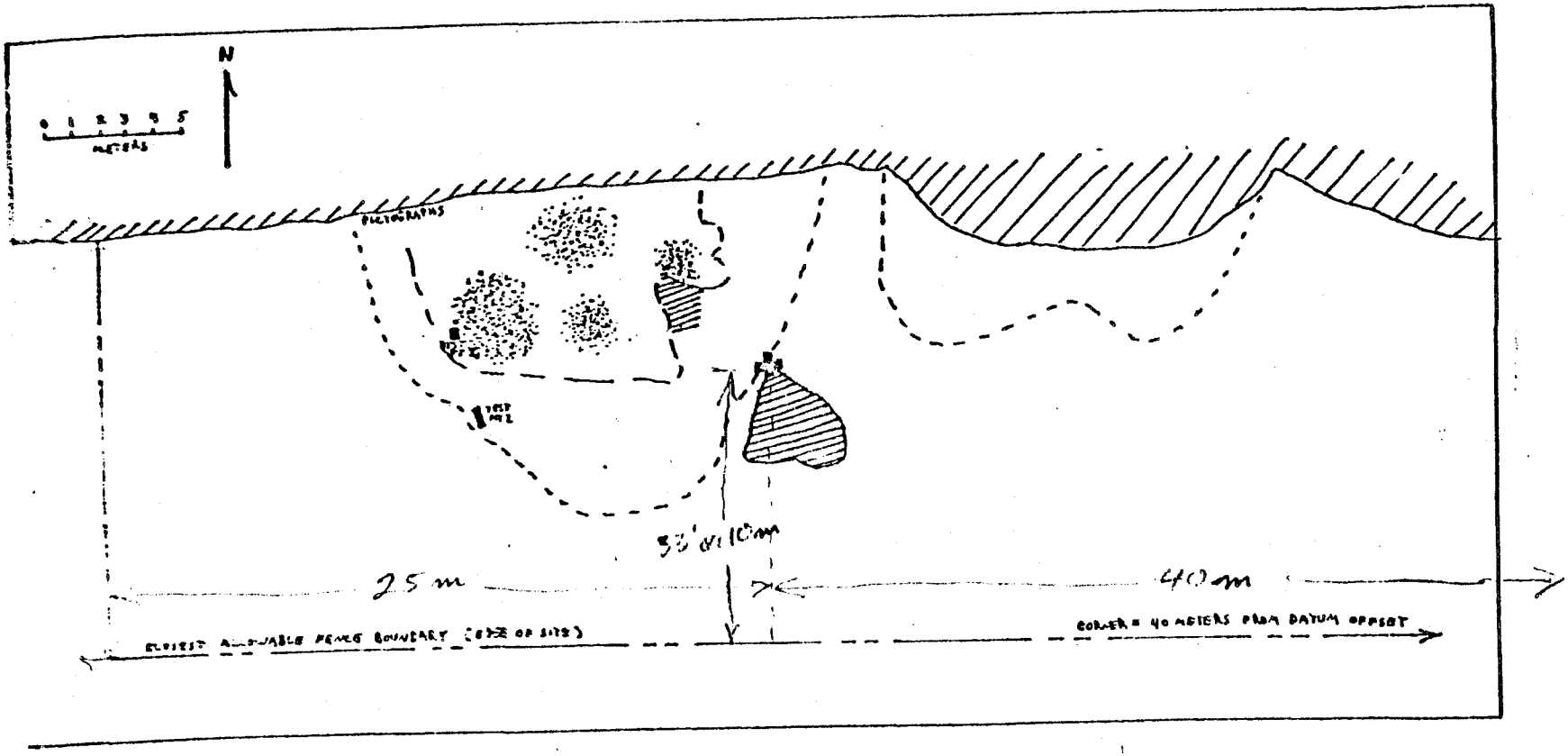


Fig. 2

SITE GEOGRAPHY

- datum point (highest tip of boulder)
- major potbunting holes
- edge of general disturbance area
- test pits
- overhang limits (approximate)
- cliff, boulder, exposed rock
- site boundary (closest allowable limit of fence)

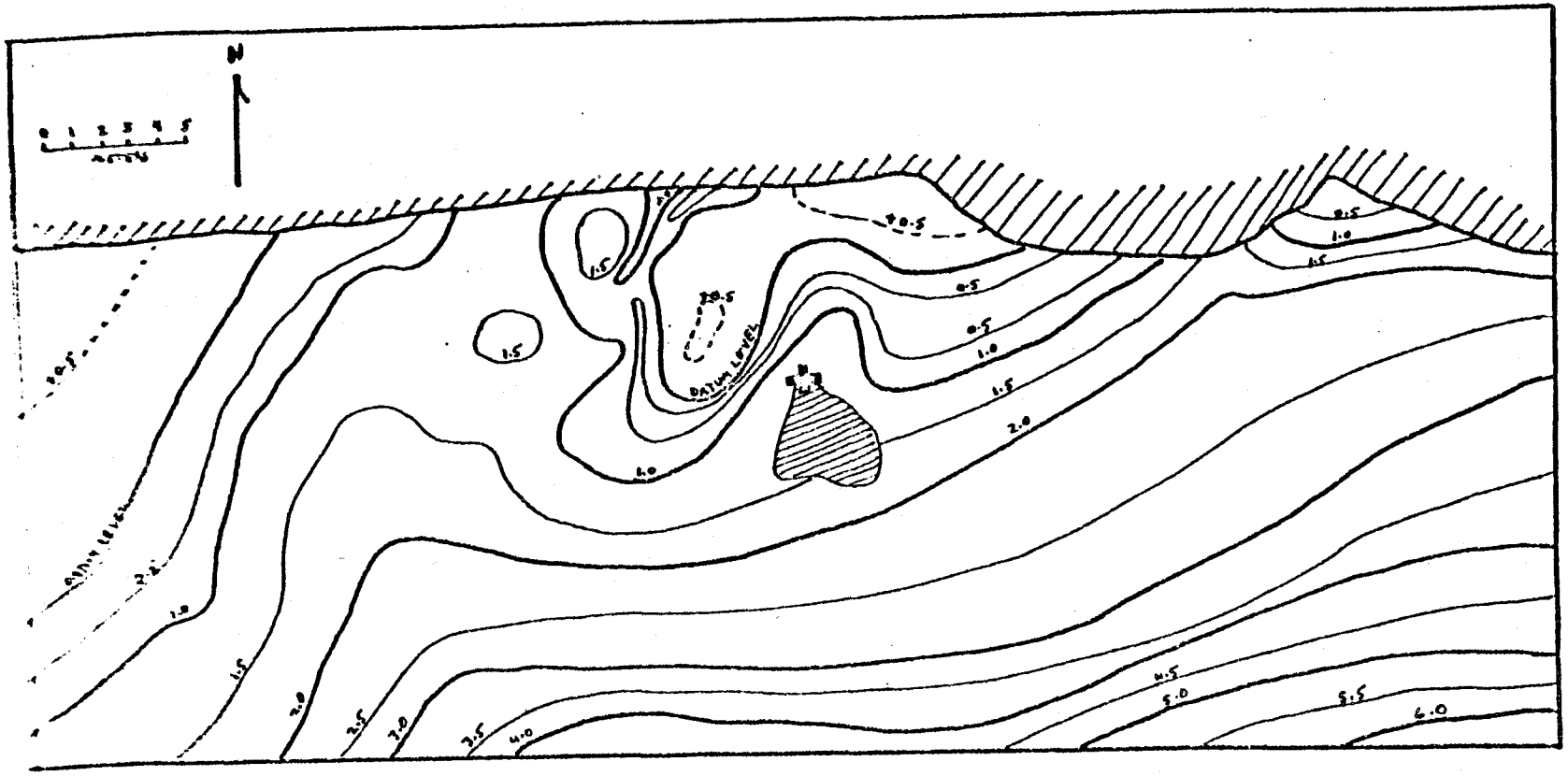


Fig. 3

SITE CONTOURS (approximate)

✚ datum point (highest tip of boulder) cliff, boulder

Contour intervals are each 0.5 meter, measured from datum point (approximately). Solid lines denote elevations below datum level, dashed lines denote elevations above datum level.

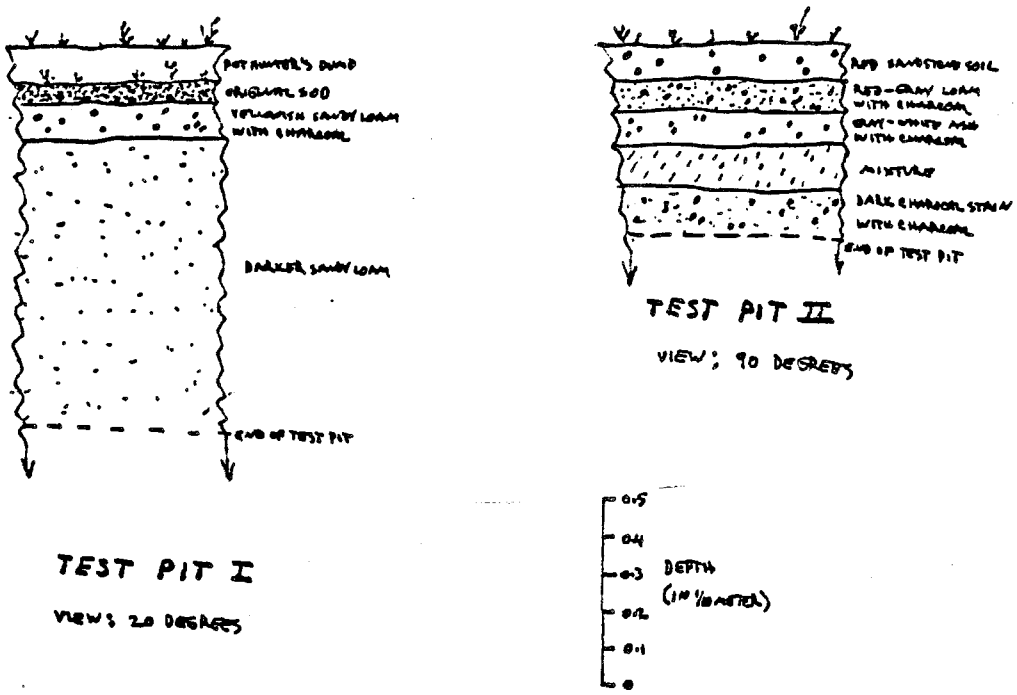


Fig. 4
TEST PIT STATIGRAPHY

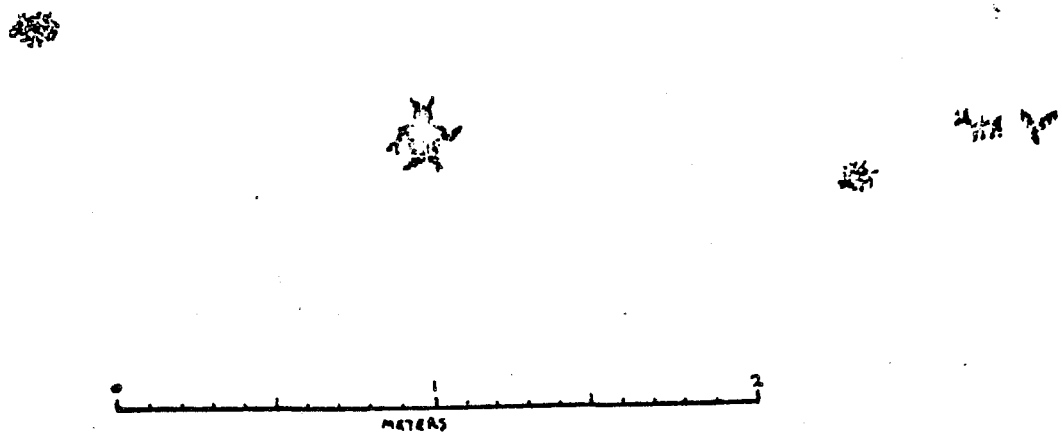


Fig. 5
[illegible] PICTOGRAPHS

Pictographs are done in red paint material. Several others, very washed away by natural causes, are not shown here. Pictographs are located on the cliff face on the west side of the pothunted area.

U.S. DEPARTMENT OF AGRICULTURE **SPEED-MEMO**

TO: WALT NOWAK AND IRA HATCH → PRICE R.D.	PART NUMBER 1	DATE 14 JAN 81
FROM: (7) LES WIKLE, MONTICELLO R.D.	SUBJECT: CRANDALL CANYON ROAD	

MESSAGE (WRITE CONCISE MESSAGE. SIGN AND FORWARD PARTS 1 AND 2 TO ADDRESSEE. RETAIN PART 3)

HERE IS MY VERSION OF AN ARCHEOLOGICAL REPORT FOR THE PROJECT. HOPEFULLY IT IS SPECIFIC ENOUGH FOR YOU TO USE AS INFO FOR YOUR E.A.R. IF YOU HAVE ANY PROBLEMS WITH IT OR FURTHER SUGGESTIONS, GIVE ME A CALL.

IMPORTANT: OUR COPY MACHINE IS AWFUL, SO I'M SENDING YOU THE ORIGINAL MAPS, ETC. (FIGURES 1 THRU 5). PLEASE COPY THEM TO ATTACH TO YOUR COPY OF THE TEXT, AND SEND THE ORIGINALS BACK TO ME! (IF YOU COULD INCLUDE A COPY OR TWO OF EACH OF THE PAGES WITH FIGURES 1-5 FOR ME TO USE FOR SENDING THE REPORT TO SHPO, ETC. I WOULD APPRECIATE IT. BUT IF YOU CAN'T, IT'S O.K.)

SIGNATURE: Les

REPLY (USE THIS SPACE FOR REPLY. SIGN AND DATE. RETURN PART 2 TO SENDER. RETAIN PART 1)

Thank you very much for your excellent report. At the present time it meets or exceeds all of our requirements. We'll be in contact if we have any further questions in this matter. Enclosed or attached are two copies of the report.

Thanks again,

FOREST SERVICE
MANTI-LASAL NATIONAL FOREST
PRICE R. D.
JAN 15 1981

ACTION	TO	INFO.
	DFE	
	Walter	
	CLERK	
PROMISE CARD FOR		

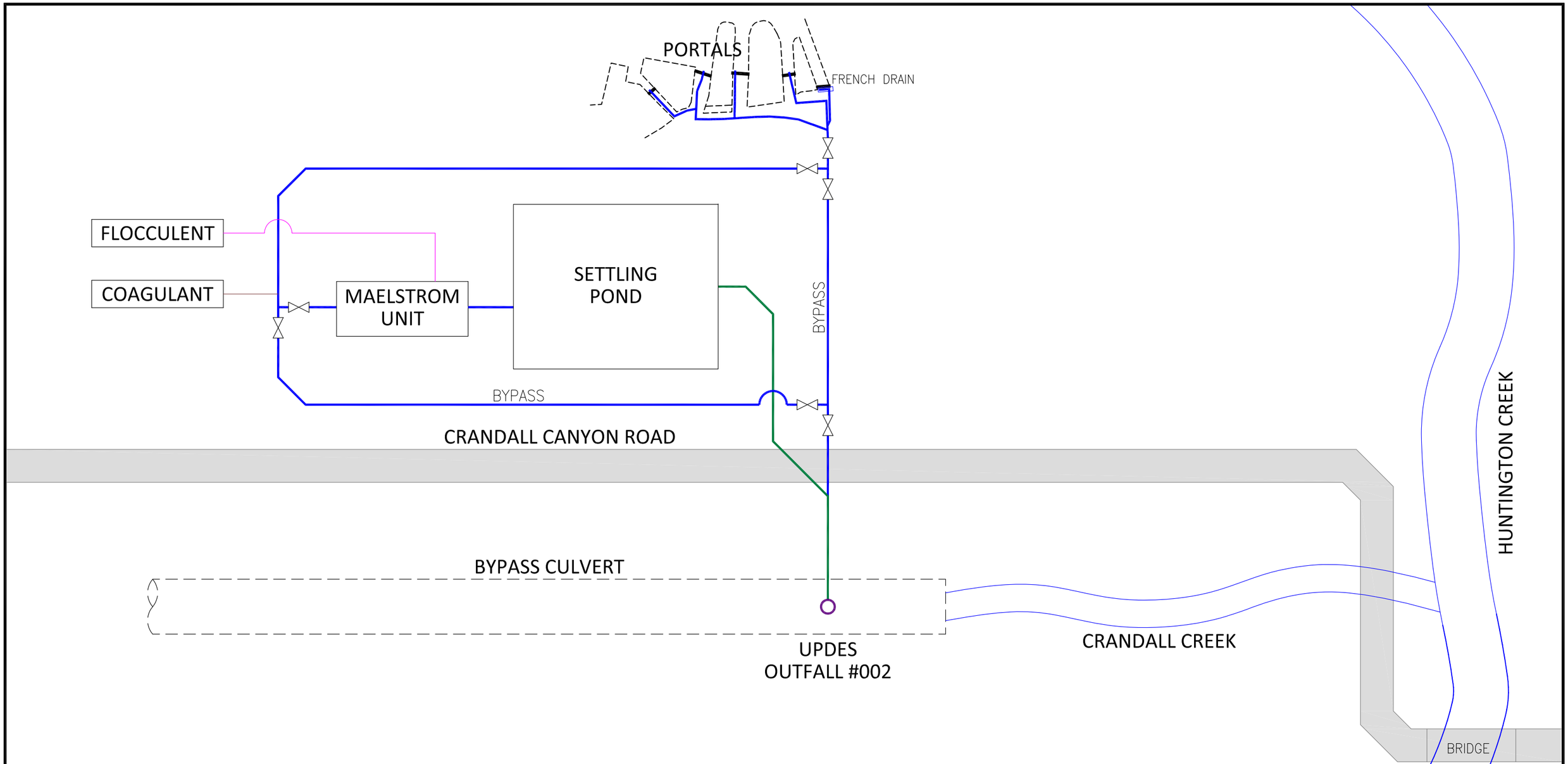
SIGNATURE: Walter E. Nowak DATE: 1/19/80

FORM AD-311 (REV. 5-68)

APPENDIX 5-30

RELOCATION OF UPDES OUTFALL #002 TO HUNTINGTON CREEK

PLATES



EXISTING PIPING SCHEMA

APPENDIX 5-30

MINE WATER PIPE SCHEMATIC

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

MSHA ID #42-01715

DRAWN BY	PJ	SCALE	NONE
APPROVED BY	KM	DATE	30 APRIL 2020
PLATE			**5-30-1a**

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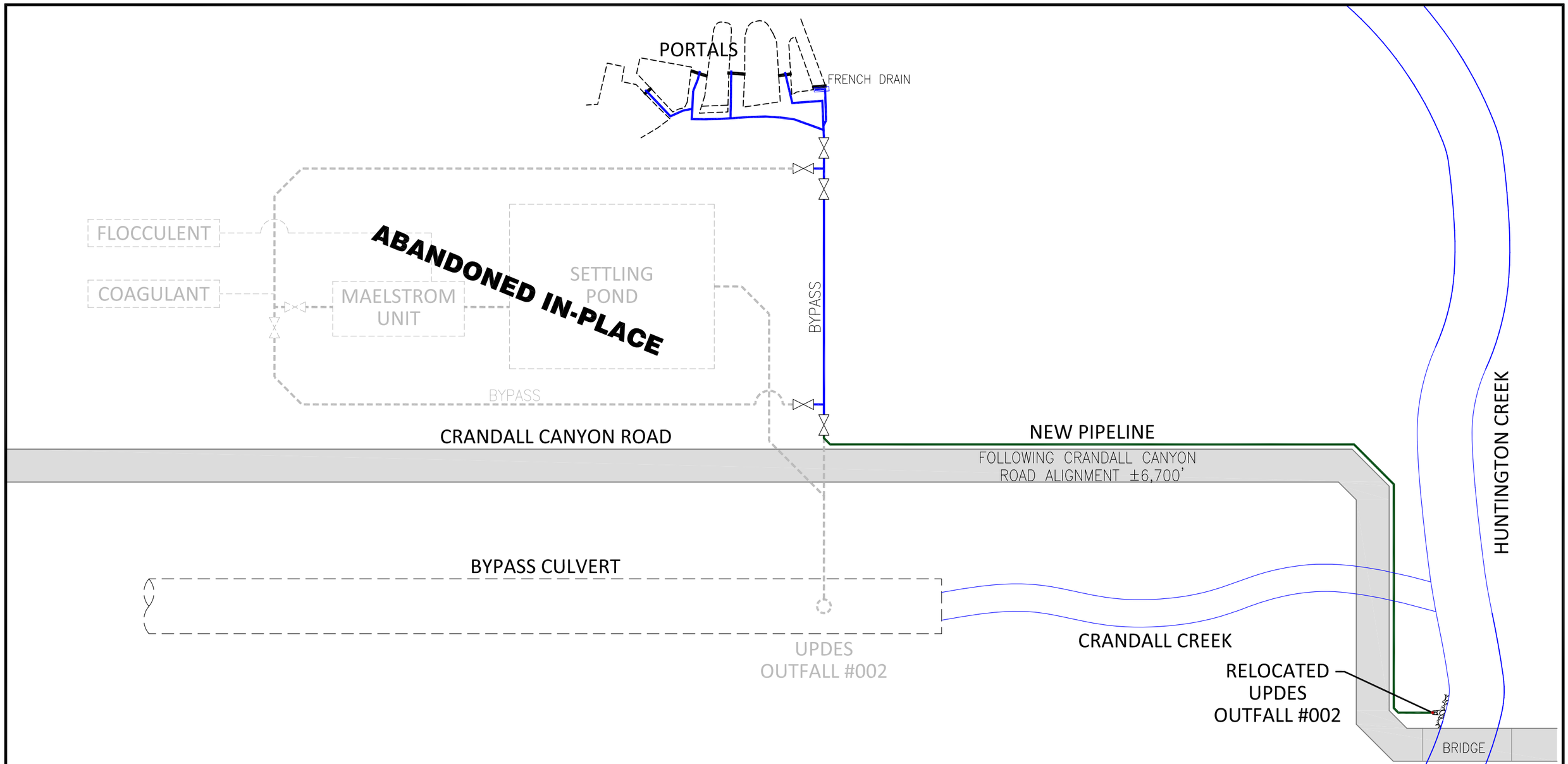

PIPING SCHEMA PRIOR TO FINAL RECLAMATION

APPENDIX 5-30

MINE WATER PIPE SCHEMATIC

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

MSHA ID #42-01715

DRAWN BY	PJ	SCALE	NONE
APPROVED BY	KM	DATE	30 APRIL 2020
PLATE	5-30-1b		

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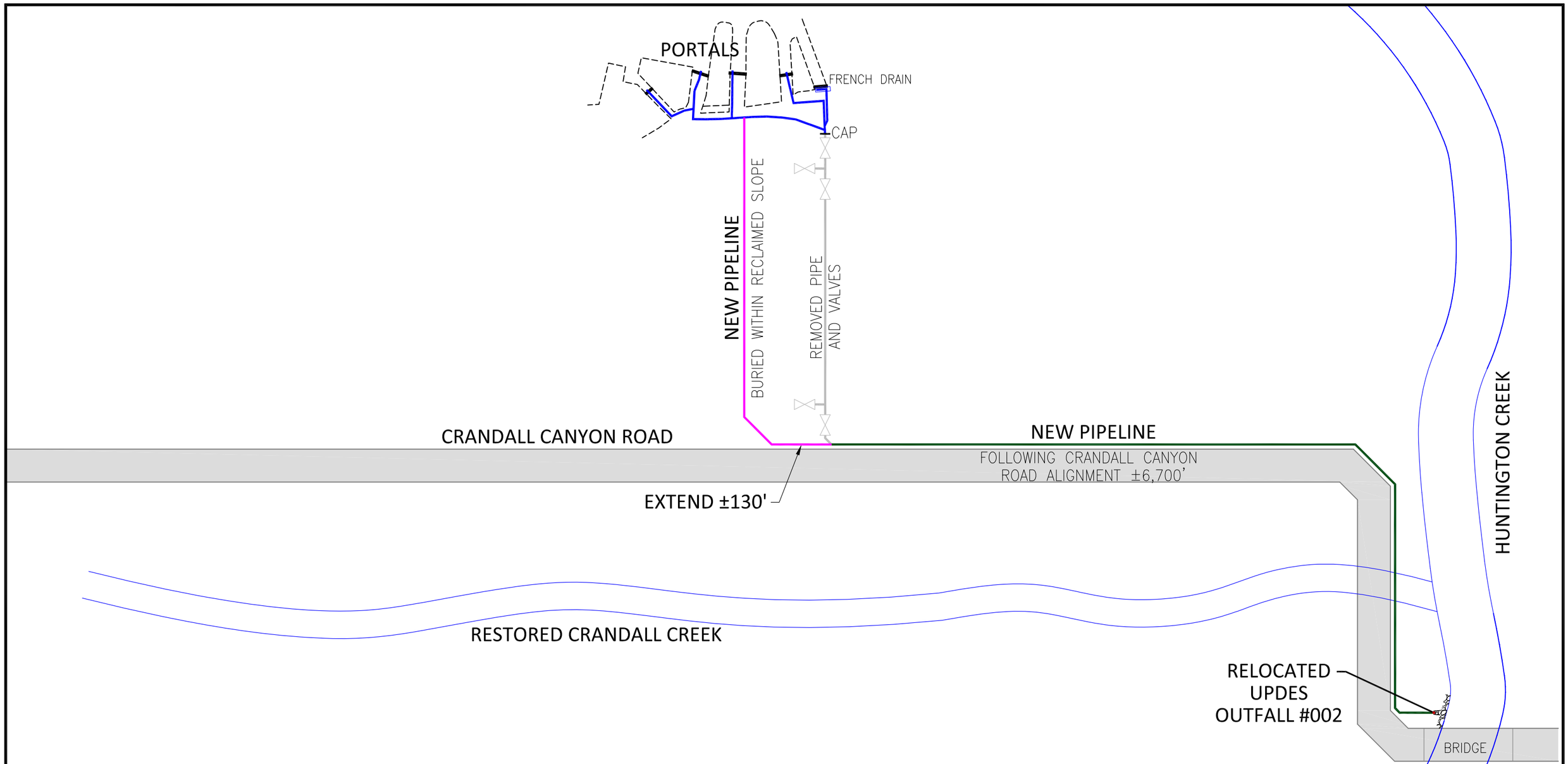

PIPING SCHEMA AT FINAL RECLAMATION

APPENDIX 5-30

MINE WATER PIPE SCHEMATIC

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

MSHA ID #42-01715

DRAWN BY PJ	SCALE NONE
APPROVED BY KM	DATE 30 APRIL 2020
SHEET 5-30-1c	

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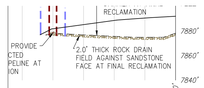

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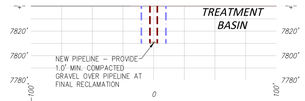

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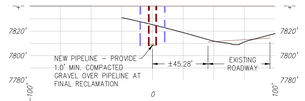

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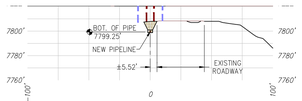

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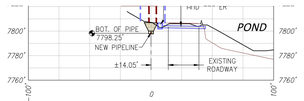

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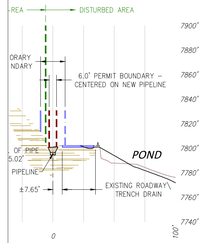

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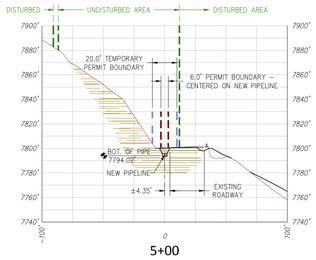

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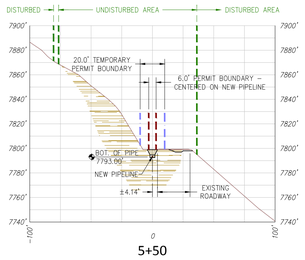

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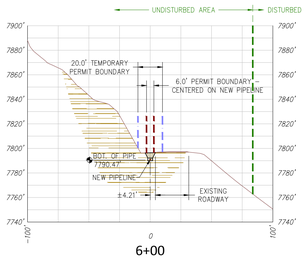

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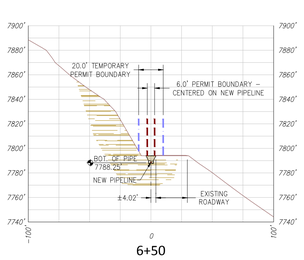

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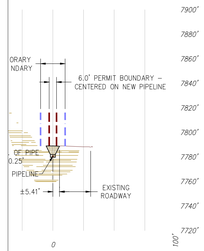

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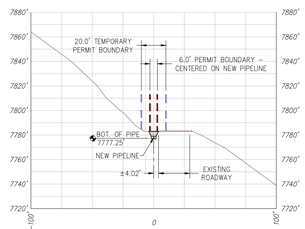

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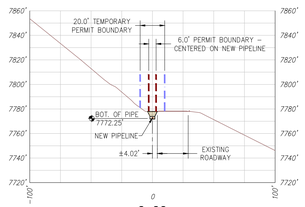

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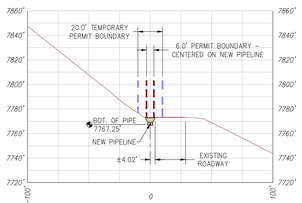

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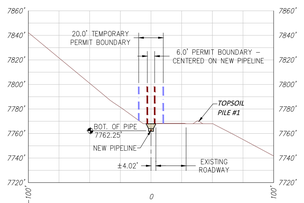

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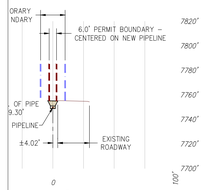

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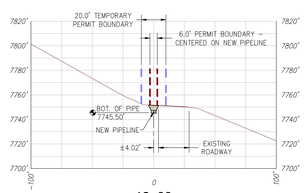

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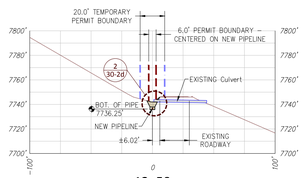

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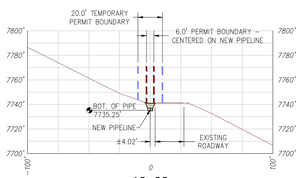

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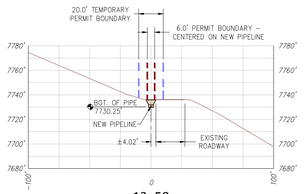

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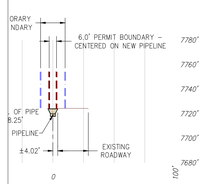

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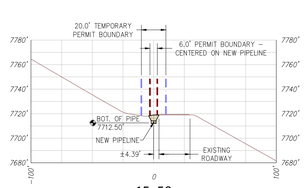

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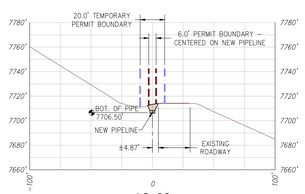

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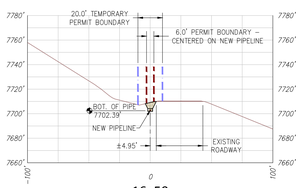

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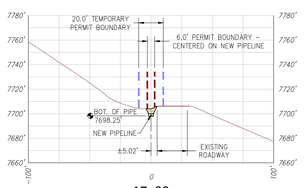

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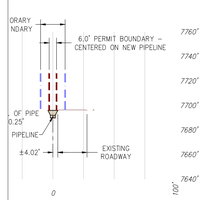

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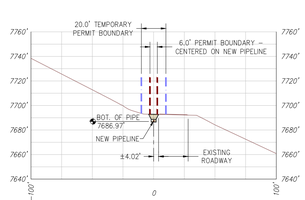

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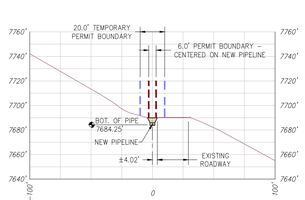

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NOTES:

1. ALL PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS:, LATEST EDITION.

2. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE TRENCH BOTTOM SHALL BE STABILIZED USING A GEOTEXTILE MATERIAL.

3. COVER: DEPTH OF COVER, AS MEASURED FROM THE TOP OF THE PIPE TO FINISHED GRADE, SHALL BE A MINIMUM OF 5'–0" AS RECOMMENDED BY THE UTAH DEPARTMENT OF TRANSPORTATION (UDOT) STANDARD DRAWING DD 16 FOR UTILITIES LOCATED LESS THAN 20 FEET FROM THE EDGE OF PAVEMENT. ONCE PIPE IS BEYOND 20 FEET FROM THE EDGE OF PAVEMENT, DEPTHS MAY VARY.

4. RE–ESTABLISH APPROXIMATE ORIGINAL CONTOURS AND CONDITIONS ABOVE PIPELINE TRENCH AFTER CONSTRUCTION OF THE PIPELINE. RESTORE ORIGINAL DRAINAGE PATTERNS AND RESEED ALL AREAS WITH CURRENT VEGETATION. SALVAGE 12" MIN. OF TOPSOIL ABOVE TRENCH PRIOR TO CONSTRUCTION AT ALL CURRENTLY VEGETATED AREAS THAT ARE TO BE TRENCHED.

25 0 50 100 FEET

LEGEND:

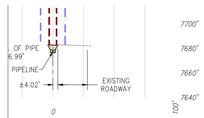
- *SPECIAL USE PERMIT BOUNDARY*
- *TEMPORARY SPECIAL USE PERMIT BOUNDARY*
- *EXISTING GRADE PROFILE LINE*
- *RECLAIMED GRADE PROFILE LINE (AFTER FINAL RECLAMATION)*
- *EXISTING DISTURBED AREA BOUNDARY LINE*
- *NEW PIPELINE TRENCH (SEE DETAIL 1/5-30-2d)*
- *PROJECTED TRENCHING THROUGH ROCK*

APPENDIX 5-30

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

CRANDALL CANYON ROAD AND PIPELINE SECTIONS

REV: 1	ACAD: APPENDIX 5-30 SECTIONS
DATE: 30 APR. 2020	BY: PJJ
SCALE: 1" = 50'	PLATE #: 5–30–2a



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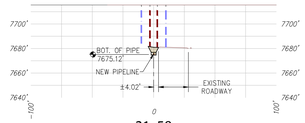

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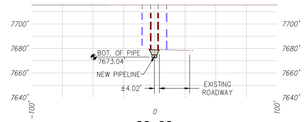

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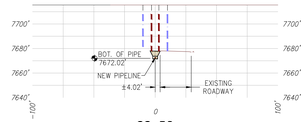

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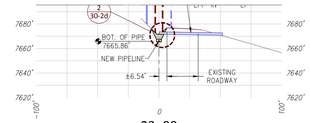

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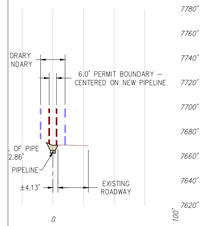

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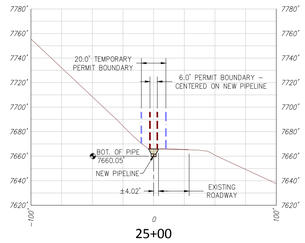

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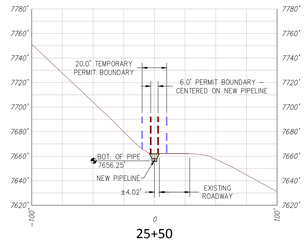

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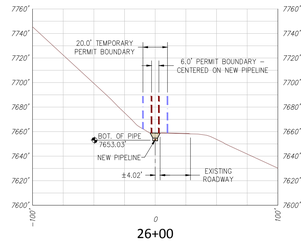

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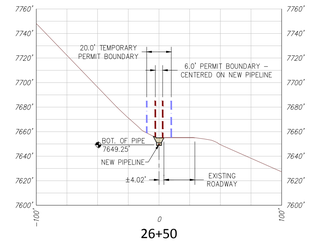

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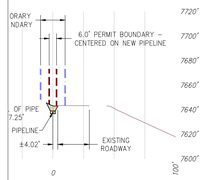

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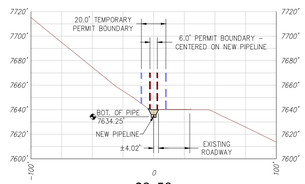

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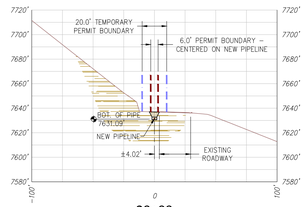

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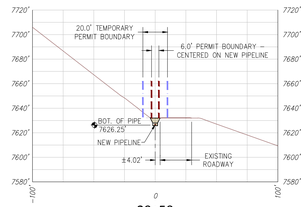

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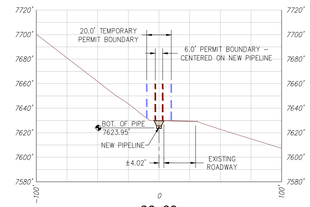

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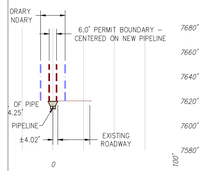

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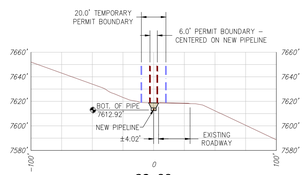

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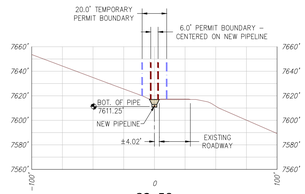

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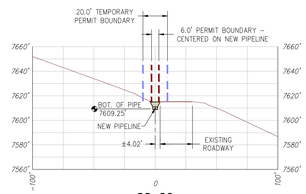

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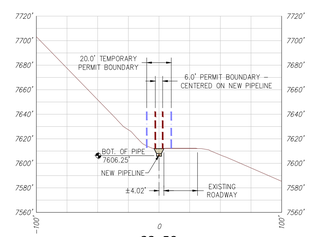

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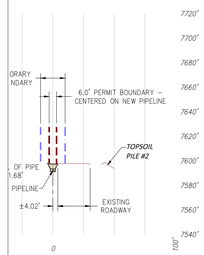

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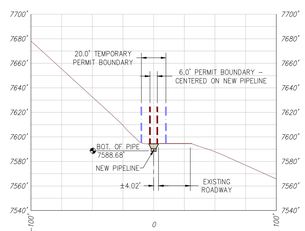

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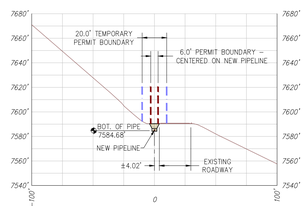

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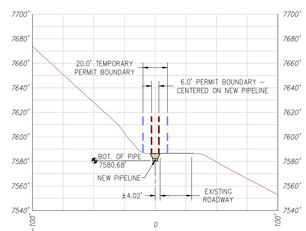

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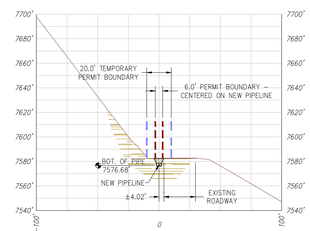

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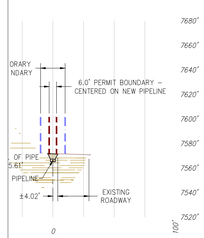

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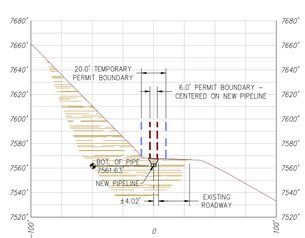

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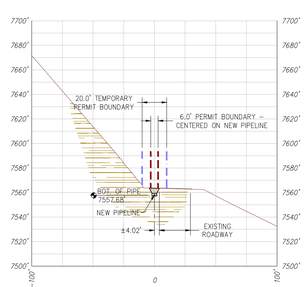

39+50

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25 0 50 100 FEET

LEGEND:

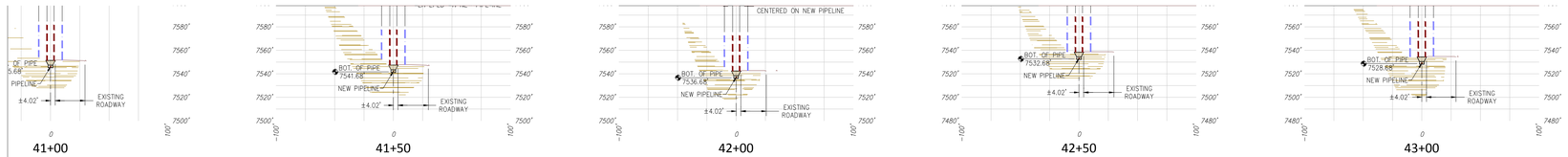
- *SPECIAL USE PERMIT BOUNDARY*
- *TEMPORARY SPECIAL USE PERMIT BOUNDARY*
- *EXISTING GRADE PROFILE LINE*
- *RECLAIMED GRADE PROFILE LINE (AFTER FINAL RECLAMATION)*
- *EXISTING DISTURBED AREA BOUNDARY LINE*
- *NEW PIPELINE TRENCH (SEE DETAIL 1/5-30-2d)*
- *PROJECTED TRENCHING THROUGH ROCK*

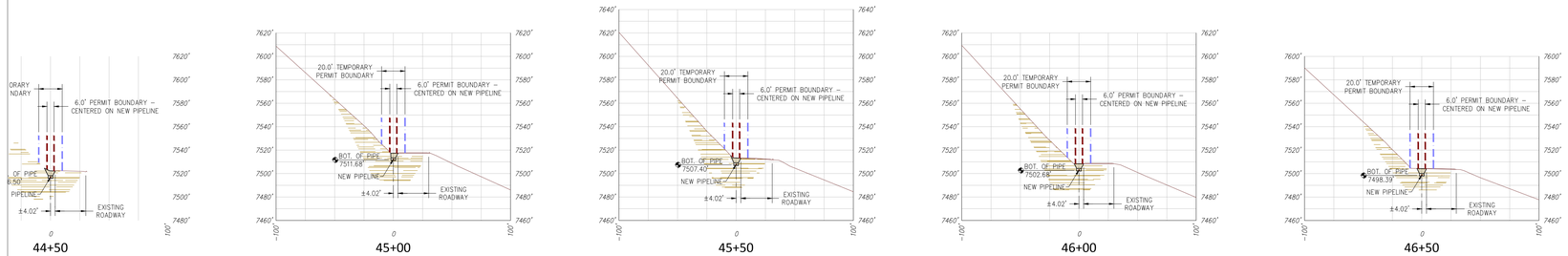
APPENDIX 5-30

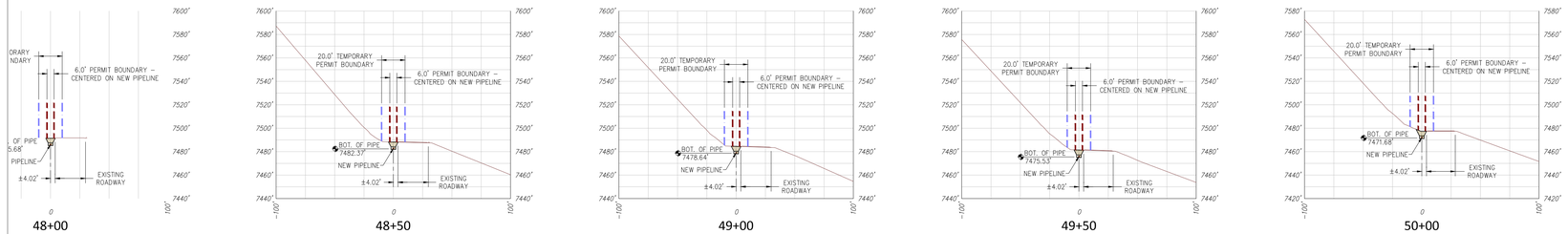
GENWAL™ RESOURCES, INC.
P.O. Box 1077, 794 North "C" Canyon Rd, Price Utah
Telephone: (435) 888-4000

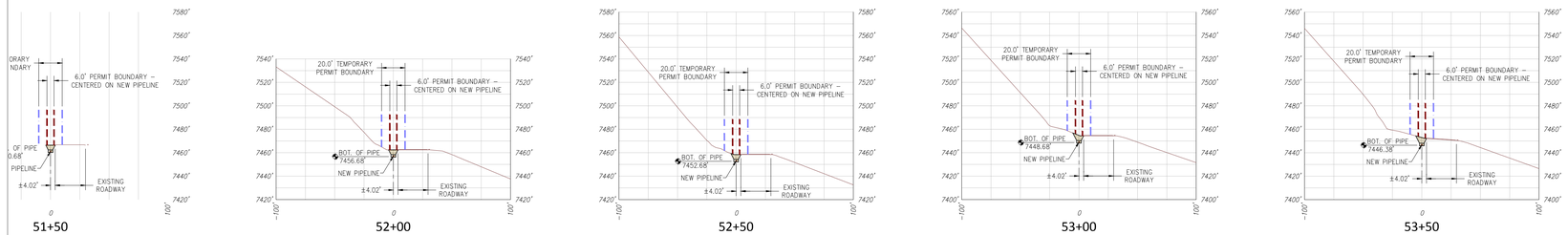
CRANDALL CANYON ROAD AND PIPELINE SECTIONS

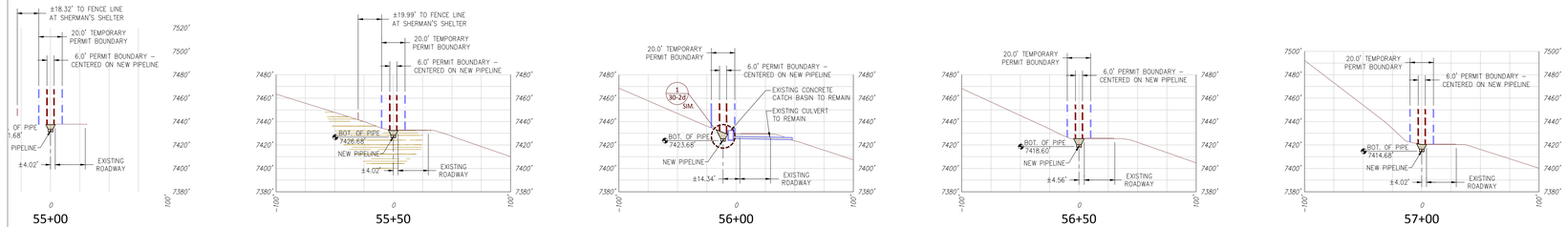
REV: 1	ACAD: APPENDIX 5-30 SECTIONS
DATE: 30 APR. 2020	BY: PJJ
SCALE: 1" = 50'	PLATE #: 5–30–2b

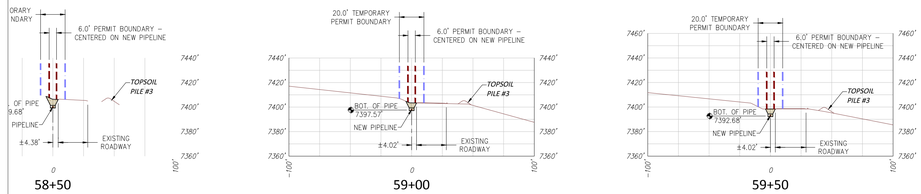












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25 0 50 100 FEET

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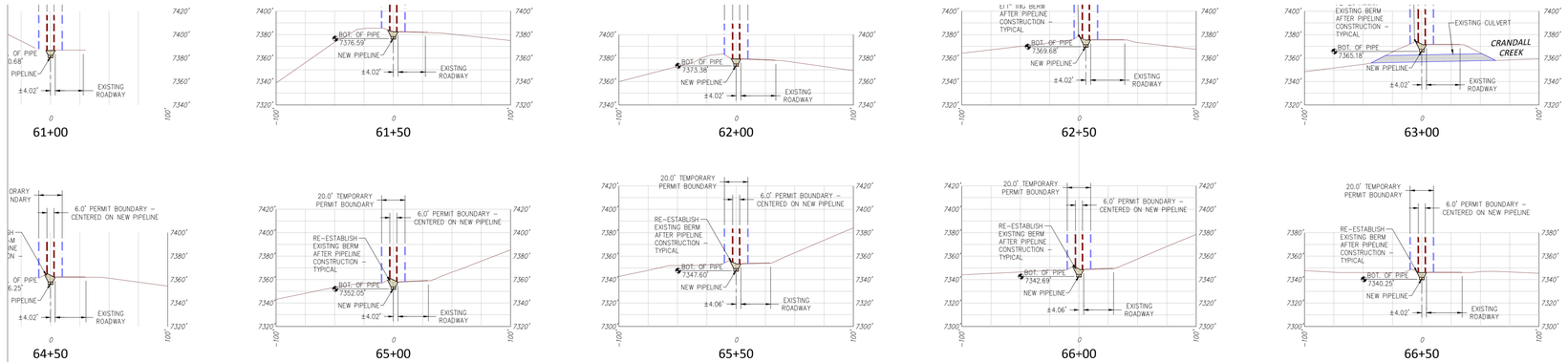
- *PROJECTED TRENCHING THROUGH ROCK*

APPENDIX 5-30

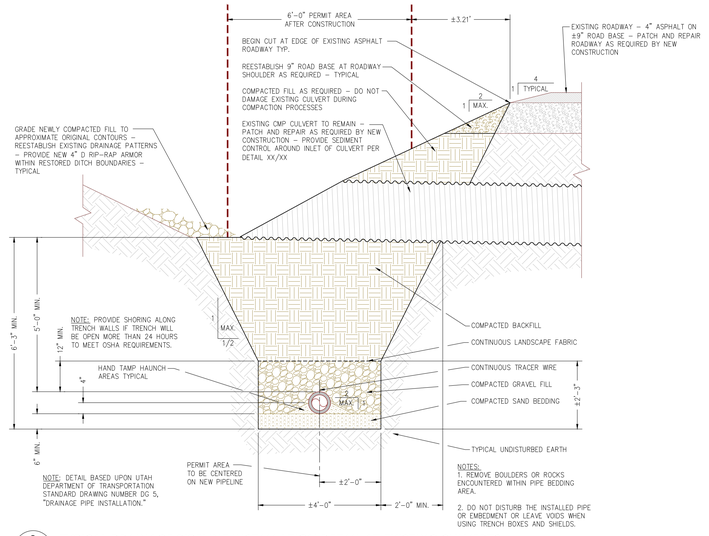
GENWAL RESOURCES, INC.™
P.O. Box 1077, 794 North "C" Canyon Rd, Price Utah
Telephone: (435) 888-4000

CRANDALL CANYON ROAD AND PIPELINE SECTIONS

REV: 1	ACAD: APPENDIX 5-30 SECTIONS
DATE: 30 APR. 2020	BY: PJJ
SCALE: 1" = 50'	PLATE #: 5-30-2c

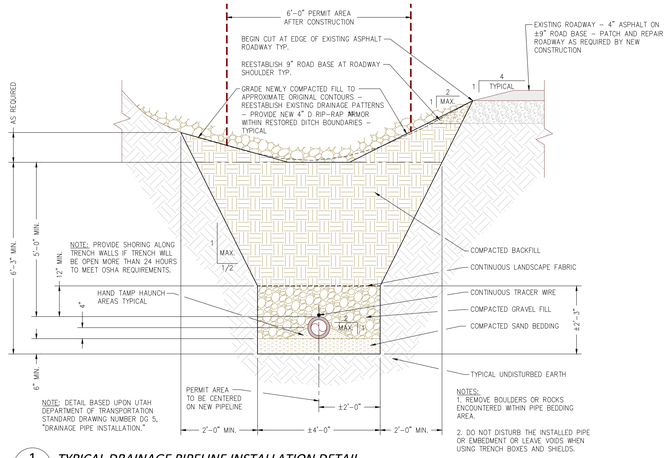


50 100 FEET



2 / 30-2d TYPICAL DRAINAGE PIPELINE INSTALLATION DETAIL AT EXISTING CULVERTS

SCALE: NO SCALE



1 / 30-2d TYPICAL DRAINAGE PIPELINE INSTALLATION DETAIL

SCALE: NO SCALE

PRECAST CONCRETE MANHOLE BASE SECTION

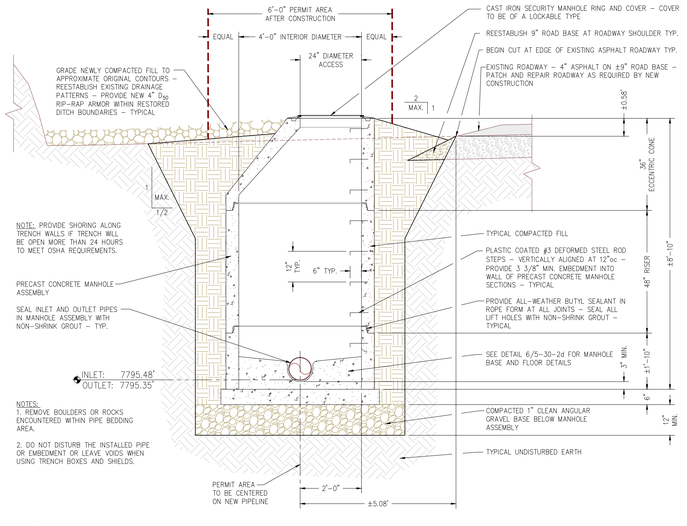
PROVIDE ±10" DIA. HOLES THROUGH WALL OF MANHOLE FOR PIPES – SEAL PIPES IN MANHOLE WITH NON-SHRINK GROUT TYPICAL

OUTLET

PRECAST CONCRETE MANHOLE BASE SECTION

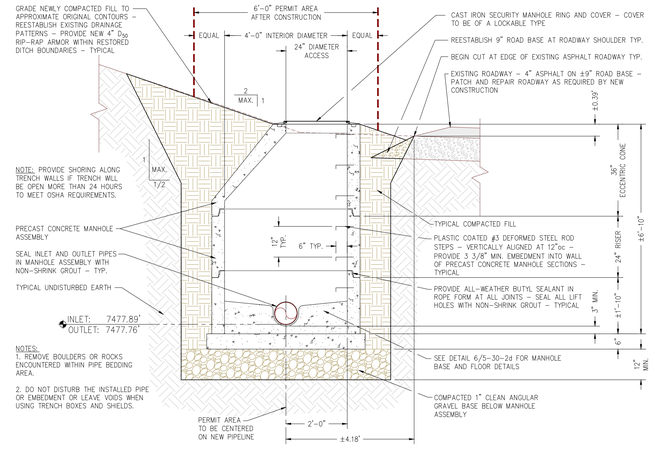
POURED CONCRETE FLOOR – SHAPE FLOOR TO DRAIN TO CENTRAL TROUGH AND TO OUTLET PIPE

PROVIDE ±10" DIA. HOLES THROUGH WALL OF MANHOLE FOR PIPES – SEAL PIPES IN MANHOLE WITH NON-SHRINK GROUT TYPICAL



5 / 30-2d MANHOLE DETAIL AT STATION 3+75

SCALE: NO SCALE



4 / 30-2d MANHOLE DETAIL AT STATION 49+75

SCALE: NO SCALE

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APPENDIX 5-30

GENWAL RESOURCES, INC.
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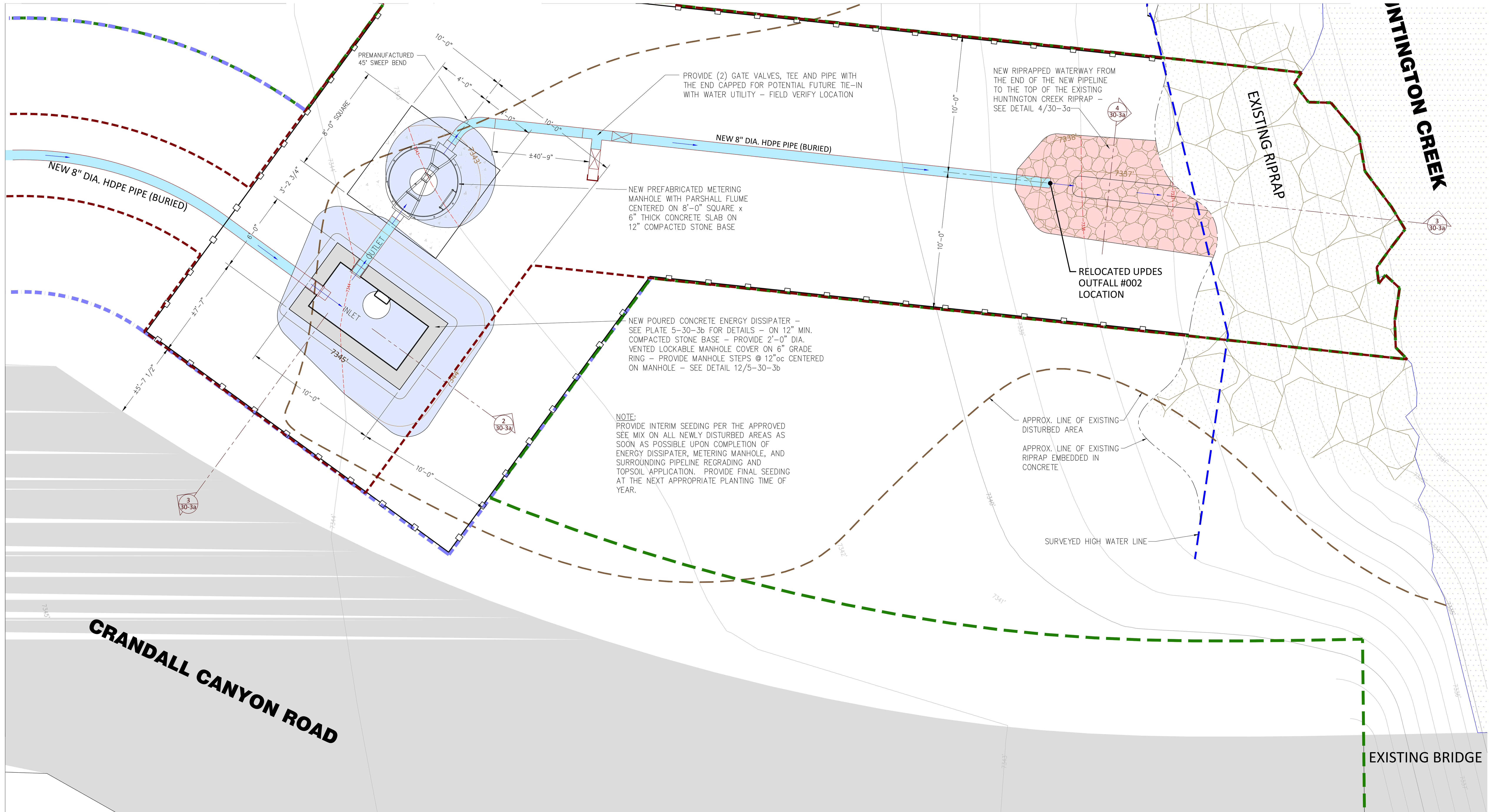
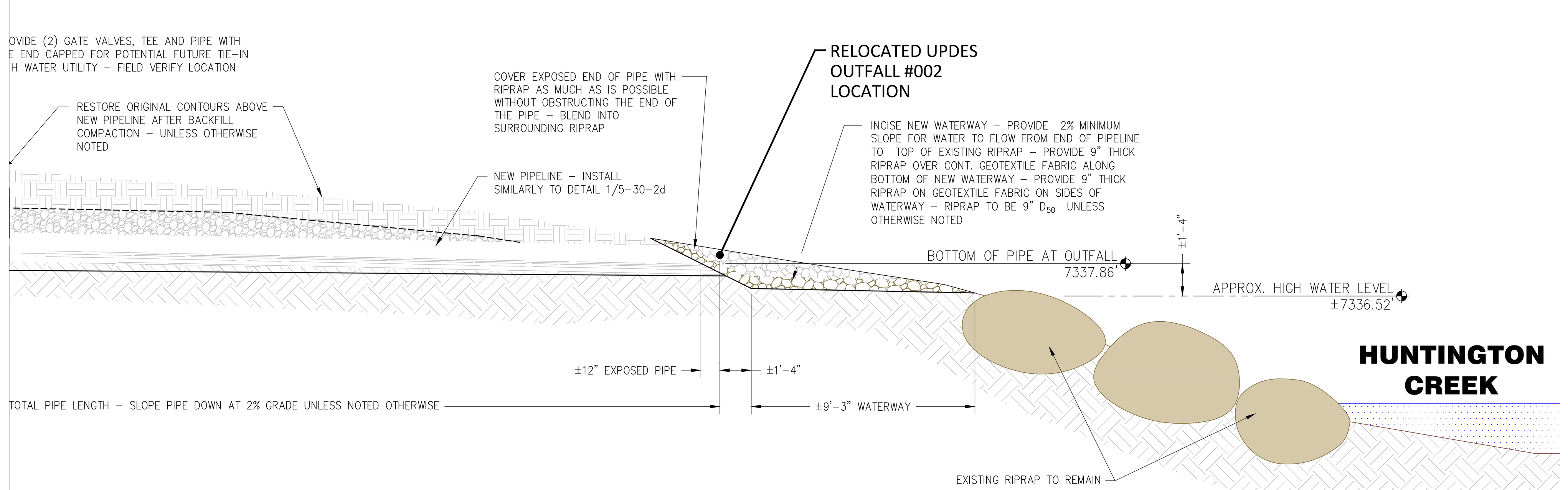
Telephone: (435) 888-4000

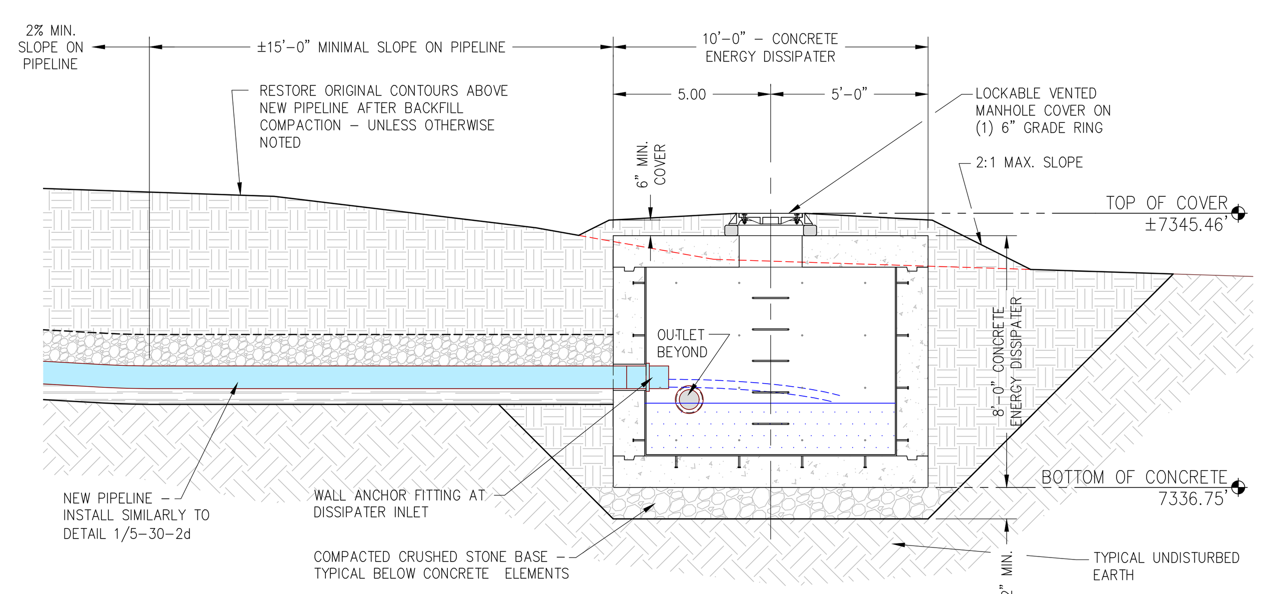
CRANDALL CANYON ROAD & PIPELINE SECTIONS & DETAILS

REV: 1	ACAD: APPENDIX 5-30 SECTIONS
DATE: 30 APR. 2020	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5-30-2d



RGY DISSIPATER AND METERING MANHOLE ENLARGED PLAN





NOTE:
INSIDE OF ENERGY DISSIPATER TO BE LINED W/ 1/2" STAINLESS STEEL PLATE ON ALL SIDES AND BOTTOM W/ 1/2" x 6" HSA ANCHORS – FULLY WELDED TO THE STAINLESS STEEL PLATE @ 24"oc HORIZ. AND @ 1'-8"oc VERTICALLY – ADJUST LOCATIONS OF ANCHORS AT HOLES FOR PIPE INLET AND OUTLET – HOLE SIZES AND LOCATIONS TO COORDINATE WITH HOLES IN CONCRETE WALLS FOR INLET AND OUTLET

2 / 30-3a *NEW PIPELINE TO ENERGY DISSIPATER SECTION*

0 1 2 3 4 8 FEET
SCALE: 1/4" = 1'-0"

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APPENDIX 5-30

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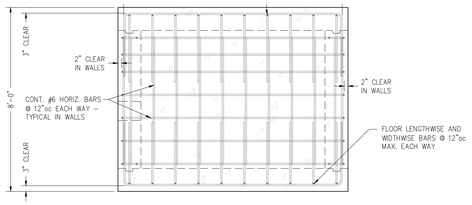
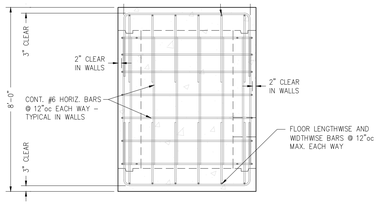
ENERGY DISSIPATER AND OUTFALL PLAN AND SECTIONS

REV: 1	ACAD: ENERGY DISSIPATER
DATE: 30 APR. 2020	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5-30-3a



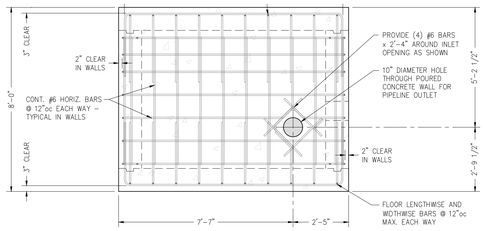
3 / 30-3b **ENERGY DISSIPATER SOUTHERN WALL**

SCALE: 3/8" = 1'-0"



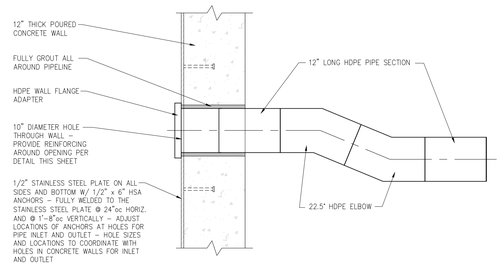
2 / 30-3b **ENERGY DISSIPATER EASTERN WALL**

SCALE: 3/8" = 1'-0"



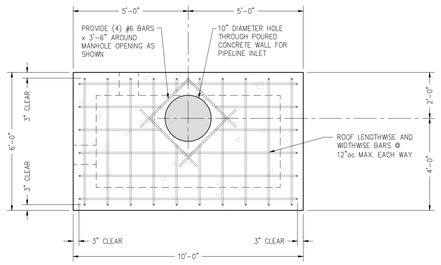
1 / 30-3b **ENERGY DISSIPATER NORTHERN WALL (OUTLET)**

SCALE: 3/8" = 1'-0"



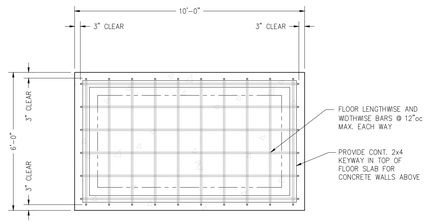
7 / 30-3b *ENERGY DISSIPATER* **PIPE OUTLET DETAIL**

SCALE: 1" = 1'-0"



6 / 30-3b **ENERGY DISSIPATER ROOF**

SCALE: 3/8" = 1'-0"



5 / 30-3b **ENERGY DISSIPATER FLOOR**

SCALE: 3/8" = 1'-0"

AL NOTES

TURER–DESIGNED COMPONENTS AND SAID SHOP DRAWINGS SHALL BE STAMPED BY A PROFESSIONAL

NUFACTURERS (SUPPLIERS) PRIOR TO FABRICATION OR INSTALLATION OF SUPPORTING

BE SUBJECTED, INCLUDING WIND. SUCH BRACING SHALL BE LEFT IN PLACE AS LONG AS MAY BE

UILDINGS
TE – ACI 318

N 28 DAYS AFTER POURING. THE WATER/CEMENT RATIO SHALL BE NO GREATER THAN 0.50 AND SLUMP

-CI STANDARDS AND PRACTICES.

BS, CONDUITS, BOLTS, INSERTS, ETC. RELATIVE TO WORK.

E OR FLOOR OR SLAB DEPRESSIONS.

URE, AND 2" WITHIN WALL STRUCTURES UNLESS NOTED OTHERWISE ON THE DRAWINGS.

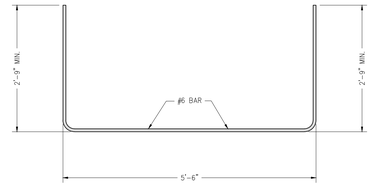
OUNTERED DURING EXCAVATIONS THAT ARE CONTRARY TO THOSE USED FOR THE DESIGN OF THE
NG.

OF MAXIMUM DENSITY BASE PER ASTM D1557 METHOD OF COMPACTION. FILL
HESIVE SOILS. FILL SHALL BE COMPACTED UNDER ALL NEW CONCRETE WORK ON THE SITE.

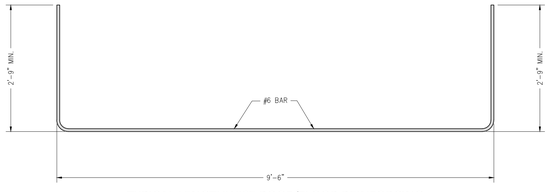
UNTIL ALL SUPPORTING MEMBERS HAVE BEEN PLACED (SUCH AS ROOF SLAB). ALL OPEN
DARDS.

CING TO THE REINFORCING IN THE SUPPORTED DOWELS SHALL EXTEND TO THE FAR SIDE OF MEMBER

315 AND ACI STANDARD 318–95.



TYPICAL WIDTHWISE ROOF/FLOOR REINFORCING



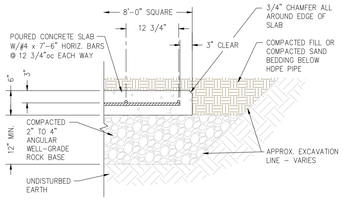
TYPICAL LENGTHWISE ROOF/FLOOR REINFORCING

10 / 30-3b **TYPICAL ROOF AND FLOOR REINFORCING BARS**

SCALE: 3/4" = 1'-0"

9 / 30-3b **ENERGY DISSIPATER TYPICAL WALL SECTION**

SCALE: 3/4" = 1'-0"



11 / 30-3b **METERING MANHOLE BASE SLAB DETAIL**

SCALE: NO SCALE

APPENDIX 5-30

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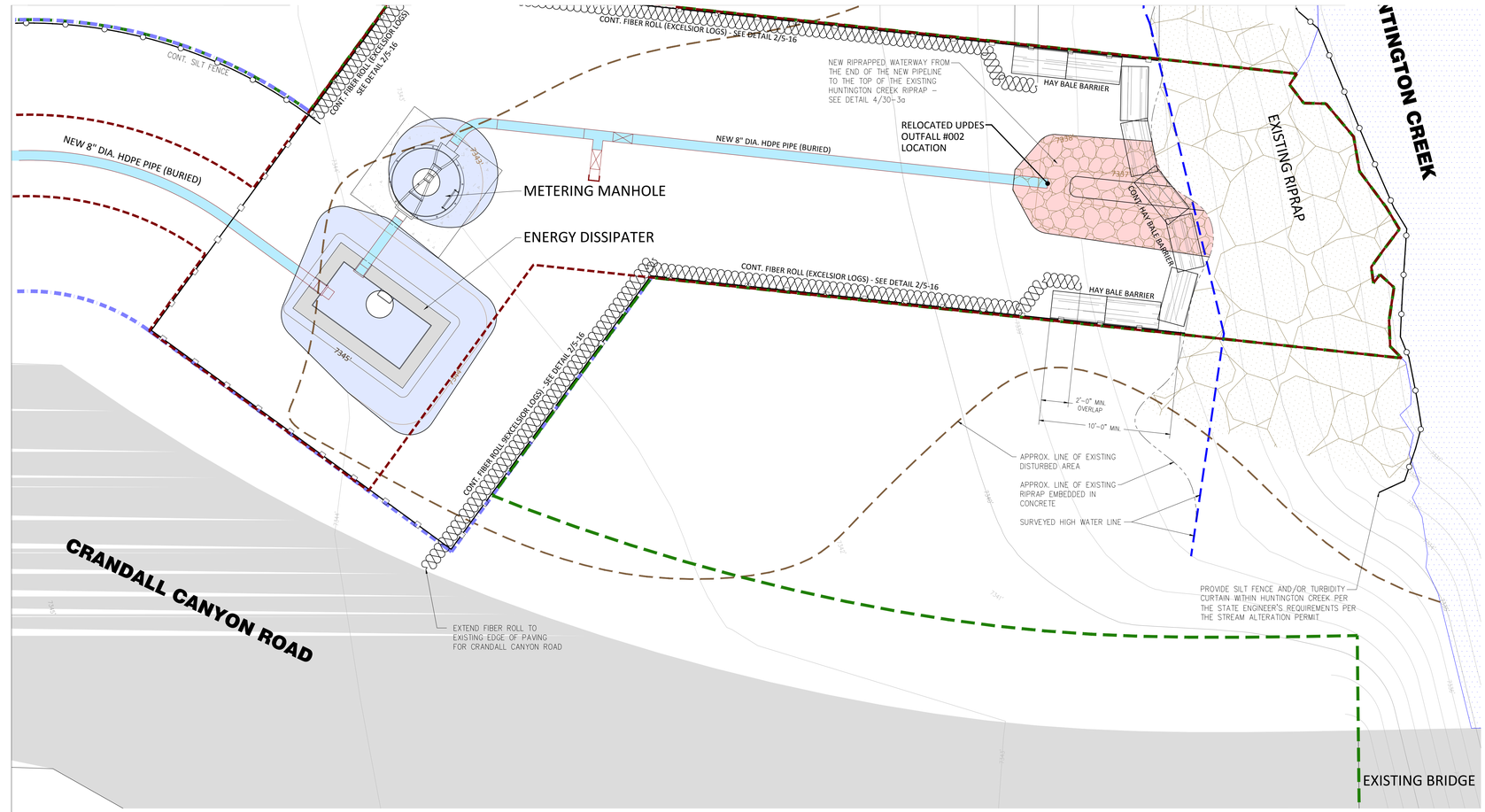
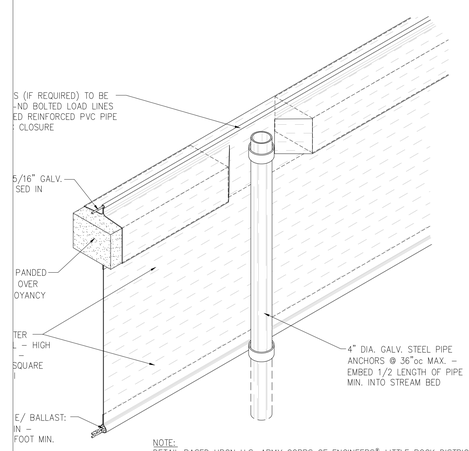
CRANDALL CANYON PIPELINE
ENERGY DISSIPATER DETAILS

REV: 0	ACAD: ENERGY DISSIPATER
DATE: 30 APR. 2020	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5–30–3b



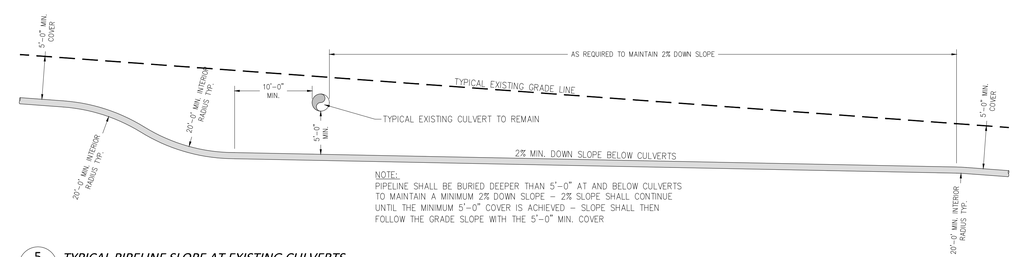
L PLAN AT BOTTOM OF PIPELINE / ENERGY DISSIPATER AND METERING MANHOLE



NOTE:
DETAIL BASED UPON U.S. ARMY CORPS OF ENGINEERS® LITTLE ROCK DISTRICT "SEDIMENT AND EROSION CONTROL GUIDELINES FOR PIPELINE PROJECTS"

CAL TURBIDITY CURTAIN DETAIL

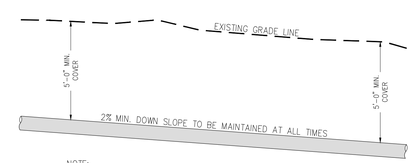
NO SCALE



NOTE:
PIPELINE SHALL BE BURIED DEEPER THAN 5'-0" AT AND BELOW CULVERTS TO MAINTAIN A MINIMUM 2% DOWN SLOPE – 2% SLOPE SHALL CONTINUE UNTIL THE MINIMUM 5'-0" COVER IS ACHIEVED – SLOPE SHALL THEN FOLLOW THE GRADE SLOPE WITH THE 5'-0" MIN. COVER

5 / 30-3C *TYPICAL PIPELINE SLOPE AT EXISTING CULVERTS*

SCALE: NO SCALE



NOTE:
5'-0" MIN. COVER AND 2% MIN. DOWNWARD SLOPE TO BE MAINTAINED ALL ALONG PIPELINE. NO HIGH SPOTS WITHIN PIPELINE WILL BE PERMITTED.

6 / 30-3C *TYPICAL PIPELINE SLOPE DETAIL*

SCALE: NO SCALE

APPENDIX 5-30

GENWAL™ RESOURCES, INC.
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TYPICAL PIPELINE CONSTRUCTION SEDIMENT CONTROL AND DETAILS

REV: 0	ACAD: ENERGY DISSIPATER
DATE: 30 APR. 2020	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5–30–3c

Crandal Canyon Mine Reclamation Cost Estimate

Total Cost Summary

Direct Costs

Demolition and Removal	$1,514,042.00	
Backfilling and Grading	$983,045.00	
Revegetation	$56,496.00	
Subtotal Direct Costs 2020 Dollars	$2,553,583.00	
Weighted Average City Cost Index (Price, UT)		88.1%
Adjusted Subtotal Direct Costs 2020 Dollars	$2,249,707.00	

Indirect Costs

Mob/Demob	$224,971.00	10.0%
Contingency	$112,485.00	5.0%
Engineering Redesign	$56,243.00	2.5%
Main Office Expense	$0.00	0.0%
Project Mainagement Fee	$78,740.00	3.5%
Subtotal Indirect Costs	$472,439.00	21.0%
Total Reclamation Cost 2020 Dollars	**$3,026,022.00**	
Escalation factor		*0.0295*
Number of years		*1*
Escalation	*$89,268.00*	
Total Escalated Reclamation Cost 2020 Dollars	**$3,115,290.00**	

Bond Summary

Bond Amount (rounded to nearest $1,000)	**$3,115,000.00**
Bond Posted 2011	$2,082,910.00
Difference Between Cost Estimate and Bond	**-$1,032,090.00**
Percent Difference	**-33.13%**

Crandall Canyon Mine Reclamation Bond Estimate

Earthwork Costs

Description	Quantity	Units	Production Rate	Units	Production Time	Units	Materials/Equipment/Labor	Cost Reference RSMeans Ref #	Unit Cost	Units	Quantity	Cost
Mine Site Earthwork Estimate												
Cut Excess Fill, Haul, Spread, and Compact - Burma Pond												
Cut excess fill	57,991	CY	1320	CY/Day	43.9	Day	Excavator, hydraulic, track mounted, 2 CY capacity	Crew B-12C	2260.43	Day	43.9	$99,233
Load trucks	57,991	CY	1480	CY/Day	39.2	Day	Front-end loader, wheel mounted, 5 CY capacity	Crew B-10U	1985.05	Day	39.2	$77,814
Haul soil to Burma Pond	57,991	CY	182	CY/Day	318.6	Day	16.5 CY truck, 15 min wait/ld/uld, 45 mph, 20 mi cycle	Crew B-34C	1279.74	Day	318.6	$407,725
Spread dumped soil	57,991	CY	1850	CY/Day	31.3	Day	Dozer, 300 HP, 50' haul, sandy clay and loam	Crew B-10M	2872.20	Day	31.3	$89,900
Compact soil	57,991	CY	10000	CY/Day	5.8	Day	Towed sheepsfoot roller, 6" lifts, 2 passes	Crew B-10D	3066.79	Day	5.8	$17,787
Scarify subsoil	1.41	ac	240	MSF/Day	0.3	Day	Scarify subsoil, large proj, 75 HP dozer w/ scarifier	Crew B-10L	1373.34	Day	0.3	$412
Load, Haul, and Spread Topsoil - Burma Pond												
Load trucks from stockpile	1,137	CY	1480	CY/Day	0.8	Day	Front-end loader, wheel mounted, 5 CY capacity	Crew B-10U	1985.05	Day	0.8	$1,588
Haul topsoil to Burma Pond	1,137	CY	348	CY/Day	3.3	Day	12 CY truck, 15 min wait/ld/uld/20 mph, 0.5 mi cycle	Crew B-34B	1216.99	Day	3.3	$4,016
Spread topsoil	1,137	CY	1850	CY/Day	0.6	Day	Dozer, 300 HP, 50' haul, sandy clay and loam	Crew B-10M	2872.20	Day	0.6	$1,723
Pock topsoiled area	2,275	CY	1320	CY/Day	1.7	Day	Excavator, hydraulic, track mounted, 2 CY capacity	Crew B-12C	2260.43	Day	1.7	$3,843
Grade, Compact, and Scarify Backfill - Mine Site												
Grade site soil	70,192	CY	1850	CY/Day	37.9	Day	Dozer, 300 HP, 50' haul, sandy clay and loam	Crew B-10M	2872.20	Day	37.9	$108,856
Compact graded soil	70,192	CY	10000	CY/Day	7.0	Day	Towed sheepsfoot roller, 6" lifts, 2 passes	Crew B-10D	3066.79	Day	7	$21,468
Scarify subsoil	6.41	ac	240	MSF/Day	1.2	Day	Scarify subsoil, large proj, 75 HP dozer w/ scarifier	Crew B-10L	1373.34	Day	1.2	$1,648
Backfill Sealed Portals - Mine Site												
D3, Track-mounted	889	CY	440	CY/Day	2.0	Day	Dozer, 80 HP, 50' haul, sandy clay and loam	Crew B-10L	1373.34	Day	2	$2,747
Vibrating plate compactor	889	CY	200	CY/Day	4.4	Day	Vibrating plate compactor, walk behind, 6" lifts, 2 passes	Crew A-1D	540.71	Day	4.4	$2,379
Load, Haul, and Spread Topsoil - Mine Site												
Load trucks from stockpile	12,827	CY	1480	CY/Day	8.7	Day	Front-end loader, wheel mounted, 5 CY capacity	Crew B-10U	1985.05	Day	8.7	$17,270
Haul topsoil to mine site	12,827	CY	348	CY/Day	36.9	Day	12 CY truck, 15 min wait/ld/uld/20 mph, 0.5 mi cycle	Crew B-34B	1216.99	Day	36.9	$44,907
Spread topsoil	12,827	CY	1850	CY/Day	6.9	Day	Dozer, 300 HP, 50' haul, sandy clay and loam	Crew B-10M	2872.20	Day	6.9	$19,818
Pock topsoiled area	10,341	CY	1320	CY/Day	7.8	Day	Excavator, hydraulic, track mounted, 2 CY capacity	Crew B-12C	2260.43	Day	7.8	$17,631
Support												
Water Truck							Truck and water tank trailer, 5000 gal	Crew B-9A	2113.99	Day	20.0	$42,280
Subtotal												**$983,045**

Sources of Production Rate Estimates:	Means Number:
16.5 CY truck, 15 min wait/ld/uld, 40 mph, 20 mi cycle	31 23 23.20 3280
12 CY truck, 15 min wait/ld/uld/20 mph, 0.5 mi cycle	31 23 23.20 1026
Dozer, 300 HP, 50' haul, sandy clay and loam	31 23 16.46 5010
Dozer, 80 HP, 50' haul, sandy clay and loam	31 23 16.46 2010
Excavator, hydraulic, track mounted, 2 CY capacity	31 23 16.42 0260
Front-end loader, wheel mounted, 5 CY capacity	31 23 16.42 1650
Scarify subsoil, large proj, 75 HP dozer w/ scarifier	32 91 13.23 3100
Towed sheepsfoot roller, 6" lifts, 2 passes	31 23 23.23 6000
Vibrating plate comp, walk behind, 6" lifts, 2 passes	31 23 23.23 7000

Crandal Canyon Mine Reclamation Cost Estimate

Demolition Cost Summary

Ref.	Description	Cost
	Shop 01	$31,044
	Ventilation Fan 02	$15,502
	Rock Dust Silo 03	$2,212
	Concrete Dumpster Pad 04	$2,708
	Power Center 05	$34,889
	Power Poles 06	$8,173
	Underground Bathhouse 07	$0
	Portals 08	$0
	Screening/Crushing Building 10	$42,980
	North Portals Mine Belt 11	$8,430
	Stacking Tube 13	$54,509
	Scale House 14	$0
	Water Treatment Plant 15	$19,090
	Truck Loadout Ramp 17	$3,956
	Parts Shed 18	$11,218
	Reclaim Tunnel 19	$26,758
	Visual Disconnect 20	$46
	New Shop 21	$0
	Shop Extension 22	$5,847
	Shotcrete Slopes 23	$5,429
	Fan Transfomer 24	$0
	Chain Link Fence 25	$516
	Concrete Guard 26	$1,736
	Retaining Wall 27	$3,980
	Culverts 28	$95,226
	Guard Rail 29	$2,905
	Sed Pond Inlets 30	$170
	Sed Pond Outlet 31	$466
	Gabion Retaining Wall 32	$8,031
	Water Wells 33	$0
	Stacking Conveyor Supports 35	$6,224
	Reclaim Tunnel 36	$60,478
	Feeder Boxes 37	$0
	Reclaim Conveyor Supports 38	$3,791
	Crusher Platform and Supports 39	$689
	Feeder Conveyor Supports 40	$4,553
	Scale Pads 41	$0
	New Scale House 42	$0
	Proposed Bathhouse 43	$0
	Coal Silo 44	$0
	Conveyors 45	$16,728
	Road & Parking Lot Reclamation 46	$206,646
	Main Cyn Culvert Liner & Bedding 48	$32,222
	New UPDES Discharge Line 49	$772,774
	Reclamation Ditch Construction 50	$457
	Water Treatment Pond 51	$19,252
	Security Fence and Gates 53	$4,406
	Total	$1,514,042

Crandall Canyon Mine Reclamation Cost Estimate

Unit Costs

All unit costs were obtained from RS Means 2020 Site Work and Landscape Costs, except as noted.
All costs include overhead and profit.

Item	Means Number	Unit Cost	Units
Floor demo, 4" Concrete, Wire Reinforced	02 41 16.17 0280	0.92	SF
Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF
Footings demo, Concrete 1' thick 2' wide	02 41 16.17 1000	12.30	LF
Wall demo, 8" Concrete, Reinforced (+10%)	02 41 16.17 2420	1.16	SF
Wall demo, 12" Concrete, Reinforced (+10%)	02 41 16.17 2500	1.63	SF
Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY
Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY
12 CY Truck, 10 mi cycle, 15 min wait	31 23 23.20 1025	12.65	CY
Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF
Utility Pole demo, wood, 20'-30' high	02 41 13.80 0100	340.00	EA
Guard Rail Removal	02 41 13.30 0800	24.00	LF
Chain link, 8'-10' high, Posts & fabric, Remove	02 41 13.60 1700	4.23	LF
Mechanical equipment demo, heavy	23 05 05.10 3600	1275.00	Ton
Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY
Tank removal, single wall, 550 thru 2,000 gallon	13 05 05.75 0520	1600.00	EA
Haul tank to certified dump, 100 mi RT, 500 gal	02 65 10.30 1243	850.00	EA
Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton
12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY
On Site Disposal	02 41 16.17 4200	12.25	CY
EB Plastic Conduit Removal, 4 @ 6" dia	02 41 13.56 1900	9.15	LF
Electrical demo, #2 wire, from conduit	23 05 05.10 1900	30.50	CLF
Electrical demo, Steel Conduit, 4" to 6" dia	26 05 05.10 0160	9.15	LF
Bldg demo, Mixture of Types, Large project	02 41 16.13 0100	0.39	CF
Bldg demo, Concrete, Large project	02 41 16.13 0050	0.52	CF
Pavement Removal, Bituminous, up to 3" thick	02 41 13.17 5010	6.10	SY
Silt Fence, install, maintain, remove	31 25 14.16 1000	1.92	LF
Broadcast seeding (equip and labor ONLY, with O&P)	32 92 19.14 0020	59.83	MSF
Hydroseeder (equip and labor ONLY - with O&P)	32 92 19.14 0200	28.11	MSF
Power mulcher, large, hay, 1" deep	32 91 13.16 0390	32.50	MSF
Plant bare root seedlings, medium soil, 11" to 16" tall	32 93 43.10 0562	1.95	EA
Seed mix, non-riparian seed mix	Seed cost spreadsheet	292.18	AC
Seed mix, riparian	Seed cost spreadsheet	296.00	AC
Seed mix, East Mountain	Seed cost spreadsheet	85.65	AC
Seed mix, Burma Evaporation Basin	Seed cost spreadsheet	234.05	AC
Seedlings, non-riparian, south facing	Seed cost spreadsheet	187.50	AC
Seedlings, non-riparian, north facing	Seed cost spreadsheet	4830.00	AC
Seedlings, riparian	Seed cost spreadsheet	2246.00	AC
Riprap, Dumped, 300 lb. average	31 37 13.10 0370	36.00	Ton
Excavate, 3/8 CY excavator, 1'-4' deep	31 23 16.13 0050	9.45	CY
Chain link, 6' high, Posts & fabric, Remove	02 41 13.60 1755	3.61	LF
Fence post demo, steel, in concrete	02 41 13.62 1000	23.50	EA
Fence demo, Barbed Wire	02 41 13.62 1200	0.38	LF
Chain link gate demo, 10'-12' wide	02 41 13.62 0200	118.00	EA
Chain link gate demo, 3'-4' wide	02 41 13.66 0100	63.00	EA
Chain link gate demo, 20' wide	02 41 13.62 0400	189.00	EA
Steel CMP demo, 12" diameter	02 41 13.40 0150	2.40	LF
Steel CMP demo, 18" diameter	02 41 13.40 0160	3.60	LF
Steel CMP demo, 24" diameter	02 41 13.40 0170	15.05	LF
Steel CMP demo, 48"-60" diameter	02 41 13.40 0190	22.50	LF
Steel CMP demo, 72" diameter	02 41 13.40 0200	49.50	LF
Steel CMP end section demo, 72" diam.	02 41 13.40 0250	495.00	EA
Gabion wall demo, 6'x3'x3'	01 41 13.90 1500	181.00	EA
Excavator, hydraulic, track mounted, 2 CY capacity	Crew B-12C	2260.43	Day
Front-end loader, wheel mounted, 5 CY capacity	Crew B-10U	1985.05	Day
16.5 CY truck, 15 min wait/ld/uld, 45 mph, 20 mi cycle	Crew B-34C	1279.74	Day
Dozer, 300 HP, 50' haul, sandy clay and loam	Crew B-10M	2872.20	Day
Towed sheepsfoot roller, 6" lifts, 2 passes	Crew B-10D	3066.79	Day
Scarify subsoil, large proj, 75 HP dozer w/ scarifier	Crew B-10L	1373.34	Day
12 CY truck, 15 min wait/ld/uld/20 mph, 0.5 mi cycle	Crew B-34B	1216.99	Day
Truck and water tank trailer, 5000 gal	Crew B-9A	2113.99	Day
Dozer, 80 HP, 50' haul, sandy clay and loam	Crew B-10L	1373.34	Day
Vibrating plate compactor, walk behind, 6" lifts, 2 passes	Crew A-1D	540.71	Day
8" dia flange adapter w/ backup ring, DR 11	22 11 13.78 1040	65.50	EA
Welding labor, 8" dia HDPE	22 11 13.78 4090	69.00	EA
Saw cutting, asphalt, 3" deep plus 1"	02 41 19.25 0015/20	3.81	LF
8" dia HDPE SDR 21, fusion welded, 6' deep	G3010 124 6510	79.50	LF
Concrete manhole, precast, 4' ID riser, 6' deep	G3030 210 5840	4,275.00	EA
Catch basin invert, concrete	33 42 33.13 3500	365.00	EA
Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59.00	CF
Grout, C476, for concrete masonry unit core	04 05 16.30 2000	13.00	CF

Item	Means Number	Unit Cost	Units
Asphalt paving, wearing course, 4" thick	32 12 16.13 0480	20.50	SY
Borrow & loading, 5 CY FE loader, wheel mntd	31 23 23.15 5080	27.50	CY
Hauling, 12 CY truck, 45 mph, 20 mi cycle	31 23 23.20 1098	9.20	CY
Gravel backfill, 80 HP, comp 6" lifts, 300' haul	G1030 205 1400	6.80	CY
Riprap, dumped, 50 lb avg per stone	31 37 13.10 0300	35.00	Ton
Structural excavation, sandy clay, 1 CY bucket	31 23 16.16 6240	18.00	CY
Crushed stone borrow, 3/4"	31 05 16.10 0320	39.00	CY
Concrete in place, strip footing, reinf, 12" thick	03 30 53.40 3950	320.00	CY
Concrete wall, free-standing, 12" thick, 8' high	03 30 53.40 4260	450.00	CY
Concrete in place, beam, 5 kg/LF, 10' span	03 30 53.40 0300	1,450.00	CY
Catch basin frames and covers, 30" to 36" dia	33 42 33.13 3380	315.00	EA
Steps, heavyweight cast iron, 7"x9"	33 05 61.10 3800	35.50	EA
Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY
Walk-behind roller compactor, 6" lifts	31 23 23.13 0400	11.15	CY
Structural excavation, sandy clay, 1 CY bucket	31 23 16.16 6240	18.00	CY
Crushed stone borrow, 3/4"	31 05 16.10 0320	39.00	CY
Concrete in place, slab on grade, 6" thick, reinf	03 30 53.40 4700	230.00	CY
Fiberglass, 6" Parshall flume, staff gauge	OpenChannelFlow.com	15,993.00	EA
Percent of purchase price	Estimate	10.00	%
2 laborers, 1 truck driver, 1 flatbed truck	Crew A-2	1,794.17	Day
Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY
Walk-behind roller compactor, 6" lifts	31 23 23.13 0400	11.15	CY
Excavating, 5 CY FE loader, wheel mntd	31 23 16.42 1650	1.34	CY
Gravel backfill, 80 HP, comp 6" lifts, 50' haul	G1030 205 1050	5.80	CY
HDPE pipe, 6" diameter, DR 17	22 11 13.78 0086	6.90	LF
HDPE pipe, 4" diameter, DR 17	22 11 13.78 0078	4.21	LF
Welding labor, 6" dia HDPE	22 11 13.78 4080	52.50	EA
Welding labor, 4" dia HDPE	22 11 13.78 4070	52.50	EA
1 building laborer with concrete saw	Crew A-1B	628.65	Day
6" dia HDPE SDR 21, fusion welded, 4' deep	G3010 124 2300	32.90	LF
12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500.00	Day
Excavating, bulk, dozer, 700 HP. 50' haul, sand & gravel	31 23 16.46 6000	1.88	CY
Compaction, riding vibrating roller, 6" lifts, 3 passes	31 23 23.23 5020	0.69	CY
Selective demo, chain link fence, 12' high	02 41 13.62 0675	4.70	LF
Hauling, 20 CY truck, 15 min wait, 50 mph, 50 mi cycle	31 23 23.20 4114	10.80	CY
Landfill charge, typ tipping fee, construction debris	02 41 19.20 0100	81.00	Ton
Geotextile, nonwoven, 120 lb tensile strength	31 32 19.16 1550	1.35	SY
Demolish plastic pipe, 3/4"-4" diameter	02 41 13.38 1600	2.69	LF
Truck driver, 380 HP truck tractor, 20 CY dump trailer	Crew B-34D	1296.24	Day

Crandall Canyon Mine Demolition Cost Estimate

Supplemental Unit Cost Information

Unit Weight of Steel Building (based on wall and roof area)

Siding unit wt =	2	Lb/SF	Typical, from Table 15.1 of Standard Handbook for Civil Engineers, 4th Edition.
Column unit wt =	3	Lb/SF	Assumed value, based on 50% increase over siding unit weight.
Rafter unit wt =	3	Lb/SF	Assumed value, based on 50% increase over siding unit weight.
Girt unit wt =	2	Lb/SF	Assumed equal to siding unit weight.
TOTAL =	10	Lb/SF	

Unit Weight of #2 Wire

Unit weight = 200.9 Lb/1000 ft Data from https://www.engineersedge.com/copper_wire.htm

Unit Weight of Chain Link Fencing

Unit weight = 0.71 Lb/SF Assumes 9-gauge wire with 2" mesh size.
See https://www.wheatland.com/wp-content/uploads/2017/12/Chain-Link-Fabric-Average-Weights.pdf

Barbed Wire Unit Weight

Std length =	625	ft	
Weight =	30	kg =	66 lb
Unit weight =	0.11	Lb/ft	

Quantity of Soil to Backfill Portals

Width =	20	ft	
Height =	6	ft	
Length =	25	ft	
No. of Portals =	8		
Soil Volume =	24000	CF =	889 CY

Available Topsoil to be Redistributed at the Mine Site

Original Surface Facilities Area =	9,195	CY
Expansion Area =	3,632	CY
Total (Mine Site) =	12,827	CY

See Section 2.42 of the MRP

Available Topsoil to be Redistributed at the Burma Pond

Topsoil Quantity = 1,137 CY See drawing titled "Evaporation Basin Sections and Details"

Volume of Soil to be Pocked

Assume pocking occurs to an average depth of 2 feet over half of the topsoiled areas.

Location	Area (acres)	Depth Pocked (ft)	% of Area Pocked	Volume Pocked (CY)
Mine Site	6.41	2	50	10,341
Burma Pond	1.41	2	50	2,275
TOTAL				12,616

Culvert Unit Weights

12" CMP =	10	Lb/FT
18" CMP =	15	Lb/FT
24" CMP =	19	Lb/FT
42" CMP =	57	Lb/FT
72"CMP =	149	Lb/FT

Typical for 2 2/3" x 1/2" corrugation
(from Contech CMP Design Guide)

Weight of Multi-Plate Galvanized Steel

Weight of 3-gauge, 6"x2" corrugation, 24 Pi steel plate =	1060	lb/section
Number of multi-plate 24-Pi sections for 12' dia tunnel =	6	
Net length of each section =	12	ft
Weight per 12' section =	6360	lb
Unit weight of above multi-plate steel =	530	Lb/FT

See Contech Structural Plate
Design Guide, 7th ed.

Guard Rail Weight

Panel length =	25	ft	See https://trafficcircle.us/highway-safety-products/
Panel weight =	182	lb	
Unit weight =	7.28	Lb/FT	

Structural Steel Unit Weight

W16x67 =	67	Lb/FT	See Coyote Steel & Company
L3x2x1/4 =	4.1	Lb/FT	Handbook of Steel Sizes & Weights
C8x11.5 =	11.5	Lb/FT	
L3x3x1/4 =	5.4	Lb/FT	
C4x5.4 =	5.4	Lb/FT	
W8x24 =	24	Lb/FT	
W10x22 =	22	Lb/FT	
W12x22 =	22	Lb/FT	
W12x26 =	26	Lb/FT	
W24x55	55	Lb/FT	
W24x68 =	68	Lb/FT	
W24x131 =	131	Lb/FT	

Geotextile Unit Weight

Unit weight =	4	oz/SY	(Typ medium weight of nonwoven geotextile)
			(See https://www.usfabricsinc.com/catalogs/nonwoven-fabrics/)

Unit Weight of Riprap

Unit weight =	1.5	Tons/CY	(Assumed value)

Water Treatment Pond Liner

The pond as-built drawings indicate that a liner has been placed against the west, south, and east earthen berms of the water treatment pond. This liner extends over the top of the inside row of Jersey barriers. Typical LLDPE and HDPE rolls are 23 feet wide. Assume the liners 23 feet wide time the length of the erathen berms.

Liner length =	230	FT	
Liner width =	23	FT	See http://www.geosindex.com/Spec_Sheets/SmoothLiner_HDPE_13.pdf
Std roll area =	23920	SF	
Std roll weight =	3900	Lb	Based on 30-mil liner
Unit weight =	0.16	Lb/SF	

Jersey Barriers

Typ length =	10	FT			
Typ weight =	2	Tons	See https://accentbarriers.com/barriers.htm		
Typ height =	2.67	FT			
Typ base width =	2	FT			
Vol occupied ea =	53.4	CF =		2	CY

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
01	**Shop 01**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	160	20	20										64000	CF	$23,680.00
	Structure's Vol. Demolished																0.35	830	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													830	CY	$1,776.20
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton								10			Lb/SF		52	Tons	$520.00
	Subtotal																			**$25,976.20**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	160	20	0.5		3200	1600							3200	SF	$3,680.00
	Concrete's Vol. Demolished																1.3	77	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													77	CY	$165.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													77	CY	$280.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													77	CY	$943.00
	Subtotal																			**$5,068.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$31,044.20**

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
02	**Ventilation Fan 02**																			
	Structure's Demolition Cost																			$0.00
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			$0.00
	Subtotal																			**$0.00**
	Equipment 's Disposal Cost	Mechanical equipment demo, heavy	23 05 05.10 3600	1275	Ton							5			2	Tons		10	Tons	$12,750.00
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs	12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500	Day													0.5	Day	$750.00
	Transport Costs																			
	Disposal Costs	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													10	Tons	$100.00
	Subtotal																			**$13,600.00**
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	60	20	0.5		1200	600							1200	SF	$1,380.00
	Concrete's Vol. Demolished																1.3	29	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													29	CY	$62.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													29	CY	$105.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													29	CY	$355.00
	Subtotal																			**$1,902.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			**$15,502.00**

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
03	**Rock Dust Silo 03**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF			30	12	1131						FT		3393	CF	$1,255.00
	Structure's Vol. Demolished																0.35	44	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													44	CY	$94.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								10			Lb/SF		6	Tons	$60.00
	Subtotal																			**$1,409.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	20	20	1		400								400	SF	$460.00
	Concrete's Vol. Demolished																1.3	19	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													19	CY	$41.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													19	CY	$69.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													19	CY	$233.00
	Subtotal																			**$803.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$2,212.00

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
04	**Concrete Dumpster Pad 04**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	30	25	1								FT		750	SF	$863.00
	Concrete's Vol. Demolished																1.3	36	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													36	CY	$77.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													36	CY	$131.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													36	CY	$441.00
	Subtotal																			**$1,512.00**
	Concrete Demolition																			
	Demolition Cost	Wall demo, 12" Concrete, Reinforced (+10%)	02 41 16.17 2500	1.63	SF	60	1	8								FT		480	SF	$782.00
	Vol. Demolished																1.3	23	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													23		$49.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													23		$83.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													23		$282.00
	Subtotal																			**$1,196.00**
	Total																			$2,708.00

Notes: See Plate 5-3 for surface facilities details, item 4.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
05	**Power Center 05**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Mechanical Equipment	Mechanical equipment demo, heavy	23 05 05.10 3600	1275	Ton							5				Ton		5	Ton	$6,375.00
	Transformer	Mechanical equipment demo, heavy	23 05 05.10 3600	1275	Ton							2				Ton		2	Ton	$2,550.00
	Underground Wire	EB Plastic Conduit Removal, 4 @ 6" dia	02 41 13.56 1900	9.15	LF	900												900	LF	$8,235.00
	Aerial Wire	Electrical demo, #2 wire, from conduit	23 05 05.10 1900	30.50	CLF	500							0.2009			Lb/ft		500	LF	$15,250.00
	Chain Link Fence	Chain link, 8'-10' high, Posts & fabric, Remove	02 41 13.60 1700	4.23	LF	120							0.71			Lb/SF		120	LF	$508.00
	Load Steel	12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500.00	Day													0.5	Day	$750.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													13	Ton	$130.00
	Subtotal																			**$33,798.00**
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	25	21	0.67		525	352					FT	1.3	683	CY	$785.45
	Concrete's Vol. Demolished																1.3	17	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													17	CY	$36.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													17	CY	$62.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													17	CY	$208.00
	Subtotal																			**$1,091.45**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$34,889.45

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
06	**Power Poles 06**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Remove Wire	Electrical demo, #2 wire, from conduit	23 05 05.10 1900	30.50	CLF	180												180	CLF	$5,490.00
	Remove Conduit	Electrical demo, Steel Conduit, 4" to 6" dia	26 05 05.10 0160	9.15	LF	100												100	LF	$915.00
	Remove Poles	Utility Pole demo, wood, 20'-30' high	02 41 13.80 0100	340	EA										5	EA		5	EA	$1,700.00
	Disposal Costs - Wire and Conduit	Haul and dispose of steel	Scamp (2020 bid)	10	Ton							1				Ton		1	Ton	$10.00
	Disposal Costs - Utility Poles	On Site Disposal	02 41 16.17 4200	12.25	CY			25	1	0.79	19.75				5	EA	1.3	4.75	CY	$58.19
	Subtotal																			**$8,173.19**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$8,173.19

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost	
07	**Underground Bathhouse 07**																				
	Structure's Demolition Cost																				
	Structure's Vol. Demolished																				
	Rubble's Weight (exclude steel)	**FACILITY ALREADY RECLAIMED AND PORTAL SEALED**																			
	Truck's Capacity																				
	Haulage																				
	Transportation Cost Non Steel Truck																				
	Transportation Cost Non Steel Drive																				
	Disposal Cost Non Steel																				
	Steel's Weight																				
	Truck's Capacity																				
	Haulage																				
	Transportation Cost Steel Truck																				
	Transportation Cost Steel Truck Drive																				
	Disposal Cost Steel																				
	Subtotal																			**$0.00**	
	Equipment 's Disposal Cost																				
	Dismantling Cost																				
	Equipment 's Vol. Demolished																				
	Loading Costs																				
	Transport Costs																				
	Disposal Costs																				
	Subtotal																				
	Concrete Demolition																				
	Demolition Cost																				
	Concrete's Vol. Demolished																				
	Loading Cost																				
	Transportation Cost																				
	Disposal Costs																				
	Subtotal																			**$0.00**	
	Concrete Demolition																				
	Demolition Cost																				
	Concrete's Vol. Demolished																				
	Loading Cost																				
	Transportation Cost																				
	Disposal Costs																				
	Subtotal																				
	Total																			$0.00	

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
08	**Portals 08**																			
	Portal sealing preparation																			$0.00
	Construct block seals (2 each portal)	**PORTALS ALREADY SEALED**																		$0.00
		SEE EARTHWORK SPREADSHEET FOR BACKFILL COSTS																		
	Subtotal																			**$0.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
10	**Screening/Crushing Building 10**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	36	20	45										32400	CF	$11,988.00
	Structure's Vol. Demolished																0.35	420	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													420	CY	$898.80
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton								10			Lb/SF		29	Tons	$290.00
	Subtotal																			**$13,176.80**
	Equipment 's Disposal Cost	Mechanical equipment demo, heavy	23 05 05.10 3600	1275.00	Ton							3				Tons		3	Tons	$3,825.00
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Load Steel	12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500.00	Day													0.25	Day	$375.00
	Disposal Costs	Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton													3	Tons	$30.00
	Subtotal																			**$4,230.00**
	Concrete Floor Demolition																			
	Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	59	27	2										118	CY	$20,768.00
	Concrete's Vol. Demolished																1.3	153	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													153	CY	$327.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1025	12.65	CY													153	CY	$1,935.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													153	CY	$1,874.00
	Subtotal																			**$24,904.00**
	Concrete Pony Wall Demolition																			
	Demolition Cost	Wall demo, 8" Concrete, Reinforced (+10%)	02 41 16.17 2420	1.16	SF	137	0.67	2.5										343	SF	$398.00
	Concrete's Vol. Demolished																	8	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY												1.3	10	CY	$21.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1025	12.65	CY													10	CY	$127.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													10	CY	$123.00
	Subtotal																			**$669.00**
	Total																			$42,979.80

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
11	**North Portals Mine Belt 11**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	30	30	10										9000	CF	$3,330.00
	Structure's Vol. Demolished																0.35	117	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													117	CY	$250.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								10			Lb/SF		11	Tons	$110.00
	Subtotal																			**$3,690.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost	Mechanical equipment demo, heavy	23 05 05.10 3600	1275.00	Ton							2.5				ton		3	ton	$3,825.00
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$3,825.00**
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	30	30	0.5								FT		450	SF	$518.00
	Concrete's Vol. Demolished																1.3	22	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													22	CY	$47.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													22	CY	$80.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													22	CY	$270.00
	Subtotal																			**$915.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$8,430.00

Notes: See Plate 5-3 for surface facilities details. Cost is per ton so must be rounded up

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
13	**Stacking Tube 13**																			
	Head House Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	18	16	12.5								FT		3600	CF	$1,332.00
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY												0.35	47	CY	$101.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								10			Lb/SF		6	Tons	$60.00
	MCC Building Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	16	11	10								FT		1760	CF	$651.00
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY												0.35	23	CY	$49.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton								10			Lb/SF		4	Tons	$40.00
	Subtotal																			**$2,233.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost	Mechanical equipment demo, heavy	23 05 05.10 3600	1275.00	Ton							20				Tons		20	Tons	$25,500.00
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Load Steel	12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500	Day													1	Day	$1,500.00
	Disposal Costs	Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton													20	Tons	$200.00
	Subtotal																			**$27,200.00**
	MCC Building Concrete Demolition																			
	Floor Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	160	20	0.5										3200	SF	$3,680.00
	Concrete's Vol. Demolished																1.3	77	CY	
	Pony Wall Demolition Cost	Wall demo, 8" Concrete, Reinforced (+10%)	02 41 16.17 2420	1.16	SF	50	2	0.5										100	SF	$116.00
	Concrete's Vol. Demolished																1.3	2	CY	
	Transformer Pad Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176	CY	13	12	1										6	CY	$1,056.00
	Concrete's Vol. Demolished																1.3	8	CY	
	Stacking Tube Foundation Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176	CY	22	16	3										39	CY	$6,864.00
	Concrete's Vol. Demolished																1.3	51	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													138	CY	$295.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													138	CY	$501.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													138	CY	$1,691.00
	Subtotal																			**$14,203.00**
	Stacking Tube Concrete Demolition																			
	Demolition Cost	Bldg demo, Concrete, Large project	02 41 16.13 0050	0.52	CF	81	1		12									9161	CF	$4,764.00
	Concrete's Vol. Demolished																0.35	339	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													339		$725.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													339		$1,231.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													339		$4,153.00
	Subtotal																			**$10,873.00**
	Total																			$54,509.00

Notes: See Plate 5-3 for surface facilities details. Volume of building is reduced by 65% due to no interior walls or insulation.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
14	**Scale House 14**																			
	Structure's Demolition Cost	**THIS STRUCTURE HAS BEEN REMOVED**																		
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details. Volume of building is reduced by 65% due to no interior walls or insulation.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
15	**Water Treatment Plant 15**																			
	Structure's Demolition Cost	Bldg demo, Mixture of Types, Large project	02 41 16.13 0100	0.39	CF	55	20	10										11000	CF	$4,290.00
	Structure's Vol. Demolished																0.35	143		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													143	CY	$306.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								10			Lb/SF		1	SF	$10.00
	Subtotal																			**$4,606.00**
	Tank																			
	Removal Cost	Tank removal, single wall, 550 thru 2,000 gallon	13 05 05.75 0520	1600.00	EA													4	EA	$6,400.00
	Transport Costs	Haul tank to certified dump, 100 mi RT, 500 gal	02 65 10.30 1243	850	EA													4	EA	$3,400.00
	Subtotal																			**$9,800.00**
	Slab																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	75	20	0.5		1500								1500	SF	$1,725.00
	Concrete's Vol. Demolished																1.3	36	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													36	CY	$77.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													36	CY	$131.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													36	CY	$441.00
	Subtotal																			**$2,374.00**
	Footings																			
	Concrete Demolition																			
	Demolition Cost	Footings demo, Concrete 1' thick 2' wide	02 41 16.17 1000	12.30	LF	150	2	1										150	LF	$1,845.00
	Concrete's Vol. Demolished																1.3	14	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													14	CY	$30.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													14	CY	$51.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													14	CY	$172.00
	Subtotal																			**$2,098.00**
	Retaining Wall																			
	Concrete Demolition																			
	Demolition Cost	Wall demo, 8" Concrete, Reinforced (+10%)	02 41 16.17 2420	1.16	SF	20	0.67	6										120	SF	$139.00
	Concrete's Vol. Demolished																1.3	4	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													4	CY	$9.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													4	CY	$15.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													4	CY	$49.00
	Subtotal																			**$212.00**
	Total																			$19,090.00

Notes: See Plate 5-3 for surface facilities details. Volume of building is reduced by 65% due to no interior walls or insulation.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
17	**Truck Loadout Ramp 17**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF				0.5	2500						CF		2500	SF	$2,875.00
	Concrete's Vol. Demolished																1.3	60	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													60	CY	$128.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													60	CY	$218.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													60	CY	$735.00
	Subtotal																			**$3,956.00**
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$3,956.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
18	**Parts Shed 18**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	20	60	23								FT		27600	CF	$10,212.00
	Structure's Vol. Demolished																0.35	358	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													358	CY	$766.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								10			Lb/SF		24	Tons	$240.00
	Subtotal																			**$11,218.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$11,218.00

Notes: See Plate 5-3 for surface facilities details. Volume of building is reduced by 65% due to no interior walls or insulation.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
19	**Reclaim Tunnel 19**																			
	Escape Tunnel Removal																			
	Backfill Excavation	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	182	7	10								FT		472	CY	$807.00
	Tunnel Demolition	Steel CMP demo, 48"-60" diameter	02 41 13.40 0190	22.5	LF				3.5									182	LF	$4,095.00
	Tunnel Weight												57			Lb/FT		5	Tons	
	Crushed Steel Volume																0.35	91	CY	
	Reclaim Tunnel Removal																			
	Backfill Excavation	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	182	16	10								FT		1079	CY	$1,845.00
	Tunnel Demolition	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF				12							FT		20584	CF	$7,616.00
	Tunnel Weight												530			Lb/FT		48	Tons	
	Crushed Steel Volume																0.35	1067	CY	
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													1158	CY	$2,478.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													53	Tons	$530.00
	Subtotal																			**$17,371.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost	Mechanical equipment demo, heavy	23 05 05.10 3600	1275	Ton							5				Tons		5	Tons	$6,375.00
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Load Steel	12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500.00	Day													0.25	Day	$375.00
	Disposal Costs	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													5	Tons	$50.00
	Subtotal																			**$6,800.00**
	Concrete Floor Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	182	9	0.5								FT		1638	SF	$1,884.00
	Concrete's Vol. Demolished																1.3	39	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													39	CY	$83.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													39	CY	$142.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													39	CY	$478.00
	Subtotal																			**$2,587.00**
	Concrete Headwall Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$26,758.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
20	**Visual Disconnect 20**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost	**EQUIPMENT HAS BEEN MOVED TO LILA CANYON MINE**																		
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	4	6	0.5										24	SF	$28.00
	Concrete's Vol. Demolished																1.3	1	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													1	CY	$2.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													1	CY	$4.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													1	CY	$12.00
	Subtotal																			**$46.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$46.00

Notes: See Plate 5-3 for surface facilities details. Amendment to 2015 midterm states equipment was moved to Lila Canyon Mine, pad remains on site

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
21	**New Shop 21**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	**NOT CONSTRUCTED**																		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$0.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details. Volume of building is reduced by 65% due to no interior walls or insulation.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
22	**Shop Extension 22**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	20	30	20								FT		12000	CF	$4,440.00
	Structure's Vol. Demolished																0.35	156	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													156	CY	$334.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								10			Lb/SF		13	ton	$130.00
	Subtotal																			**$4,904.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 6" Concrete, Wire Reinforced	02 41 16.17 0420	1.15	SF	20	30	0.5										600	SF	$690.00
	Concrete's Vol. Demolished																1.3	14	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													14	CY	$30.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													14	CY	$51.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													14	CY	$172.00
	Subtotal																			**$943.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$5,847.00

Notes: See Plate 5-3 for surface facilities details. Volume of building is reduced by 65% due to no interior walls or insulation.

Ref.	Description	Materials	Means Reference	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
23	**Shotcrete Slopes 23**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Floor demo, 4" Concrete, Wire Reinforced	02 41 16.17 0280	0.92	SF			0.25		5000								5000	SF	$4,600.00
	Concrete's Vol. Demolished																1.3	46	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													46	CY	$98.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													46	CY	$167.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													46	CY	$564.00
	Subtotal																			**$5,429.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$5,429.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
24	**Fan Transfomer 24**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	**TRANSFORMER HAS BEEN REMOVED**																		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
25	**Chain Link Fence 25**																			
	Structure's Demolition Cost	Chain link, 8'-10' high, Posts & fabric, Remove	02 41 13.60 1700	4.23	LF	120				1200								120	LF	$508.00
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													2	CY	$4.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								0.71			Lb/SF		0.4	Ton	$4.00
	Subtotal																			**$516.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$516.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
26	**Concrete Guard 26**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Wall demo, 8" Concrete, Reinforced (+10%)	02 41 16.17 2420	1.16	SF	250	0.67	4								FT		1000	SF	$1,160.00
	Concrete's Vol. Demolished																1.3	32	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													32	CY	$68.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													32	CY	$116.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													32	CY	$392.00
	Subtotal																			**$1,736.00**
	Total																			$1,736.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
27	**Retaining Wall 27**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Wall demo, 12" Concrete, Reinforced (+10%)	02 41 16.17 2500	1.63	SF	530	1	3										1590	SF	$2,592.00
	Concrete's Vol. Demolished																1.3	77	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													77	CY	$165.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													77	CY	$280.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													77	CY	$943.00
	Subtotal																			**$3,980.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$3,980.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
28	**Culverts 28**																			
	Culvert Backfill Excavation Cost																			
	12" CMP (UD-3, C3, C5, C6, C7, C9, C14)	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	320	1	2										24	CY	$41.00
	18" CMP (C1, C11, C11A, C17)	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	210	1.5	3										35	CY	$60.00
	24" CMP (C3, C4, C12, C13, C-16)	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	899	2	4										266	CY	$455.00
	42" CMP (UD-1)	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	270	3.5	7										245	CY	$419.00
	72" CMP (Main Canyon Culvert)	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	1300	6	12										3467	CY	$5,929.00
	Subtotal																			**$6,904.00**
	Culvert Removal Cost																			
	12" CMP (UD-3, C3, C5, C6, C7, C9, C14)	Steel CMP demo, 12" diameter	02 41 13.40 0150	2.40	LF	320							10	Lb/FT				320	LF	$768.00
	12" CMP Crushed Volume								1								0.35	3	CY	
	18" CMP (C1, C11, C11A, C17)	Steel CMP demo, 18" diameter	02 41 13.40 0160	3.60	LF	210							15	Lb/FT				210	LF	$756.00
	18" CMP Crushed Volume								1.5								0.35	5	CY	
	24" CMP (C3, C4, C12, C13, C-16)	Steel CMP demo, 24" diameter	02 41 13.40 0170	15.05	LF	899							19	Lb/FT				899	LF	$13,530.00
	24" CMP Crushed Volume								2								0.35	37	CY	
	42" CMP (UD-1)	Steel CMP demo, 48"-60" diameter	02 41 13.40 0190	22.50	LF	270							57	Lb/FT				270	LF	$6,075.00
	42" CMP Crushed Volume								3.5								0.35	34	CY	
	72" CMP (Main Canyon Culvert)	Steel CMP demo, 72" diameter	02 41 13.40 0200	49.50	LF	1300							149	Lb/FT				1300	LF	$64,350.00
	72" CMP Crushed Volume								6								0.35	476	CY	
	Main Canyon inlet structure	Steel CMP end section demo, 72" diam.	02 41 13.40 0250	495.00	EA	1												1	EA	$495.00
	Subtotal																			**$85,974.00**
	Culvert Disposal Cost																			
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													555	CY	$1,188.00
	Transportation Cost																			
	Disposal Costs	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													116	Tons	$1,160.00
	Subtotal																			**$2,348.00**
	Total																			$95,226.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
29	**Guard Rail 29**																			
	Structure's Demolition Cost	Guard Rail Removal	02 41 13.30 0800	24.00	LF	120										LF		120	LF	$2,880.00
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													10	CY	$21.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								7.28			Lb/FT		0.4	Ton	$4.00
	Subtotal																			**$2,905.00**
	Equipment 's Disposal Cost																			
	Remove Rails																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$2,905.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
30	**Sed Pond Inlets 30**																			
	Structure's Demolition Cost	Steel CMP demo, 24" diameter	02 41 13.40 0170	15.05	LF	10												10	LF	$151.00
	Structure's Vol. Demolished								2								0.35	0.4	CY	$0.00
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													0.4	CY	$1.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								19			Lb/FT		0.1	Ton	$1.00
	Subtotal																			**$153.00**
	Walkway Removal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	16	4	0.5								FT		32	CF	$12.00
	Equipment 's Vol. Demolished																1.3	2	CY	
	Loading Costs																			
	Transport Costs	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													2	CY	$4.00
	Disposal Costs	Haul and dispose of steel	Scamp (2020 bid)	10.00	Ton													0.1	Ton	$1.00
	Subtotal																			**$17.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Total																			$170.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
31	**Sed Pond Outlet 31**																			
	Excavate Cover Over Culvert	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	110	2	4										33	CY	$56.00
	Remove Culvert	Steel CMP demo, 18" diameter	02 41 13.40 0160	3.60	LF	110												110	LF	$396.00
	Culvert Crushed Volume								1.5								0.35	3	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													3	CY	$6.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton								15			Lb/FT		0.8	Ton	$8.00
	Subtotal																			**$466.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$466.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
32	**Gabion Retaining Wall 32**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Gabion Wall Demolition																			
	Demolition Cost	Gabion wall demo, 6'x3'x3'	01 41 13.90 1500	181.00	EA										37	EA		37	EA	$6,697.00
	Concrete's Vol. Demolished																			
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													74	CY	$158.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													74	CY	$269.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													74	CY	$907.00
	Subtotal																			**$8,031.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$8,031.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
33	**Water Wells 33**																			
	Structure's Demolition Cost	**NO WELLS ON THE SURFACE**																		
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
35	**Stacking Conveyor Supports 35**																			
	Structure's Demolition Cost - TB-01	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			618					2	EA		1236	CF	$457.00
	Structure's Vol. Demolished - TB-01																1	46	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Steel's Weight - Support Members					248							67			Lb/FT		8	Ton	
	Steel's Weight - Bracing Members					528							4.1			Lb/FT		1	Ton	
	Transportation Cost Steel Truck																			
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													46	CY	$98.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													9	Ton	$90.00
	Subtotal																			**$645.00**
	Concrete Demolition																			
	Footing F1 Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	13	3	2							1	EA		3	CY	$528.00
	Concrete's Vol. Demolished																1.3	4	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													4	CY	$9.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													4	CY	$15.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													4	CY	$49.00
	Subtotal																			**$601.00**
	Concrete Demolition																			
	Footing C1 Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY			21	3						2	EA		11	CY	$1,936.00
	Concrete's Vol. Demolished																1.3	14	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													14	CY	$30.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													14	CY	$51.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													14	CY	$172.00
	Subtotal																			**$2,189.00**
	Concrete Demolition																			
	Footing C2 Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY			26	3						2	EA		14	CY	$2,464.00
	Concrete's Vol. Demolished																1.3	18	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													18	CY	$39.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													18	CY	$65.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													18	CY	$221.00
	Subtotal																			**$2,789.00**
	Total																			$6,224.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
36	**Reclaim Tunnel 36**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Concrete Demolition - Roof																			
	Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	65.5	16	4.5										175	SF	$30,800.00
	Concrete's Vol. Demolished																1.3	228	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													228	CY	$488.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													228	CY	$828.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													228	CY	$2,793.00
	Subtotal																			**$34,909.00**
	Concrete Demolition - Floor																			
	Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	65.5	16	3										116	SF	$20,416.00
	Concrete's Vol. Demolished																1.3	151	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													151	CY	$323.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													151	CY	$548.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													151	CY	$1,850.00
	Subtotal																			**$23,137.00**
	Concrete Demolition - Headwall and Wingwalls																			
	Demolition Cost	Wall demo, 12" Concrete, Reinforced (+10%)	02 41 16.17 2500	1.63	SF			1		972						SF		972	SF	$1,584.00
	Concrete's Vol. Demolished																1.3	47	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													47	CY	$101.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													47	CY	$171.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													47	CY	$576.00
	Subtotal																			**$2,432.00**
	Total																			$60,478.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
37	**Feeder Boxes 37**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	**NOT CONSTRUCTED**																		
	Rubble's Weight (exclude steel)																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$0.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
38	**Reclaim Conveyor Supports 38**																			
	Structure's Demolition Cost - TB-01	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			52					1	EA		52	CF	$19.00
	Structure's Vol. Demolished - TB-01																1	2	CY	
	Structure's Demolition Cost - TB-02	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			136					1	EA		136	CF	$50.00
	Structure's Vol. Demolished - TB-02																1	5	CY	
	Structure's Demolition Cost - All SBs	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			646								646	CF	$239.00
	Structure's Vol. Demolished - All SBs																1	24	CY	
	Steel Weight - Truss Bent Support Mbrs																	0.7	Ton	
	Steel Weight - Truss Bent Bracing Mbrs																	0.3	Ton	
	Steel's Weight - Stinger Bent Support Mbrs					152							11.5			Lb/FT		0.9	Ton	
	Steel's Weight - Stringer Bent Grip Struts					162							5.4			Lb/FT		0.4	Ton	
	Steel's Weight - Stringer Bent Bracing Mbrs					228							5.4			Lb/FT		0.6	Ton	
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													31	CY	$66.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													2.9	Ton	$29.00
	Subtotal																			**$403.00**
	Concrete Demolition																			
	Foundation F2 Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	8.5	3	1							4	EA		4	CY	$704.00
	Concrete's Vol. Demolished																1.3	5	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													5	CY	$11.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													5	CY	$18.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													5	CY	$61.00
	Subtotal																			**$794.00**
	Concrete Demolition																			
	Foundation F3 Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	14	10	1.5							1	EA		8	CY	$1,408.00
	Concrete's Vol. Demolished																1.3	10	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													10	CY	$21.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													10	CY	$36.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													10	CY	$123.00
	Subtotal																			**$1,588.00**
	Concrete Demolition																			
	Foundation F4 Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	14	6	1.5							1	EA		5	CY	$880.00
	Concrete's Vol. Demolished																1.3	7	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													7	CY	$15.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													7	CY	$25.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													7	CY	$86.00
	Subtotal																			**$1,006.00**
	Total																			$3,791.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
39	**Crusher Platform and Supports 39**																			
	Structure's Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	22	24	1										528	CF	$195.00
	Structure's Vol. Demolished																1	20	CY	
	Steel Weight:																			
	W8x24					75							24			Lb/FT		0.9	Ton	
	W10x22					22							22			Lb/FT		0.2	Ton	
	W12x22					34							22			Lb/FT		0.4	Ton	
	W12x26					24							26			Lb/FT		0.3	Ton	
	W24x55					22							55			Lb/FT		0.6	Ton	
	W24x68					22							68			Lb/FT		0.7	Ton	
	W24x131					22							131			Lb/FT		1.4	Ton	
	Transportation Cost Steel Truck Drive	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													20	CY	$43.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													4.5	Ton	$45.00
	Subtotal																			**$283.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	1.5	1.5	2							12	EA		2	CY	$352.00
	Concrete's Vol. Demolished																1.3	3	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													3	CY	$6.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													3	CY	$11.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													3	CY	$37.00
	Subtotal																			**$406.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Total																			$689.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
40	**Feeder Conveyor Supports 40**																			
	Structure's Demolition Cost - TB-01	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			38					1	EA		38	CF	$14.00
	Structure's Vol. Demolished - TB-01																1	1	CY	
	Structure's Demolition Cost - TB-02	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			230					1	EA		230	CF	$85.00
	Structure's Vol. Demolished - TB-02																1	9	CY	
	Structure's Demolition Cost - TB-03	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			370					1	EA		370	CF	$137.00
	Structure's Vol. Demolished - TB-03																1	14	CY	
	Structure's Demolition Cost - SB-01	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF		1			70					1	EA		70	CF	$26.00
	Structure's Vol. Demolished - SB-01																1	3	CY	
	Steel Weight - Support Members																	4	Ton	
	Steel Weight - Bracing/Gripstrut Mbrs																	1	Ton	
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													27	CY	$58.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													5	Ton	$50.00
	Subtotal																			**$370.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	23.5	8	1.5							1	EA		10	CY	$1,760.00
	Concrete's Vol. Demolished																1.3	13	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													13	CY	$28.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													13	CY	$47.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													13	CY	$159.00
	Subtotal																			**$1,994.00**
	Concrete Demolition																			
	Demolition Cost	Concrete demo, 7" to 24" thick, Reinforced	02 41 13.17 5500	176.00	CY	25	8	1.5							1	EA		11	CY	$1,936.00
	Concrete's Vol. Demolished																1.3	14	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													14	CY	$30.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													14	CY	$51.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													14	CY	$172.00
	Subtotal																			**$2,189.00**
	Total																			$4,553.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
41	**Scale Pads 41**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	**SCALE PADS HAVE BEEN REMOVED.**																		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
42	**New Scale House 42**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	NOT CONSTRUCTED																		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$0.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
43	**Proposed Bathhouse 43**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	**NOT CONSTRUCTED**																		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
44	**Coal Silo 44**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished	**STRUCTURE HAS BEEN REMOVED.**																		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$0.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$0.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
45	**Conveyors 45**																			
	Stacking Conveyor Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	394	4	8.67								FT		13664	CF	$5,056.00
	Structure's Vol. Demolished																0.35	177	CY	
	Loadout Conveyor Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	308	4	8.67								FT		10681	CF	$3,952.00
	Structure's Vol. Demolished																0.35	138	CY	
	Reclaim Conveyor Demolition Cost	Bldg. demo, Steel, Large project	02 41 16.13 0020	0.37	CF	434	4.5	8.67								FT		16933	CF	$6,265.00
																	0.35	220	CY	
	Steel Weight - Stacking Conveyor											20590				Lb		10	Tons	
	Steel Weight - Loadout Conveyor											19925				Lb		10	Tons	
	Steel Weight - Reclaim Conveyor											21150				Lb		11	Tons	
	Load Steel	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													535	CY	$1,145.00
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													31	Tons	$310.00
	Subtotal																			**$16,728.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$16,728.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
46	**Road & Parking Lot Reclamation 46**																			
	Parking Area at Shop																			
	Demolition Cost	Pavement Removal, Bituminous, up to 3" thick	02 41 13.17 5010	6.10	SY					16390						SY		1821	SY	$11,108.00
	Asphalt Vol. Demolished							0.25								FT	1.3	197	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													197	CY	$422.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													197	CY	$715.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													197	CY	$2,413.00
	Subtotal																			**$14,658.00**
	North Portal Road																			
	Demolition Cost	Pavement Removal, Bituminous, up to 3" thick	02 41 13.17 5010	6.10	SY					7659						SY		851	SY	$5,191.00
	Asphalt Vol. Demolished							0.25								ST	1.3	92	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													92	CY	$197.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													92	CY	$334.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													92	CY	$1,127.00
	Subtotal																			**$6,849.00**
	Main Canyon Road																			
	Demolition Cost	Pavement Removal, Bituminous, up to 3" thick	02 41 13.17 5010	6.10	SY					206925						SY		22992	SY	$140,251.00
	Asphalt Vol. Demolished							0.25								FT	1.3	2491	CY	
	Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													2491	CY	$5,331.00
	Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY													2491	CY	$9,042.00
	Disposal Costs	On Site Disposal	02 41 16.17 4200	12.25	CY													2491	CY	$30,515.00
	Subtotal																			**$185,139.00**
	Remove and Replace Roadbase on Main Road																			
	Grade excess road base	Excavating, bulk, dozer, 700 HP. 50' haul, sand & gravel	31 23 16.46 6000	1.88	CY	7510	7	0.67										1305	CY	$2,453.00
	Water truck	Truck and water tank trailer, 5000 gal	Crew B-9A	2113.99	Day													1	Day	$2,114.00
	Compact on existing road base	Compaction, riding vibrating roller, 6" lifts, 3 passes	31 23 23.23 5020	0.69	CY	7510	14	0.33										1285	CY	$887.00
	Subtotal																			**$5,454.00**
	Total																			$206,646.00

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
48	**Main Cyn Culvert Liner & Bedding 48**																			
	Lower Geotextile Removal Cost	Selective demo, chain link fence, 12' high	02 41 13.62 0675	4.70	LF	1300												1300	LF	$6,110.00
	Upper Geotextile Removal Cost	Selective demo, chain link fence, 12' high	02 41 13.62 0675	4.70	LF	1300												1300	LF	$6,110.00
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Geotextile Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													500	CY	$1,070.00
	Geotextile Transportation Cost	Hauling, 20 CY truck, 15 min wait, 50 mph,	31 23 23.20 4114	10.80	CY													500	CY	$5,400.00
	Geotextile Disposal Cost	Landfill charge, typ tipping fee, construction	02 41 19.20 0100	81.00	Ton	2600	13.5						4			oz/SY		0.5		$41.00
	Subtotal																			**$18,731.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Underdrain Sand Beneath Main Canyon Culvert																			
	Demolition Cost	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	1300	12	2										1156	CY	$1,977.00
	Concrete's Vol. Demolished																1.3	1503	CY	
	Grade into Local Fill	Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY													1503	CY	$1,879.00
	Subtotal																			**$3,856.00**
	Bed Sand Beneath Main Canyon Culvert																			
	Demolition Cost	Trackhoe, 2 CY capacity	31 23 16.42 0260	1.71	CY	1300	15	4										2889	CY	$4,940.00
	Concrete's Vol. Demolished																1.3	3756	CY	
	Grade into Local Fill	Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY													3756	CY	$4,695.00
	Subtotal																			**$9,635.00**
	xxxxx																			
	Total																			$32,222.00

Notes: See Plate 5-3 for surface facilities details.

Title: **New UPDES Discharge Line 49**
Project: Pipeline to Relocate UPDES Outfall #2, Crandall Canyon Mine
Project #: C-06-05
Estimator: R.B. White
Date: 5-Mar-2020
Costs: Means 2020 Site Work and Landscape Cost Data except as noted
Unit costs include overhead and profit.

CONSTRUCTION COST ESTIMATE

Item No.	Task	Means Description	Means No./Source	Unit Price	Units	Est. Quan.	Total Price
Initial Pipeline Installation							
	Initial connection to existing discharge pipe - Material	8" dia flange adapter w/ backup ring, DR 11	22 11 13.78 1040	65.50	EA	1	66
	Initial connection to existing discharge pipe - Labor	Welding labor, 8" dia HDPE	22 11 13.78 4090	69.00	EA	1	69
	Cut asphalt for pipe installation	Saw cutting, asphalt, 3" deep plus 1"	02 41 19.25 0015/20	3.81	LF	1,000	3,810
	Install 8" dia HDPE to Huntington Creek	8" dia HDPE SDR 21, fusion welded, 6' deep	G3010 124 6510	79.50	LF	6,550	520,725
	Install manholes	Concrete manhole, precast, 4' ID riser, 6' deep	G3030 210 5840	4,275.00	EA	2	8,550
	Poured concrete manhole inverts	Catch basin invert, concrete	33 42 33.13 3500	365.00	EA	2	730
	Manhole sidewall cutouts for pipe	Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59.00	CF	6	354
	Seal pipe at manhole edges	Grout, C476, for concrete masonry unit core	04 05 16.30 2000	13.00	CF	3	39
	Repair asphalt edge	Asphalt paving, wearing course, 4" thick	32 12 16.13 0480	20.50	SY	500	10,250
	Purchase and load granular fill	Borrow & loading, 5 CY FE loader, wheel mntd	31 23 23.15 5080	27.50	CY	100	2,750
	Haul granular fill	Hauling, 12 CY truck, 45 mph, 20 mi cycle	31 23 23.20 1098	9.20	CY	100	920
	Re-establish roadway shoulder	Gravel backfill, 80 HP, comp 6" lifts, 300' haul	G1030 205 1400	6.80	CY	100	680
	Load riprap	Borrow & loading, 5 CY FE loader, wheel mntd	31 23 23.15 5080	27.50	CY	1,000	27,500
	Haul riprap	Hauling, 12 CY truck, 45 mph, 20 mi cycle	31 23 23.20 1098	9.20	CY	1,000	9,200
	Install riprap ditch over pipe	Riprap, dumped, 50 lb avg per stone	31 37 13.10 0300	35.00	Ton	2,000	70,000
Initial Pipeline Construction Subtotal							655,643
Energy Dissipator Installation							
	Excavate soil for dissipator	Structural excavation, sandy clay, 1 CY bucket	31 23 16.16 6240	18.00	CY	50	900
	Install crushed stone base	Crushed stone borrow, 3/4"	31 05 16.10 0320	39.00	CY	2.3	90
	Install dissipator floor	Concrete in place, strip footing, reinf, 12" thick	03 30 53.40 3950	320.00	CY	2.3	736
	Install energy dissipator walls	Concrete wall, free-standing, 12" thick, 8' high	03 30 53.40 4260	450.00	CY	6.3	2,835
	Install energy dissipator roof	Concrete in place, beam, 5 kg/LF, 10' span	03 30 53.40 0300	1,450.00	CY	2.3	3,335
	Manhole cover cutout	Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59.00	CF	5.0	295
	Manhole cover	Catch basin frames and covers, 30" to 36" dia	33 42 33.13 3380	315.00	EA	1	315
	Sidewall cutouts for pipe	Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59.00	CF	2.0	118
	Seal pipe at dissipator edges	Grout, C476, for concrete masonry unit core	04 05 16.30 2000	13.00	CF	1.5	20
	Entry steps	Steps, heavyweight cast iron, 7"x9"	33 05 61.10 3800	35.50	EA	6	213
	Backfill excavated soil	Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY	50	63
	Compact backfilled soil	Walk-behind roller compactor, 6" lifts	31 23 23.13 0400	11.15	CY	50	558
Energy Dissipator Construction Subtotal							9,478
Metering Manhole Installation							
	Excavate soil for metering manhole	Structural excavation, sandy clay, 1 CY bucket	31 23 16.16 6240	18.00	CY	50	900
	Install crushed stone base	Crushed stone borrow, 3/4"	31 05 16.10 0320	39.00	CY	2.4	94
	Install concrete pad	Concrete in place, slab on grade, 6" thick, reinf	03 30 53.40 4700	230.00	CY	1.2	276
	Purchase packaged metering manhole	Fiberglass, 6" Parshall flume, staff gauge	OpenChannelFlow.com	15,993.00	EA	1	15,993
	Ship packaged metering manhole	Percent of purchase price	Estimate	10.00	%	1	1,599
	Install packaged metering manhole	2 laborers, 1 truck driver, 1 flatbed truck	Crew A-2	1,794.17	Day	0.5	897
	Backfill excavated soil	Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY	50	63
	Compact backfilled soil	Walk-behind roller compactor, 6" lifts	31 23 23.13 0400	11.15	CY	50	558
Metering Manhole Construction Subtotal							20,380
Install Waterway Downstream from Metering Manhole							
	Load riprap	Borrow & loading, 5 CY FE loader, wheel mntd	31 23 23.15 5080	27.50	CY	3	83
	Haul riprap	Hauling, 12 CY truck, 45 mph, 20 mi cycle	31 23 23.20 1098	9.20	CY	3	28
	Install riprap in waterway	Riprap, dumped, 50 lb avg per stone	31 37 13.10 0300	35.00	Ton	6	210
Downstream Waterway Construction Subtotal							321
Install Final Reclamation Piping at North Portals							
	Load drain rock	Excavating, 5 CY FE loader, wheel mntd	31 23 16.42 1650	1.34	CY	2,260	3,028
	Haul riprap	Hauling, 12 CY truck, 45 mph, 20 mi cycle	31 23 23.20 1098	9.20	CY	2,260	20,792
	Install drain rock	Gravel backfill, 80 HP, comp 6" lifts, 50' haul	G1030 205 1050	5.80	CY	2,260	13,108
	Purchase 6" HDPE	HDPE pipe, 6" diameter, DR 17	22 11 13.78 0086	6.90	LF	614	4,237
	Purchase 4" HDPE	HDPE pipe, 4" diameter, DR 17	22 11 13.78 0078	4.21	LF	46	194
	Weld 6" HDPE joints	Welding labor, 6" dia HDPE	22 11 13.78 4080	52.50	EA	18	945
	Weld 4" HDPE joints	Welding labor, 4" dia HDPE	22 11 13.78 4070	52.50	EA	4	210
	Cut slots in HDPE pipe	1 building laborer with concrete saw	Crew A-1B	628.65	Day	1	629
	Install 6" dia HDPE pipeline extension	6" dia HDPE SDR 21, fusion welded, 4' deep	G3010 124 2300	32.90	LF	130	4,277
Final Reclamation Piping Construction Subtotal							47,420
TOTAL ESTIMATED ***CONSTRUCTION*** COST							**733,242**

OPERATION AND MAINTENANCE COST ESTIMATE

The pipe will be constructed using 8-inch diameter DR17 HDPE with a pressure rating of 125 psi. However, the pipe will not flow full. Therefore, it is assumed that the pipe will not operate under pressure.

Burns et al (2005) present the results of an analysis of failure rates of 8-inch diameter Class 150 PVC in the USA. The lowest operating pressure that they evaluated was 105 psi. At this pressure, a failure rate of approximately 1 failure/100 km/yr was reported with pipe having an age of 100 years. At this rate, the 6550 ft (2 km) long Crandall Canyon pipeline would experience 0.02 failures within 100 years.

Assume: 1 pipe failure (20 ft)
2 manhole replacements
1 energy dissipator replacement
1 metering manhole replacement

Item No.	Task	Means Description	Means No./Source	Unit Price	Units	Est. Quan.	Total Price
Pipeline Replacement							
	Pipeline installation	8" dia HDPE SDR 21, fusion welded, 6' deep	G3010 124 6510	79.5	LF	20	1,590
Manhole Replacement							
	Install manholes	Concrete manhole, precast, 4' ID riser, 6' deep	G3030 210 5840	4275	EA	2	8,550
	Poured concrete manhole inverts	Catch basin invert, concrete	33 42 33.13 3500	365	EA	2	730
	Manhole sidewall cutouts for pipe	Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59	CF	6	354
	Seal pipe at manhole edges	Grout, C476, for concrete masonry unit core	04 05 16.30 2000	13	CF	3	39
Enery Dissipator Replacement							
	Excavate soil for dissipator	Structural excavation, sandy clay, 1 CY bucket	31 23 16.16 6240	18	CY	50	900
	Install crushed stone base	Crushed stone borrow, 3/4"	31 05 16.10 0320	39	CY	2.3	90
	Install dissipator floor	Concrete in place, strip footing, reinf, 12" thick	03 30 53.40 3950	320	CY	2.3	736
	Install energy dissipator walls	Concrete wall, free-standing, 12" thick, 8' high	03 30 53.40 4260	450	CY	6.3	2,835
	Install energy dissipator roof	Concrete in place, beam, 5 kg/LF, 10' span	03 30 53.40 0300	1450	CY	2.3	3,335
	Manhole cover cutout	Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59	CF	5.0	295
	Manhole cover	Catch basin frames and covers, 30" to 36" dia	33 42 33.13 3380	315	EA	1	315
	Sidewall cutouts for pipe	Concrete cutout, wall, reinforced, under 6 CF	02 41 19.16 1400	59	CF	2.0	118
	Seal pipe at dissipator edges	Grout, C476, for concrete masonry unit core	04 05 16.30 2000	13	CF	1.5	20
	Entry steps	Steps, heavyweight cast iron, 7"x9"	33 05 61.10 3800	35.5	EA	6	213
	Backfill excavated soil	Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY	50	63
	Compact backfilled soil	Walk-behind roller compactor, 6" lifts	31 23 23.13 0400	11.15	CY	50	558
Metering Manhole Replacement							
	Excavate soil for metering manhole	Structural excavation, sandy clay, 1 CY bucket	31 23 16.16 6240	18	CY	50	900
	Install crushed stone base	Crushed stone borrow, 3/4"	31 05 16.10 0320	39	CY	2.4	94
	Install concrete pad	Concrete in place, slab on grade, 6" thick, reinf	03 30 53.40 4700	230	CY	1.2	276
	Purchase packaged metering manhole	Fiberglass, 6" Parshall flume, staff gauge	OpenChannelFlow.co	15993	EA	1	15,993
	Ship packaged metering manhole	Percent of purchase price	Estimate	10	%	1	10
	Install packaged metering manhole	2 laborers, 1 truck driver, 1 flatbed truck	Crew A-2	1794.17	Day	0.5	897
	Backfill excavated soil	Backfill, sandy clay, 50' haul, 80 HP dozer	31 23 23.14 2010	1.25	CY	50	63
	Compact backfilled soil	Walk-behind roller compactor, 6" lifts	31 23 23.13 0400	11.15	CY	50	558
TOTAL ESTIMATED ***OPERATION AND MAINTENANCE*** COST							**39,532**
TOTAL UPDES PIPELINE COST (CONSTRUCTION PLUS 100 YEARS O&M)							***772,774***

Ref.	Description See Backfilling and Grading	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Reclamation Ditch Construction 50																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Channel DD-4 Geotextile	Geotextile, nonwoven, 120 lb tensile strengt	31 32 19.16 1550	1.35	SY	168	4									SY		75	SY	$101.00
	Channel DD-4 Riprap	Riprap, dumped, 50 lb avg per stone	31 37 13.10 0300	35.00	Ton								1.5			Ton/CY		4	Ton	$140.00
	Channel DD-13 Geotextile	Geotextile, nonwoven, 120 lb tensile strengt	31 32 19.16 1550	1.35	SY	80	6									SY		53	SY	$72.00
	Channel DD-13 Riprap	Riprap, Dumped, 300 lb. average	31 37 13.10 0370	36	Ton								1.5			Ton/CY		4	Ton	$144.00
	Subtotal																			**$457.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$457.00

Notes: See Plate 5-3 for surface facilities details.

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
51	**Water Treatment Pond 51**																			
	Pipe Demolition Cost	Demolish plastic pipe, 3/4"-4" diameter	02 41 13.38 1600	2.69	LF	3350	0.33											3350	LF	$9,012.00
	Remove Fabric Curtains	Silt Fence, install, maintain, remove	31 25 14.16 1000	1.92	LF	320	23											320	LF	$614.00
	Remove Pond Liner	Selective demo, chain link fence, 12' high	02 41 13.62 0675	4.7	LF	230									2	EA		460	LF	$2,162.00
	Remove Jersey Barriers																			
	Pipe and Liner Loading Cost	Excavate/Load, Front End Loader 3 CY	31 23 16.42 1300	2.14	CY													300	CY	$642.00
	Pipe and Liner Transportation Cost	Hauling, 20 CY truck, 15 min wait, 50 mph, 50 r	31 23 23.20 4114	10.8	CY													300	CY	$3,240.00
	Pipe and Liner Disposal Cost	Landfill charge, typ tipping fee, construction deb	02 41 19.20 0100	81	Ton								0.16			Lb/SF		0.6	Ton	$49.00
	Jersey Barrier Remove/Load Cost	12-ton truck-mounted hydraulic crane & crew	01 54 19.50 0100	1500	Day													1	Day	$1,500.00
	Jersey Barrier Transportation Cost	12 CY Truck 0.5 mi cycle, 15 min wait	31 23 23.20 1014	3.63	CY								2		64	CY/EA		128	CY	$465.00
	Jersey Barrier Disposal Cost	On Site Disposal	02 41 16.17 4200	12.25	CY													128	CY	$1,568.00
	Subtotal																			**$19,252.00**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			**$0.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$19,252.00

Ref.	Description	Materials	Means Reference No.	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Security Fence and Gates 52																			
	Chainlink Fence	Chain link, 6' high, Posts & fabric, Remove	02 41 13.60 1755	3.61	LF	500									500	LF		500	LF	$1,805.00
	Fence Posts	Fence post demo, steel, in concrete	02 41 13.62 1000	23.5	EA										25	EA		25	EA	$588.00
	Barbed Wire	Fence demo, Barbed Wire	02 41 13.62 1200	0.38	LF	1000									1000	LF		1000	LF	$380.00
	Chainlink Gate	Chain link gate demo, 10'-12' wide	02 41 13.62 0200	118.00	EA										1	EA		1	EA	$118.00
	Metal Gate	Chain link gate demo, 3'-4' wide	02 41 13.66 0100	63.00	EA										9	EA		9	EA	$567.00
	Metal Gate	Chain link gate demo, 20' wide	02 41 13.62 0400	189.00	EA										5	EA		5	EA	$945.00
	Structure's Vol Demolished																			
	Bubble's Weight (exclude steel)																			
	Truck's capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	Haul and dispose of steel	Scamp (2020 bid)	10	Ton													0.3		$3.00
	Subtotal																			**$4,406.00**
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Cost																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Cost																			
	Subtotal																			
	Total																			$4,406.00

Crandal Canyon Mine Reclamation Cost Estimate

Revegetation Cost Estimate

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Revegetation															
	Non-Riparian Mulching and Seeding															
	Apply Mulch	*Power mulcher, large, hay, 1" deep	32 91 13.16 0390	32.50	MSF	6						AC		261.4	MSF	$ 8,496
	Seed mix	Seed mix, non-riparian seed mix	Seed cost spreadsheet	292.18	AC	6						AC		6	AC	$ 1,753
	Hydroseeder	*Hydroseeder (equip and labor ONLY - with O&P)	32 92 19.14 0200	28.11	MSF	6						AC		261.4	MSF	$ 7,348
	Non-Riparian Transplanting South Slope															
	Transplant Labor	*Plant bare root seedlings, medium soil, 11" to 16" tall	32 93 43.10 0562	1.95	EA						150	Plant/ac		675	EA	$ 1,316
	Seedlings	Seedlings, non-riparian, south facing	Seed cost spreadsheet	187.50	AC	4.5						AC		4.5	AC	$ 844
	Non-Riparian Transplanting North Slope															
	Transplant Labor	*Plant bare root seedlings, medium soil, 11" to 16" tall	32 93 43.10 0562	1.95	EA						2300	Plant/ac		4140	EA	$ 8,073
	Seedlings	Seedlings, non-riparian, north facing	Seed cost spreadsheet	4830.00	AC	1.8						AC		1.8	AC	$ 8,694
	Riparian Seeding															
	Apply Mulch	*Power mulcher, large, hay, 1" deep	32 91 13.16 0390	32.50	MSF	0.3						AC		13.1	MSF	$ 426
	Seed mix	Seed mix, riparian	Seed cost spreadsheet	296.00	AC	0.3						AC		0.3	AC	$ 89
	Hydroseeder	*Hydroseeder (equip and labor ONLY - with O&P)	32 92 19.14 0200	28.11	MSF	0.3						AC		13.1	MSF	$ 368
	Riparian Transplanting															
	Transplant Labor	*Plant bare root seedlings, medium soil, 11" to 16" tall	32 93 43.10 0562	1.95	EA						630	Plant/ac		189	EA	$ 369
	Seedlings	Seedlings, riparian	Seed cost spreadsheet	2246.00	AC	0.3						AC		0.3	AC	$ 674
	Burma Basin Seeding															
	Apply Mulch	*Power mulcher, large, hay, 1" deep	32 91 13.16 0390	32.50	MSF	1.41						AC		61.4	MSF	$ 1,996
	Seed mix	Seed mix, Burma Evaporation Basin	Seed cost spreadsheet	234.05	AC	1.41						AC		1.41	AC	$ 330
	Hydroseeder	*Hydroseeder (equip and labor ONLY - with O&P)	32 92 19.14 0200	28.11	MSF	1.41						AC		61.4	MSF	$ 1,726
	East Mountain - Augmented Seeding Prior to Phase III Bond Release (Assume 1 acre)															
	Seed mix	Seed mix, East Mountain	Seed cost spreadsheet	85.65	AC	1.0	(Assumed area requiring augmented seeding. Total					AC		1	AC	$ 86
	Broadcast Seeding	*Broadcast seeding (equip and labor ONLY, with O&P)	32 92 19.14 0020	59.83	MSF	1.0	9.46-acre area has already been fully reseeded.)					AC		43.6	MSF	$ 2,609
	Subtotal															**$ 45,197**
	Assume 25% revegetation rate															$ 11,299
	Subtotal															**$ 11,299**
	Total															**$ 56,496**

Crandall Canyon Mine Revegetation Seed and Seedling Costs

Non-Riparian Areas

Common Name	Broadcast Rate (lb PLS/ac)	Unit Cost ($/lb)	Mix Cost ($/ac)
Grasses and Forbs			
Yarrow	0.5	39.00	19.50
Mountain Big Sage	1.0	18.50	18.50
Western Wheatgrass	3.0	4.25	12.75
Bluebunch Wheatgrass	2.0	7.95	15.90
Blueleaf Aster	1.0	27.75	27.75
Mountain Brome	3.0	3.15	9.45
Paiute Orchardgrass	0.5	4.25	2.13
Lewis Flax	1.0	25.00	25.00
Ranger Alfalfa	0.5	3.75	1.88
Yellow Sweetclover	0.5	2.75	1.38
Rocky Mountain Penstemon	1.0	29.50	29.50
Small Burnet (aka Skunkbush Sumac)	1.0	2.95	2.95
Showy Goldeneye	0.5	75.00	37.50
Shrubs			
Snowberry	1.0	49.00	49.00
Woods Rose	1.0	18.00	18.00
Squawbush	1.0	21.00	21.00
Unit cost of non-riparian seed mix ($/ac) =			**292.18**

Common Name	Planting Rate (Plants/ac)	Unit Cost ($/Plant)	Mix Cost ($/ac)
Seedlings			
Quaking Aspen (south-facing slopes)	150	1.25	187.50
Quaking Aspen (north-facing slopes)	600	1.25	750.00
Buffaloberry (north-facing slopes)	1,000	1.28	1280.00
Woods Rose (north-facing slopes)	700	4.00	2800.00
Unit cost of seedlings for south-facing non-riparian ($/ac) =			**187.50**
Unit cost of seedlings for north-facing non-riparian ($/ac) =			**4830.00**

Riparian Areas

Common Name	Broadcast Rate (lb PLS/ac)	Unit Cost ($/lb)	Mix Cost ($/ac)
Grasses and Forbs			
Yarrow	0.5	39.00	19.50
Mountain Big Sage	1.0	18.50	18.50
Western Wheatgrass	3.0	4.25	12.75
Bluebunch Wheatgrass	2.0	7.95	15.90
Blueleaf Aster	1.0	27.75	27.75
Mountain Brome	3.0	3.15	9.45
Paiute Orchardgrass	0.5	4.25	2.13
Lewis Flax	1.0	25.00	25.00
Ranger Alfalfa	0.5	3.75	1.88
Yellow Sweetclover	0.5	2.75	1.38
Rocky Mountain Penstemon	1.0	29.50	29.50
Small Burnet (aka Skunkbush Sumac)	1.0	2.95	2.95
Showy Goldeneye	0.5	75.00	37.50
Redtop	1.0	1.90	1.90
Kentucky Bluegrass	0.5	3.85	1.93
Shrubs			
Snowberry	1.0	49.00	49.00
Woods Rose	1.0	18.00	18.00
Squawbush	1.0	21.00	21.00
Unit cost of riparian seed mix ($/ac) =			**296.00**

Common Name	Planting Rate (Plants/ac)	Unit Cost ($/Plant)	Mix Cost ($/ac)
Seedlings	Plants/ac		
Woods Rose	500	4.00	2000.00
Red Osier Dogwood	20	2.05	41.00
Narrowleaf Cottonwood	100	2.05	205.00
Unit cost of seedlings for riparian area ($/ac) =			**2246.00**

East Mountain Drill Pads and Roads

Common Name	Broadcast Rate (lb PLS/ac)	Unit Cost ($/lb)	Mix Cost ($/ac)
Mountain Brome	2.5	3.15	7.88
Slender Wheatgrass	2.0	2.95	5.90
Paiute Orchardgrass	2.0	4.25	8.50
Alpine Bluegrass	1.0	8.50	8.50
Thickspike Wheatgrass	2.0	6.25	12.50
Timothy	1.0	2.10	2.10
Red Fescue	1.0	1.90	1.90
Hard Fescue	1.0	2.85	2.85
Cereal Rye	9.0	0.45	4.05
Sterile Triticale	10.0	0.54	5.40
Showy Goldeneye	0.25	75.00	18.75
American Vetch	0.5	3.25	1.63
Prairie Sage	0.1	18.00	1.80
Western Yarrow	0.2	19.50	3.90
Unit cost of East Mountain seed mix ($/ac) =			**85.65**

Burma Evaporation Basin

Common Name	Broadcast Rate (lb PLS/ac)	Unit Cost ($/lb)	Mix Cost ($/ac)
Galleta Grass	1.5	22.95	34.43
Indian Ricegrass	4.0	5.95	23.80
Crested Wheatgrass	2.5	3.95	9.88
Needle and Thread Grass	1.5	42.00	63.00
Rocky Mountain Penstemon	0.5	29.50	14.75
Globemallow	0.3	149.00	44.70
Fourwing Saltbush	1.3	13.00	16.90
Winterfat	0.7	38.00	26.60
Unit cost of Burma Evaporation Basin seed mix ($/ac) =			**234.05**

Notes

Seed mixes, seedlings, and rates based on Appendices 3-6 and 7-66of the MRP.

Seed prices downloaded February 2020 from greatbasinseeds.com except Blueleaf Aster (which was not available in February 2020) and Sterile Triticale. A placeholder of $27.75/lb was used, which is the cost of the Great Basin Wildflower Mix from Great Basin Seed. The cost of Sterile Triticale was downloaded from hancockseed.com.

Quaking Aspen, Red Osier Dogwood, and Narrowleaf Cottonwood seedling prices downloaded February 2020 from chiefrivernursery.com.

Buffaloberry and Woods Rose seedling prices downloaded February 2020 from 4htrees.org.

Native Willow seedlings to generated as cuttings from the adjacent area.

Scamp Excavation Inc.
PO Box 50, Wellington, UT 84542
Phone: 435-636-8101 Fax: 435-637-5696
E-Mail: SEOPLLC@EMERYTELCOM.NET

"24 hours a day, 7 days a week"

February 18, 2020

Genwal Resources, Crandall Mine
Attn: Karin Madsen

Re: Crandall Canyon Steel Salvage

Scamp Excavation will salvage all steel buildings and steel products at the Crandall Mine and bill Genwal Resources at a rate of $10.00 per ton, additionally all steel salvaged from the Crandall Mine shall belong to Scamp Excavation.

Thank you,

Shane Campbell
President/Scamp Excavation, Inc.

EVALUATION OF MINE-LAND RECLAMATION COSTS IN UTAH

Richard B. White[1] and John A. Gefferth[2]

Prepared for
Utah Mining Association

April 2019

BACKGROUND

In July 2017, the Utah Division of Oil, Gas and Mining (the "Division") revised their Technical Directive 007 ("Calculation Guidelines for Determining Coal Mining Reclamation Bond Amounts") in response to a review of that directive by the U.S. Office of Surface Mining Reclamation and Enforcement. The directive indicates that direct costs associated with mine-land reclamation can be estimated using unit costs published by R.S. Means (now Gordian). Overhead and profit are to be included when estimating direct project costs.

When calculating indirect project costs, the most recent (October 2017) version of Technical Directive 007 requires the use of the following percentages of total direct cost:

Indirect Cost Item	Percentage of Total Direct Cost
Mobilization/Demobilization (including permits, insurance, and bonds)	10.0%
Engineering Redesign Fee	2.5%
General Requirement Cost	5.8%
Project Management Fee	3.5%
Contingency	5.0%

Technical Directive 007 acknowledges that R.S. Means cost data books provide local adjustment factors for five cities in Utah. These adjustment factors apply to various aspects of construction and demolition. The weighted average adjustment factor for Price was typically applied by coal mine operators to reclamation cost estimates prior to July 2017 to account for differences in local costs compared to the national averages published by R.S. Means. However, the July 2017 Technical Directive 007 revision indicated that regional adjustment factors would no longer be allowable when estimating reclamation bond costs.

The Utah Mining Association submitted information in August 2017 indicating that the regional adjustment factors were still appropriate. Therefore, as part of an October 2017 revision to Technical Directive 007, the Division indicated that, "if the Permittee is able to present compelling evidence to demonstrate why local costs should be applied to their performance bond, the Division may accommodate those requests where appropriate." The purpose of this paper is to evaluate the appropriateness of the regional adjustment factor and the indirect cost factors required by Technical Directive 007 when estimating reclamation bond amounts.

[1] Principal Civil and Environmental Engineer, Richard B. White, PE, PLLC, Draper, Utah
[2] Senior Mining Engineering Consultant, Barr Engineering Company, Salt Lake City, Utah

METHODS

The appropriateness of the regional adjustment factor and the indirect cost factors required by Technical Directive 007 were evaluated by comparing actual reclamation cost data with independently-generated costs estimates based on equivalent unit costs published by R.S. Means. Actual reclamation costs were obtained for competitively-bid projects designed and managed by the Division's Abandoned Mine Reclamation ("AMR") program. Direct cost data were obtained from Chris Rohrer, Senior Reclamation Specialist with the AMR program, for six reclamation projects completed in 2015, 2017, and 2018.

It is acknowledged that AMR reclamation standards do not necessarily comply with the standards required of mine operators under Utah Administrative Code R645-301. However, the unit costs associated with project implementation are not affected by differences in the design standards. The cost to move and compact a cubic yard of soil or demolish a concrete pad or apply mulch is independent of the regulatory standard. Therefore, this source of cost data was considered representative of actual costs that would be incurred during reclamation of land disturbed by coal mining activities in Utah under equivalent construction specifications. The projects all involved mine-land reclamation, they were competitively bid, and they were successfully contracted. It is of note that both the July 2017 and October 2017 versions of Technical Directive 007 allow the use of AMR cost data when calculating reclamation bond amounts.

Total direct costs on the evaluated projects ranged from approximately $99,000 to $429,000. Five of the six projects for which direct-cost data were obtained involved the reclamation of sites affected by prior coal mining activities, while the remaining project involved reclamation of subsidence impacts resulting from mineral mining activities. Four of the projects were in Carbon County, one in Sanpete County, and one in Juab County.

Where available, construction specifications were reviewed for those projects for which direct cost data were obtained. If construction specifications were not available, the successful contractors were contacted by the authors and project methods were discussed. Based on the specifications and/or discussions with the project contractors, the direct costs of each project were then independently estimated using R.S. Means Site Work and Landscape Cost Data for the year in which the project was done. As a result, these independent estimates are considered equivalent to that which an operator would prepare if the reclamation project was being bonded for permitting purposes.

Vendor data (primarily from Great Basin Seed Company) were used to determine seed costs when the seed mix was known. In those cases when the bid involved a lump sum item, the tasks involved in the lump sum item were evaluated individually based on a review of the construction specifications and/or discussions with the successful bidders.

Indirect cost bid data were also obtained from the Chris Rohrer of the Division for seven projects completed in 2012, 2015, 2017, and 2018. These included three of the six projects for which direct costs data were available (two in Carbon County and one in Sanpete County) plus four other coal-mine reclamation projects completed in Carbon County. Indirect cost data were readily available only on projects where individual Division project managers maintained bid tabulations, thereby resulting in differences in the projects for which direct and indirect cost data were available. Total direct costs for which indirect costs were available ranged from approximately $105,000 to $1,073,000.

RESULTS

Regional Adjustment Factor

Direct cost comparisons between actual bids and independent estimates are presented in Attachment A and summarized in Table 1. Independent estimates exceeded direct cost bids by 34% to 94%, averaging an exceedance of 54% for the six projects. Figure 1 shows that a general inverse relationship exists between the cost of a reclamation project and the degree to which the actual cost varied from the estimated cost. However, that relationship was weak (with a coefficient of determination of less than 50%).

As indicated above, the current version of Technical Directive 007 does not allow the use of City Cost Indices for adjusting direct reclamation cost estimates. For Price, Utah the City Cost Index has historically been approximately 85%, which indicates that a 15% reduction would be applied to direct costs following preparation of the cost estimate. With this evaluation showing that estimated reclamation costs exceed actual reclamation costs by 34% to 94%, it is obvious that a 15% reduction in the estimated direct cost would be appropriate for bonding purposes and should be allowed by the Technical Directive.

Indirect Costs

An evaluation of indirect mobilization/demobilization, insurance, and bond costs associated with the examined AMR projects is presented in Attachment B and summarized in Table 2. The combination of these costs for the seven projects included in this evaluation averaged 9.4% of the direct cost. Since Technical Directive 007 recommends an indirect cost equal to 10% of the direct cost for those items, an indirect cost of 10% of the direct cost for mobilization/demobilization, insurance, and bonding is appropriate.

R.S. Means indicates that engineering fees for the design of landscaping and site development projects typically range from a minimum of 2.5% to a maximum of 6.0% of the total project cost. For the design of buildings, industrial facilities, stadiums, and parking ramps, R.S. Means recommends that 1.6% to 2.5% of the total project cost be budgeted for initial engineering design on projects with total costs of $500,000 to $1,000,000. Engineering re-design to account for unintended conditions would normally be less than these percentages. However, given the variation in project conditions between sites, an engineering redesign indirect cost equal to 2.5% of the direct cost is probably appropriate

The October 2017 revision of Technical Directive 007 requires a “General Requirement Cost” equal to 5.8% of the direct project cost. The Directive indicates that this cost represents “items that are typically provided by the General Contractor.” The Directive further indicates that this cost is “required to facilitate successful on-site reclamation work and generally include[s] the following: On-site utilities, temporary facilities, security, testing, and project cleanup.” These general costs were all included in the direct costs bid by the contractors on the projects that were evaluated for this paper. Therefore, adding a general requirement indirect cost to a reclamation bond estimate is repetitive and inappropriate.

The October 2017 revision of Technical Directive 007 requires a project management fee equal to 2.5% of the direct project cost. The Directive indicates that this fee would cover “a project management firm . . . charged with inspecting and supervising the reclamation efforts to ensure they are carried out to desired specifications.” R.S. Means indicates that construction management fees typically range from

4.5% to 7.5% of the total project cost for a $1,000,000 job and decrease with increasing project magnitude. The higher fees would be typical of complex building construction projects. A project management fee of 3.5% is considered appropriate for mine-land reclamation projects.

Technical Direction 007 requires a contingency of 5% of the total direct project cost. R.S. Means recommends a contingency of 3% for projects that are in the "final working drawing stage." Given the potential for below-grade unknown conditions, particularly in older mining sites, a contingency of 5% is considered appropriate.

CONCLUSIONS

The following conclusions were reached in this study:

- The Price, Utah City Cost Index should be allowed by Technical Directive 007 and applied to direct cost reclamation bond estimates.
- The indirect General Requirement Cost recommended in Technical Directive 007 is repetitive and should be eliminated.
- All other indirect cost factors recommended in Technical Directive 007 are appropriate.

TABLE 1

Comparison of Actual Reclamation Bids and
Independent Reclamation Cost Estimates

Project	Year	Direct Cost		Difference	
		Bid	Estimate	($)	(%)
Chief #1 Subsidence Project	2018	$ 148,500.00	$ 273,506.04	$ 125,006.04	84.2%
Horizon Mine Final Reclamation	2018	$ 289,653.50	$ 490,880.45	$ 201,226.95	69.5%
Indian-Price Canyons Project: Lower Willow Creek Phase	2017	$ 251,176.47	$ 337,821.83	$ 86,645.36	34.5%
Kenilworth Maintenance III Project	2018	$ 429,243.00	$ 592,833.80	$ 163,590.80	38.1%
Morrison Project	2015	$ 146,469.54	$ 253,803.22	$ 107,333.69	73.3%
Trash Canyon Project	2017	$ 99,017.40	$ 191,707.31	$ 92,689.91	93.6%
TOTAL COST COMPARISON		$ 1,215,559.91	$ 1,867,046.61	$ 651,486.71	53.6%

TABLE 2

Summary of Indirect Mobilization/Demobilization,
Insurance, and Bond Costs

Project Name	Contractor	Year	Total Direct Cost ($)	Total Mob/Demob, Ins, & Bonds	
				Cost ($)	% of Direct
Horizon Site Reclamation	Nelco Contractors	2018	$ 298,413.50	$ 20,238.00	6.8%
Hiawatha Mine Portal Closure	The 5 Seventeen Co.	2018	$ 141,285.00	$ 17,609.00	12.5%
Knight-Ideal Loadout	Kent Bethers Const.	2012	$ 1,073,188.00	$ 80,875.00	7.5%
Indian-Price Canyon Project: Lower Willow Creek	Harrison Oilfield Serv.	2017	$ 276,337.15	$ 36,782.00	13.3%
Morrison Site Reclamation	Harrison Oilfield Serv.	2015	$ 158,298.31	$ 23,151.96	14.6%
Pondtown Creek II Project	Kent Bethers Const.	2012	$ 126,573.75	$ 8,628.00	6.8%
Trash Canyon Project	Nelco Contractors	2017	$ 105,448.90	$ 17,353.60	16.5%
TOTALS (Weighted Average Percentages)			$ 2,179,544.61	$ 204,637.56	9.4%

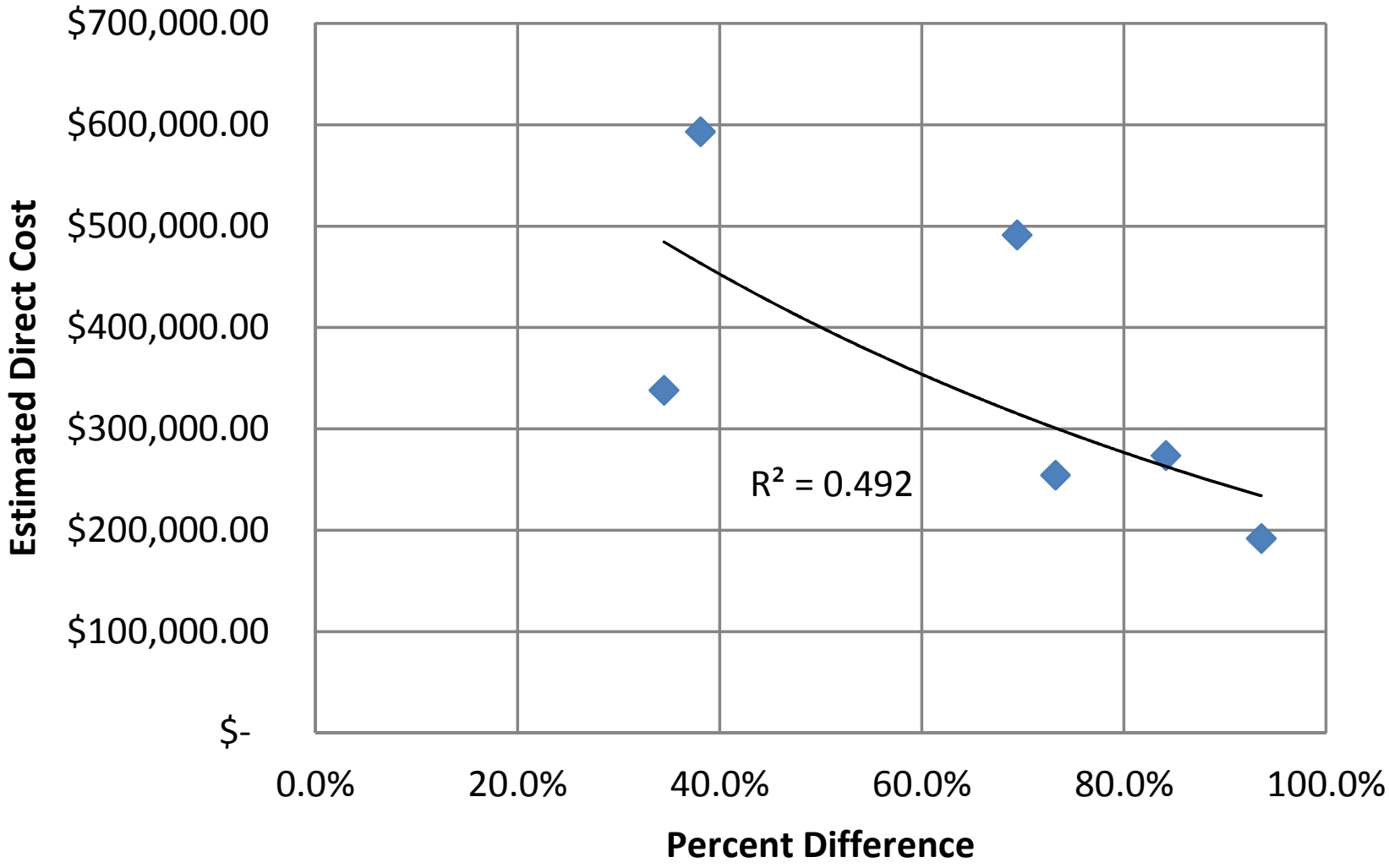


Figure 1. Percent Difference vs. Estimated Direct Cost

ATTACHMENT A

Direct Cost Evaluation

UTAH ABANDONED MINE RECLAMATION PROGRAM
COMPARISON OF ACTUAL BIDS AND STANDARD RECLAMATION COST ESTIMATES

The estimated quantities and unit costs were obtained from original bids accepted by UDOGM and may not reflect changes made to either during the course of construction. Some bid items specific to a project and lump sum tasks were omitted in the file provided by UDOGM.

Estimated unit prices from Means Site Work and Landscape Cost Data, except as noted. See accompanying unit price and seed mix worksheets.

Trash Canyon Project
Drainage channel reconstruction incorporating a series of massive rock step pools.
Carbon County: Price Canyon, north of Helper
Nelco Contractors (Price)
2017

Item of Work	Est. Qty	Unit	Unit Price	Bid Total	Means Number	Means Description	Means Rate	Means Subtotal	Means Total	Means Diff
					31-14-13.23-1420	Loam or topsoil, remove and stockpile on site, 6" deep, 200' haul	$2.79	$2,092.50		
Strip & Replace Topsoil (6-inches)	750	cy	$6.41	$4,807.50	31-23-23.17-0020	Spread dumped material by dozer, no compaction	$2.41	$1,807.50	$3,900.00	-18.9%
Channel Excavation	2,900	cy	$2.64	$7,656.00	31-23-16.42-0250	Excavating, excavator, hydraulic, crawler mtd, 1.5 CY capacity	$2.21	$6,409.00	$6,409.00	-16.3%
					31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.65	$1,095.50		
					31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$11.05	$773.50		
Grade Step Pools	70	cy	$93.14	$6,519.80	31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$65.00	$4,550.00	$6,419.00	-1.5%
Geotextile, Riprap Filter	3,000	sy	$2.70	$8,100.00	31-32-19.16-1500	Geotextile fabric, woven, 200 lb tensile strength	$1.41	$4,230.00	$4,230.00	-47.8%
					31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$65.00	$97,500.00		
					31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.65	$23,475.00		
Riprap Class A	1,500	cy	$38.21	$57,315.00	31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$11.05	$16,575.00	$137,550.00	140.0%
					31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$65.00	$1,950.00		
					31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.65	$469.50		
Riprap Class B	30	cy	$92.57	$2,777.10	31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$11.05	$331.50	$2,751.00	-0.9%
Import Topsoil	800	cy	$11.82	$9,456.00	31-05-13.10-0800	Borrow, topsoil, weed free, spread w/ 200 HP dozer, no compaction, 2 mi RT haul	$35.50	$28,400.00	$28,400.00	200.3%
					Project seed mix	Indian-Price Canyon mix (see accompanying worksheet	$529.16	$1,058.31		
Revegetation	2	ac	$1,193.00	$2,386.00	32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	$495.00	$990.00	$2,048.31	-14.2%
DIRECT COST TOTAL				$99,017.40					$191,707.31	93.6%

Indian-Price Canyons Project: Lower Willow Creek Phase
Coal excavation, transport to ECDC, import clean fill, riprap ditch construction.
Carbon County: Willow Creek Canyon, north of Helper
Harrison Oilfield Services (Moab)
2017

Item of Work	Est. Qty	Unit	Unit Price	Bid Total	Means Number	Means Description	Means Rate	Means Subtotal	Means Total	Means Diff
Heavy-Duty Silt Fence	800	lf	$3.00	$2,400.00	31-25-14.16-1000	Silt fence, install and maintain, remove	$1.96	$1,568.00	$1,568.00	-34.7%
Clear, Grub, Stockpile, and Spread Vegetation	1.7	ac	$500.00	$850.00	31-13-13.10-0550	Clearing brush with dozer and brush rake, medium brush to 4" diameter	$330.00	$561.00	$561.00	-34.0%
Salvage Existing Cover Soil	0.25	ac	$1,000.00	$250.00	31-14-13.23-1420	Topsoil stripping and stockpiling, on site, 6" deep, 200' haul, CY unit cost converted to acre unit cost	$2,250.00	$562.50	$562.50	125.0%
					31-23-16.42-1601	Excavating, front end loader, wheel mounted, 3 CY capacity, common earth, piled. Increased 15% for loading (see 31-23-16.42-0020)	$1.54	$22,137.50		
Excavate, Load, and Haul Coal Refuse for Disposal	14,375	cy	$9.25	$132,968.75	31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$11.05	$158,843.75	$180,981.25	36.1%
Grade and Track Roll Exposed Coal Refuse	1.7	ac	$1,050.00	$1,785.00	31-22-16.120-3300	Finish grading slopes, gentle, SY unit cost converted to acre unit cost	$1,015.00	$1,725.50	$1,725.50	-3.3%
Place Geotextile Over Coal Refuse	8,228	sy	$1.30	$10,696.40	31-32-19.16-1500	Geotextile fabric, woven, 200 lb tensile strength	$1.41	$11,601.48	$11,601.48	8.5%
					31-23-16.42-1601	Excavating, front end loader, wheel mounted, 3 CY capacity, common earth, piled. Increased 15% for loading (see 31-23-16.42-0020)	$1.45	$13,340.00		
Excavate, Load, and Haul Cover Material to Site	9,200	cy	$4.70	$43,240.00	31-23-23.20-1072	Hauling, 12 CY truck, 15 min wait/Ld/Uld, 40 mph, cycle 6 miles	$5.25	$48,300.00	$61,640.00	42.6%
Regrade Borrow Area	1.5	ac	$500.00	$750.00	31-22-16.120-3300	Finish grading slopes, gentle, SY unit cost converted to acre unit cost	$1,015.00	$1,522.50	$1,522.50	103.0%
Place Clean Cover Material	9,200	cy	$2.80	$25,760.00	31-23-23.17-0020	Spread dumped material by dozer, no compaction	$2.41	$22,172.00	$22,172.00	-13.9%
Compact Clean Cover Material	3,067	cy	$0.96	$2,944.32	31-23-23.23-5600	Compaction, sheepsfoot roller, 6" lifts, 2 passes	$0.97	$2,974.99	$2,974.99	1.0%

Construct Riprap Channel – North Edge	185	lf	$30.80	$5,698.00	Crew B-38	1 Foreman, 2 Laborers, 2 Equip. Oper. (light and medium), 1 Backhoe Loader (48 HP), 1 Hyd. Hammer (1200 lb), 1 FE Loader (WM, 4 CY), 1 Pvmt. Rem. Bucket	$4,119.78	$2,059.89		
					31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$65.00	$12,025.00	$14,084.89	147.2%
Construct Riprap Channel – Middle (Culvert Outlet)	176	lf	$30.75	$5,412.00	Crew B-38	1 Foreman, 2 Laborers, 2 Equip. Oper. (light and medium), 1 Backhoe Loader (48 HP), 1 Hyd. Hammer (1200 lb), 1 FE Loader (WM, 4 CY), 1 Pvmt. Rem. Bucket	$4,119.78	$2,059.89		
					31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$65.00	$11,440.00	$13,499.89	149.4%
Construct Riprap Channel – Southwest Side	165	lf	$30.80	$5,082.00	Crew B-38	1 Foreman, 2 Laborers, 2 Equip. Oper. (light and medium), 1 Backhoe Loader (48 HP), 1 Hyd. Hammer (1200 lb), 1 FE Loader (WM, 4 CY), 1 Pvmt. Rem. Bucket	$4,119.78	$2,059.89		
					31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$65.00	$10,725.00	$12,784.89	151.6%
Construct Riprap Aprons at Channel Outlets	3	ea	$500.00	$1,500.00	Crew B-38	1 Foreman, 2 Laborers, 2 Equip. Oper. (light and medium), 1 Backhoe Loader (48 HP), 1 Hyd. Hammer (1200 lb), 1 FE Loader (WM, 4 CY), 1 Pvmt. Rem. Bucket	$4,119.78	$2,059.89		
					31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	$325.00	$975.00	$3,034.89	102.3%
Surface Roughening: LWC Site	1.7	ac	$500.00	$850.00	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	$1,437.48	$2,443.72	$2,443.72	187.5%
Surface Roughening: UDOT Soil/Rock Stockpile	1.5	ac	$500.00	$750.00	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	$1,437.48	$2,156.22	$2,156.22	187.5%
Surface Roughening: Turnaround Site	0.5	ac	$500.00	$250.00	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	$1,437.48	$718.74	$718.74	187.5%
Seeding: LWC Site	1.7	ac	$2,700.00	$4,590.00	Project seed mix	Indian-Price Canyon mix (see accompanying worksheet	$529.16	$899.56		
					32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	$495.00	$841.50	$1,741.06	-62.1%
Seeding: UDOT Soil/Rock Stockpile	1.5	ac	$2,700.00	$4,050.00	Project seed mix	Indian-Price Canyon mix (see accompanying worksheet	$529.16	$793.73		
					32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	$495.00	$742.50	$1,536.23	-62.1%
Seeding: Turnaround Site	0.5	ac	$2,700.00	$1,350.00	Project seed mix	Indian-Price Canyon mix (see accompanying worksheet	$529.16	$264.58		
					32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	$495.00	$247.50	$512.08	-62.1%
DIRECT COST TOTAL				$251,176.47					$337,821.83	34.5%

Omitted items (all lump sum): Traffic Control, Dust Control, Trackout Control — Insufficient information in specification upon which an estimate could be based.

Notes:
1. Assumes coal waste hauled to ECDC, as indicated by UDOGM.
2. Armored channels were designed to consist of riprap a minimujm of 3' thick and 10' wide (i.e., minimum of 30 CF or 1.1 CY of riprap per foot of channel). Round this value down and base armored channel costs on 1 CY/ft riprap. Assumes geotextile liner is accounted for in the coal refuse cover.
3. Riprap apron cost based on 5 CY riprap per apron.
4. Riprap generated on site or from nearby UDOT stockpile. Broken with trackhoe hammer for sizing.
5. One-half crew day required to generate riprap for each channel location. No additional hauling cost outside of crew cost.

Kenilworth Maintenance III Project
Drainage channel reconstruction incorporating a series of massive rock step pools.
Carbon County: Kenilworth
Nelco Contractors (Price)
2018

Item of Work	Est. Qty	Unit	Unit Price	Bid Total	Means Number	Means Description	Means Rate	Means Subtotal	Means Total	Means Diff
Kenilworth Creek Channel Excavation	14,876	cy	$3.30	$49,090.80	31-23-16.42-0250	Excavating, excavator, hydraulic, crawler mtd, 1.5 CY capacity	$2.14	$31,834.64	$31,834.64	-35.2%
Kenilworth Creek Channel Fill (imported)	8,866	cy	$25.00	$221,650.00	31-23-23.15-4060	Borrow, loading, common earth, front end loader, wheel mtd., 1.5 CY bucket	$20.50	$181,753.00		
					31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$10.30	$91,319.80		
					G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.76	$51,068.16	$324,140.96	46.2%
Kenilworth Creek Channel Fill (sourced from channel excavation)	5,800	cy	$6.85	$39,730.00	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.76	$33,408.00	$33,408.00	-15.9%
Kenilworth Creek Channel Fill (sourced from dis. cell and Ditch 1-10 ex)	8,124	cy	$3.65	$29,652.60	G 1030-210-1500	Common earth backfill, 80 HP dozer & roller compactors, 300' haul, 8" lifts, 2 passes	$7.15	$58,086.60	$58,086.60	95.9%
Haul and Load Mine Dump Material to Disposal Cell	9,076	cy	$2.00	$18,152.00	G 1030-120-2800	Excavate and haul common earth, 2-1/2 CY excavator, six 12 CY dump trucks, 1 mile RT	$7.29	$66,164.04	$66,164.04	264.5%
Excavate Disposal Cell	9,568	cy	$3.85	$36,836.80	31-23-16.46-4220	Excavating, bulk, dozer, open site, 200 HP, 150' haul, common earth	$4.44	$42,481.92	$42,481.92	15.3%
Moisture Condition Disposal Cell	9,076	cy	$1.75	$15,883.00	31-23-23.23-9000	Compaction water, 3000 gal truck, 3 mile haul	$2.42	$21,963.92	$21,963.92	38.3%
Compact Disposal Cell	9,076	cy	$1.55	$14,067.80	31-23-23.23-5600	Compaction, sheepsfoot roller, 6" lifts, 2 passes	$0.97	$8,803.72	$8,803.72	-37.4%
Plant Pinyon Pine (no less than 4' tall)	5	ea	$410.00	$2,050.00	32-93-43.40-4703	Trees, material cost only, Rocky Mountain Juniper, 4' to 5'	$80.00	$400.00		
					32-96-23.43-0300	Planting, moving trees on site, 36" ball	$515.00	$2,575.00	$2,975.00	45.1%
Plant Moonglow Juniper (no less than 4' tall)	5	ea	$426.00	$2,130.00	32-93-43.40-4703	Trees, material cost only, Rocky Mountain Juniper, 4' to 5'	$80.00	$400.00		
					32-96-23.43-0300	Planting, moving trees on site, 36" ball	$515.00	$2,575.00	$2,975.00	39.7%
DIRECT COST TOTAL				$ 429,243.00					$592,833.80	38.1%

Chief #1 Subsidence Project
Closure of a large subsidence hole with concrete slab and backfill.
Juab County: Eureka
Nelco Contractors (Price)
2018

Item of Work	Est. Qty	Unit	Unit Price	Bid Total	Means Number	Means Description	Means Rate	Means Subtotal	Means Total	Means Diff
Excavate, Haul, Backfill Waste	23,000	cy	$4.00	$92,000.00	G 1030-120-2800	Excavate and haul common earth, 2-1/2 CY excavator, six 12 CY dump trucks, 1 mile RT	$ 7.29	$ 167,670.00		
					31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$ 1.72	$ 39,560.00	$ 207,230.00	125.3%
Geotextile	16,000	sf	$0.30	$4,800.00	31-32-19.16-1500	Geotextile fabric, woven, 200 lb tensile strength	$ 1.42	$ 2,524.44	$ 2,524.44	-47.4%
Obtain, Haul, and Place Crushed Rock	440	cy	$60.00	$26,400.00	31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$ 15.60	$ 6,864.00		
					03-05-13.25-1050	Stone, 3/4" to 1-1/2", loaded at pit, crushed bank gravel	$ 37.00	$ 16,280.00		
					31-23-23.17-0020	Spread dumped material by dozer, no compaction	$ 2.29	$ 1,007.60	$ 24,151.60	-8.5%
Pour Concrete Slab (100'x30'x1')	110	cy	$230.00	$25,300.00	03-30-53.40-4050	Concrete, including forms, Grade 60 rebar, placement, and finishing, foundation mat over 20 CY	$ 360.00	$ 39,600.00	$ 39,600.00	56.5%
DIRECT COST TOTAL				$ 148,500.00					$ 273,506.04	84.2%

Omitted item: Equipment Wash/Dust Suppression Water (bid on a "per gallon" basis)

Morrison Project
Excavation and burial of coal refuse.
Sanpete County: West of Sterling
Harrison Oilfield Services (Moab)
2015

Item of Work	Est. Qty	Unit	Unit Price	Bid Total	Means Number	Means Description	Means Rate	Means Subtotal	Means Total	Means Diff
Clear and Grub Site	1.5	ac	$300.00	$450.00	31-13-13.10-0550	Clearing brush with dozer and brush rake, medium brush to 4" diameter	$325.00	$487.50	$487.50	8.3%
Disposal Cell – Excavate and Stockpile	2,530	cy	$1.99	$5,034.70	31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$1.81	$4,579.30	$4,579.30	-9.0%
4180236WP001 – Excavate and Haul Coal Refuse	3,680	cy	$2.00	$7,360.00	31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$1.81	$6,660.80	$25,796.80	250.5%
					31-23-23.20-1216	Hauling, 12 CY truck, 20 min wait/Ld/Uld, 15 mph, cycle 1 mile	$5.20	$19,136.00		
4180236WP001 – Haul and Place Excess Disposal Cell Spoils	460	cy	$5.43	$2,497.80	31-23-16.42-1601	Excavating, front end loader, wheel mounted, 3 CY capacity, common earth, piled. Increased 15% for loading (see 31-23-16.42-0020)	$1.45	$667.00	$5,639.60	125.8%
					31-23-23.20-1216	Hauling, 12 CY truck, 20 min wait/Ld/Uld, 15 mph, cycle 1 mile	$5.20	$2,392.00		
					G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$2,580.60		
Disposal Cell – Place and Compact Coal Refuse	3,680	cy	$3.43	$12,622.40	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$20,644.80	$20,644.80	63.6%
Disposal Cell – Place Nonwoven Geotextile	1,100	sy	$0.50	$550.00	31-32-19.16-1550	Geotextile fabric, nonwoven, 120 lb tensile strength	$1.59	$1,749.00	$1,749.00	218.0%
Disposal Cell – Place Cap Material	2,140	cy	$1.42	$3,038.80	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$12,005.40	$12,005.40	295.1%
Disposal Cell – Construct Perimeter Ditch	150	lf	$2.00	$300.00	31-23-19.10-0020	Cut drainage ditch, common earth, 30' wide x 1' deep	$0.32	$48.00	$48.00	-84.0%
Surface Roughen Disturbed Areas – Slopes <2H:1V	1.3	ac	$923.07	$1,199.99	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	$1,415.70	$1,840.41	$1,840.41	53.4%
Erosion Control Blanket – Slopes >2H:1V	2,420	sy	$1.76	$4,259.20	31-25-14.16-0020	Rolled erosion control mats and blankets, jute mesh, 100 SY per roll, 4' wide, stapled	$1.85	$4,477.00	$4,477.00	5.1%
Seeding/Mulching	2.3	ac	$1,333.00	$3,065.90	Project seed mix	Indian-Price Canyon mix (see accompanying worksheet	$529.16	$1,217.06	$22,903.76	647.0%
					32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	$475.00	$1,092.50		
					31-25-14.16-0020	Rolled erosion control mats and blankets, jute mesh, 100 SY per roll, 4' wide, stapled	$8,954.00	$20,594.20		
Clearing and Grubbing	1.5	ac	$500.00	$750.00	31-13-13.10-0550	Clearing brush with dozer and brush rake, medium brush to 4" diameter	$325.00	$487.50	$487.50	-35.0%
Disposal Cell – Excavate and Stockpile	3,190	cy	$1.50	$4,785.00	31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$1.81	$5,773.90	$5,773.90	20.7%
4180235WP006 – Excavate and Haul Coal Refuse	1,440	cy	$2.77	$3,988.80	31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$1.81	$2,606.40	$10,094.40	153.1%
					31-23-23.20-1216	Hauling, 12 CY truck, 20 min wait/Ld/Uld, 15 mph, cycle 1 mile	$5.20	$7,488.00		
4180235WP007 – Excavate and Haul Coal Refuse	105	cy	$7.14	$749.70	31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$1.81	$190.05	$736.05	-1.8%
					31-23-23.20-1216	Hauling, 12 CY truck, 20 min wait/Ld/Uld, 15 mph, cycle 1 mile	$5.20	$546.00		
4180235WP008 – Excavate and Haul Coal Refuse	1,520	cy	$3.36	$5,107.20	31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	$1.81	$2,751.20	$10,655.20	108.6%
					31-23-23.20-1216	Hauling, 12 CY truck, 20 min wait/Ld/Uld, 15 mph, cycle 1 mile	$5.20	$7,904.00		
4180235WP009 – Excavate and Haul Coal Refuse	75	cy	$4.66	$349.50	31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.20	$1,140.00	$1,661.25	375.3%
					G 1030-210-1500	Common earth backfill, 80 HP dozer & roller compactors, 300' haul, 8" lifts, 2 passes	$6.95	$521.25		
4180235WP006 – Cap in Place	735	cy	$1.50	$1,102.50	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$4,123.35	$4,123.35	274.0%
4180235WP008 – Cap in Place	1,025	cy	$2.10	$2,152.50	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$5,750.25	$5,750.25	167.1%
4180235WP008 – Construct Upper Wall	113	sf	$42.37	$4,787.81	A 1010-110-2500	Strip footing, 24" wide x 12" deep, reinf., including excavation, forms, compacted backfill, and concrete	$40.25	$1,207.50	$4,787.81	-35.6%
					32-32-23.13-7250	Geo-grid soil reinforcement, 4'x50'	$0.88	$99.44		
					32-32-23.13-7170	Segmental concrete unit masonry retaining wall, medium, lt. wt., straight split	$15.70	$1,774.10		

					A 1010-110-2500	Strip footing, 24" wide x 12" deep, reinf., including excavation, forms, compacted backfill, and concrete	$40.25	$1,610.00		
					32-32-23.13-7250	Geo-grid soil reinforcement, 4'x50'	$0.88	$290.40		
4180235WP008 – Construct Lower Wall	330	sf	$42.37	$13,982.10	32-32-23.13-7170	Segmental concrete unit masonry retaining wall, medium, lt. wt., straight split	$15.70	$5,181.00	$7,081.40	-49.4%
Disposal Cell – Place and Compact Coal Refuse	2,730	cy	$3.43	$9,363.90	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$15,315.30	$15,315.30	63.6%
Disposal Cell – Place Nonwoven Geotextile	1,035	sy	$0.50	$517.50	31-32-19.16-1550	Geotextile fabric, nonwoven, 120 lb tensile strength	$1.59	$1,645.65	$1,645.65	218.0%
Disposal Cell – Place Cap Material	1,155	cy	$1.42	$1,640.10	G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	$5.61	$6,479.55	$6,479.55	295.1%
Disposal Cell – Construct Perimeter Ditch	300	lf	$1.50	$450.00	31-23-19.10-0020	Cut drainage ditch, common earth, 30' wide x 1' deep	$0.32	$96.00	$96.00	-78.7%
					31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.20	$8,360.00		
					31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$10.85	$5,967.50		
4180235WP007 – Place D50=24" Riprap Bank Stabilization	550	ton	$56.63	$31,146.50	31-37-13.10-0370	Riprap and rock lining, random broken stone, dumped, 300 lb average	$33.50	$18,425.00	$32,752.50	5.2%
					31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.20	$4,940.00		
					31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$10.85	$3,526.25		
4180235WP007 – Place D50=12" Riprap Bank Stabilization	325	ton	$56.63	$18,404.75	31-37-13.10-0350	Riprap and rock lining, random broken stone, dumped, 100 lb average	$32.50	$10,562.50	$19,028.75	3.4%
					31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	$15.20	$228.00		
					31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	$10.85	$162.75		
4180235WP007 – Place Pea Gravel Bank Stabilization	15	ton	$30.00	$450.00	03-05-13.25-0500	3/8" rounded stone & 1/2" pea gravel, loaded at pit, crushed bank gravel	$28.50	$427.50	$818.25	81.8%
Place Geotextile	455	sy	$0.50	$227.50	31-32-19.16-1550	Geotextile fabric, nonwoven, 120 lb tensile strength	$2.46	$1,119.30	$1,119.30	392.0%
Surface Roughen Disturbed Areas – Slopes <2H:1V	1.8	ac	$923.05	$1,661.48	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	$32.50	$2,548.26	$2,548.26	53.4%
Erosion Control Blanket – Slopes >2H:1V	800	sy	$1.76	$1,408.00	31-25-14.16-0020	Rolled erosion control mats and blankets, jute mesh, 100 SY per roll, 4' wide, stapled	$1.85	$1,480.00	$1,480.00	5.1%
					Project seed mix	Indian-Price Canyon mix (see accompanying worksheet	$529.16	$1,217.06		
					32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	$475.00	$1,092.50		
Seeding/Mulching	2.3	ac	$1,333.00	$3,065.90	31-25-14.16-0020	Rolled erosion control mats and blankets, jute mesh, 100 SY per roll, 4' wide, stapled	$8,954.00	$20,594.20	$22,903.76	647.0%
DIRECT COST TOTAL				$ 146,469.54					$253,803.22	73.3%

Assumptions: 1. Strip footings lengths beneathe retaining walls scaled from Drawing 3 of reclamation specifications. Lengths scaled as follows:

Upeer wall (ft) = 30

Lower wall (ft) = 40

Horizon Mine Final Reclamation
Seal portals., clear coal waste, demolish concrete, construct channels, revegetate
Carbon County
Nelco Contractors (Price)
2018

Item of Work	Est. Qty	Unit	Unit Price	Bid Total	Means Number	Means Description	Task	Est Qty	Unit	Means Rate	Means Subtotal	Means Total	Means Diff
					01-31-13.20-0120	Field personnel, engineer, a	Monitor portal air	1	Week	$2,300.00	$2,300.00		
					31-22-13.20-0170	Rough grade sites, 8100-10000 SF, dozer	Grade road to upper topsoil pile	1	Ea	$1,400.00	$1,400.00		
					02-41-16.17-2080	Building demolition, walls, block, 8" thick	Demo return portal temp seal	144	SF	$0.88	$126.72		
					02-41-13.62-0675	Selective demolition, chain link, fence, 12' high	Remove belt portal chain link	20	LF	$4.84	$96.80		
					31-23-16.42-0250	Excavating, excavator, hydraulic, crawler mtd, 1.5 CY capacity	Remove collapse material from belt portal	200	CY	$2.14	$428.00		
					04-22-10.26-0500	Concrete block, solid, 8"x16" block, 8" thick, normal weight, horiz. joint reinf.	Construct belt portal seal	432	SF	$10.00	$4,320.00		
					02-41-13.90-1200	Selective demolition, metal bin retaining wall, 10' wide, 16-28' high	Demo fan portal temp seal	144	SF	$4.37	$629.28		
					03-05-05.10-0070	Selective demolition, concrete, break into small pieces, reinforcing more than 2% of cross-sectional area	Demolish portal conrete collars	70	CY	$335.00	$23,450.00		
					31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	Backfill portals and highwall with local soil	540	CY	$1.72	$928.80		
Seal and Reclaim Portals	1	LS	$30,850.00	$30,850.00	31-23-23.13-0900	Compaction in 12" layers, roller compaction operator walking	Compact portal and highwall backfill	540	CY	$7.25	$3,915.00	$37,594.60	21.9%
					02-41-13.17-5050	Pavement removal, bituminous roads, 4"-6" thick	Demolish pavement from site roadway	1267	SY	$9.50	$12,036.50		
					03-05-05.10-0050	Selective demolition, concrete, break into small pieces, reinforcing less than 1% of cross-sectional area	Demolish site concrete	1,337	CY	$113.00	$151,081.00		
					31-23-16.46-4220	Excavating, bulk, dozer, open site, 200 HP, 150' haul, common earth	Remove waste coal from surface	4,963	CY	$4.44	$22,035.72		
					02-41-16.17-4200	On-site disposal of demolition debris	Bury waste coal, asphalt and concrete on site	6,300.00	CY	$10.95	$68,985.00		
					31-23-23.17-0020	Spread dumped material by dozer, no compaction	Cover waste repository with clean soil	3,970	CY	$2.29	$9,091.30		
Clear Surface of Coal Waste, Demolish Concrete & Asphalt, Bury Onsite	1	LS	$32,450.00	$32,450.00	31-14-13.23-1420	Loam or topsoil, remove and stockpile on site, 6" deep, 200' haul	Remove and stockpile gravel beneath roadway	422	CY	$2.65	$1,118.30	$264,347.82	714.6%
Excavate Jewkes and Portal Canyon Channels	9,630	BCY	$6.70	$64,521.00	31-23-16.42-0250	Excavating, excavator, hydraulic, crawler mtd, 1.5 CY capacity	Excavate channels	9,630	CY	$2.14	$20,608.20	$20,608.20	-68.1%
					31-23-23.17-0170	Spread fill from stockpile with 2-1/2 CY F.E. loader, 130 HP, 300' haul	Backfill soil against cut slopes	9,090	CY	$3.70	$33,633.00		
					31-23-23.23-5600	Compaction, sheepsfoot roller, 6" lifts, 2 passes	Compact backfill	9,090	CY	$0.97	$8,817.30		
Backfill and Compact Excavated Fill Against Cut Slopes	1	LS	$25,000.00	$25,000.00	02-41-13.40-0170	Selective demolition, metal drainage piping, CMP, steel, 24" diam.	Remove culvert	390	LF	$14.55	$5,674.50	$48,124.80	92.5%
					32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	Rip area before topsoiling	182	MSF	$31.50	$5,721.82		
					31-23-23.17-0170	Spread fill from stockpile with 2-1/2 CY F.E. loader, 130 HP, 300' haul	Place topsoil	6,040	CY	$3.70	$22,348.00		
Topsoil Reclaimed Hillslopes	6,040	BCY	$5.50	$33,220.00	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	Rip upper topsoil area following removal	35	MSF	$31.50	$1,111.32	$29,181.14	-12.2%
Install Gravel Filter in Channel	925	CY	$21.00	$19,425.00	31-23-23.17-0170	Spread fill from stockpile with 2-1/2 CY F.E. loader, 130 HP, 300' haul	Place gravel filter blanket	520	CY	$3.70	$1,924.00	$1,924.00	-90.1%
Place Dso = 6" Riprap in Constructed Channels	925	CY	$48.50	$44,862.50	31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	Place riprap in channels	520	CY	$67.50	$35,100.00	$35,100.00	-21.8%
Engineered Log Jam Structures	20	Ea	$1,350.00	$27,000.00	Crew B-3B	2 Laborers, 1 Equip. Oper., 1 Truck Driver, 1 Backhow Loader (80 HP), 1 Dump Truck (12 CY)	Construct log jams	4	Days	$3,194.58	$12,778.32	$12,778.32	-52.7%
					32-91-13.16-0600	Mulching, oat straw, 1" deep, hand spread	Spread straw mulch	20,183	SY	$1.64	$33,099.76		
Roughen Reclaimed Area with Pocks and Apply Straw Mulch	5	Acre	$2,110.00	$10,550.00	32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	Roughen the area	182	MSF	$31.50	$5,721.82	$38,821.57	268.0%
Apply Seed to Reclaimed Area	5	Acre	$355.00	$1,775.00	32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P				$480.00	$2,400.00	$2,400.00	35.2%
DIRECT COST TOTAL				$289,653.50								$490,880.45	69.5%

Omitted items (all lump sum): File Notice of Intent for General Construction Permit and Implement Storm Water Pollution Prevention Plan (SWPPP)

Assumes: All demolished metal became the property of the contractor (i.e., no on-site burial or off-site disposal costs included)

Horizon Mine Final Reclamation Quantities:

Item of Work	Height (ft)	Width (ft)	Length (ft)	Area (SF)	Volume CF	Volume CY			
Seal and Reclaim Portals									
Return portal temp block seal	8	18		144	0	0			
Fan portal temp metal seal	8	18		144	0	0			
Belt portal chain link barrier	14	20		280	0	0			
Belt portal block seal	12	18		216	0	0			
Belt portal collapsed roof material	12	18	25	216	5,400	200			
Return portal concrete collar	1	40	10	40	400	15			
Fan portal concrete collar	1	40	25	40	1,000	37	Total =	70	CY
Belt portal concrete collar	1	48	10	48	480	18			
Return portal backfill	8	18	25	144	3,600	133			
Return portal highwall backfill	10	20	10	200	2,000	74			
Fan portal backfill	8	18	25	144	3,600	133	Total =	540	CY
Belt portal backfill	12	18	25	216	5,400	200			
Clear Surface of Coal Waste, Demolish Concrete & Asphalt, and Bury On Site									
(Distances and Area from Google Earth. Thicknesses [i.e., Height] estimated)									
Asphalt roadway	0.33	20	570	11,400					
Waste coal on surface	2			67,000	134,000	4,963			
Total material (from specification)						6,300			
Site concrete (difference)						1,337			
Waste repository cover	4			26,800	107,200	3,970			
Gravel beneath roadway	1	20	570	11,400	11,400	422			
Construct Reclamation Channels (Quantities from construction specification)									
Gravel filter blanket						520			
Riprap (generated on site)						520			
Backfill and Compact Excavated Fill Against Cut Slopes									
Available backfill (channel excav.)						9,630			
Used for portal backfill						540			
Available for general site backfill						9,090			
Culvert in Portal Canyon	2		390						
Spread Topsoil									
Volume of topsoil						6,040			
Area to be topsoiled (4.17 ac)					181,645				
Upper topsoil storage area 0.81 ac)					35,280				

UNIT PRICES FROM RS MEANS SITE WORK AND LANDSCAPE COST DATA

Means Number	Description	Means Unit Rates ($)			Units
		2015	2017	2018	
01-31-13.20-0120	Field personnel, engineer, average	2,150.00	2,275.00	2,300.00	Week
02-41-13.17-5050	Pavement removal, bituminous roads, 4"-6" thick	9.60	9.80	9.50	SY
02-41-13.40-0170	Selective demolition, metal drainage piping, CMP, steel, 24" diam.	14.40	14.70	14.55	LF
02-41-13.62-0675	Selective demolition, chain link, fence, 12' high	4.79	4.95	4.84	LF
02-41-13.90-1200	Selective demolition, metal bin retaining wall, 10' wide, 16-28' high	4.32	4.42	4.37	SF
02-41-16.17-2080	Building demolition, walls, block, 8" thick	0.88	0.89	0.88	SF
02-41-16.17-4200	On-site disposal of demolition debris	11.25	11.40	10.95	CY
03-05-05.10-0050	Selective demolition, concrete, break into small pieces, reinforcing less than 1% of cross-sectional area	108.00	111.00	113.00	CY
03-05-05.10-0070	Selective demolition, concrete, break into small pieces, reinforcing more than 2% of cross-sectional area	325.00	335.00	335.00	CY
03-05-13.25-0500	3/8" rounded stone & 1/2" pea gravel, loaded at pit, crushed bank gravel	28.50	30.50	33.00	Ton
03-05-13.25-1050	Stone, 3/4" to 1-1/2", loaded at pit, crushed bank gravel	37.50	41.50	37.00	CY
03-30-53.40-4050	Concrete, including forms, Grade 60 rebar, placement, and finishing, foundation mat over 20 CY	335.00	355.00	360.00	CY
04-22-10.26-0500	Concrete block, solid, 8"x16" block, 8" thick, normal weight, horiz. joint reinf.	9.30	9.65	10.00	SF
31-05-13.10-0800	Borrow, topsoil, weed free, spread w/ 200 HP dozer, no compaction, 2 mi RT haul	35.00	35.50	35.00	CY
31-13-13.10-0550	Clearing brush with dozer and brush rake, medium brush to 4" diameter	325.00	330.00	315.00	Acre
31-14-13.23-1420	Topsoil stripping and stockpiling, on site, 6" deep, 200' haul, CY unit cost converted to acre unit cost	2,210.00	2,250.00	2,140.00	Acre
31-14-13.23-1420	Loam or topsoil, remove and stockpile on site, 6" deep, 200' haul	2.74	2.79	2.65	CY
31-22-13.20-0170	Rough grade sites, 8100-10000 SF, dozer	1,375.00	1,400.00	1,400.00	Ea
31-22-16.120-3300	Finish grading slopes, gentle, SY unit cost converted to acre unit cost	1,015.00	1,015.00	1,015.00	Acre
31-23-16.42-0250	Excavating, excavator, hydraulic, crawler mtd, 1.5 CY capacity	2.22	2.21	2.14	BCY

Means Number	Description	Means Unit Rates ($)			Units
		2015	2017	2018	
31-23-16.42-0300	Excavating, excavator, hydraulic, crawler mtd, 3 CY capacity	1.81	1.82	1.72	BCY
31-23-16.42-1601	Excavating, front end loader, wheel mounted, 3 CY capacity, common earth, piled. Increased 15% for loading (see 31-23-16.42-0020)	1.45	1.54	1.51	BCY
31-23-16.46-4220	Excavating, bulk, dozer, open site, 200 HP, 150' haul, common earth	4.60	4.67	4.44	BCY
31-23-19.10-0020	Cut drainage ditch, common earth, 30' wide x 1' deep	0.32	0.31	0.31	LF
31-23-23.13-0900	Compaction in 12" layers, roller compaction operator walking	6.95	7.25	7.25	ECY
31-23-23.15-4060	Borrow, loading, common earth, front end loader, wheel mtd., 1.5 CY bucket	19.70	20.50	20.50	BCY
31-23-23.15-6040	Borrow, loading, blasted rock, front end loader, wheel mtd., 1.5 CY bucket	15.20	15.65	15.60	BCY
31-23-23.17-0020	Spread dumped material by dozer, no compaction	2.38	2.41	2.29	LCY
31-23-23.17-0170	Spread fill from stockpile with 2-1/2 CY F.E. loader, 130 HP, 300' haul			3.70	LCY
31-23-23.20-1072	Hauling, 12 CY truck, 15 min wait/Ld/Uld, 40 mph, cycle 6 miles	5.20	5.25	4.80	LCY
31-23-23.20-1216	Hauling, 12 CY truck, 20 min wait/Ld/Uld, 15 mph, cycle 1 mile	5.20	5.25	4.80	
31-23-23.20-4314	Hauling, 20 CY truck, 20 min wait/Ld/Uld, 50 mph, cycle 50 miles	10.85	11.05	10.30	LCY
31-23-23.23-5600	Compaction, sheepsfoot roller, 6" lifts, 2 passes	0.90	0.96	0.97	ECY
31-23-23.23-9000	Compaction water, 3000 gal truck, 3 mile haul	2.45	2.46	2.42	ECY
31-25-14.16-0020	Rolled erosion control mats and blankets, jute mesh, 100 SY per roll, 4' wide, stapled	1.85	1.57	1.72	SY
31-25-14.16-1000	Silt fence, install and maintain, remove	2.11	1.96	1.88	LF
31-32-19.16-1500	Geotextile fabric, woven, 200 lb tensile strength	2.46	1.41	1.42	SY
31-32-19.16-1550	Geotextile fabric, nonwoven, 120 lb tensile strength	1.59	1.30	1.31	
31-37-13.10-0100	Riprap and rock lining, machine placed for slope protection	63.00	65.00	67.50	LCY
31-37-13.10-0350	Riprap and rock lining, random broken stone, dumped, 100 lb average	32.50	33.00	31.50	Ton
31-37-13.10-0370	Riprap and rock lining, random broken stone, dumped, 300 lb average	33.50	33.50	32.00	Ton

Means Number	Description	Means Unit Rates ($)			Units
		2015	2017	2018	
32-32-23.13-7170	Segmental concrete unit masonry retaining wall, medium, lt. wt., straight split	15.70	14.80	15.10	SF
32-32-23.13-7250	Geo-grid soil reinforcement, 4'x50'	0.88	0.79	0.79	SF
32-91-13.16-0600	Mulching, oat straw, 1" deep, hand spread	1.63	1.63	1.64	SY
32-91-13.23-2610	Rough grade and scarify, 200 HP dozer with scarifier	32.50	33.00	31.50	MSF
32-92-19.13-0020	Mechanical seeding, equipment only, including 10% O&P	475.00	495.00	480.00	Acre
32-93-43.40-4703	Trees, material cost only, Rocky Mountain Juniper, 4' to 5'	78.00	79.50	80.00	Ea
32-96-23.43-0300	Planting, moving trees on site, 36" ball	510.00	525.00	515.00	Ea
A 1010-110-2500	Strip footing, 24" wide x 12" deep, reinf., including excavation, forms, compacted backfill, and concrete	40.25	42.50	42.60	LF
G 1030-210-1300	Common earth backfill, 80 HP dozer & roller compactors, 150' haul, 8" lifts, 2 passes	5.61	5.77	5.76	CY
G 1030-210-1500	Common earth backfill, 80 HP dozer & roller compactors, 300' haul, 8" lifts, 2 passes	6.95	7.16	7.15	CY
G 1030-120-2800	Excavate and haul common earth, 2-1/2 CY excavator, six 12 CY dump trucks, 1 mile RT	7.79	7.86	7.29	CY
Crew B-3B	2 Laborers, 1 Equip. Oper., 1 Truck Driver, 1 Backhow Loader (80 HP), 1 Dump Truck (12 CY)	3,215.08	3,298.30	3,194.58	Day
Crew B-38	1 Foreman, 2 Laborers, 2 Equip. Oper. (light and medium), 1 Backhoe Loader (48 HP), 1 Hyd. Hammer (1200 lb), 1 FE Loader (WM, 4 CY), 1 Pvmt. Rem. Bucket	4,019.70	4,119.78	3,986.34	Day

Indian-Price Canyon Seed Mix

From UDOGM AMR Reclamation Construction Specification for Indian-Price Canyon site

Common Name	Scientific Name	Pounds PLS/ac	Unit Cost ($/lb)	Project Cost ($)
Grasses				
Indian Rice Grass	Achnatherum hymenoides	1.50	6.95	10.43
Muttongrass	Poa fendleriana	1.25	28.00	35.00
Purple Three-awn	Aristida purpurea	0.75	59.95	44.96
Squirreltail	Elymus elymoides	1.50	18.95	28.43
Western Wheatgrass	Pascopyrum smithii	2.00	5.95	11.90
Alkali sacoton	Sporobolus airoides	0.75	29.95	22.46
Sand Dropseed	Sporobolus cryptandrus	1.25	7.50	9.38
Sandberg Bluegrass	Poa secunda	1.00	8.50	8.50
Forbs				
Sticky Geranium	Geranium viscosissimum	0.50	98.00	49.00
Firecracker penstemon	Penstemon eatonii	0.50	75.00	37.50
Common Globemallow	Sphaeralcea coccinea	0.75	59.00	44.25
Blue flax	Linum lewisii	1.00	14.50	14.50
Early Indian Paintbrush	Castilleja chromosa	0.25	150.00	37.50
Blueleaf Aster	Aster glaucodes Var. glaucodes	0.50	60.00	30.00
Mountain Lupine	Lupinus alpestris argenteus	0.50	59.00	29.50
Shrubs				
Nevada Ephedra	Ephedra nevadensis	0.50	18.00	9.00
Black Sage	Artemisia nova	0.50	18.00	9.00
Four-wing Saltbush	Atriplex canescens	0.75	18.00	13.50
Shadscale	Atriplex confertifolia	0.75	9.00	6.75
Utah Serviceberry	Amelanchier utahensis	0.50	59.00	29.50
SUBTOTAL =				481.05
Percent increase to account for Pure Live Seed =		10.00	%	48.11
TOTAL PROJECT UNIT SEED COST PER ACRE =				529.16

Unit costs from Great Basin Seed (www.greatbasinseeds.com), downloaded 19 Mar 2019, except:

Purple Three-awn cost from Native American Seed (http://www.seedsource.com)

Blueleaf Aster cost estimated

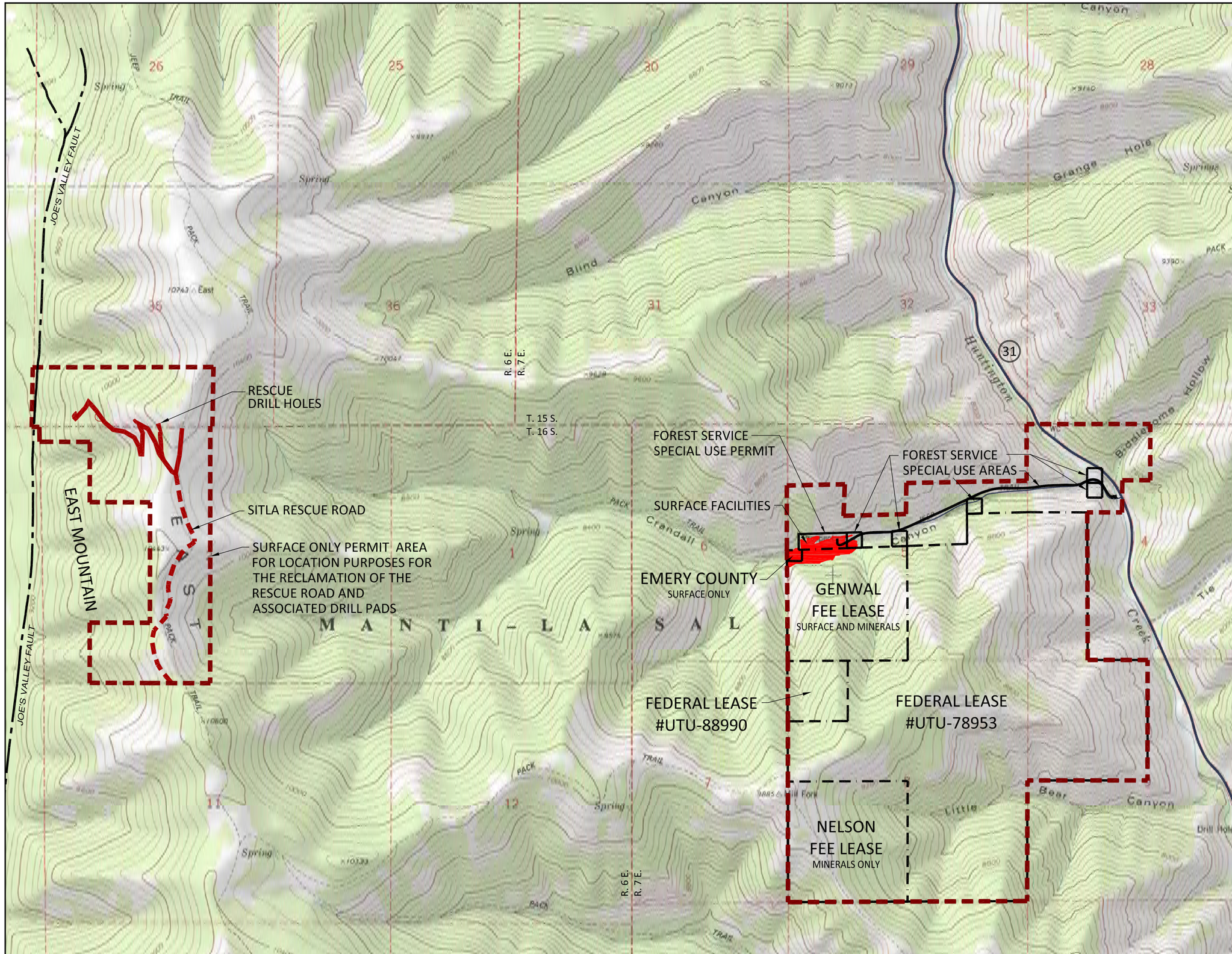
ATTACHMENT B

Indirect Cost Evaluation

UTAH ABANDONED MINE RECLAMATION PROGRAM
INDIRECT COSTS FROM PROJECT BIDS

Project Name	Contractor	Year	Total Direct Cost ($)	Mob/Demob		Insurance		Bonds		Total	
				Cost ($)	% of Direct	Cost ($)	% of Direct	Cost ($)	% of Direct	Cost ($)	% of Direct
Horizon Site Reclamation	Nelco Contractors	2018	$ 298,413.50	$ 10,350.00	3.5%	$ 950.00	0.3%	$ 8,938.00	3.0%	$ 20,238.00	6.8%
Hiawatha Mine Portal Closure	The 5 Seventeen Company	2018	$ 141,285.00	$ 5,000.00	3.5%	$ 2,589.00	1.8%	$ 10,020.00	7.1%	$ 17,609.00	12.5%
Knight-Ideal Loadout	Kent Bethers Construction	2012	$ 1,073,188.00	$ 28,085.00	2.6%	$ 7,000.00	0.7%	$ 45,790.00	4.3%	$ 80,875.00	7.5%
Indian-Price Canyon Lower Willow Creek	Harrison Oilfield Services	2017	$ 276,337.15	$ 31,640.00	11.4%	$ 100.00	0.04%	$ 5,042.00	1.8%	$ 36,782.00	13.3%
Morrison Site Reclamation	Harrison Oilfield Services	2015	$ 158,298.31	$ 16,867.00	10.7%	$ 1,000.00	0.6%	$ 5,284.96	3.3%	$ 23,151.96	14.6%
Pondtown Creek II Project	Kent Bethers Construction	2012	$ 126,573.75	$ 2,100.00	1.7%	$ 2,611.00	2.1%	$ 3,917.00	3.1%	$ 8,628.00	6.8%
Trash Canyon Project	Nelco Contractors	2017	$ 105,448.90	$ 12,500.00	11.9%	$ 1,250.00	1.2%	$ 3,603.60	3.4%	$ 17,353.60	16.5%
TOTALS (Weighted Average Percentages)			$ 2,179,544.61	$ 106,542.00	4.9%	$ 15,500.00	0.7%	$ 82,595.56	3.8%	$ 204,637.56	9.4%

Note: UDOGM Tech Directive 007 recommends an indirect cost of 10% for mobilization/demobilization, permits, insurance, and bonds.



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CRANDALL CANYON MINE
LEASE / PERMIT AREA MAP

REV: 18	ACAD: 1-1 LEASE MAP R18	
DATE: 4-30-20	BY: JDS/PJJ	
SCALE: 1"=2000'	PLATE #: 1-1	

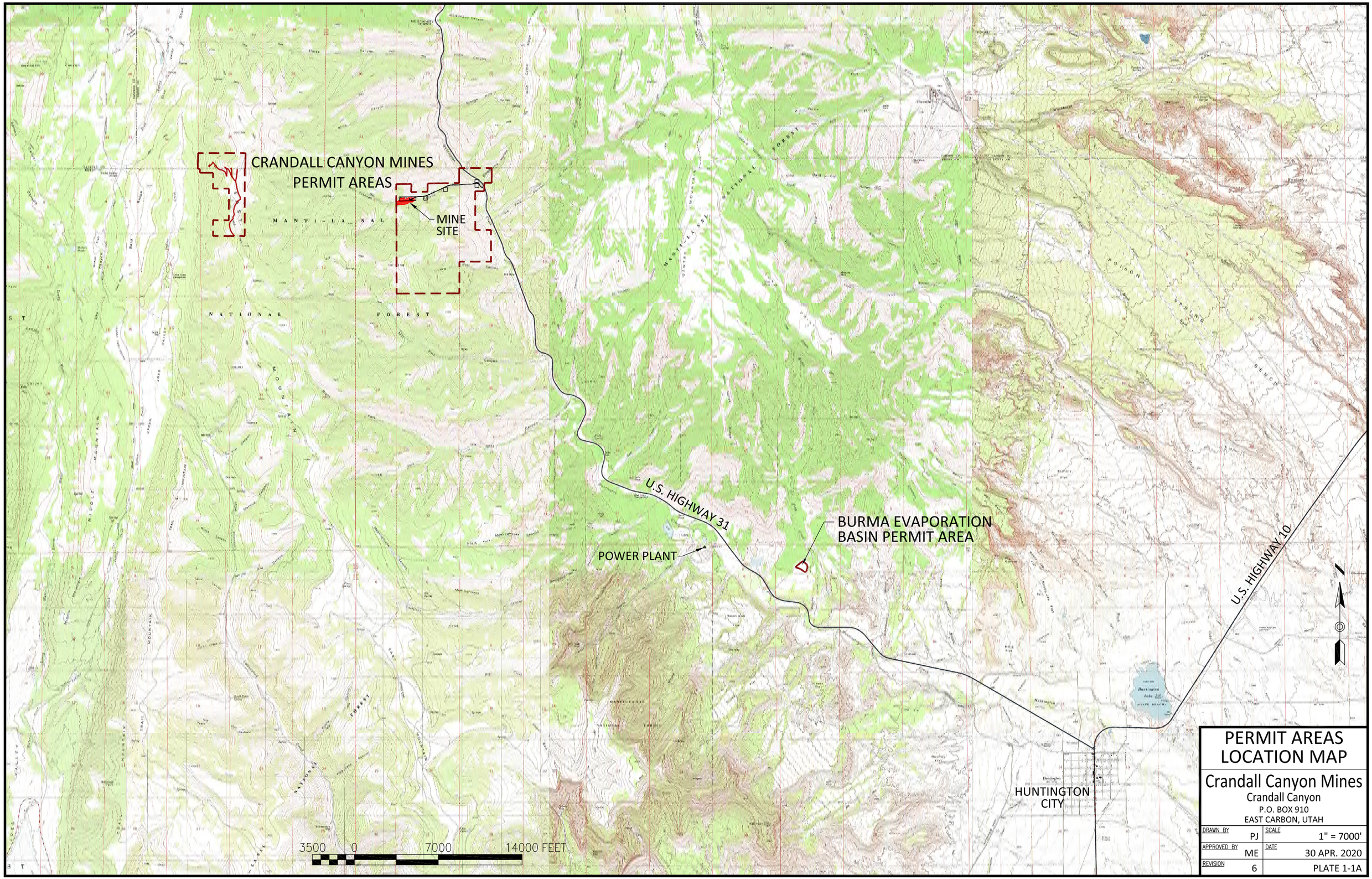
N

LEGEND

- UDOGM PERMIT BOUNDARY
- TYPICAL LEASE BOUNDARY
- MINE SURFACE FACILITIES
- THE PERMIT AREA IS ENTIRELY WITHIN THE MANTI - LA SAL NATIONAL FOREST

NOTE:
SEE PLATE 1-1A FOR LOCATION OF BURMA EVAPORATION POND (PERMIT AREA).

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\1-1 LEASE MAP REV18.dwg, Plate 1-1, 4/27/2020 10:07:07 AM



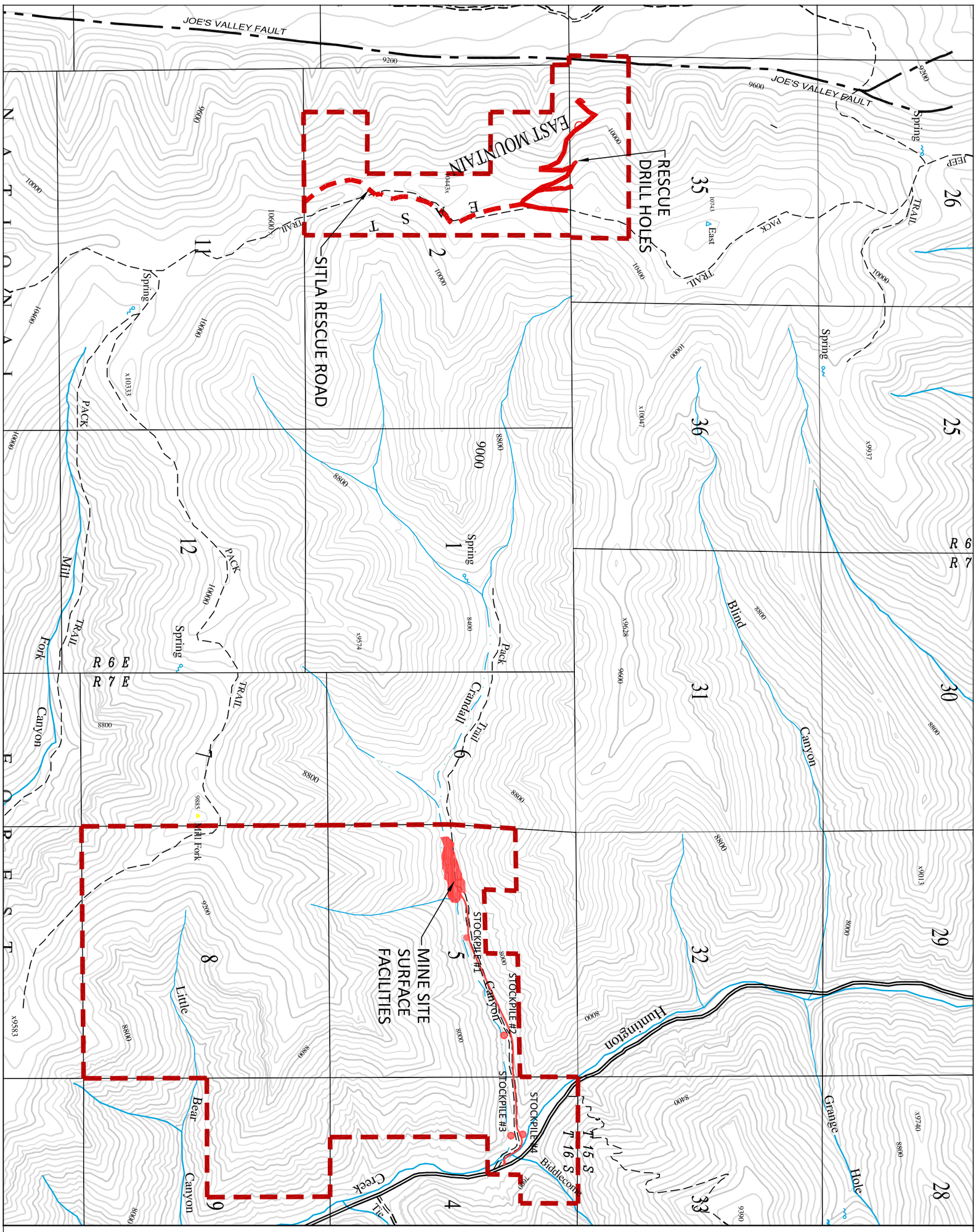
PERMIT AREAS LOCATION MAP

Crandall Canyon Mines

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

DRAWN BY	PJ	SCALE	1" = 7000'
APPROVED BY	ME	DATE	30 APR. 2020
REVISION	6		PLATE 1-1A

G:\Current Drawings\WRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\1-1A Permit Areas R6.dwg, Plate 1-1a, 4/27/2020 10:10:05 AM



LEGEND

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

THE PERMIT AREA IS ENTIRELY WITHIN THE MANTI – LA SAL NATIONAL FOREST

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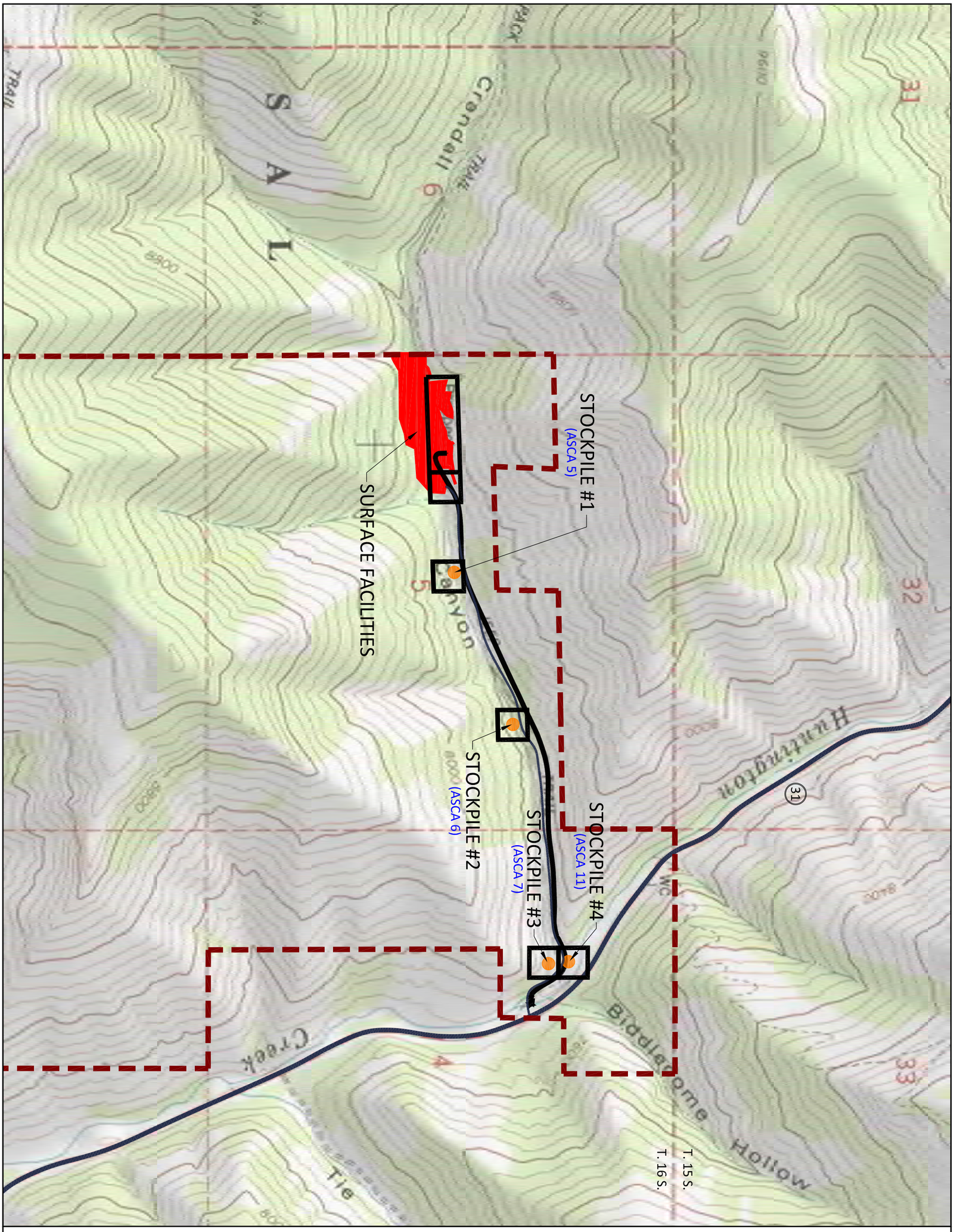
CRANDALL CANYON MINE
DISTURBED AREAS MAP

REV: 4	ACAD: 1-2 DISTURBED AREAS R4
DATE: 4-30-20	BY: PJJ
SCALE: 1"=2000'	PLATE #: 1-2



LEGEND

UDOGM PERMIT BOUNDARY

TYPICAL LEASE BOUNDARY

STOCKPILE LOCATIONS (PERMIT AREA)

USFS SPECIAL USE PERMIT AREAS

THE PERMIT AREA IS ENTIRELY WITHIN
THE MANTI - LA SAL NATIONAL FOREST

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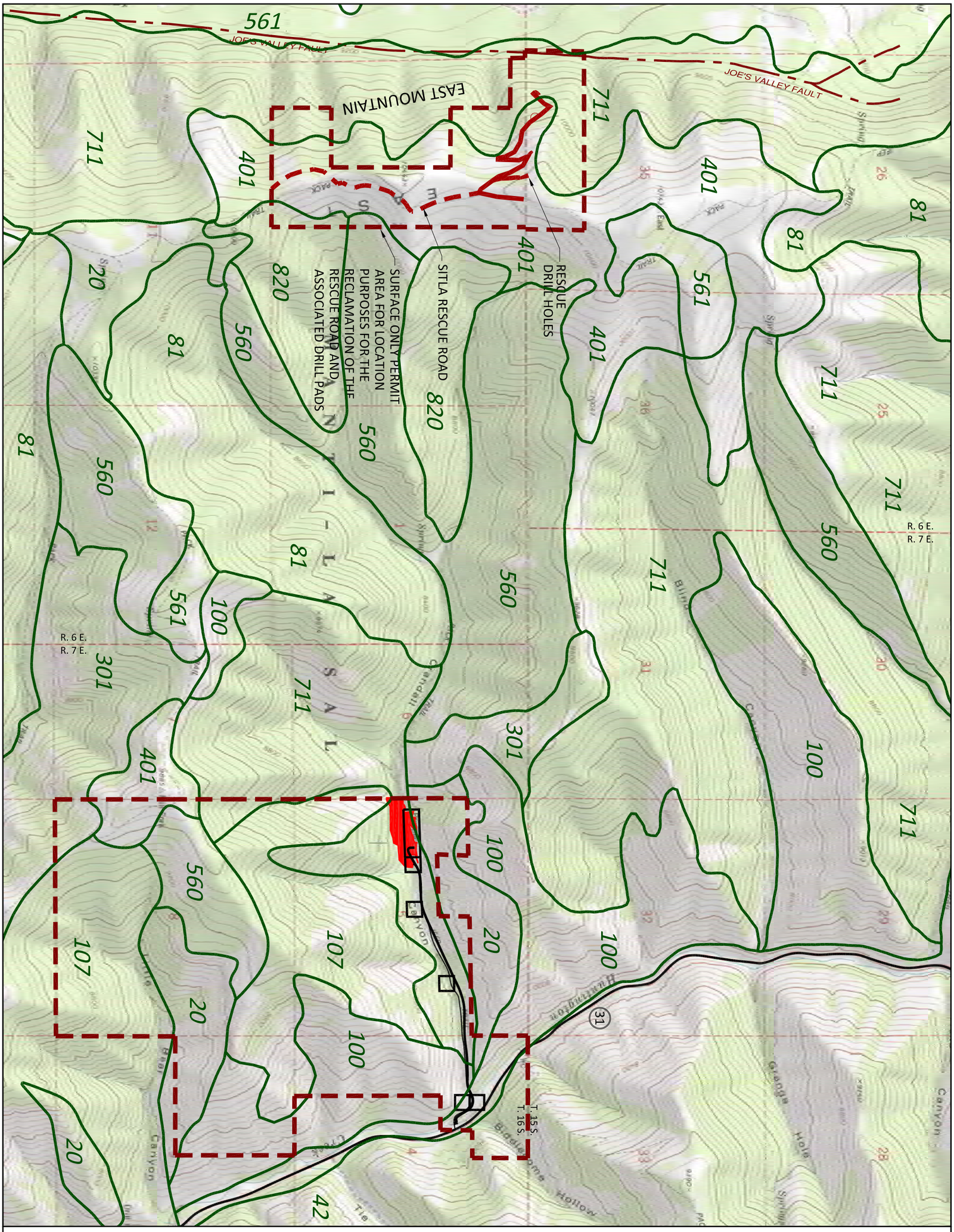
CRANDALL CANYON MINE
TOPSOIL STOCKPILE LOCATIONS

REV: 9	ACAD: STOCKPILE LOCATIONS R9
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=1000'	PLATE #: 2-3

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\2-6 REGIONAL SOILS MAP R15.dwg, Plate 2-6, 4/27/2020 10:22:13 AM



SOIL TYPE KEY

- 8 GREYBACK FAMILY-CRYOTHENTS COMPLEX
- 20 STRYCH-PATHEAD-PODO FAMILIES-RUBBLELAND COMPLEX
- 41 CASTINO FAMILY
- 42 BECKS FAMILY-CRYAQUOLLS-SILAS FAMILY COMPLEX
- 81 BUNDO-LUCKY STAR-SCOUT FAMILIES COMPLEX
- 100 GRALIC-BEHANIN-ELWOOD FAMILIES COMPLEX
- 107 CURECANTI-ELWOOD-DUSCHENE FAMILIES COMPLEX
- 301 GREYBACK-LOAMY, MIXED (NONACIDIC) LITHIC CRYORTHENTS-BACHELOR FAMILIES COMPLEX
- 401 ADEL-MERINO FAMILIES COMPLEX
- 560 CLAYBURN-BROAD CANYON FAMILIES COMPLEX
- 561 CLAYBURN-FAIM-BEHANIN FAMILIES COMPLEX
- 711 BUNDO-LUCKY STAR-ADEL FAMILIES COMPLEX
- 820 LUCKY STAR-BUNDO-ADEL FAMILIES COMPLEX

SOIL TYPE BOUNDARY
MINE SURFACE FACILITIES
UDOGM PERMIT BOUNDARY
USFS SPECIAL USE PERMIT AREAS

SOURCE: Manti-LaSal Forest Service, 1995

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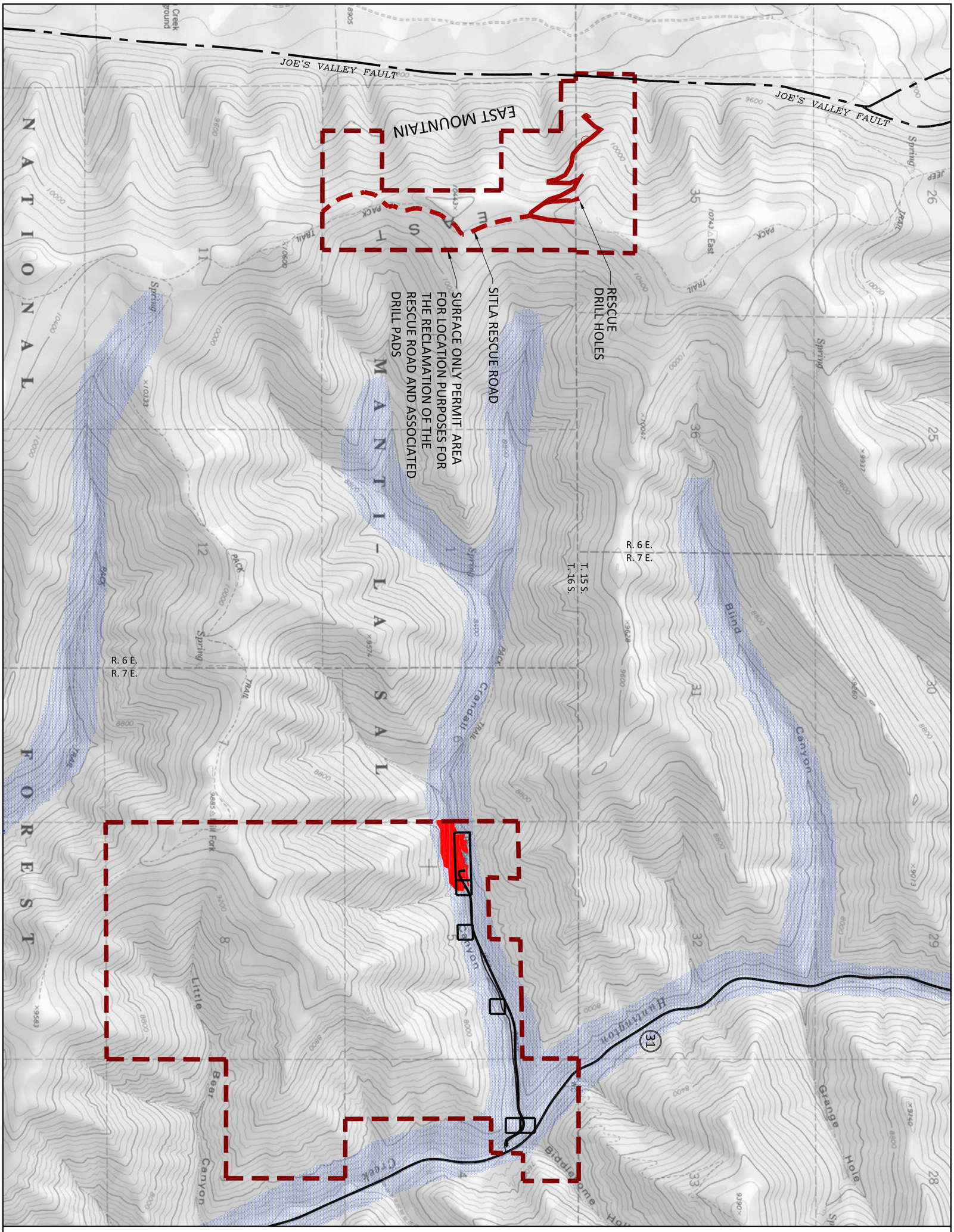
CRANDALL CANYON MINE
REGIONAL SOILS MAP

REV: 15	ACAD: REGIONAL SOILS MAP R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000	PLATE #: 2-6



LEGEND

MOOSE - YEAR ROUND

SOURCE: U.D.W.R. 2004

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

USFS SPECIAL USE PERMIT AREAS

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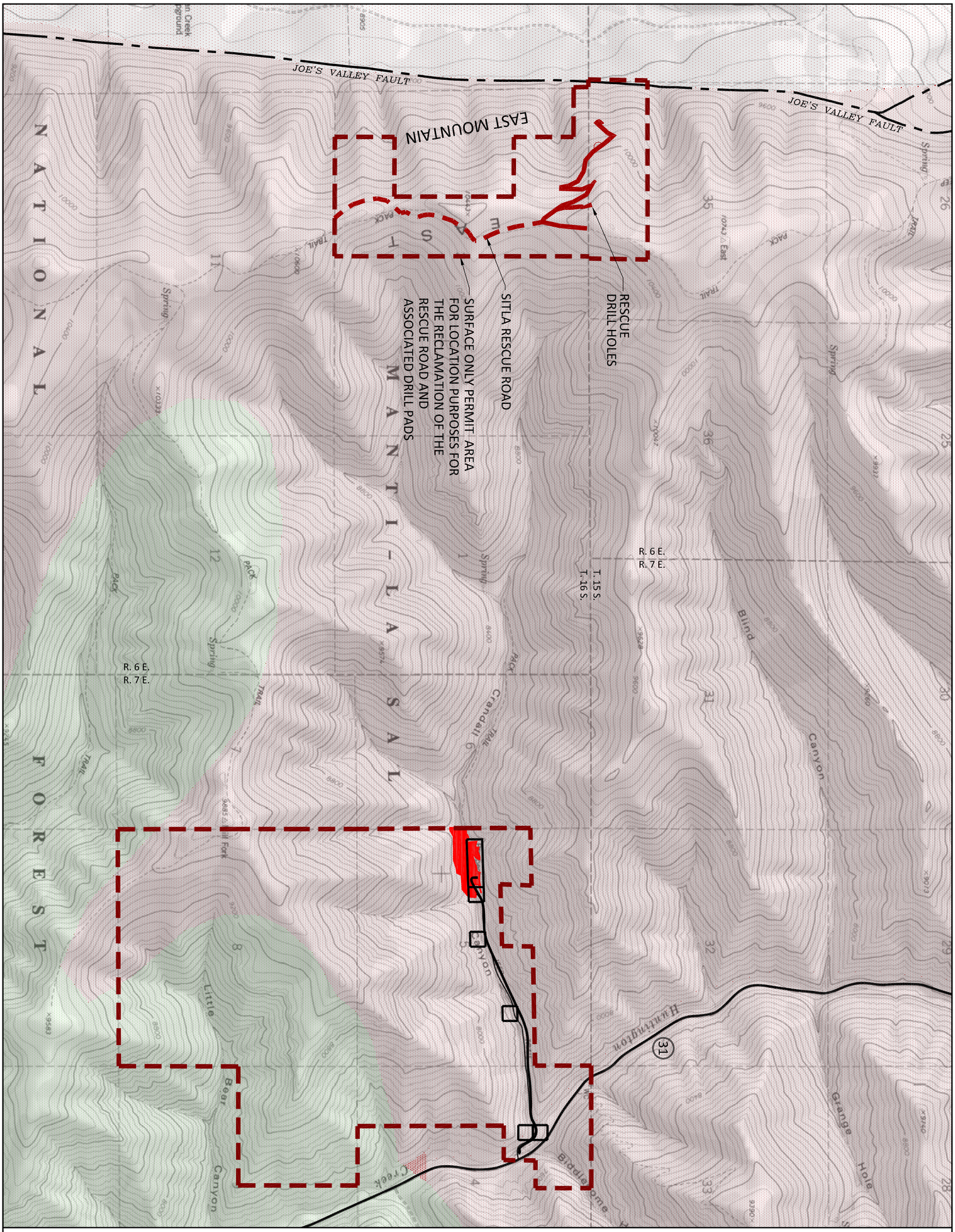
CRANDALL CANYON MINE
WILDLIFE MAP - MOOSE

REV: 15	ACAD: WILDLIFE-MOOSE R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 3-1 (A)

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\3-1B WILDLIFE-ELK R16.dwg, Plate 3-1b, 4/28/2020 2:43:16 PM



LEGEND

ELK - SUMMER

ELK - WINTER

SOURCE: U.D.W.R. 2004

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

USFS SPECIAL USE PERMIT AREAS

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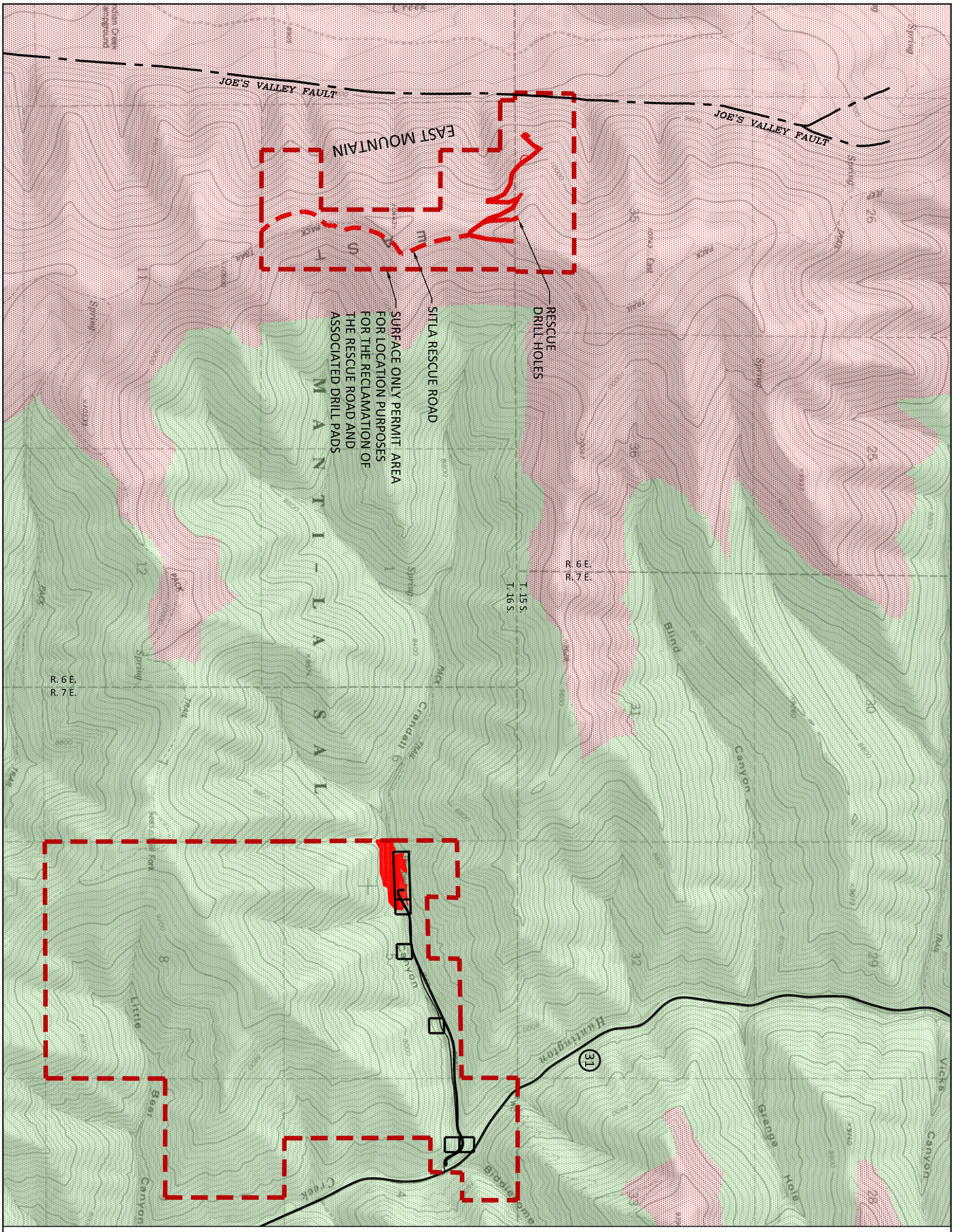
CRANDALL CANYON MINE

WILDLIFE MAP - ELK

REV: 16	ACAD: WILDLIFE-ELK R16
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 3-1 (B)

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\3-1C WILDLIFE-DEER R16.dwg, Plate 3-1c, 4/27/2020 10:30:44 AM



LEGEND

DEER - SUMMER

DEER - WINTER

SOURCE: U.D.W.R. 2004

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

USFS SPECIAL USE PERMIT AREAS

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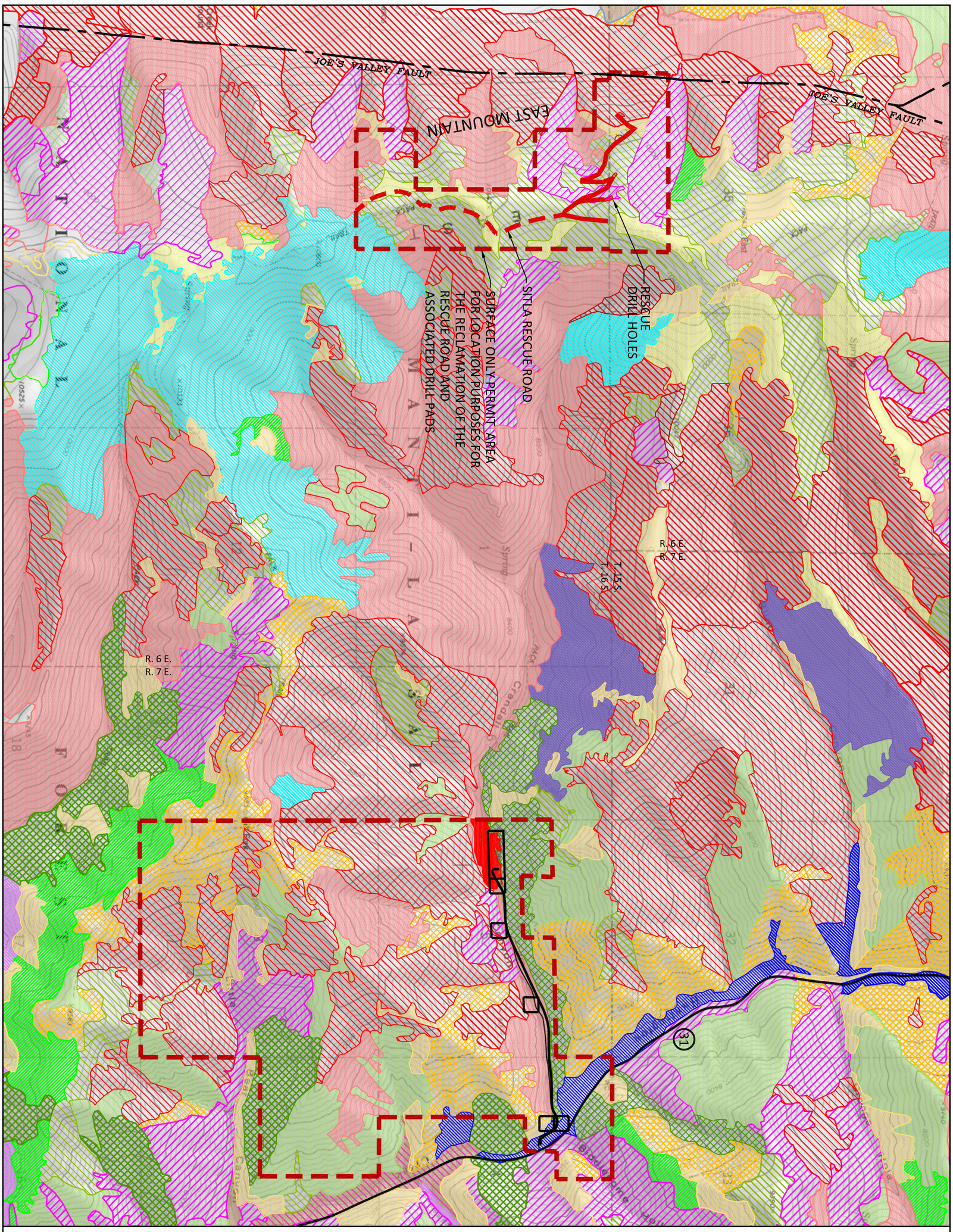
CRANDALL CANYON MINE

WILDLIFE MAP - DEER

REV: 16	ACAD: WILDLIFE-DEER R16
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 3-1 (C)



LEGEND

ASPEN	
ASPEN WITH CONIFER	
ASPEN WITH MOUNTAIN BRUSH	
BARREN ROCK OR LEDGE	
BLUE SPRUCE	
CURLLEAF MOUNTAIN MAHOGANY	
DOUGLAS FIR	
LIMBER/BRISTLECONE PINE	
MOUNTAIN BRUSH	
OAK BRUSH	

VEGETATION TYPES

PERENNIAL FORB	
PERENNIAL GRASSLAND	
PERENNIAL WETLAND	
ROCKY MOUNTAIN JUNIPER	
SAGEBRUSH	
SPRUCE-FIR	
TREE DOMINATED RIPARIAN	

SOURCE: U.S.F.S. 2005

UDOGM PERMIT BOUNDARY	
MINE SURFACE FACILITIES	
USFS SPECIAL USE PERMIT AREAS	

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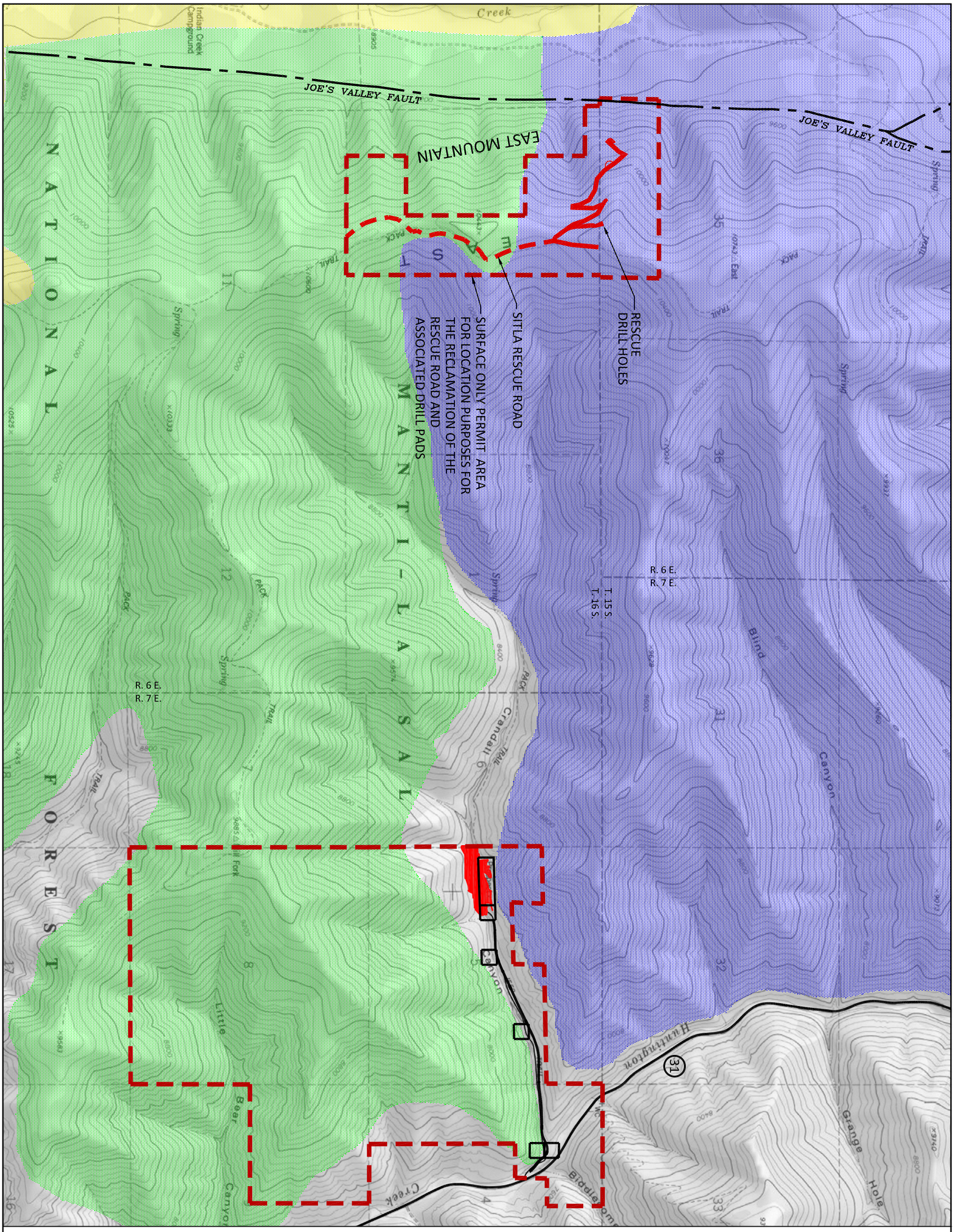
CRANDALL CANYON MINE
REGIONAL VEGETATION MAP

REV: 16	ACAD: VEGETATION MAP R16
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000	PLATE #: 3-2



LEGEND

CRANDALL CANYON SHEEP & GOAT ALLOTMENT

CRANDALL RIDGE SHEEP & GOAT ALLOTMENT

TRAIL MOUNTAIN COW & HORSE ALLOTMENT

SOURCE- Manti-LaSal Forest Service, 1998

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

USFS SPECIAL USE PERMIT AREAS

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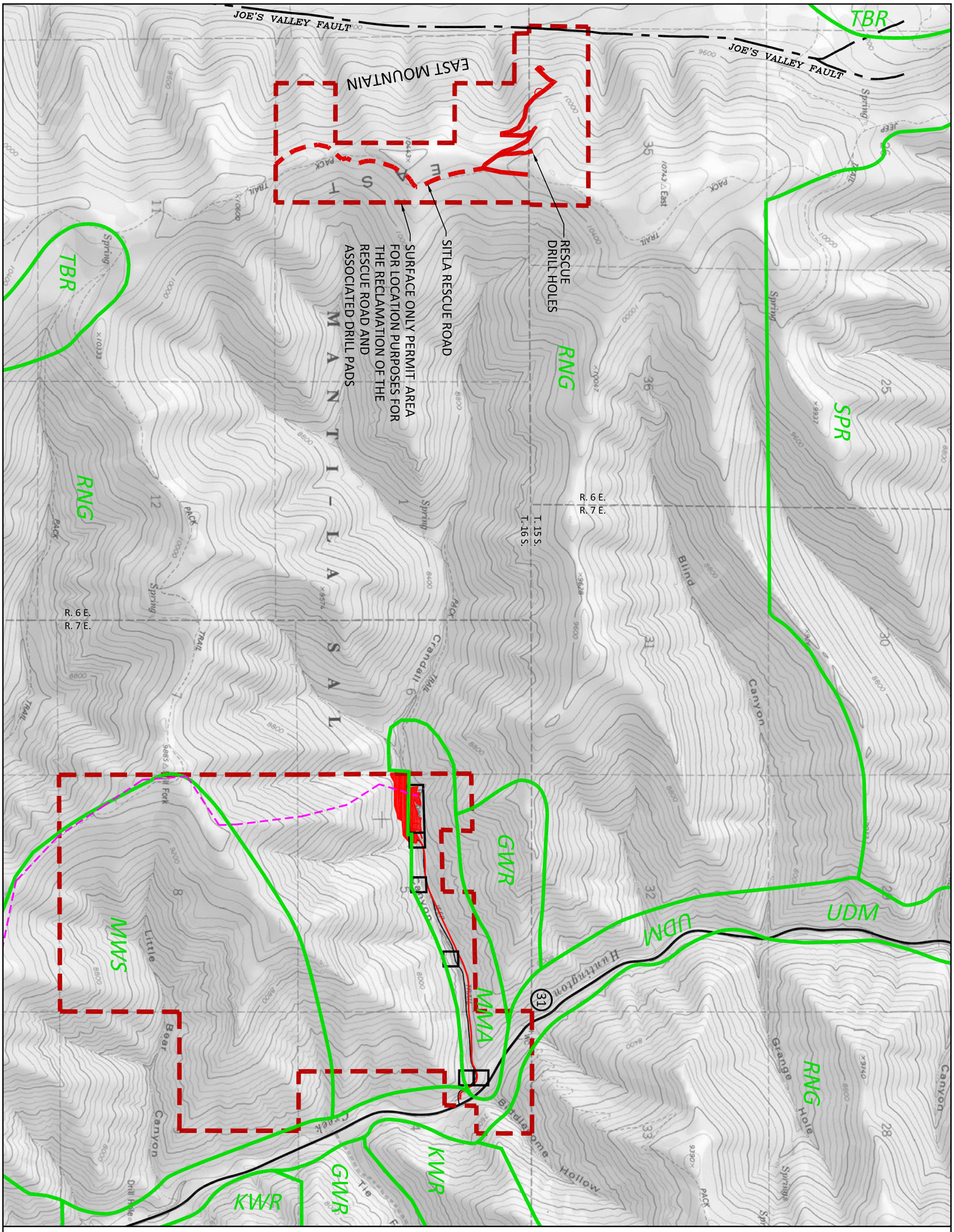
CRANDALL CANYON MINE
GRAZING ALLOTMENTS

REV: 14	ACAD: 4-1 LAND USE R14
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 4-1

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\4-2 LAND USE R15.dwg, Plate 4-2, 4/28/2020 2:50:08 PM



LEGEND

LAND USE BOUNDARY LINE	
MAIN POWER LINE	
WOOD FIBER PRODUCTION & HARVEST	TBR
GENERAL BIG GAME WINTER RANGE	GWR
LEASABLE MINERAL DEVELOPMENT	MMA
RANGELAND MAINTENANCE	RNG
MUNICIPAL WATER SUPPLY	MWS
UTILITY CORRIDORS & WINDOWS	UCW
KEY BIG GAME WINTER RANGE	KWR
SEMI-PRIMITIVE RECREATION USE	SPR
UNDEVELOPED MOTORIZED SITE	UDM
DEVELOPED RECREATIONAL SITE	DRS
GAS WELL	

SOURCE:
FOREST LAND AND RESOURCE MANAGEMENT PLAN, 1986 MANAGEMENT UNITS.

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

USFS SPECIAL USE PERMIT AREAS

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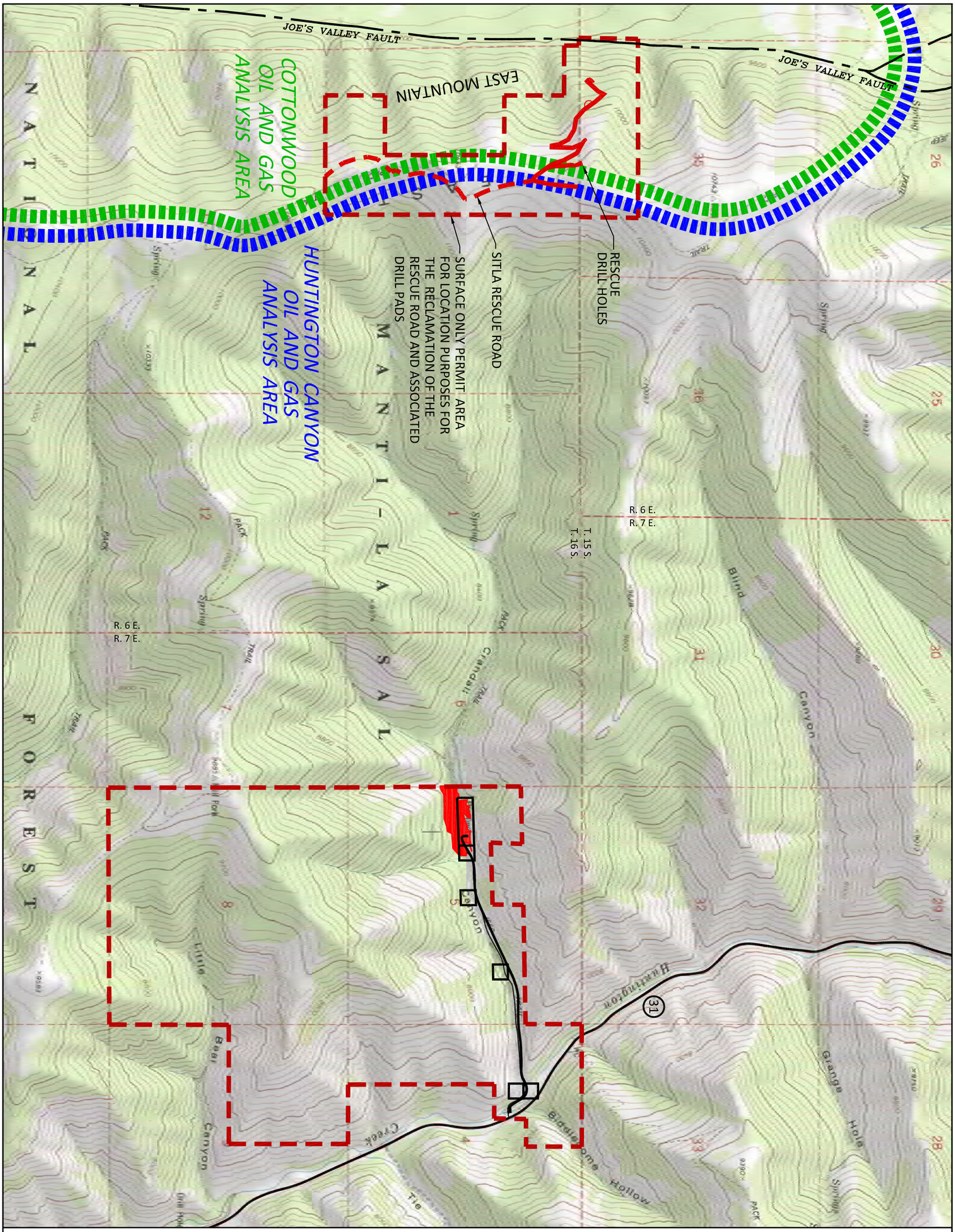
CRANDALL CANYON MINE LAND USE MAP

REV: 15	ACAD: LAND USE R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 4-2

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\4-3 OIL AND GAS R15.dwg, Plate 4-3, 4/27/2020 10:44:07 AM



LEGEND

GAS WELL

BOUNDARY OF ANALYSIS AREA

SOURCE:
FOREST LAND AND RESOURCE MANAGEMENT PLAN, 1986 MANAGEMENT UNITS.

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

USFS SPECIAL USE PERMIT AREAS

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CRANDALL CANYON MINE
OIL & GAS DEVELOPMENT

REV: 15	ACAD: OIL AND GAS R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 4-3

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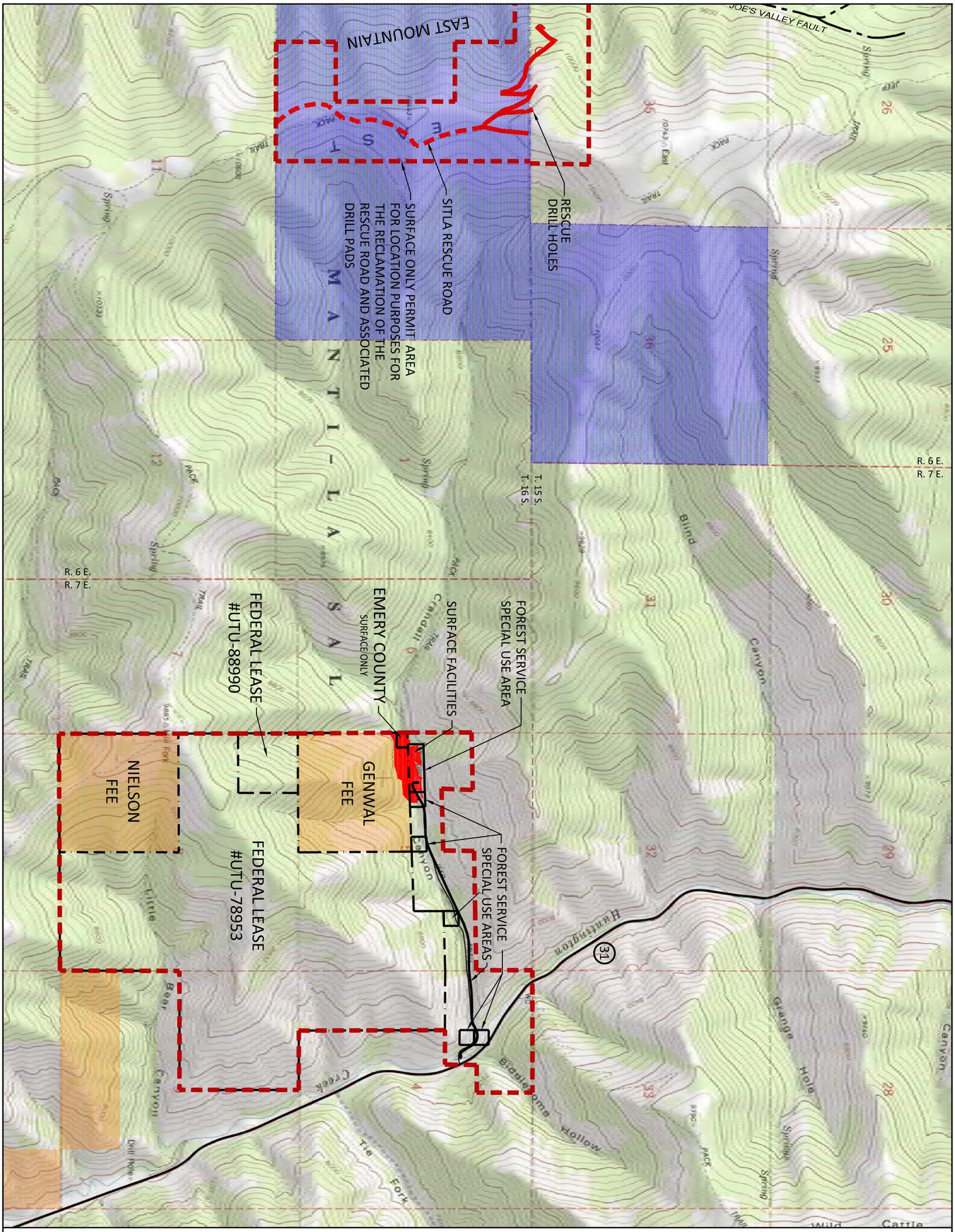

LEGEND

PRIVATE	
SCHOOL & INSTITUTIONAL TRUST LANDS ADMINISTRATION	
U.S. FOREST SERVICE	UNSHADED AREA
UDOGM PERMIT BOUNDARY	
MINE SURFACE FACILITIES	
USFS SPECIAL USE PERMIT AREAS	
LEASE BOUNDARY LINES	

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CRANDALL CANYON MINE
SURFACE OWNERSHIP MAP

REV: 15	ACAD: SURFACE OWNERSHIP R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 4-4

E WITH WOODEN STAKES

"U" STAKES AT 12"oc MAX.

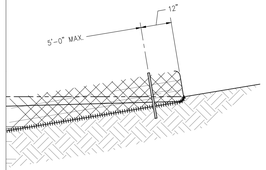
FIBER ROLL CHECK DAM NOTES:
1. PLACE A CHECK DAM AT 50.0' MAX. INTERVALS.

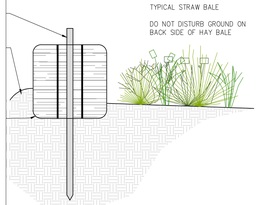
2. PLACE CHECK DAMS PERPENDICULAR TO THE FLOW LINE OF THE DITCH.

3. DO NOT PLACE CHECK DAMS ACROSS NATURAL STREAM BEDS.

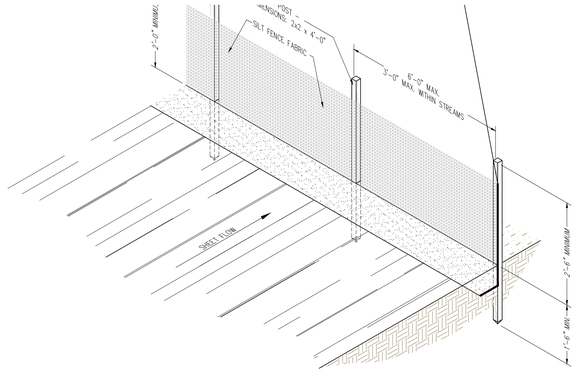
4. INSTALL CHECK DAMS PRIOR TO CONSTRUCTION AND MAINTAIN DAMS THROUGHOUT THE COURSE OF CONSTRUCTION. COMPLETELY REMOVE CHECK DAMS ONLY AFTER PIPELINE CONSTRUCTION AND ALL REQUIRED RECLAMATION ACTIVITES ARE COMPLETE.

5. CHECK DAMS OUTSIDE DITCHES TO CONTROL SHEET FLOW TO BE CONSTRUCTED AND INSTALLED SIMILARLY.

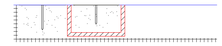




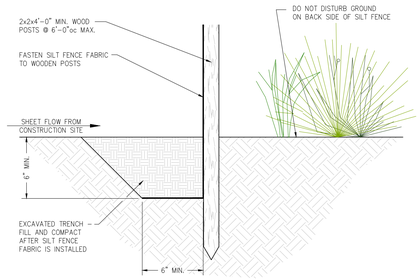
RAW BALE BARRIER SECTION



SILT FENCE ISOMETRIC VIEW



TYPICAL SILT FENCE SPLICE DETAIL



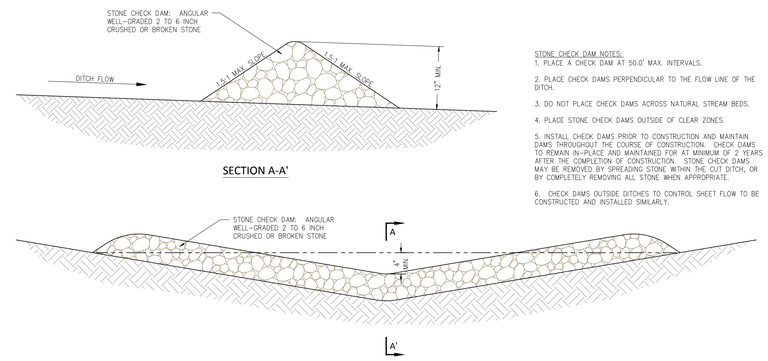
SILT FENCE SECTION

SILT FENCE NOTES:

1. POSITION SILT FENCES 5'-0" MINIMUM BEYOND THE TOE OF SLOPES. INSTALL SILT FENCES AT TO OF SLOPE WHEN PLACING WITHIN OR IMMEDIATELY ADJACENT TO A WETLAND.
2. ALIGN THE SILT FENCE ALONG THE CONTOUR AS MUCH AS IS POSSIBLE TO AVOID CREATING LOW POINTS ALONG THE SILT FENCE. PROVIDE AN OPENING IN THE FENCE AND INSTALL A SEDIMENT TRAP PER DETAIL 6/5-16 WHERE EXCESSIVE RUNOFF WILL ACCUMULATE AT A LOW POINT.
3. SECURE FENCE FABRIC SECURELY INTO THE GROUND BY EXCAVATING A 6" MINIMUM DEEP AND WIDE TRENCH, PLACING THE SILT FENCE FABRIC INTO THE TRENCH, THEN BACKFILLING THE EXCAVATED MATERIAL.
4. SECURE FENCE FABRIC TO WOODEN POSTS ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
5. MINIMIZE DISTURBANCE WHEN EXCAVATING TRENCH.
6. SILT FENCE INSTALLATION EQUIPMENT MAY BE USED AS AN ALTERNATIVE INSTALLATION METHOD IF BOTTOM 6 INCHES OF SILT FENCE FABRIC IS TRENCHED FIRMLY INTO THE GROUND, AND THE SILT FENCE MEETS ALL OTHER REQUIREMENTS.
7. RUN THE ENDS OF THE SILT FENCE SLIGHTLY UP SLOPE TO PREVENT RUNOFF FROM FLOWING AROUND THE ENDS OF THE SILT FENCE.
8. DO NOT PLACE SILT FENCES ACROSS AREAS OF CONCENTRATED FLOWS.
9. AVOID USING SPLICES ALONG THE FENCE AS MUCH AS POSSIBLE. OVERLAP THE END POSTS AND TWIST 180 DEGREES BEFORE STAKING THE POSTS WHEN NECESSARY.
10. WITHIN STREAMS, PROVIDE GALVANIZED CHAIN-LINK FENCING REINFORCING BETWEEN FENCE FABRIC AND POSTS. EXTEND SILT FENCE A MINIMUM OF 2'-6" ABOVE WATER LINE TYPICAL.

1 / 5-16 *TYPICAL SILT FENCE SEDIMENT CONTROL DETAIL*

SCALE: NO SCALE



STONE CHECK DAM NOTES:
1. PLACE A CHECK DAM AT 50.0' MAX. INTERVALS.

2. PLACE CHECK DAMS PERPENDICULAR TO THE FLOW LINE OF THE DITCH.

3. DO NOT PLACE CHECK DAMS ACROSS NATURAL STREAM BEDS.

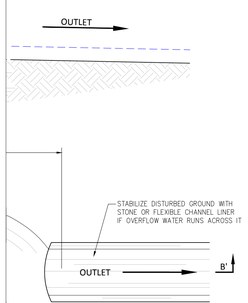
4. PLACE STONE CHECK DAMS OUTSIDE OF CLEAR ZONES.

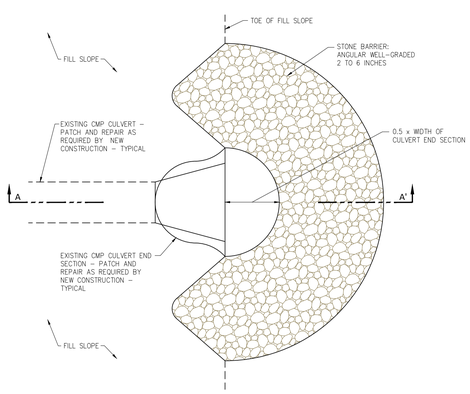
5. INSTALL CHECK DAMS PRIOR TO CONSTRUCTION AND MAINTAIN DAMS THROUGHOUT THE COURSE OF CONSTRUCTION. CHECK DAMS TO REMAIN IN-PLACE AND MAINTAINED FOR AT MINIMUM OF 2 YEARS AFTER THE COMPLETION OF CONSTRUCTION. STONE CHECK DAMS MAY BE REMOVED BY SPREADING STONE WITHIN THE CUT DITCH, OR BY COMPLETELY REMOVING ALL STONE WHEN APPROPRIATE.

6. CHECK DAMS OUTSIDE DITCHES TO CONTROL SHEET FLOW TO BE CONSTRUCTED AND INSTALLED SIMILARLY.

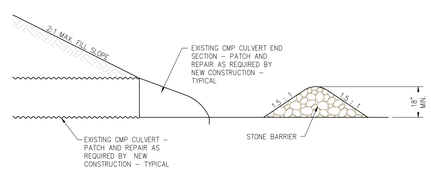
4 / 5-16 *TYPICAL STONE CHECK DAM (SEDIMENT CONTROL) DETAIL WITHIN DITCHES*

SCALE: NO SCALE





PLAN



SECTION A-A'

NOTES:
1. STONE BARRIER TO BE REMOVED AFTER CONSTRUCTION OF THE PIPELINE IS COMPLETE AND ALL RECLAMATION WORK ABOVE THE EXISTING CULVERT IS COMPLETE. REMOVE BARRIER BY SPREADING THE STONE ALONG THE RESTORED DRAINAGE DITCH.

2. AN 18" DIAMETER FIBER ROLL MAY BE USED IN LIEU OF A STONE BARRIER. FIBER ROLL TO BE STAKED AND KEYED-IN PER DETAIL 2/5-16.

3. ALLOW RUNOFF TO FLOW THROUGH THE BARRIER AND ENTER THE EXISTING PIPE CULVERT.

4. BARRIER TO BE INSTALLED PRIOR TO CONSTRUCTION AND REMAIN IN-PLACE THROUGHOUT THE COURSE OF THE CONSTRUCTION OF THE PIPELINE.

5 / 5-16 *TYPICAL EXISTING CULVERT INLET SEDIMENT CONTROL DETAIL*

0
SCALE: NO SCALE

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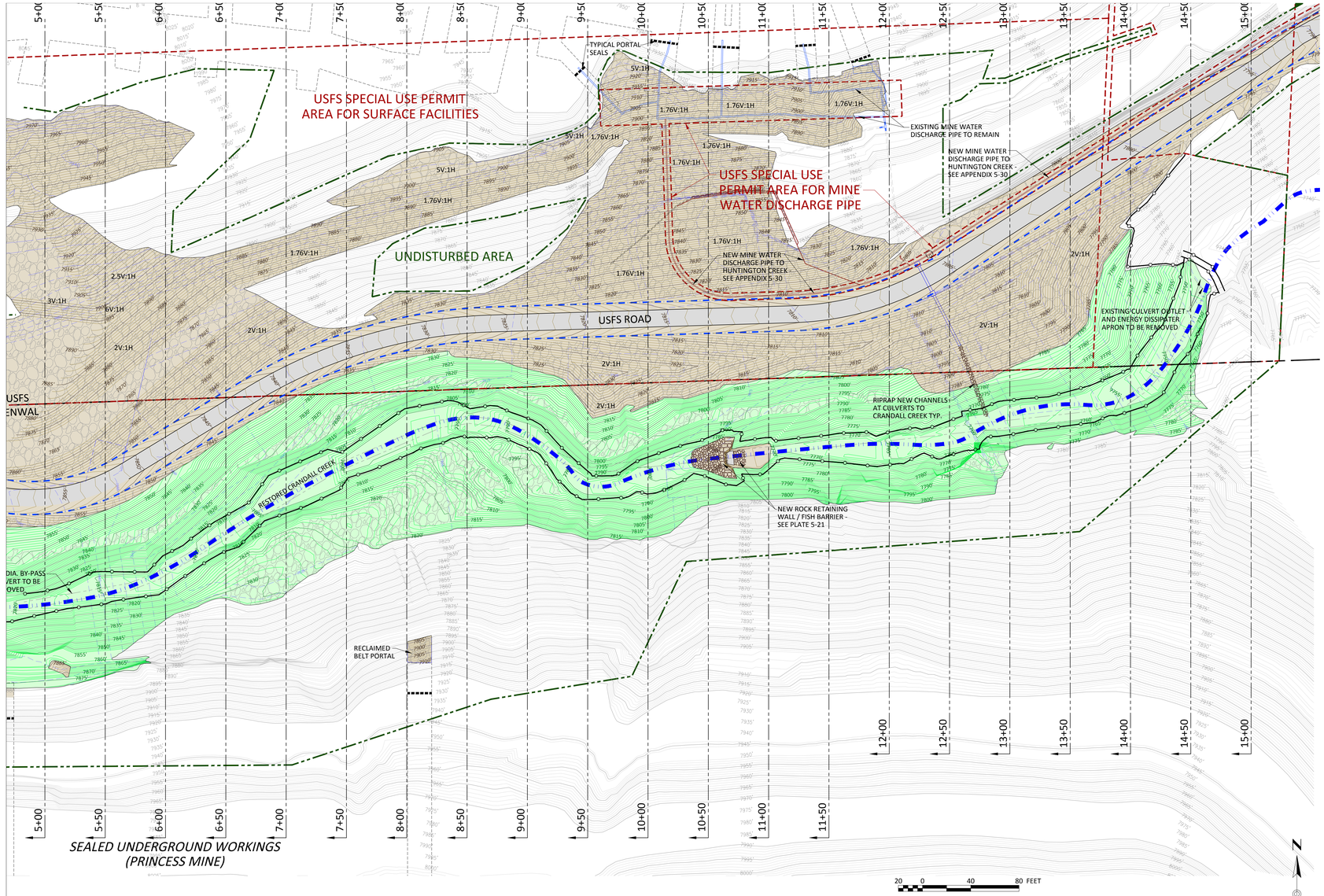
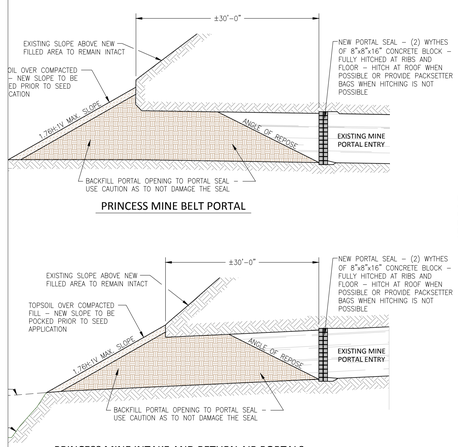
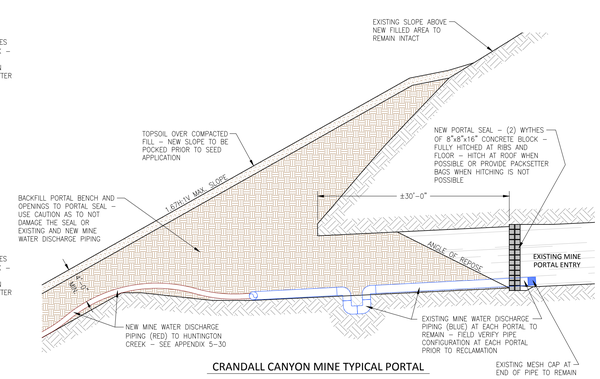
Telephone: (435) 888-4000

CRANDALL CANYON ROAD
SEDIMENT CONTROL DETAILS

REV: 1	ACAD: --
DATE: 4-30-2020	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5-16







NOTE: PROVIDE (1) 24"x24" FULL HEIGHT PILASTER AT THE CENTERLINE OF EACH PORTAL SEAL.

TYPICAL RECLAMATION OF MINE PORTAL OPENINGS

NO SCALE

COLOR KEY

- APPROX. RESTORED CRANDALL CREEK AREA
- APPROX. RECLAIMED AREA TO AOC
- RECLAIMED FOREST SERVICE ROAD
- FOREST SERVICE / MEMORIAL PARKING AREA
- RECLAIMED AREAS TO RECEIVE POCKING

LEGEND

- PERMIT AREA BOUNDARY
- DISTURBED AREA BOUNDARY
- FOREST SERVICE SPECIAL USE PERMIT BOUNDARY
- SITE CROSS SECTION (SEE PLATE 5-17A)
- ALTERNATIVE SEDIMENT CONTROL
- NEW RIPRAP CHANNEL PROTECTION
- 7910 UNAFFECTED INDEX CONTOURS (5' INTERVALS)
- UNAFFECTED INTERMEDIATE CONTOURS (1' INTERVALS)
- 7865 RESTORED INDEX CONTOURS (5' INTERVALS)
- RESTORED INTERMEDIATE CONTOURS (1' INTERVALS)
- 7865 RECLAIMED INDEX CONTOURS (5' INTERVALS)
- RECLAIMED INTERMEDIATE CONTOURS (1' INTERVALS)
- 7910 FORMER INDEX CONTOURS (5' INTERVALS) FOR REFERENCE ONLY
- NEW DITCH TO REMAIN AFTER RECLAMATION
- SILT FENCE FOR TEMPORARY SEDIMENT CONTROL - SEE DETAILS 1/5-16 AND 1/5-17a

RECLAMATION PLAN GENERAL NOTES:

1. CONTOURS SOUTH OF CRANDALL CREEK AND NORTH OF CRANDALL CREEK, BUT SOUTH OF THE USFS ROAD, TO BE ORIGINAL RESTORED CONTOURS UNLESS OTHERWISE NOTED.

2. NEW SLOPES SHALL HAVE A MAXIMUM SLOPE OF 2 HORIZONTAL UNITS TO 1 VERTICAL UNIT UNLESS OTHERWISE NOTED.

3. SEE PLATE 5-17A FOR CROSS-SECTION PROFILES.

4. COORDINATE WITH PLATE 5-3 AND APPENDIX 5-30 FOR MINE WATER DISCHARGE PIPELINE TO HUNTINGTON CREEK.

5. "USFS" REFERS TO THE UNITED STATES FOREST SERVICE.

6. ALL NEW RECLAIMED AREAS TO RECEIVE POCKING PRIOR TO SEED APPLICATION, EXCEPT NEW DITCHES AND ROAD SHOULDERS.

7. ALL RESTORED AREAS WITH A SLOPE OF LESS THAN 2 VERTICAL TO 1 HORIZONTAL UNITS SHALL BE POCKED PRIOR TO THE SEED APPLICATION.

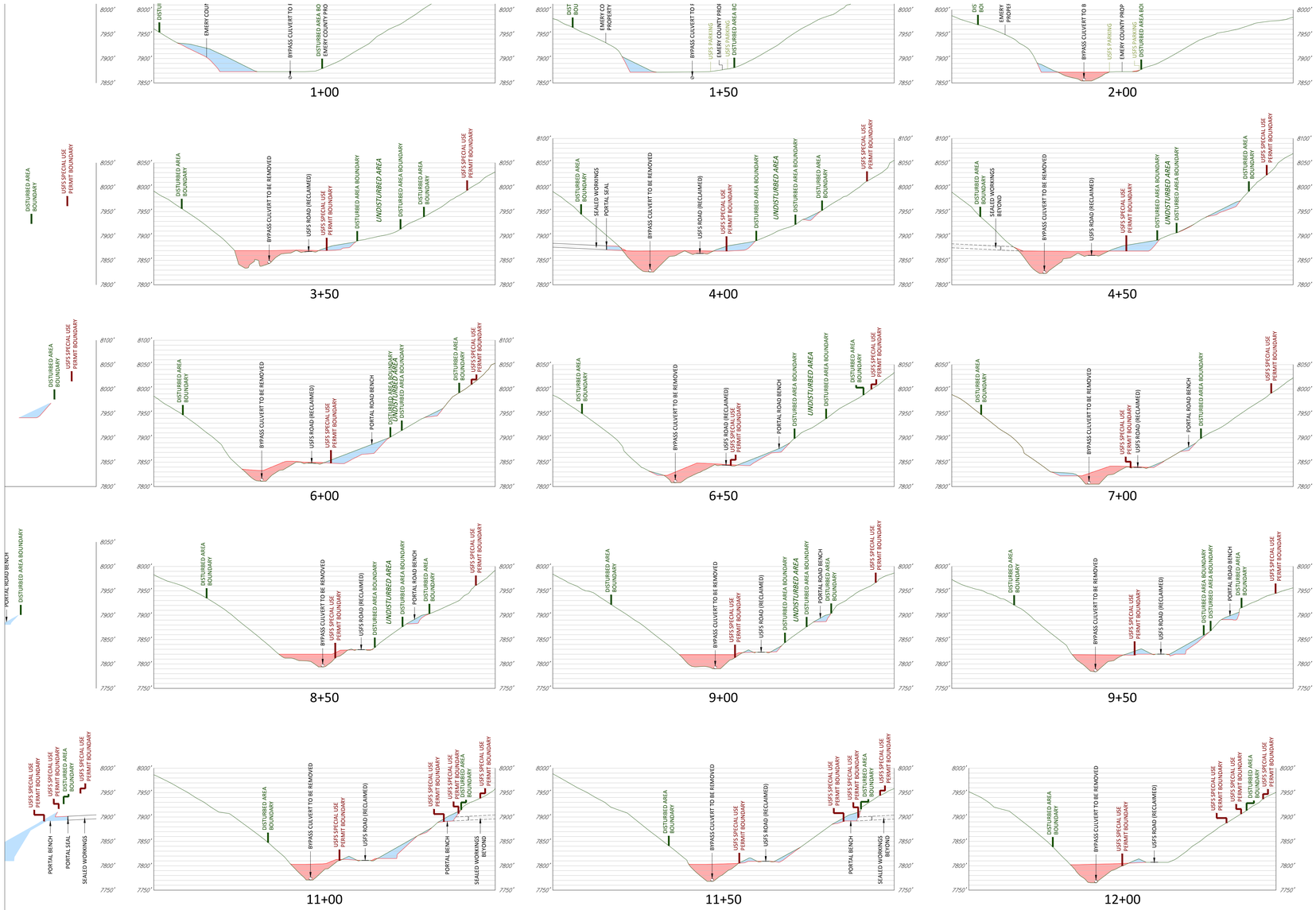
8. FEATHER NEW / RESTORED SLOPES INTO EXISTING UNAFFECTED SLOPES AT RESPECTIVE SLOPE INTERSECTIONS TYPICAL.

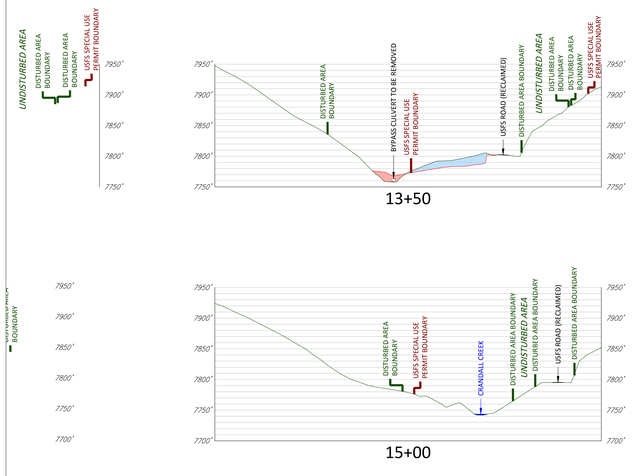
T. 16 S., R. 7 E., SLBM

MINE SITE RECLAMATION
RECLAMATION CONTOURS

GENWAL RESOURCES, INC.
794 NORTH "C" CANYON ROAD, EAST CARBON, UTAH 84520
P.O. BOX 910, PRICE, UTAH 84520
PHONE: (435) 888-4000 FAX: (435) 888-4002

CRANDALL CANYON MINES			
PERMIT NUMBER C015/032			
DRAWN BY:	PJ	SCALE	AS NOTED
APPROVED BY:	ME	DATE	30 APR. 2020
REVISION:	10	PLATE	5-17





CUT / FILL TABULATIONS

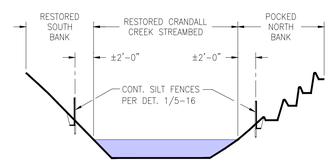
Station Number	CUT				FILL			
	Area (square feet)	Distance Between Stations (feet)	Total Cubic Footage	Total Cubic Yardage	Area (square feet)	Distance Between Stations (feet)	Total Cubic Footage	Total Cubic Yardage
0+00	0.00	50	0.00	0.00	0.00	50	0.00	0.00
0+50	0.00	50	0.00	0.00	2550.08	50	127,503.76	4,722.36
1+00	0.00	50	0.00	0.00	2729.04	50	136,451.86	5,053.77
1+50	0.00	50	0.00	0.00	778.66	50	38,933.03	1,441.96
2+00	1,143.27	50	57,163.56	2,117.17	323.94	50	16,197.09	599.89
2+50	1,578.31	50	78,915.68	2,922.80	0.00	50	0.00	0.00
3+00	2,113.24	50	105,661.78	3,913.40	0.00	50	0.00	0.00
3+50	2,575.91	50	128,795.75	4,770.21	533.68	50	26,684.17	988.30
4+00	3,246.82	50	162,341.18	6,012.64	1187.80	50	59,390.15	2,199.64
4+50	3,594.74	50	179,736.78	6,656.92	1593.42	50	79,671.00	2,950.78
5+00	3,684.94	50	184,246.76	6,823.95	3112.72	50	155,635.91	5,764.29
5+50	3,349.55	50	167,477.61	6,202.87	2625.90	50	131,295.10	4,862.78
6+00	1,709.78	50	85,489.00	3,166.26	1806.55	50	90,327.38	3,345.46
6+50	1,813.50	50	90,675.23	3,358.34	679.85	50	33,992.45	1,258.98
7+00	1,684.37	50	84,218.53	3,119.20	1111.53	50	55,576.64	2,058.39
7+50	1,565.36	50	78,268.10	2,898.82	194.59	50	9,729.28	360.34
8+00	1,547.32	50	77,366.21	2,865.42	197.41	50	9,870.49	365.57
8+50	1,885.95	50	94,297.74	3,492.51	258.77	50	12,938.32	479.20
9+00	2,383.94	50	119,197.04	4,414.71	369.52	50	18,476.21	684.30
9+50	1,870.48	50	93,524.18	3,463.86	1260.86	50	63,042.93	2,334.92
10+00	2,434.05	50	121,702.40	4,507.50	3762.26	50	188,112.85	6,967.14
10+50	1,710.41	50	85,520.58	3,167.43	3608.38	50	180,418.98	6,682.18
11+00	1,779.43	50	88,971.48	3,295.24	1239.41	50	61,970.39	2,295.20
11+50	2,053.51	50	102,675.43	3,802.79	871.25	50	43,562.34	1,613.42
12+00	2,359.77	50	117,988.52	4,369.95	144.35	50	7,217.70	267.32
12+50	2,565.24	50	128,262.05	4,750.45	1538.40	50	76,920.13	2,848.89
13+00	430.95	50	21,547.48	798.05	2973.41	50	148,670.34	5,506.31
13+50	432.78	50	21,638.93	801.44	1382.02	50	69,100.75	2,559.29
14+00	2,427.06	50	121,353.03	4,494.56	144.98	50	7,249.02	268.48
14+50	799.31	50	39,965.54	1,480.21	0.00	50	0.00	0.00
15+00	0.00	50	0.00	0.00	0.00	50	0.00	0.00
Subtotals	52,740.01	50	2,637,000.50	97,666.69	36978.76	50	1,848,938.18	68,479.19
	Add 18% Swell Factor			17,580.00	Add Topsoil for Crandall Canyon Road Reclamation			1,688.44
	Total Topsoil (see Chapter 2)			12,912.00				
Total Cut (cubic yards)				**128,158.69**	**Total Fill (cubic yards)**			**70,167.63**

PROFILE LEGEND

- EXISTING SURFACE LINE
- RECLAIMED / UNAFFECTED SURFACE LINE
- CUT AREA
- FILL AREA

NOTES:
1. CROSS SECTION LOCATIONS ARE SHOWN ON PLATE 5-17.

2. CRANDALL CREEK STREAM BED IS BASED UPON ACTUAL SURVEY CONDUCTED PRIOR TO THE EXPANSION OF THE SURFACE FACILITIES.



1 / 5-17a *TYPICAL SILT FENCES AT CRANDALL CREEK*

SCALE: NO SCALE

MINE SITE RECLAMATION
RECLAMATION PROFILES

GENWAL RESOURCES, INC.
794 NORTH "C" CANYON ROAD, EAST CARBON, UTAH 84520
P.O. BOX 910, PRICE, UTAH 84520
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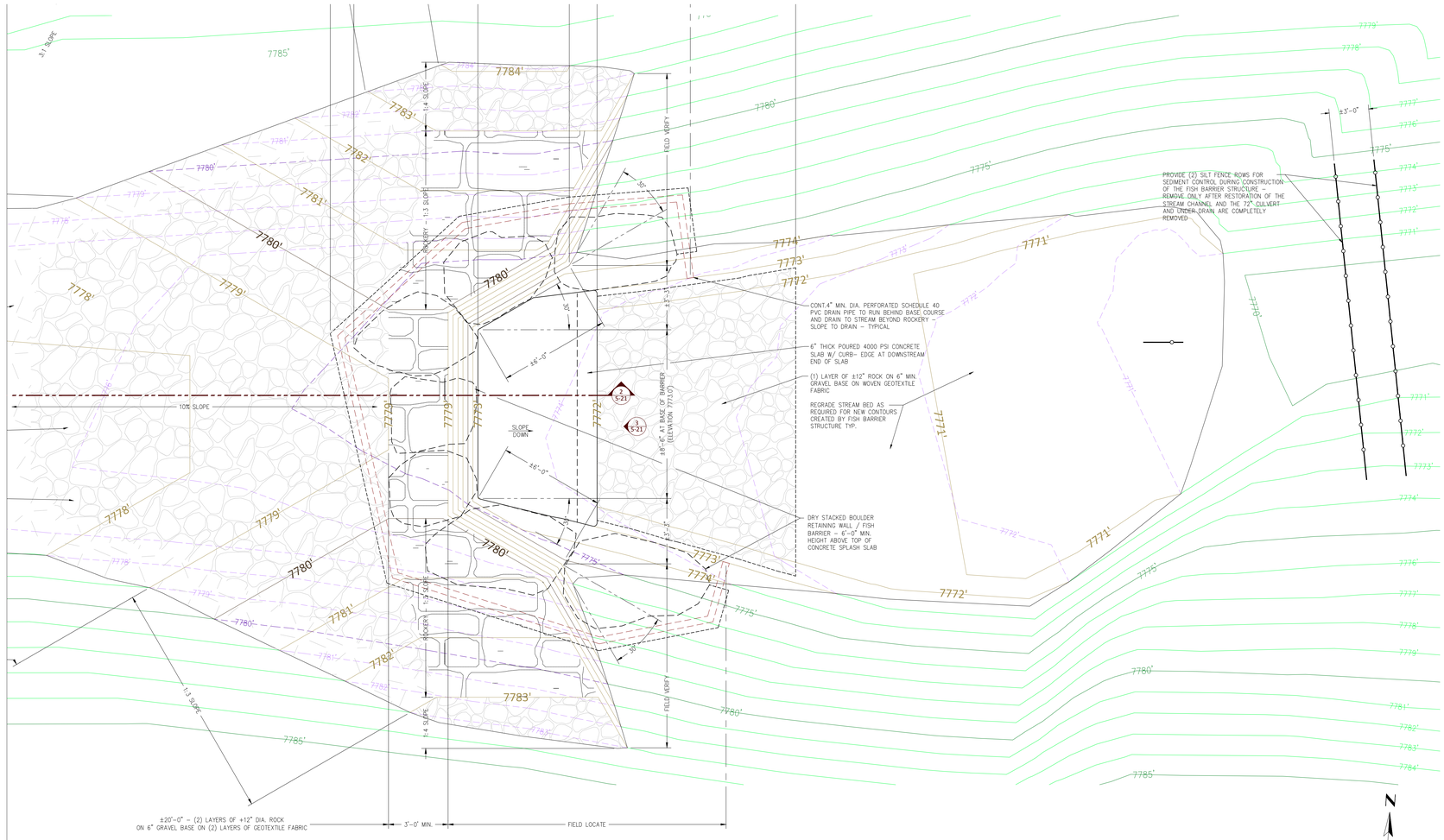
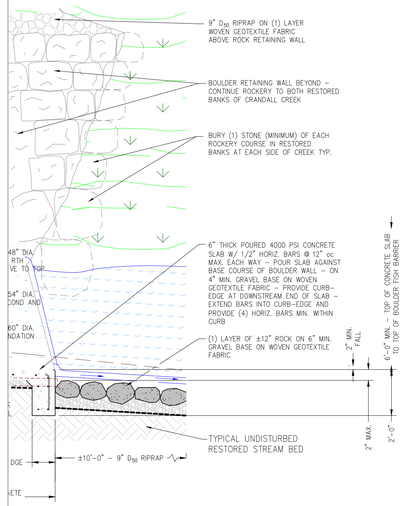
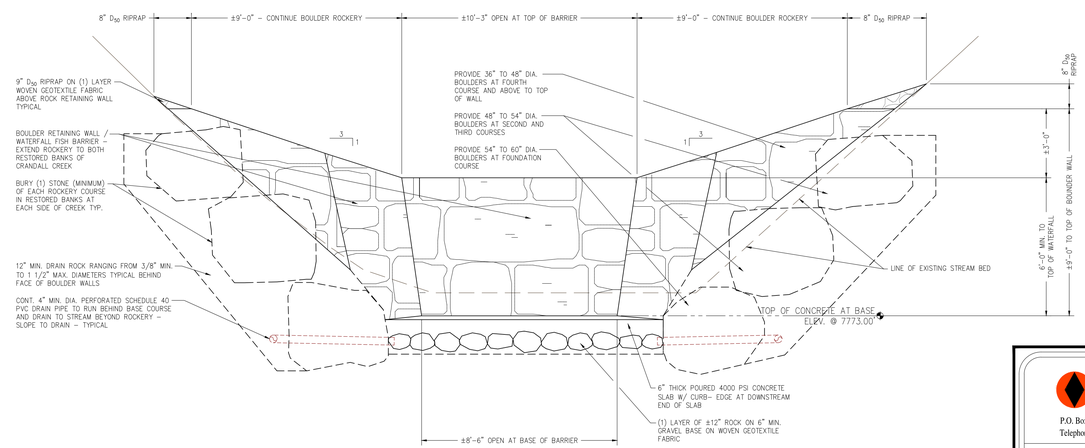
CRANDALL CANYON MINES
PERMIT NUMBER C015/032

DRAWN BY:	PJ	SCALE	AS NOTED
APPROVED BY:	ME	DATE	30 APR. 2020
REVISION:	10	PLATE	5-17a







3 / 5-21 *NEW FISH BARRIER WATERFALL FACE DETAIL*

SCALE: NO SCALE

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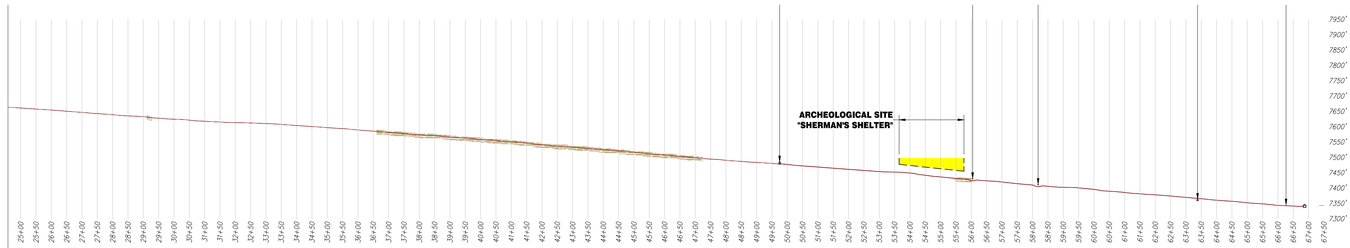
FISH BARRIER PLAN AND DETAILS

REV: 0	ACAD: PLATE 5-21 FISH BARRIER
DATE: 30 APR. 2020	BY: PJJ
SCALE: AS SHOWN	PLATE #: 5-21



STRUCTURES AT THE INLETS OF ALL CULVERTS PER SHEET 5-16.

3. PROVIDE NEW MANHOLE AT STATION 3+75 PER DETAIL 5/5-30-2d.

4. PROVIDE NEW MANHOLE AT STATION 49+75 PER DETAIL 4/5-30-2d.

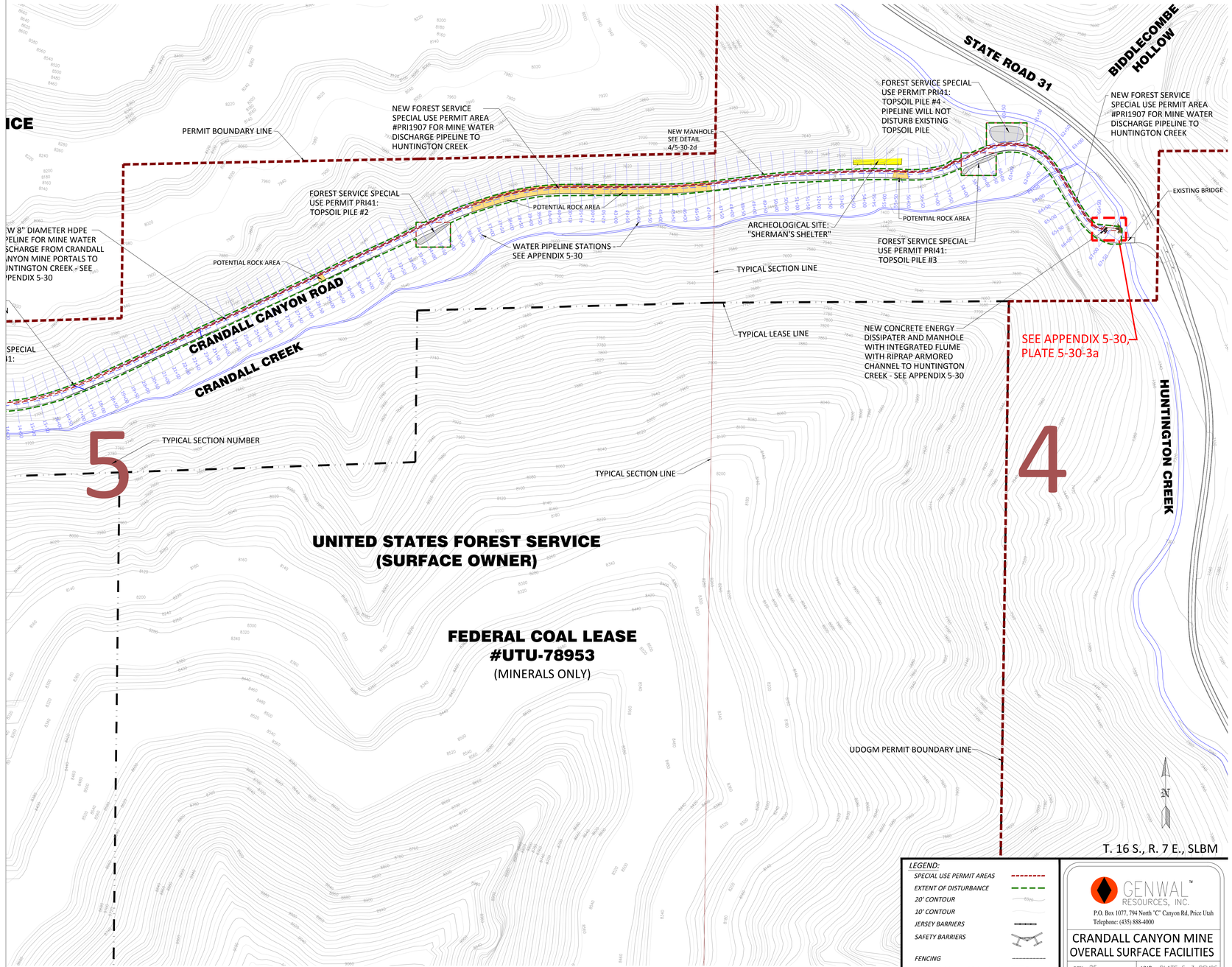
5. ALL PIPELINE VERTICAL CURVES SHALL BE OF MINIMUM OF 25.0 FEET. ALL PIPELINE HORIZONTAL CURVES SHALL BE A MINIMUM OF 20.0 FEET.

6. ALL EFFORTS SHALL BE MADE TO PROTECT ALL EXISTING STRUCTURES WITHIN THE PERMIT BOUNDARY DURING CONSTRUCTION OF THE PIPELINE. ANY/ALL STRUCTURES DAMAGED DURING THE COURSE OF CONSTRUCTION SHALL BE REPAIRED OR REPLACED.

7. VERIFY LOCATIONS OF ALL UTILITIES (ELECTRICITY, TELECOMMUNICATIONS, WATER, ETC.) PRIOR TO CONSTRUCTION.

8. SEE DETAIL 1/5-30-2d FOR TYPICAL PIPELINE INSTALLATION REQUIREMENTS.

NEW PIPELINE PROFILE (SEE APPENDIX 5-30)



ERALL SURFACE FACILITIES / PIPELINE PLAN

100 0 200 400 FEET

LEGEND:

- *SPECIAL USE PERMIT AREAS*
- *EXTENT OF DISTURBANCE*
- *20' CONTOUR*
- *10' CONTOUR*
- *JERSEY BARRIERS*
- *SAFETY BARRIERS*
- *FENCING*
- *SURFACE DRAINAGE CHANNEL*
- *EXISTING MINE WATER PIPING*
- *NEW MINE WATER PIPING*

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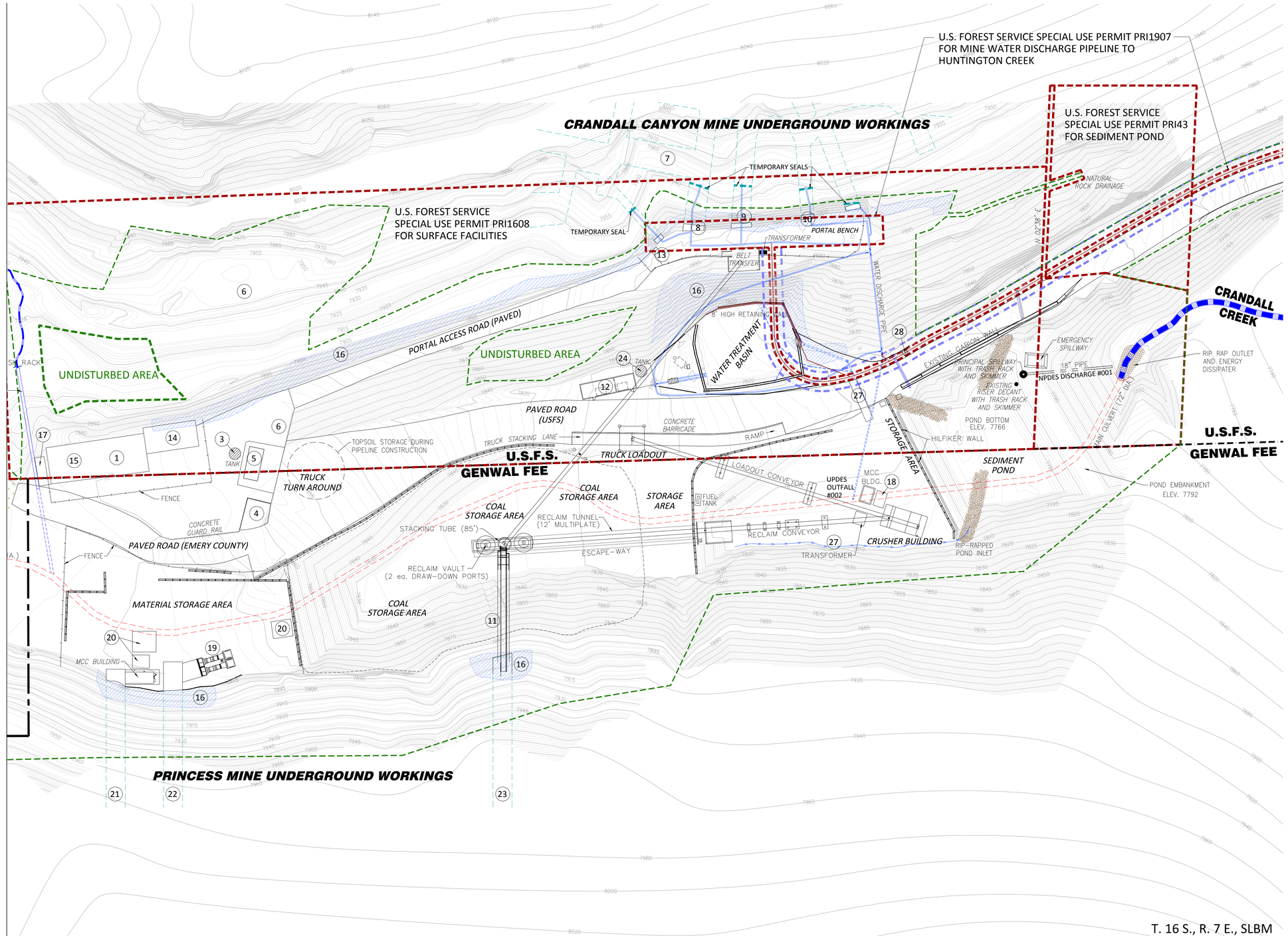
CRANDALL CANYON MINE
OVERALL SURFACE FACILITIES

REV: 25	ACAD: PLATE 5-3 REV25
DATE: 4-30-2020	BY: PJJ
SCALE: 1" = 200'	PLATE #: 5-3



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

FACILITY LEGEND:

1. Shop
2. Not Used
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. Warehouse / Office Building
15. 4500 Gal. Culinary 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. Not Used
27. Concrete Ditch
28. Water Pipeline Manhole

N

NOTE: COORDINATE WITH PLATE 5-3.

25 0 50 100 FEET

LEGEND:

- SPECIAL USE PERMIT AREAS
- EXTENT OF DISTURBANCE
- 20' CONTOUR
- 10' CONTOUR
- JERSEY BARRIERS
- SAFETY BARRIERS
- FENCING
- SURFACE DRAINAGE CHANNEL
- EXISTING MINE WATER PIPING
- NEW MINE WATER PIPING

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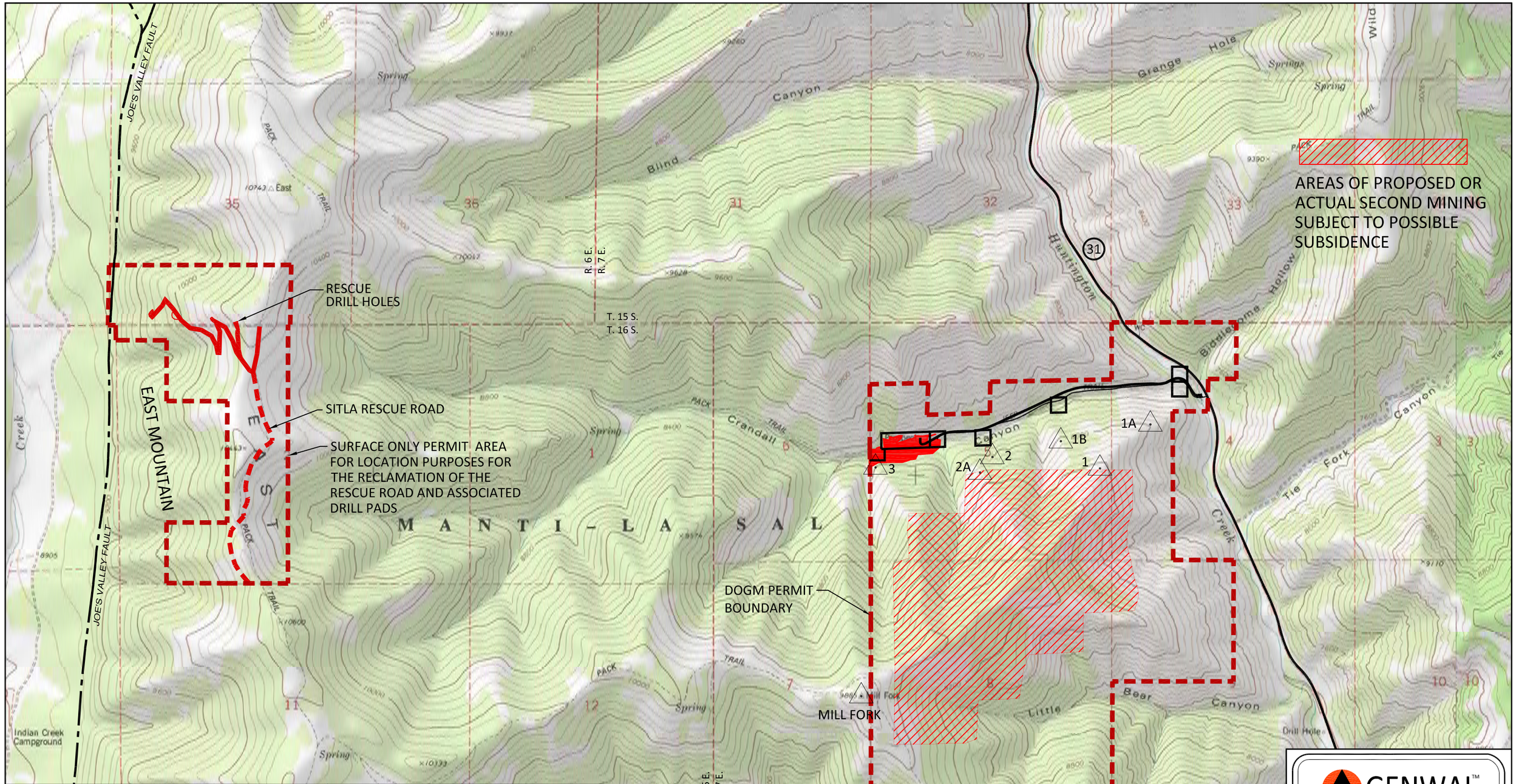
Telephone: (435) 888-4000

CRANDALL CANYON MINE
MINE SURFACE FACILITIES

REV: 25	ACAD: PLATE 5-3 REV25
DATE: 4-30-2020	BY: PJJ
SCALE: 1" = 50'	PLATE #: 5-3a



SUBSIDENCE CONTROL POINT △4

INITIAL COORDINATES LEVEL OF SUBSIDENCE CONTROL POINTS

CONTROL POINT	NORTHING	EASTING	ELEVATION
1	410092.47	2098132.85	8442.6
1A	411049.12	2099227.84	7947.3
1B	410683.22	2097282.38	8025.1
2	410340.61	2095796.0	8041.9
2A	410002.74	2095524.69	8225.1
3	410113.74	2093255.08	7932.5
MILL FORK	405134.87	2092946.18	9888.45

ALL COORDINATES ARE SHOWN AT SEA LEVEL: CAF=1.000397447

NOTES:

1. SUBSIDENCE FOR THE CRANDALL CANYON MINE IS SUBSTANTIALLY COMPLETE AS OF THE DATE OF THIS DRAWING. ACCORDING TO THE 2014 SUBSIDENCE MONITORING REPORT, ALL MONITORING POINTS HAVE NOT RECORDED SUBSIDENCE GREATER THAN SIX INCHES SINCE 2012.

GENWAL™ RESOURCES, INC.
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East Carbon, Utah
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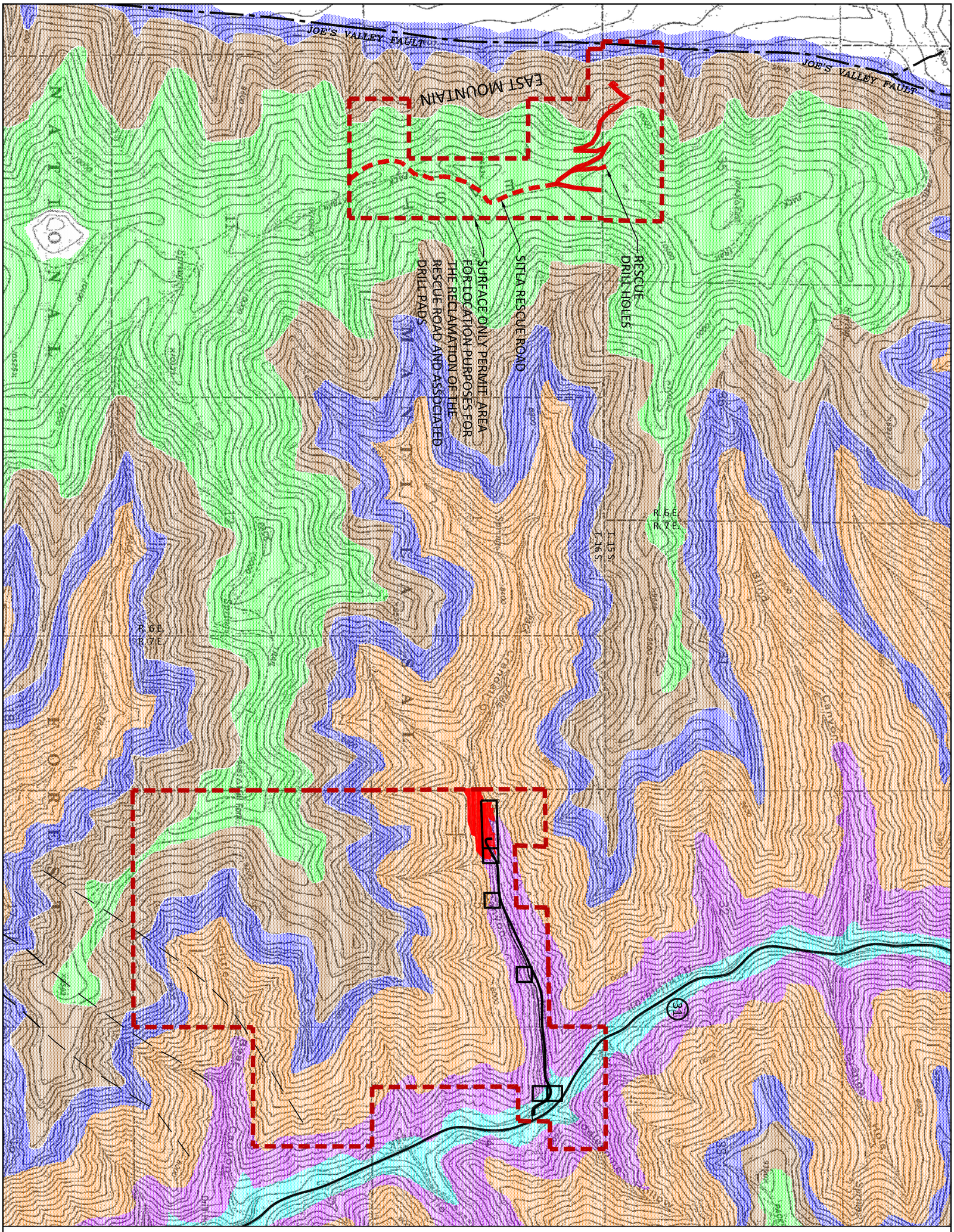
CRANDALL CANYON MINE SUBSIDENCE MAP

REV: 13	ACAD: SUBSIDENCE MONITORING R13
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"= 2000'	PLATE #: 5-5

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Defidences Task 6049\5-5 SUBIDENCE MONITORING R13.dwg, Plate 5-5, 4/28/2020 3:00:21 PM



LEGEND:

TKn:	*NORTH HORN FORMATION*
Kpr:	*PRICE RIVER FORMATION*
Kc:	*CASTLEGATE SANDSTONE*
Kbh:	*BLACKHAWK FORMATION*
Ksp:	*STAR POINT SANDSTONE*
Kmm:	*MASUK MEMBER*

UDOGM PERMIT BOUNDARY

USFS SPECIAL USE PERMIT AREAS

SOURCE: USGS MISCELLANEOUS INVESTIGATION SERIES MAP 1-1631
GEOLOGIC MAP OF THE MANTI 30' x 60' QUADRANGLE

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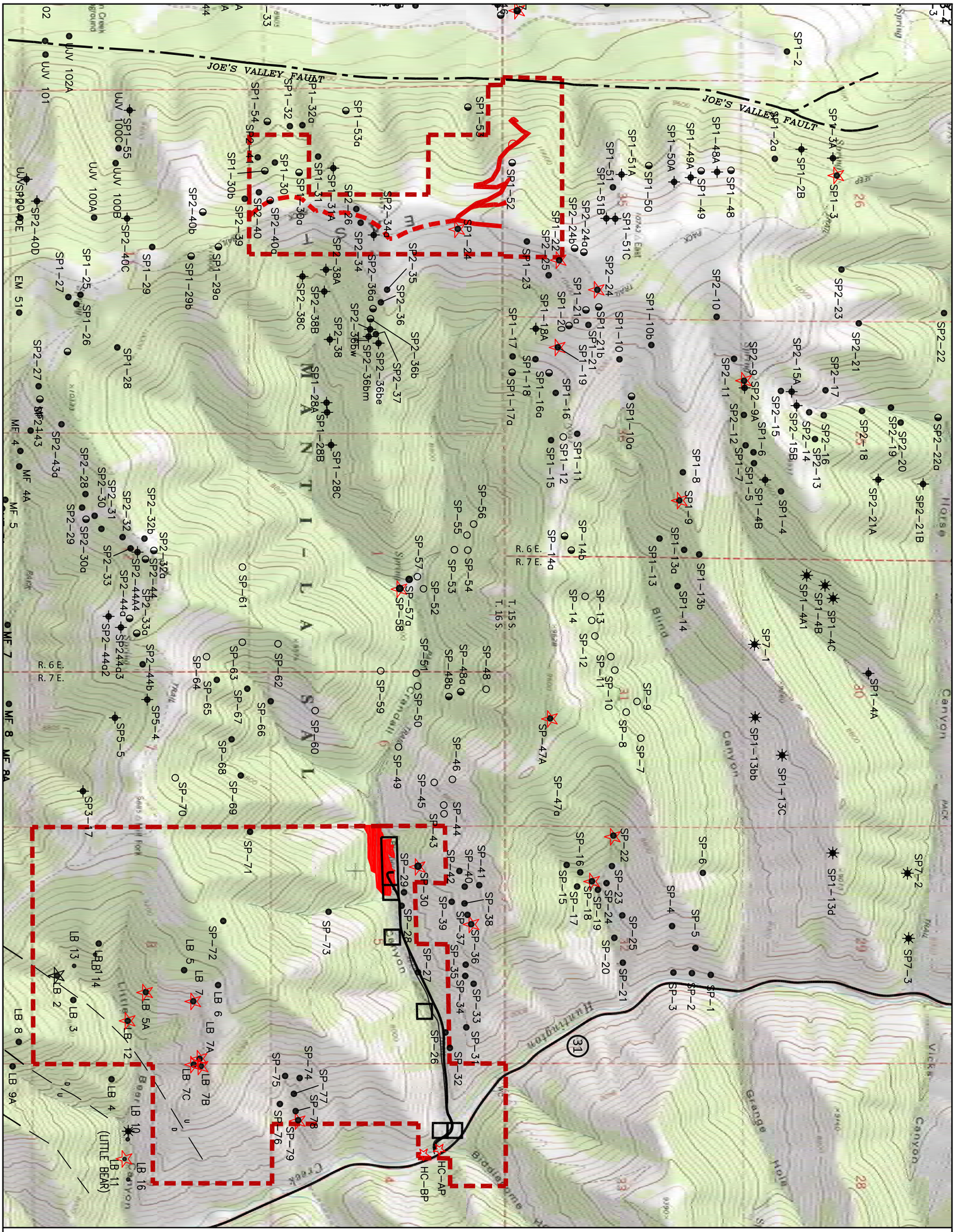
P.O. Box 910, 794 North "C" Canyon Rd.
East Carbon, Utah
Telephone: (435) 888-4000

CRANDALL CANYON MINE
REGIONAL GEOLOGY MAP

REV: *15*	**ACAD:** *GEOLOGY MAP R15*
DATE: *4-30-20*	**BY:** *JDS/PJJ*
SCALE: *1"=2000'*	**PLATE #:** *6-1*

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\7-12 SEEP AND SPRINGS R15.dwg, Layout3, 4/27/2020 10:56:29 AM



LEGEND

500' CONTOUR:

SEEP AND SPRING LOCATIONS: • EM 219

APPROXIMATE LOCATION OF FAULTS:

- SPRING LOCATION (1992 SURVEY)
- SPRING LOCATION (1991 SURVEY)
- SPRING LOCATION (1989-1990 SURVEY)
- SPRING LOCATION (1987 SURVEY)
- SPRING LOCATION (1985 SURVEY)
- MONITORING LOCATIONS

UDOGM PERMIT BOUNDARY

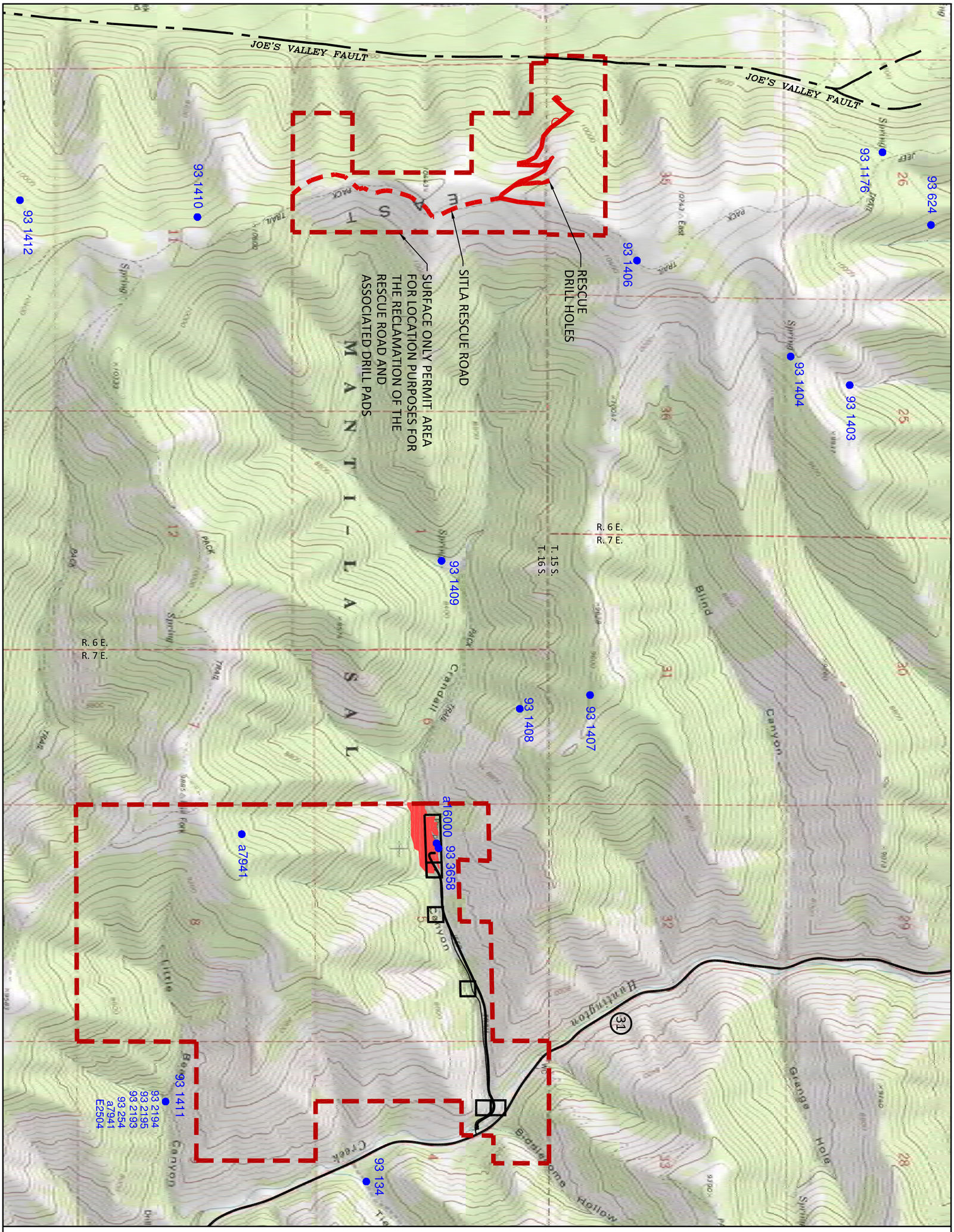
USFS SPECIAL USE PERMIT AREAS

GENWAL™ RESOURCES, INC.

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

CRANDALL CANYON MINE
SEEP AND SPRING LOCATIONS

REV: 15	ACAD: SEEP AND SPRINGS R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 7-12



LEGEND

WATER RIGHT	93 1412
UDOGM PERMIT BOUNDARY	
SURFACE FACILITIES	
USFS SPECIAL USE PERMIT AREAS	

THE PERMIT AREA IS ENTIRELY WITHIN THE MANTI - LA SAL NATIONAL FOREST

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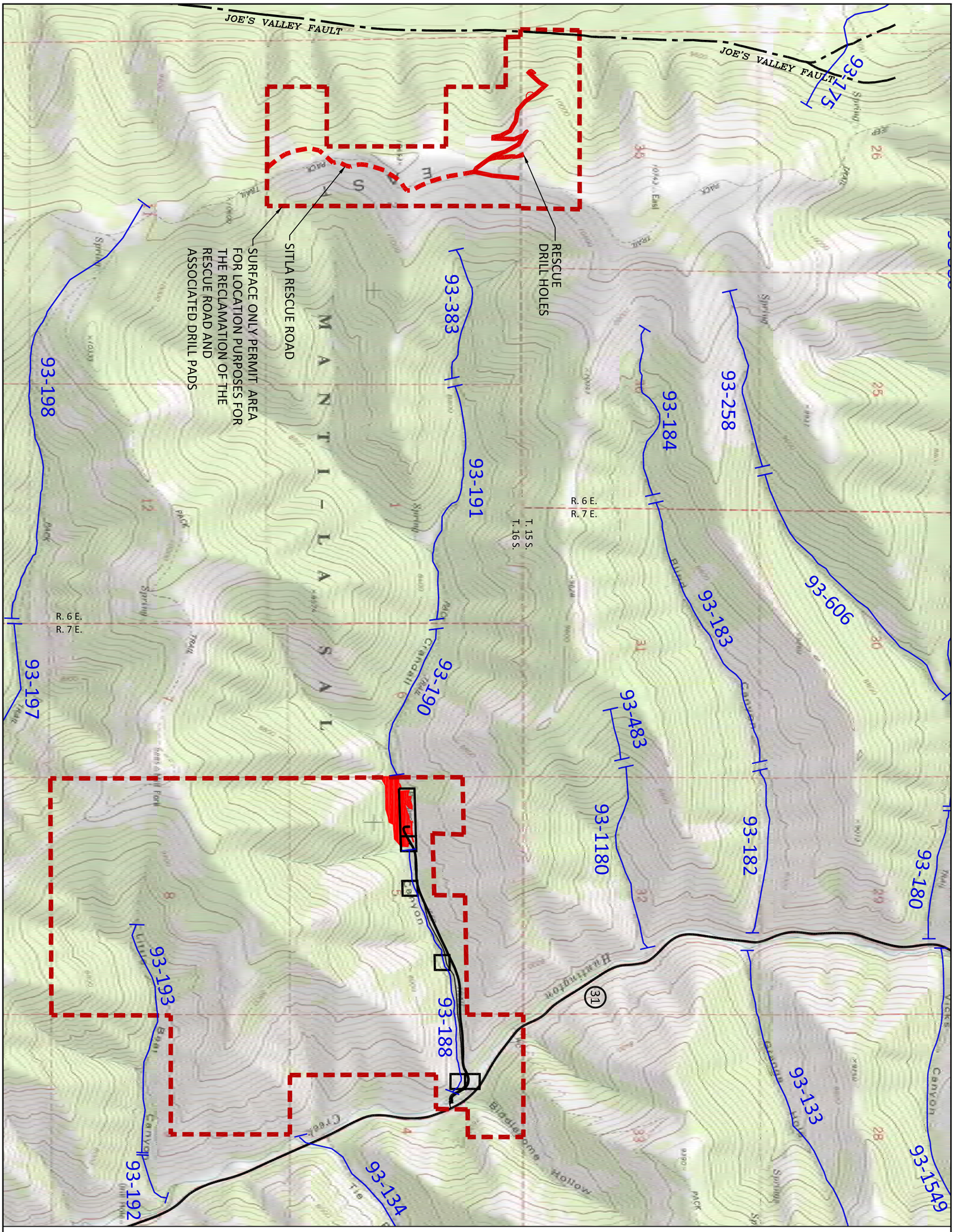
CRANDALL CANYON MINE
GROUNDWATER RIGHTS

REV: 15	ACAD: GRNDWTR RIGHTS R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000	PLATE #: 7-14



LEGEND

UDOGM PERMIT BOUNDARY

MINE SURFACE FACILITIES

EXTENT OF SURFACE WATER RIGHT 93-198

USFS SPECIAL USE PERMIT AREAS

THE PERMIT AREA IS ENTIRELY WITHIN THE MANTI - LA SAL NATIONAL FOREST

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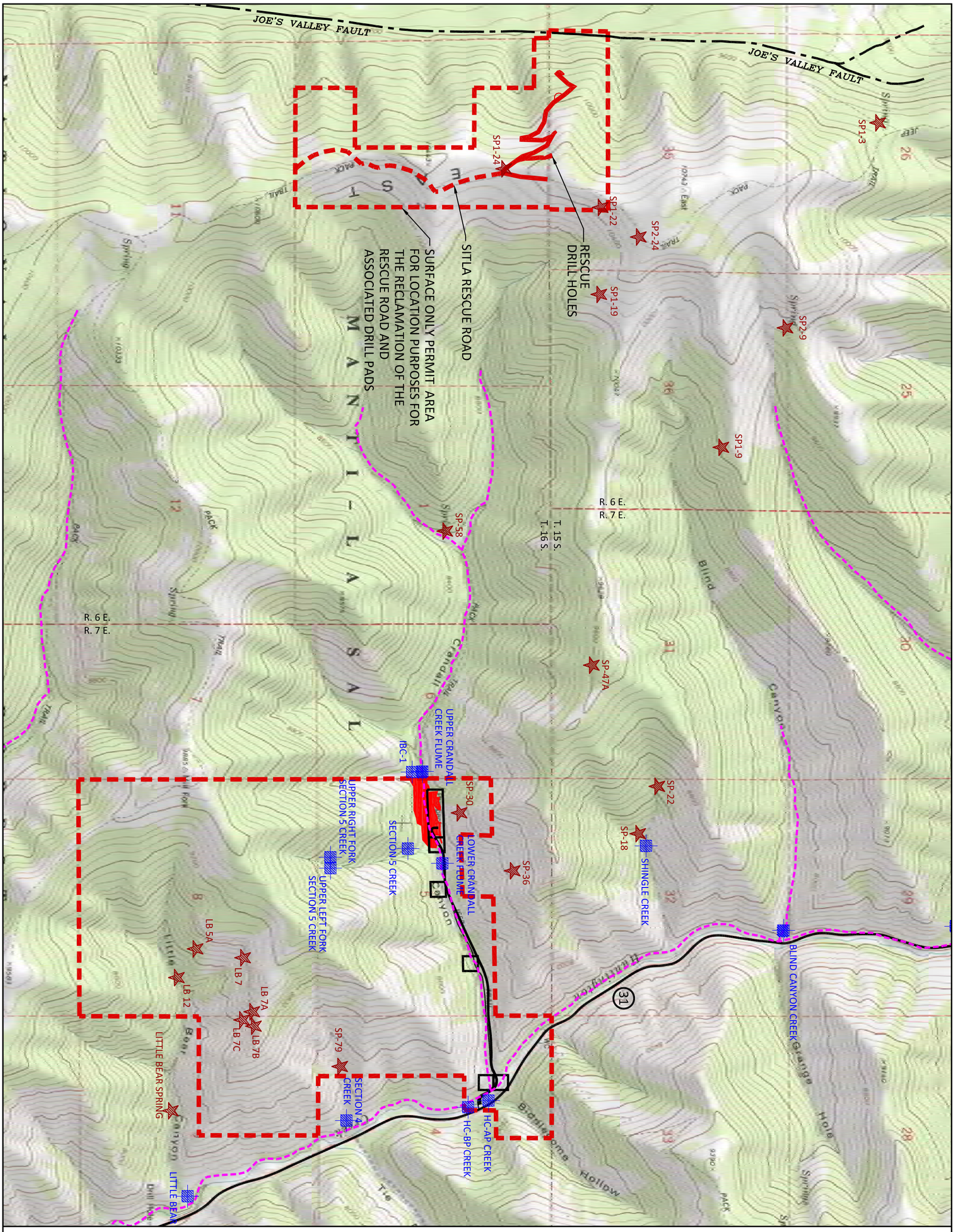
CRANDALL CANYON MINE
SURFACE WATER RIGHTS

REV: 15	ACAD: SURFACE WTR RIGHTS R15
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 7-15

G:\Current Drawings\MRP Maps\Crandall Canyon\Pipe Mine Water to Huntington Creek\Deficiencies Task 6049\7-18 WATER SITES MAP R16.dwg, Plate 7-18, 4/28/2020 3:20:48 PM



LEGEND

- MINE SURFACE FACILITIES
- UDOGM PERMIT BOUNDARY
- PERENNIAL STREAM REACHES (based on 1992 thru 1998 observations)
- MONITORING LOCATIONS OF SURFACE SPRINGS
- MONITORING LOCATIONS OF UNDERGROUND WELLS
- MONITORING LOCATIONS OF STREAMS
- USFS SPECIAL USE PERMIT AREAS

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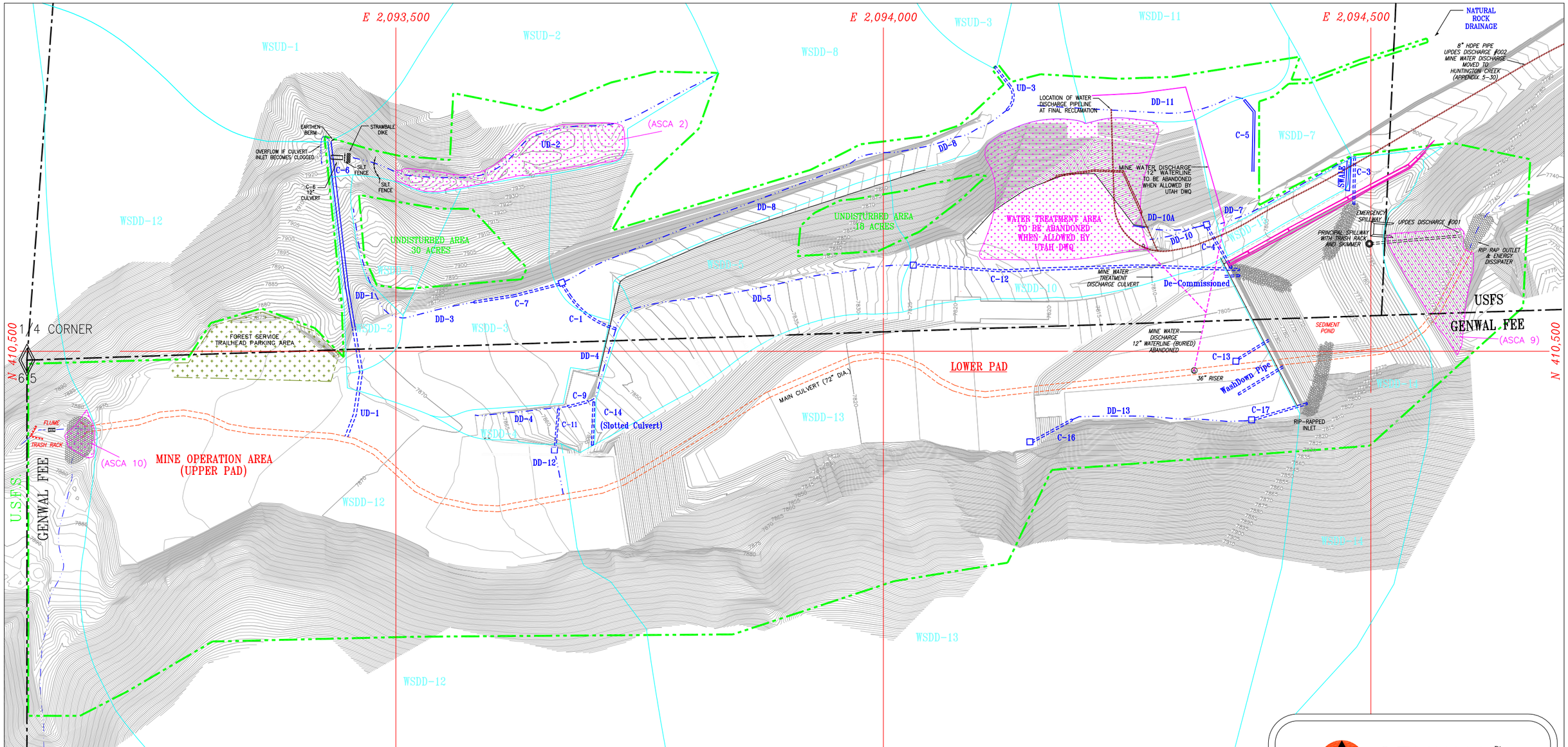
East Carbon, Utah
Telephone: (435) 888-4000

CRANDALL CANYON MINE
WATER MONITORING SITES MAP

REV: 16	ACAD: WATER SITES MAP R16
DATE: 4-30-20	BY: JDS/PJJ
SCALE: 1"=2000'	PLATE #: 7-18



LEGEND:

- POTENTIAL EXTENT OF DISTURBANCE
- 10' CONTOUR
- JERSEY BARRIERS
- WATERSHED BOUNDARY
- UNDISTURBED/DISTURBED WATERSHED — WSUD-1 WSDD-10
- DIVERSION DITCH — DD-4
- CULVERT (Solid-Above Grd/Dashed-Buried) — C-8
- 6' DIAMETER CULVERT
- ASCA AREA:

N

CONTOUR INTERVAL = 5'

GENWAL™ RESOURCES, INC.

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Telephone: (435) 888-4000

CRANDALL CANYON MINE DRAINAGE MAP

REV: 22	ACAD: ACAD 7-5 R22
DATE: 4-30-20	BY: PJJ
SCALE: 1" = 100'	PLATE #: 7-5

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