Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

January 31, 2017

VIA E-MAIL

Mr. Daron Haddock
Utah Division of Oil, Gas and Mining
Coal Program
1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, UT 84114-5801

RE: Bronco Utah Operations LLC
Emery Mine
DOGM Permit No. C/015/0015
Phase II Additional Permit Boundary Second Deficiency Responses
Task ID 5350

Mr. Haddock:

Per you memo dated January 26, 2017, please consider these responses to your deficiencies to the above mentioned minor permit revision. Executed C1 form, C2 form, revised pages, and Plates are included for your review. Deficiencies have been addressed on specific pages and Plates and the entire minor revision has been resubmitted herein. Also attached is the Divisions list of deficiencies with Bronco responses in italics. This should enable the reviewer to check responses quickly.

This Phase II revision will add 29 acres to the existing Emery permit to provide access to a new portal area via a boxcut, road, and conveyor system. The revision will allow access to the remaining approved Emery coal reserve.

Bond calculations for the additional structures are included and have been modified in format with updated unit costs per the recently approved Phase I submittal.

If you have any questions concerning this request, please contact me at 435-286-2027, or 435-650-7339.

Sincerely,

Kit Pappas
Environmental Manager

Attachments

Technical Analysis and Findings
Utah Coal Regulatory Program

Deficiency List
Task ID #5350
Emery Deep Mine
Phase II Additional Permit Boundary

The members of the review team who have identified deficiencies include the following individuals:

Priscilla Burton (Pburton)
Steve Christensen (Schriste)
Ingred Reinhart (Ireinhart)
Cheryl Parker (Cparker)
Beverly Wiser (Bwiser)

GENERAL CONTENTS

Right of Entry

The amendment does not meet the State of Utah R645 requirements for Right of Entry. The following deficiency must be addressed prior to final approval:

R645-301-114: The Permittee must revise the amendment to comply with R645-301–114. R645-301-114, Right of Entry Information, requires a description of the documents upon which the applicant bases their legal right to enter and begin coal mining and reclamation operations. The Permittee does not currently have the legal right to enter Federal Coal Lease U-5287 and initiate the mining plan depicted on Plate IV-2, UG Operations Plan. The Permittee must provide a commitment within the approved MRP that a revised R2P2 will be obtained from the Bureau of Land Management in 2017. The commitment must be provided in Chapter 1, page 7a, Section UMC 782.15 and in Appendix 1-2. (Schriste)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

The language below has been inserted on CH I, page 7a and CH I, Appendix I-2 page 7.

Bronco currently holds Federal Coal Lease U-5287 in good standing (executed on June 25, 1984). Mining in U-5287 will not occur until 2019 at the earliest. As the current approved R2P2 with the BLM does not accurately reflect the proposed mining plan depicted on Plate-IV-2, Bronco will initiate the R2P2 modification in January 2017 and endeavor to provide the Division with documentation of the modified R2P2 by December 31, 2017 which would be several years prior to entering the lease. Bronco

cannot control the BLM approval process. Bronco will report on the status of the modified R2P2 beginning with the 2017 annual report.

ENVIRONMENTAL RESOURCE INFORMATION

Soils Resource Information

R645-301-121.100: The application does not meet the requirements of R645-301-220 and R645-301-121.100, because the disturbed area information in the soil survey map legend still does not agree with that introduced into the MRP on Table III-2 of Chap III p.2, as the result of a ground survey. (Pburton)

The affected acreage listing contained in the legend of Plate VII-1 (Soil Map) has been revised to reflect the recently surveyed disturbed boundaries listed on CH III, page 2, Table III-2.

Probable Hydrologic Consequences Determination

The amendment does not meet the State of Utah R645 requirements for Hydrologic Resource Information. The following deficiency must be addressed prior to final approval:

R645-301-728.350: The Permittee must provide documentation from the State of Utah Division of Water Rights that sufficient water rights have been obtained to facilitate the mining operation during operation. Pages VI-21 and VI-22 discuss how a temporary right to divert water from Quitchupah Creek or leasing water from a user with an existing right on Quitchupah Creek will be required in order to facilitate the initiation of mining operations. In order to evaluate the potential for impacts to State-appropriated water, the Division must confirm that sufficient water rights have been obtained for the mining operation prior to final approval of the amendment. (Schriste)

The regulation quoted does not require this commitment and/or data. *The applicant has provided the Utah Division of Oil, Gas and Mining with four options for obtaining the water needed for construction and operation of the Emery 2 portal. Also, in Section VI.2.8.3, the applicant provided the Utah Division of Oil, Gas and Mining with quantitative information regarding the potential impacts of consuming this water. In light of this fact and the fact that regulatory authority over the diversion and consumptive use of water in the State of Utah rests with the Utah Division of Water Rights not the Utah Division of Oil, Gas and Mining, the applicant is of the opinion the information submitted in Section VI.2.8.3 (specifically the four options for obtaining water necessary to construct and operate the Emery 2 portal) is sufficient for the Utah Division of Oil, Gas and Mining to make a finding of adequacy under their regulatory authority.* ***However, to expedite the approval process of this important project, Bronco has complied with the deficiency request as stated below.***

An Application for Temporary Change of Water associated with Water Right 94-1178 has been executed and submitted to the Utah Division of Water Rights. That application addresses a change in point of diversion and a change in use for an appropriate portion of the water associated with Water Right 94-1178. The Utah Division of Water Rights is currently reviewing that application, including the calculations indicating the number of irrigated acres that must be taken out of service during the period that water associated with that right is being used for mining purposes. When approved, the water associated with that Application for Temporary Change of Water will be relied on as the primary source of water for construction and operation of the Emery 2 portal until sufficient water is encountered underground for continued operation of the mine without the use of water diverted from the surface. A copy of the Application for Temporary Change of Water, as submitted to the Utah Division of Water Rights, has been added to Appendix VI-4. Once this application is approved by the Utah Division of Water Rights, the approval will be provided in Appendix VI-1. However, the applicant is retaining the other supply options listed on CH VI, pages 21 and 22 in the mine permit application in case currently unforeseen conditions necessitate a quantity of water beyond that anticipated by the aforementioned Application for Temporary Change of Water. The use of any such water will occur only if such use complies with the requirements of Utah Division of Water Rights.

Maps Surface and Subsurface Manmade Features

The amendment does not meet the State of Utah R645 requirements for Surface and Subsurface Manmade Features.

R645-301-521.123, R645-301-521.133: The Permittee shall provide a narrative in Chapter 2 page 18 detailing basic information regarding the jeep trail called out on various Plates. The Permittee must control access to the mine and establish if the jeep trail will be replaced upon the cessation of mining operations. The basic information regarding the jeep trail access controls during mining operations, and if the trail will be restored after mining operations are required for the Division to show R645-301-521.133.1 does not apply. (Cparker)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Refer to CH II, page 18 for a statement regarding Emery 2 expansion roads within 100 feet of public road right-of-way.

Refer to CH III, page 15e for a statement regarding the post-mine disposition of the Jeep Trail.

Refer to CH IV, page 8d for clarification regarding the Jeep Trail.

OPERATION PLAN

Relocation or Use of Public Roads

The amendment does not meet the State of Utah R645 requirements for Surface and Subsurface Manmade Features.

R645-301-521.123, R645-301-521.133: The Permittee shall provide a narrative in Chapter 2 page 18 detailing basic information regarding the jeep trail called out on various Plates. The Permittee must control access to the mine and establish if the jeep trail will be replaced upon the cessation of mining operations. The basic information regarding the jeep trail access controls during mining operations, and if the trail will be restored after mining operations are required for the Division to show R645-301-521.133.1 does not apply. (Cparker)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Refer to CH II, page 18 for a statement regarding Emery 2 expansion roads within 100 feet of public road right-of-way.

Refer to CH III, page 15e for a statement regarding the post-mine disposition of the Jeep Trail.

Refer to CH IV, page 8d for clarification regarding the Jeep Trail.

Air Pollution Control Plan

The amendment does not meet the State of Utah R645 requirements for Air Pollution Control Plan. The following deficiency must be addressed prior to final approval:

R645-301-420,-422: The Permittee must update Chapter X, Part C: Air Quality to reflect the mine expansion. The update must include the revised Approval Order (AO) issued from the State of Utah Division of Air Quality as well as revisions to the supporting text/narrative found in Chapter X Part C (i.e. contain a description of coordination and compliance efforts which have been undertaken by the applicant with the Utah Division of Air Quality). (Schriste)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Refer to CH X Part X.3 (Air Quality) Appendix X.C-2 for the approved Modification to Approval Order DAQE-AN0229006-05 for Mine Expansion Project Number N10229-0010 (DAQE reference DAQE-AN102290010-16).

Coal Recovery

The amendment does not meet the State of Utah R645 requirements for Coal Recovery. The following deficiency must be addressed prior to final approval.

R645-301 -522: The Permittee provide their response to the Divisions Technical Analysis and Findings of Task 5299 that mining will not occur in the Federal Coal Lease U-5287 until 2019 within Chapter 4. This narrative must be included within the MRP as it is paramount to describing measures to be used to maximize the use and conservation of the coal resource. (Cparker)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

The language below has been inserted on CH I, page 7a and CH I, Appendix I-2 page 7.

Bronco currently holds Federal Coal Lease U-5287 in good standing (executed on June 25, 1984). Mining in U-5287 will not occur until 2019 at the earliest. As the current approved R2P2 with the BLM does not accurately reflect the proposed mining plan depicted on Plate-IV-2, Bronco will initiate the R2P2 modification in January 2017 and endeavor to provide the Division with documentation of the modified R2P2 by December 31, 2017 which would be several years prior to entering the lease. Bronco cannot control the BLM approval process. Bronco will report on the status of the modified R2P2 beginning with the 2017 annual report.

Topsoil and Subsoil

R645-301-231.400 and R645-301-121.100, Plate II-1 A provides the location of 8 subsoil stockpiles. Some of these stockpiles are likely topsoil stockpiles and are named T-6 through T-9. The legend should be corrected accordingly. Chap. IV p. 8c describes the placement of topsoil into topsoil stockpile T-2. This stockpile is shown on Plate II-1, but should also be shown in relation to other immediately adjacent stockpiles shown on recently submitted Plate II-1A. The Plate must also include existing topsoil stockpiles T-1 and existing subsoil stockpile S-1 and the outline of the waste disposal site, all of which are within the frame of Plate II-1A.

R645-301-234.240: The plate shows placement of topsoil and subsoil storage piles on top of an escarpment potentially exposed to wind blow coal fines from proposed raw coal storage piles. Since topsoil and subsoil piles should be placed where they will not be re-disturbed, is this the best placement for the long term piles T-8, S-9, T-9, and T-1 0?

R645-301-141, Plate II-IA must show contour lines with two foot intervals, such that the as built survey can be meaningfully interpreted. (Pburton)

Refer to Chapter II, Pages 20 and 23 for clarification regarding the proposed preparation plant depicted on Plate II-1A.

Hydrologic General

The amendment does not meet the State of Utah R645 General Hydrologic Information requirements. The following deficiency must be addressed prior to final approval:

R645-301-731: The Permittee must revise Appendix XI-21 with a comprehensive narrative that describes the routing of the surface drainage system. (Schriste)

The requested narrative has been added to Section 3.4 of Appendix VI-21 as well as to Plate VI-10E.

Hydrologic Diversion General

The amendment does not meet the State of Utah R645 requirements for Diversions. The following deficiency must be addressed prior to final approval:

R645-301-742.300: The Permittee must revise Plate VI-1 1 B, Emery 2 Drainage Details. Please clarify the culverts that the depicted culvert inlet/outlet trash rack detail applies to. (Schriste)

Plate VI-11B has been revised accordingly.

Hydrologic Siltation Sedimentation

The amendment does not meet the State of Utah R645 requirements for Hydrologic Siltation Sedimentation Measures. The following deficiencies must be addressed prior to final approval:

R645-301-742.220, -742.221.36: The Permittee must revise the design information of Sediment Pond 3 to include the installation of a sediment marker within the pond. Plate VI-1 5B, Pond 3 Modifications must be revised to clearly show the installation of a sediment and how it will identify the 60% design sediment capacity (i.e. the point at which the pond must be cleaned). The sediment marker must be shown on the plan and cross-sectional view.

The regulations quoted do not require this commitment and/or data. *Specifically, R645-301-742.221.36 requires only that the application "provide periodic sediment removal sufficient to maintain adequate volume for the design event" with no requirement as to how the applicant can determine when sediment removal is necessary. In fact, no mention is made in the regulations requiring that sediment be removed when the sediment volume reaches 60% of its design capacity. Rather, the regulations state only that sediment must be removed when needed "to maintain adequate volume for the design*

event." ***However, to expedite the approval process of this important project, Bronco has complied with the deficiency request as stated below.***

Plate VI-15B has been modified to show the installation of a sediment marker, marked to show elevations representing 60% and 100% of the design sediment volume.

R645-301-743.130, -743.131: The Permittee must revise the spillway information and design information for Sediment Pond 3 to comply with R645-301-743.130 which requires either a combination of principal and emergency spillway or a single spillway that complies with R645-301-743.131. The secondary spillway inlet elevation is a foot lower than the top of the primary spillway. Please clarify. Additionally, identify the length of the 12 in diameter CHDPE culvert of the secondary spillway and its grade (i.e. provide outlet elevation where the culvert daylights on the downgradient side of the embankment).

Plate VI-15B has been modified to designate the top of the primary spillway as an "overflow" rather than a "secondary spillway", thereby hopefully clarifying the operation of the spillway system. The approximate length, outlet elevation, and grade of the 12-inch diameter CHDPE secondary spillway have also been added to Plate VI-15B.

R645-301-731,-740: In order to facilitate inspection of the site, the Permittee must provide a detailed design and supporting narrative (Appendix VI-21) as to how the sump located in the portal area of the box cut will be constructed, maintained etc. (Schriste)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Information regarding construction and maintenance of the sump at the bottom of the portal box cut is provided in Section 3.4 of Appendix VI-21

Explosives Preblasting Survey

The amendment does not meet the State of Utah R645 requirements for Preblasting Survey. The following deficiency must be addressed prior to final approval.

R645-301-524.300: The Permittee shall include a copy of the preblast survey notification sent to all partied identified on Plate I-1 and copies of the notifications the signed waivers of preblast surveys to meet the requirements R645-301 -524.300 preblast survey described in the permit application. Plate I-1 shall be modified so that all surface ownership information is shown within the half mile buffer. (Cparker)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Refer to CH II page 24 and CH IV Appendix IV 12a for blasting notifications, waivers, and pre-blast surveys.

RECLAMATION PLAN

Mine Openings

The amendment does not meet the State of Utah R645 requirements for Mine Openings. The following deficiency must be addressed prior to final approval.

R645-301-513.500, R645-301 -529, R645-301 -532.100 and R645-301 -551: To meet R645-301 -532.100 regulations the Permittee must include a more detailed reclamation timing sequence in Chapter III Section III.A.2. that includes reducing the disturbed area to the smallest practicable at any one time during mining operations through the reclamation of the 4th east portals area. (Cparker)

Refer to CH III page 3 for a discussion on reclamation timing.

Road System Reclamation

The amendment does not meet the State of Utah R645 requirements for General Road Reclamation plan. The following deficiency must be addressed prior to final approval.

R645-301 -521.123, R645-301 -521.133, R645-301 -542: The Permittee shall provide a narrative in Chapter 2 page 18 detailing basic information regarding the jeep trail called out on various Plates. The Permittee must control access to the mine and establish if the jeep trail will be replaced upon the cessation of mining operations. The basic information regarding the jeep trail access controls during mining operations, and if the trail will be restored after mining operations are required for the Division to show R645-301-521.133.1 does not apply. (Cparker)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Refer to CH II, page 18 for a statement regarding Emery 2 expansion roads within 100 feet of public road right-of-way.

Refer to CH III, page 15e for a statement regarding the post-mine disposition of the Jeep Trail.

Refer to CH IV, page 8d for clarification regarding the Jeep Trail.

Maps Bonded Area

The amendment does not meet the State of Utah R645 requirements for Bonded Area Map. The following deficiency must be addressed prior to final approval.

R645-301-800: To meet R645-301-121.200 and R645-301-800 Plate I-1 shall be modified so that all surface ownership information is shown within the half mile buffer. (Cparker)

The regulations quoted do not require this commitment and/or data; however, to expedite the approval process of this important project, Bronco has complied with the deficiency request.

Refer to revised Plate I-1 for property ownership within the half mile buffer.

Bonding Determination of Amount

The amendment does not meet the State of Utah R645 requirements for Determination of Bond Amount. In accordance with the requirements of R645 the Permittee is responsible to provide detailed estimated cost sheets to support the reclamation cost estimate.

R645-301-542.800 & R645-301 -830.140: The Permittee shall correct the earthwork sheets so that the updated CLAB and FAO of $37.90 and $51.90 facilitate through all the earthwork sheets and not just on the unit rate cost sheet. (Bwiser)

Bond calculation spreadsheets for earthwork have been revised to reflect the correct unit rates for CLAB and FAO. The total Bond Amount summary page Chapter IV, page 12 has also been revised.

SPECIAL CATEGORIES

Operations Alluvial Protection of Agricultural

R645-302-322.250, Updated Plate V-5 shows SR 10 being the end of the stream buffer zone on the West. This manmade feature should not interfere with the illustration of the stream buffer zone. In addition, the application does not provide coal seam elevation or coal seam thickness isopachs west of the highway on plates V-17 through 25. Of immediate concern is the elevation and thickness isopachs shown on Plates V-19 through V-22 which illustrate the seams to be mined in the proposed five year mining plan. (Pburton)

Refer to revised Plate V-5 for the Stream Buffer Zone.

Plates V-17 through V-25 depicting coal isopachs and coal thickness on the west side of SR 10 will be revised and submitted prior to or at mid-term review.

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Bronco Utah Operations LLC (BUOLLC)
Mine: Emery Mine **Permit Number:** 015/0015
Title: e2 Phase II Additional Permit Area
Description, Include reason for application and timing required to implement:
e2 Phase II Additional Permit Area second deficiency response tsk id 5350 1/2017

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: 29 Disturbed Area: 10.3 ☒ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☒ Yes ☐ No 5. Does the 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? NOV # _____
☐ 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 the 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 calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☒ Yes ☐ No 21. Have reclamation costs for bonding been provided?
☒ Yes ☐ No 22. Does the 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?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

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.

DAN R. BAKER
Print Name

Dan R. Baker PRES. & CEO 1/30/2017
Sign Name, Position, Date

Subscribed and sworn to before me this 30 day of JANUARY, 2017

John C Pappas
Notary Public

My commission Expires: MARCH 7, 2018
Attest: State of UTAH } ss:
County of CARBON

JOHN CHRISTOPHER PAPPAS
Notary Public, State of Utah
Commission # 674103
My Commission Expires
March 07, 2018

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining

Form DOGM- C1 (Revised March 12, 2002)

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Bronco Utah Operations LLC
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 1/5 second deficiency response tsk id 5350 1/2017

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	CH I page 7a and 8
☐ Add	☒ Replace	☐ Remove	CH I, App I-2, pages 1-5 and 7
☐ Add	☒ Replace	☐ Remove	CH II pgs 17d - 17f
☒ Add	☐ Replace	☐ Remove	CH II pgs 17g - 17i
☐ Add	☒ Replace	☐ Remove	CH II pgs 18, 20, 23, 24, and 25a
☐ Add	☒ Replace	☐ Remove	CH III Table of Contents page 2
☐ Add	☒ Replace	☐ Remove	CH III pgs 2 and 3
☒ Add	☐ Replace	☐ Remove	CH III page 4a
☐ Add	☒ Replace	☐ Remove	CH III page 8
☒ Add	☐ Replace	☐ Remove	CH III page 10b
☐ Add	☒ Replace	☐ Remove	CH III page 12
☒ Add	☐ Replace	☐ Remove	CH III pgs 15d, 15e, 15f, 15g, 21a, and 21b
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Bronco Utah Operations LLC
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 2/5 second deficiency response tsk id 5350 1/2017

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	CH IV Table of Contents pages 2 and 3
☐ Add	☒ Replace	☐ Remove	CH IV pgs 1, 2, 7, 7a, 7b, and 10
☒ Add	☐ Replace	☐ Remove	CH IV pages 7c, 8c, 8d, 8e, and 8f
☐ Add	☒ Replace	☐ Remove	CH IV, Page 12 (bond summary sheet), page 13
☐ Add	☒ Replace	☐ Remove	CH IV, Page 39b
☐ Add	☒ Replace	☐ Remove	CH IV page 40
☒ Add	☐ Replace	☐ Remove	CH IV, Part IV.B, bond calc backup
☐ Add	☒ Replace	☐ Remove	CH IV, Part IV.B, Demo bond calc sheets
☐ Add	☒ Replace	☐ Remove	CH IV, Part IV.B, Earth bond calc sheets
☐ Add	☒ Replace	☐ Remove	CH IV, Part IV.B, Reveg bond calc sheets
☐ Add	☒ Replace	☐ Remove	CH IV App IV-7H, page 10g
☒ Add	☐ Replace	☐ Remove	CH IV App IV-11 (Bond Calculation Competitive Bid Support) CONFIDENTIAL
☒ Add	☐ Replace	☐ Remove	CH IV App IV-12 (Emery 2 Blasting Plan)
☒ Add	☐ Replace	☐ Remove	CH IV App IV-12a (Emery 2 Blasting Notifications, Waivers and Pre-Blast Surveys)
☒ Add	☐ Replace	☐ Remove	CH IV App IV-13 (Emery 2 Expansion Civil Design Drawings, R & M Consultants)
☒ Add	☐ Replace	☐ Remove	CH IV App IV-14 (Emery 2 Expansion Slope Stability Analyses)
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☒ Add	☐ Replace	☐ Remove	CH VII Table of Contents
☒ Add	☐ Replace	☐ Remove	CH VII Appendix VII-5 (Order 2 Soil Survey of Emery 2 Mine Pernit Area-12/16)
☐ Add	☒ Replace	☐ Remove	CH VIII Table of Contents page 1
☒ Add	☐ Replace	☐ Remove	CH VIII Table of Contents page 2
☒ Add	☐ Replace	☐ Remove	CH VIII Appendix VIII-8 (Vegetation and Sensitive Species of the Emery 2 Area-12/16)
☐ Add	☐ Replace	☐ Remove	
☒ Add	☐ Replace	☐ Remove	CH X Part X.C Table of Contents
☒ Add	☐ Replace	☐ Remove	CH X Part X.C Appendix X.C-2 (Air Approval Order)
☐ Add	☐ Replace	☐ Remove	

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Bronco Utah Operations, LLC
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 3/5 second deficiency response tsk id 5350 1/2107

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	CH VI, text and tables
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-2
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-3
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-4
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-5
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-6
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-7
☐ Add	☒ Replace	☐ Remove	CH VI, Figure VI-9
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH VI, Appendix VI-1
☐ Add	☐ Replace	☐ Remove	CH VI, Insert material at the back of Appendix VI-4
☐ Add	☒ Replace	☐ Remove	CH VI, Appendix VI-10
☐ Add	☒ Replace	☐ Remove	CH VI, Appendix VI-12
☒ Add	☐ Replace	☐ Remove	CH VI, Insert material at the back of Appendix VI-14
☒ Add	☐ Replace	☐ Remove	CHVI, Appendix VI-20
☒ Add	☐ Replace	☐ Remove	CH VI, Appendix VI-21
☒ Add	☐ Replace	☐ Remove	CH VI, Appendix VI-22
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Bronco Utah Operations LLC
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 4/5 second deficiency response tsk id 5350 1/2017

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	CH I Plate I-1 (Surface and Coal Ownership)
☐ Add	☒ Replace	☐ Remove	CH II Plate II-1, Structures and Facilities Main Portal Area
☐ Add	☒ Replace	☐ Remove	CH II Plate II-1A, Proposed Structures and Facilities Main Portal Area
☐ Add	☒ Replace	☐ Remove	CH III Plate III-9 (Permit Boundaries and Bonding map- Exhibit D)
☒ Add	☐ Replace	☐ Remove	CH III Plate III-11 (Emery 2 Reclamation Hydrology)
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH IV, Plate IV-2, UG Operations Plan
☐ Add	☒ Replace	☐ Remove	CH IV Plate IV-8a (Emery 2 Phase I & II Expansion, Roads & Conveyor Plan view)
☐ Add	☒ Replace	☐ Remove	CH IV Plate IV-8b (Emery 2 Phase I & II Expansion, Roads & Conveyor Profile/x-sect)
☒ Add	☐ Replace	☐ Remove	CH IV Plate IV-8c (Emery 2 Expansion Road Sec 7 Plan, Profile/x-sect)
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	CH V, Plate V-1, Pre-subsidence Survey Structures and Utilities
☐ Add	☐ Replace	☐ Remove	CH V, Plate V-2, Pre-subsidence Survey Roadways
☐ Add	☐ Replace	☐ Remove	CH V, Plate V-3, Pre-subsidence Survey Hydrology
☐ Add	☐ Replace	☐ Remove	CH V, Plate V-4, Pre-subsidence Survey Vegetation
☐ Add	☒ Replace	☐ Remove	CH V, Plate V-5, Subsidence Monitoring Points and Buffer Zones
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-1, Upper Ferron Sandstone potentiometric Surface (1979)
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-2, Lower Ferron Sandstone Potentiometric Surface (1985)
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-4, Ground Water Monitoring Well and Surface Water Monitoring Site Location Map
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-5, General Geology

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Bronco Utah Operations LLC
Mine: Emery Mine **Permit Number:** 015/015
Title: e2 Phase II Additional Permit Area Page 5/5 second deficiency response tsk id 5350 1/2017

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-6, anticipated initial groundwater depth
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-7, Upper Ferron Sandstone Potentiometric Surface (2006)
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-8, Lower Ferron Sandstone Potentiometric Surface (2006)
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-9, Misc Surface Water Data Collection Sites
☐ Add	☒ Replace	☐ Remove	CH VI, Plate VI-10, Surface Drainage Control index Map
☒ Add	☐ Replace	☐ Remove	CH VI, Plate VI-10E
☒ Add	☐ Replace	☐ Remove	CH VI, Plate VI-11B
☒ Add	☐ Replace	☐ Remove	CH VI, Plate VI-15B
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH VII, Plate VII-1, Soil Map
☐ Add	☒ Replace	☐ Remove	CH VIII, Plate VIII-1, Vegetation and Landuse Map
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☒ Replace	☐ Remove	CH XI, Plate XI-1,Alluvial Valley Floor Along Upper Quitchupah Creek
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
☐ Add	☐ Replace	☐ Remove	
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☐ Add	☐ Replace	☐ Remove	

Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**

Operator: Wild West Equipment & Hauling, LLC ("Wild West")
PO Box 1
Price, Utah 84501
435-472-3988

On July 22, 2013, IPA, the owner of the Wildcat Loadout filed an application to change the operator of the Wildcat Loadout to Wild West. The application listed Dan Baker as the Vice President of Wild West and included his name, title and contact information in the Operator Information section of the permit filing.

UMC 782.15

Right of entry and operation is based on surface or subsurface ownership by Bronco Utah Operations LLC and Bronco Utah Reserves Inc. and or on lease agreements. A detailed description of these documents is provided in Appendix I-2. These rights are not subject to pending litigation.

Bronco currently holds Federal Coal Lease U-5287 in good standing (executed on June 25, 1984). Mining in U-5287 will not occur until 2019 at the earliest. As the current approved R2P2 with the BLM does not accurately reflect the proposed mining plan depicted on Plate-IV-2, Bronco will initiate the R2P2 modification in January 2017 and endeavor to provide the Division with documentation of the modified R2P2 by December 31, 2017 which would be several years prior to entering the lease. Bronco cannot control the BLM approval process. Bronco will report on the status of the modified R2P2 beginning with the 2017 annual report.

There will not be any surface mining of coal at the Emery Mine during the five (5) year term of this permit renewal.

UMC 782.16

The permit area and adjacent area, shown on Plate Ill-9 (Permit Boundaries and Bonding Map Exhibit D), including areas depicted as full extraction (planned subsidence) on Plate V-5 (Subsidence Monitoring Points and Buffer Zones) do not contain any of the following areas designated as unsuitable for mining:

National Park System
National Wildlife Refuge System
National System of Trails
National Wilderness Preservation System
Wild and Scenic Rivers System
National Recreation Areas
National Forests
Public Parks
Public places included on the National Register of Historic Places
Public Buildings, Schools, Churches, Cemeteries, Community or Institutional Buildings

The adjacent area contains one dwelling that is occupied intermittently (located in Sec. 30, Twp. 225, R6E) and several public roads (shown on Plate Ill). These will not be affected by the underground mining operation. Surface operations will not be conducted within 300 feet of the dwelling. Protection of land surface features is discussed in Chapter V.

Inserted 03/2016
Revised 01/2017

UMC 782,17

Underground operations at the Emery Mine are an ongoing situation which does not occur in phases. The extent of the underground workings over the life of the permit is shown on Plate~~s~~ ~~IV-I and~~ IV-2. The approved permit area encompasses approximately 44~~4~~2.8~~5~~ acres and the additional Emery 2 expansion permit area encompasses 29 acres, for a total of 473.8 acres. ~~t~~The adjacent area encompasses approximately 5,776 acres. A minor permit area adjustment was done due to the disturbed area survey.

It is anticipated that mining activities will continue considerably beyond the five (5) year permit term. This will require renewals at the end of each term.

UMC 782.18, UMC 800.60

Appendix I-5 contains a copy of the insurance certificate, for the Emery Mine, covering personal injury and property damage.

Revised 8-31-95
Revised 4/2005
Revised 9/2006
Revised 5/2009
Revised 8/2009
Revised 4/2010
Revised 12/2016

Surface Land Ownership Within and Adjacent to the Permit Area

The following information describes the surface land ownership within and adjacent to the permit. Plate I-1 shows surface land ownership in and adjacent to the permit area.

On December 16, 2015, CONSOL Mining Company LLC conveyed its interest in the surface lands at the Emery Deep Mine and Hidden Valley Mine to Bronco Utah Operations, LLC by (i) Special Warranty Deed, recorded in Emery County on December 22, 2015 at Entry 411521, and recorded in Sevier County on December 23, 2015 at Document No. 00391679, Book 0709, Page 0986 and (ii) Assignment and Assumption Agreement, recorded in Emery County on December 22, 2015 at Entry 411523. The surface interests owned, leased or controlled by Bronco Utah Operations, LLC at the Emery Deep Mine and Hidden Valley Mine are not subject to litigation.

Section 19 T22S, R6E

~~George E. & Patricia Olsen~~
~~15 E. Center~~
~~Orangeville, Utah 84537~~
~~(801) 748-2522~~

James Olsen
647 North Main
Spanish Fork, UT 84660
801-798-3322

United States of America (BLM)
Lease No. U-5287
Utah State Offices
440 West 200 South, Suite 500
Salt Lake City, UT 84145-0155

Utah Power and Light
PO Box 899
Salt Lake City, UT 84522
801-748-2570

Wynona P. Olsen (trustee)
3805 Highland Cove Lane
Apt D18
Salt Lake City, UT 84146

M. Christensen
Box 35
Emery, UT 84522
801-286-2348

~~Young Investment LLC~~
~~c/o Walt Young~~
~~6590 W. Center St.~~
~~Mendon, UT 84325~~

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
(801) 286-2447~~2301~~

Derek Beagley
PO Box 106
Emery, UT 84522

Julian Bowman
PO Box 141
Huntington, UT 84528-0141

Chuck A. & Cheryl A. Harris
4204 South Bennion Road
Taylorsville, UT 84129

Inserted 12/2007
Revised 9/2009
Revised 12/2013
Revised 3/2016
Revised 12/2016

Surface Land Ownership Within and Adjacent to the Permit Area

The following information describes the surface land ownership within and adjacent to the permit. Plate I-1 shows surface land ownership in and adjacent to the permit area.

Section 20 T22S, R6E

~~Gary Petty & Jolene~~
~~P.O. Box 44~~
~~Emery, Utah 84522~~

~~Glen R. Anderson~~
~~1462 W. 6235 S.~~
~~Murray, Utah 84107~~
~~(801) 266-4324~~

Emery County
Emery County Courthouse
Castle Dale, UT 84513

Osburn Bret and Lori Lynn Carter
PO Box 24
Emery, UT 84522

Kenneth L. & Earlene Christensen
PO Box 552
Emery, UT 84522

~~Jeffery Christensen~~
~~P.O. Box 235~~
~~Cleveland, UT 84518~~

Osburn Bret Carter & J.R. Lawrence
PO Box 24
Emery, UT 84522

Utah Power and Light
P.O. Box 899
Salt Lake City, UT 84110
801-748-2570

Eric Andersen ETAL
PO Box 587
Emery, UT 84522

Michael L. & Jodi Christensen
PO 14
Emery, UT 84522

Kent & Abbie Christensen
PO Box 5
Emery, UT 84522

Section 21 T22S, R6E

Wayne & Delise Staley
482 North 2 W.
Emery, UT 84522
801-286-2213

John & Vicki Byars
PO Box 575
Emery, UT 84522

Bronco Utah Operations LLC.
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

Osburn Bret and Lori Lynn Carter
PO Box 24
Emery, UT 84522

~~L.D. & C.A. Jensen~~
~~179 W. 4 S.~~
~~Emery, Utah 84522~~
~~(801) 286-2297~~

Gayle~~Kent Alan~~ Jorgensen Trustee~~et al~~
3663 Bountiful Boulevard
Bountiful, UT 84010-3313

Morris & Ronnie Sorensen
PO Box 104
Emery, UT 84522-0104

Richard R. Benson & Genevieve Bensen
PO Box 104
Ferron, UT 84523

Inserted 12/2007
Revised 9/09
Revised 12/13
Revised 3/16
Revised 12/2016

Surface Land Ownership Within and Adjacent to the Permit Area

The following information describes the surface land ownership within and adjacent to the permit. Plate I-1 shows surface land ownership in and adjacent to the permit area.

Section 22 T22S, R6E

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

John & Vicki Byars
PO Box 575
Emery, UT 84522

Kenneth L. & Earlene Christiansen
PO Box 552
Emery, UT 8452

D.U. Company, Inc.
53 West Angelo Avenue
Salt Lake City, UT 84115

Section 23 T22S, R6E

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

United States of America BLM
Leased UTU 86038

Section 26 T22S, R6E

United States of America BLM
Leased ~~to Consolidation Coal~~ UTU 86038

Clark J. Thomas
PO Box 861
St. George, UT 84771

Section 27 T22S, R6E

Bronco Utah Operations LLC.
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

Section 28 T22S, R6E

Wayne & Delise Staley
PO Box 83
Emery, UT 84522
801-286-2213

Bronco Utah Operations LLC.
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

~~Russell H. Odle~~
~~P.O. Box 23~~
~~Emery, UT 84522-0023~~

Jesse L. Megan Allan
PO Box 43
Emery, UT 84522

Section 29 T22S, R6E

~~Russell H. Odle~~
~~P.O. Box 23~~
~~Emery, UT 84522-0023~~

Emery County
Emery County Courthouse
Castle Dale, UT 84513

~~Morgan Robertson~~
~~P.O. Box 65~~
~~Emery, Utah 84522~~
~~(Refer to Page 7b thru 7d for Exploration & Surface Agreement)~~

Rainbow Glass
PO Box 340
Orangeville, UT 84537

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

Osburn Bret Carter ~~& J.R. Lawrence~~
PO Box 24
Emery, UT 84522

Jesse L. Megan Allan
PO Box 43
Emery, UT 84522

William Boyd Stansfield Jr.
PO Box 553
Emery, UT 84522

Inserted 12/2007
Revised 9/09
Revised 12/13
Revised 3/16
Revised 12/2016

Surface Land Ownership Within and Adjacent to the Permit Area

The following information describes the surface land ownership within and adjacent to the permit. Plate I-1 shows surface land ownership in and adjacent to the permit area.

Section 30 T22S, R6E

~~George E. & Patricia L. Olsen~~
~~15 E. Center~~
~~Orangeville, Utah 84537~~
~~(801) 748-2522~~

Josiah K. Eardley
2433 South Highway 10
Price, UT 84501

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2301

Emery County
Emery County Courthouse
Castle Dale, UT 84513

~~Morgan C. Robertson~~
~~P.O. Box 65~~
~~Emery, Utah 84522~~
~~(Right of Entry - Road &Monitoring~~
~~Facilities, right-of-way & easement~~
~~grant executed 10-3-88, filed &~~
~~recorded 10-6-88, Utah, Emery County~~
~~Book 174, Page 600-601)~~

~~Wynona P. Olsen (trustee)~~
~~3805 Highland Cove Lane~~
~~Apt #D18~~
~~Salt Lake City, Utah 84146~~

~~Young Investment LLC~~
~~c/o Walt Young~~
~~6590 W. Center St.~~
~~Mendon, UT 84325~~

~~Clara V. Albrechtsen~~
~~893 N 800 E~~
~~Bountiful, UT 84010-2848~~

~~M. Christensen~~
~~Box 35~~
~~Emery, Utah 84522~~
~~(801) 286-2348~~

Horace Petty Trustee
PO Box 144
Orangeville, UT 84537

Michael L. Christensen
PO Box 14
Emery, UT 84522

William Boyd Stansfield Jr.
PO Box 553
Emery, UT 84522

Derek Beagley
PO Box 106
Emery, UT 84522

Section 31 T22S, R6E

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2301

~~Morgan Robertson~~
~~P.O. Box 65~~
~~Emery, Utah 84522~~

Josiah K. & Etta Marie Eardley
2433 South Highway 10
Price, UT 84501

~~Osburn Bret Carter et al~~
~~P.O. Box 24~~
~~Emery, Utah 84522~~

William Boyd Stansfield Jr.
PO Box 553
Emery, UT 84522

Section 32 T22S, R6E

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

William Boyd Stansfield Jr.
PO Box 553
Emery, UT 84522

~~Osburn Bret Carter~~
~~P.O. Box 24~~
~~Emery, Utah 84522~~

Inserted 12/2007
Revised 9/09
Revised 12/13
Revised 3/16
Revised 12/2016

Surface Land Ownership Within and Adjacent to the Permit Area

The following information describes the surface land ownership within and adjacent to the permit. Plate I-1 shows surface land ownership in and adjacent to the permit area.

Section 33 T22S, R6E

Bronco Utah Operations LLC.
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

Section 34 T22S, R6E

Bronco Utah Operations LLC
Emery Mine
PO Box 527
Emery, UT 84522
801-286-2447~~2301~~

United States of America (BLM)

Section 25 T22S, R5E

Rex Addley
Emery, UT 84522
801-286-2250

George Lewis
75 East 3rd South
Salt Lake City, UT 84111
Phone Unknown

Robert Lewis
107 W. 2 S.
Emery, UT 84522
801-286-2424

United States of America (BLM)
Not Leased

Inserted 12/2007
Revised 9/09
Revised 12/13
Revised 3/16
Revised 12/2016

Coal Ownership Within and Adjacent to the Permit Area

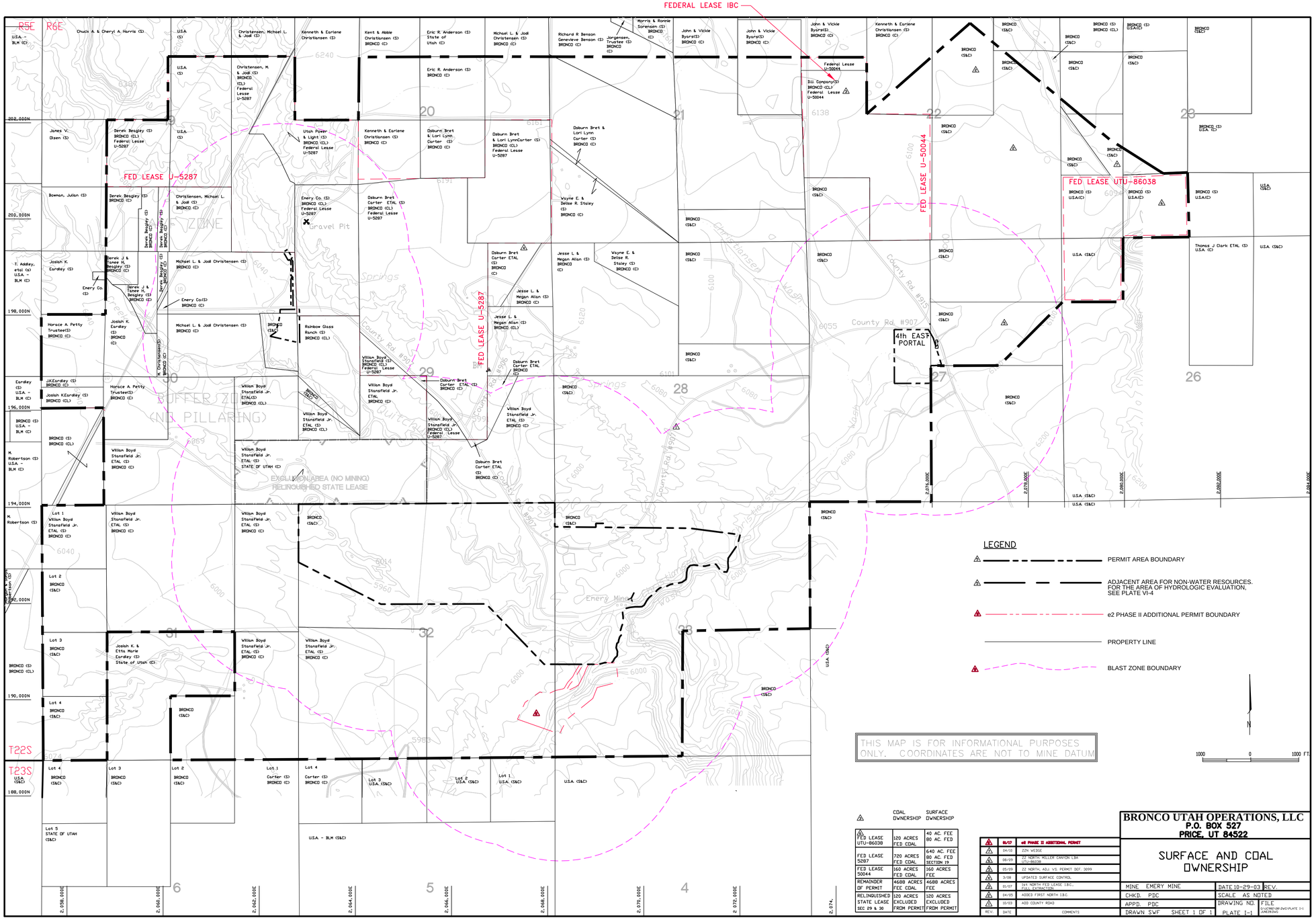
On December 16, 2015, CONSOL Mining Company LLC conveyed and assigned its interest in the below holdings (except Federal Coal Leases UTU-5287, UTU-50044, UTU86038 and Federal Logical Mining Unit UTU-73335, the "Federal Leases") to Bronco Utah Operations, LLC by Special Warranty Deed and Assignment and Assumption Agreement, recorded in Emery County on December 22, 2015 at Entry 411521 and 411523, respectively. On December 16, 2015, CONSOL Mining Company LLC assigned the Federal Leases to Bronco Utah Reserves, Inc. by Assignment and Assumption Agreement, recorded in Emery County on December 22, 2015 at Entry 411524. By Sublease Agreement dated December 16, 2015 Bronco Utah Reserves, Inc. subleased its interest in the Federal Leases to Bronco Utah Operations, LLC. Bronco Utah Operations, LLC is the successor in interest to Kemmerer and Consol, and references to Kemmerer and Consol below should be read as Bronco Utah Operations LLC for periods of time after December 16, 2015. The documents and lands listed below pertain only to coal ownership and are not subject to litigation. Plate I-1 shows coal ownership in and adjacent to the permit area.

Bronco currently holds Federal Coal Lease U-5287 in good standing (executed on June 25, 1984). Mining in U-5287 will not occur until 2019 at the earliest. As the current approved R2P2 with the BLM does not accurately reflect the proposed mining plan depicted on Plate-IV-2, Bronco will initiate the R2P2 modification in January 2017 and endeavor to provide the Division with documentation of the modified R2P2 by December 31, 2017 which would be several years prior to entering the lease. Bronco cannot control the BLM approval process. Bronco will report on the status of the modified R2P2 beginning with the 2017 annual report.

Township 22 South, Range 6 East (SLM)

Section 19	NE¼SW¼ NW¼SE¼ E½SE¼ S½NE¼	Lease from USA (BLM) to Kemmerer and Consol dated 7/1/70 (#U-527) Utah State Offices University Club Building Salt Lake City, Utah (801) 524-5330
	SE¼SW¼	Deed from Emery County to Kemmerer Coal Co. dated 5/14/68
	SW¼SE¼	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co. dated 6/22/49
	N½NE¼ NW¼	United States of America Not Leased
	W½SW¼	Emery County 95 E. Main Castledale, Utah 84513 (801) 748-2474
Section 20	NW¼SW¼ S½S½ NE¼SE¼	Lease from United States of America (BLM) to Kemmerer and Consol dated 7/1/70 (#U-5287)
	NE¼ E½NW¼ NE¼SW¼ NW¼SE¼	Deed from San Rafael Fuel Co. to Kemmerer Coal Co. date 10/1/58
	W½NW¼	United States of America Not Leased
Section 21	W½ SE¼ NE¼NE¼ W½NE¼	Deed from San Rafael Fuel Co. to Kemmerer Coal Co.
	SE¼NE¼	Deed from L.M. and S.M. Pratt to Kemmerer Coal Co.

Replaced/reordered 09/2009
Revised 03/2016
Revised 01/2017



	COAL OWNERSHIP	SURFACE OWNERSHIP
FED LEASE UTU-86038	120 ACRES FED COAL	40 AC. FEE 80 AC. FED
FED LEASE 5287	720 ACRES FED COAL	640 AC. FEE 80 AC. FED SECTION 19
FED LEASE 50044	160 ACRES FED COAL	160 ACRES FEE
REMAINDER OF PERMIT	4688 ACRES FEE COAL	4688 ACRES FEE
RELINQUISHED STATE LEASE SEC 29 & 30	120 ACRES EXCLUDED FROM PERMIT	120 ACRES EXCLUDED FROM PERMIT

REV.	DATE	COMMENTS
8	8/17	e2 PHASE II ADDITIONAL PERMIT
7	04/13	ZZN WEDGE
6	08/09	22 NORTH MILLER CANYON LBA UTU-86038
5	05/09	22 NORTH, ADJ. VS. PERMIT DEF. 3699
4	3/08	UPDATED SURFACE CONTROL
3	01/07	1st NORTH FED LEASE IBC, FULL EXTRACTION
2	04/05	ADDED FIRST NORTH IBC
1	10/03	ADD COUNTY ROAD

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

SURFACE AND COAL OWNERSHIP

MINE	EMERY MINE	DATE 10-29-03	REV.
CHKD.	PDC	SCALE	AS NOTED
APPD.	PDC	DRAWING NO.	FILE G:\ACTIVE\BRJV\PLATE I-1 SHEET.DWG
DRAWN	SWF	SHEET 1 OF 1	PLATE I-1

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

Road to Mine Substation
Map Code: Identified on Plate II-1
Status: Existing – prior to 1975

The road to the mine substation is on top of the canyon, north of the mine entrance and is used to access the substation.

This road will be used to access the proposed preparation plant facilities area. The design information to upgrade this structure for use as the plant access road is presented in Chapter IV.

Road to Borehole Pump Facility No. 1
Map Code: Shown on CH IV, Appendix IV-7 and Plate IV-8
Status: Existing – prior to 1975

The road to borehole pump no. 1 is located approximately 3/4 of a mile north of the mine entrance and branches off County Road 9-07. The road is used solely to access and maintain dewatering pump no. 1.

Road to Mine Discharge Sedimentation Pond No. 1
Map Code: Shown on Plate II-2
Status: Existing – 4th quarter 1976

This road (located about ½ mile north of the mine entrance) was used in the past to access Sedimentation Pond No. 1 but a culvert used for crossing Quitchupah Creek was washed out in a flood, thereby making the road impassable.

Upon construction of the preparation plant, the road will be constructed to access the plant waste disposal facilities. The design for rebuilding this road as a coal refuse haulage road is presented in Chapter IV.

Emery 2 Expansion Facilities

Mine Substation
Map Code: e1, Plate II-1
Status: Proposed 2016

Electric substation mounted on a concrete pad. The 20 MVA substation is located adjacent to the existing mine substation (Map Code 42). The pad contains 75 cubic yards of concrete. The substation area is within the approved surface drainage control area and disturbed area.

Conveyor 6/Truck Loadout
Map Code: e2, Plate II-1
Status: Proposed 2016

48-inch Conveyor from Screen/Crusher Building to Truck Loadout area. The conveyor is 217 feet long consisting of 122 feet of elevated structure and 95 feet on grade. Two concrete pads with dimensions 16'x12'x3' and 12'x9'x3' (33 cubic yards total) along with metal frame structure support the elevated portion of the belt. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. The conveyor and loadout area is within the approved surface drainage control area and disturbed area.

Screening & Crushing Facility
Map Code: e3, Plate II-1
Status: Proposed 2016

Screening and crushing equipment with metal support structure mounted on a 46'x26'x3' concrete pad and 10 piers (143 cubic yards total). Equipment structure will have approximate dimensions of 40'x20'x55' high. The facility will receive coal from Conveyor 5 and discharge to Conveyor 6. The Screening & Crushing Facility is within the approved surface drainage control area and disturbed area.

Conveyor 5
Map Code: e4, Plate II-1
Status: Proposed 2016

54-inch conveyor partially elevated and supported by metal frame structure mounted on concrete pads with the remaining conveyor length constructed on grade and within a reclaim tunnel. Four concrete pads and piers with dimensions 20'x20'x3' pad with 8-foot diameter by 4.5-foot high pier, 34'x18'x3' pad with 10-foot diameter by 4.5-foot high pier, 36'x20'x3' pad with 10-foot diameter by 4.5-foot high pier, and 28'x8'x3' pad with 20'x3'x3' pad, for a total of 259 cubic yards.

Conveyor 5 will receive coal from feeders beneath the Conveyor 4/Radial Stacker stockpile and discharge to the Screening and Crushing Facility. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 5 is within the approved surface drainage control area and disturbed area.

Emery 2 Expansion Facilities (cont.)

Reclaim Tunnel
Map Code: e5, Plate II-1
Status: Proposed 2016

Corrugated metal tunnel to house a portion of Conveyor 5. The tunnel will be 320 feet long and consist of a 12-foot diameter corrugated metal pipe buried in a backfilled trench. Concrete (141 cubic yards) will be poured to a thickness of 2.7 feet to form a floor surface within the pipe for mounting the conveyor structure. Approximately half the tunnel length will be utilized under the current mine plan. The full length will be utilized during future mine expansion. A 3-foot diameter, 120-foot long escape tunnel is also included with this structure. Coal from the Radial Stacker stockpile will fall through feeders onto Conveyor 5. The Reclaim Tunnel is located within the approved surface drainage control area and disturbed area. Reclamation of the tunnels will consist of excavating cover soil, removing the tunnels, and backfilling the trenches. The cross sectional area of the excavation required for tunnel demolition is 666 square feet for the main tunnel and 232 square feet for the escape tunnel, resulting in 7,893 cubic yards and 1,031 cubic yards of excavation/backfill, respectively. Final surface reclamation costs are included in bond calculations for the entire portal area grading costs.

Conveyor 4/Radial Stacker
Map Code: e6, Plate II-1
Status: Proposed 2016

48-inch radial stacking conveyor supported by metal frame structure. The conveyor will receive coal from the drop chute at the end of Conveyor 2 and discharge to a stockpile. The stacker will travel on a compacted rock surface. The conveyor will be anchored to a concrete pad supporting the drop chute (concrete included with Conveyor 2). Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 4/Radial Stacker is located within the approved surface drainage control area and disturbed area.

Conveyor 2, Phase I
Map Code: e7p1 Plate II-1
Status: Proposed 2016

60-inch conveyor supported by metal frame structure. ~~A~~The 260-foot portion of ~~the~~ Conveyor 2, Phase I will be located within the original~~current~~ permit area.~~ The remaining conveyor length will be included in an expanded permit boundary.~~

The conveyor is elevated and supported by metal framework anchored to 2 concrete pads with dimensions of 36'x20'x3'. A 10-foot diameter, 4.5-foot high concrete pier is mounted on each pad for a total concrete volume (includes the 2 pad/piers) of 186 cubic yards. The drop chute at the end of Conveyor 2 is supported by a 22'x16'x3' concrete pad (39 cubic yards) that also anchors the Radial Stacker. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 2, Phase I is located within the approved surface drainage control area and disturbed area.

Replaced 7/2016
Revised 10/2016

Emery 2 Expansion Facilities (cont.)

Conveyor 2, Phase II
Map Code: e7p2 Plate II-1
Status: Proposed 2016

60-inch conveyor supported by metal frame structure. The remaining 680-foot portion of Conveyor 2, Phase II will be located within the expanded permit boundary.

The 365-foot portion of Conveyor 2, Phase II is elevated and supported by metal framework anchored to 2 concrete pads with dimensions of 34'x18'x3' and 36'x20'x3', respectively. A 10-foot diameter, 4.5-foot high concrete pier is mounted on each pad for a total concrete volume of 174 cubic yards (includes the 2 pad/piers).

A 315-foot section of Conveyor 2 is constructed on grade utilizing small, portable pads. The transition pad (to Conveyor 1) dimensions are 23.5'x16'x3', with a volume of 42 cubic yards. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 2, Phase II will be located within an approved surface drainage control area and disturbed area.

Conveyor 1
Map Code: e8 Plate II-1
Status: Proposed 2016

60-inch conveyor supported by metal frame structure. The 700-foot conveyor system transports coal from the Emery 2 mine portal to Conveyor 2 (Map Code e8).

A 215-foot section of conveyor is elevated and supported by metal framework anchored to 2 concrete pads with dimensions of 20'x20'x3' and 18'x18'x3, respectively. A 10-foot diameter, 4.5-foot high concrete pier is mounted on each pad for a total concrete volume of 102 cubic yards (includes the 2 pads/piers). The remaining 485-foot section is built on grade utilizing small, portable pads. The transition pad dimensions into the mine are 25'x16'x3', with a volume of 44 cubic yards. Suspended solids contributions will be minimized by utilizing covered conveyors (Plate II-I, photo log P5) and water sprays. Conveyor 1 will be located within the approved surface drainage control area and disturbed area.

Emery 2 Expansion Facilities (cont.)

Portals
Identified on Plate II-1
Status: Proposed 2016

This 3-entry portal is designed to provide access to the Emery 2 Expansion operating sections of the mine and for future reserve development. The entries will be established at the bottom of an open boxcut located at the southern edge of the permit area in Section 33. The majority of the excavated material will be used as fill to establish grade to support the conveyor system and mine access road. The excess material from the boxcut will be stockpiled and used in future reclamation. A ramp on a grade of approximately 10% will lead to the bottom of the portal boxcut. Each entry will be approximately 8 feet high by 14 feet wide and will be driven on 45-foot centers. Once established, the portal will be utilized for two purposes: 1) to allow access of rubber-tired vehicles for transportation of men and supplies into the mine and 2) to serve as a coal haulage portal.

Unaffected drainage will be diverted past the portal site to Quitchupah Creek. Affected drainage will collect in retention basin 1 and be pumped to Sediment Pond 3 (UPDES Outfall 005).

Culvert (UC-1)
Map Code: e10 Plate II-1
Status: Proposed 2016

Culvert (UC-1) is a 30-inch diameter CHDPE 800 feet in length. This culvert conveys unaffected drainage upstream of the portals to Quitchupah Creek.

Culvert (UC-2)
Map Code: e11 Plate II-1
Status: Proposed 2016

Culvert (UC-2) is 30-inch diameter CHDPE 760 feet in length. This culvert conveys unaffected drainage to Quitchupah Creek.

Water Tank
Map Code: e12 Plate II-1
Status: Proposed 2016

The 100,000-gallon tank was disassembled at 4th East Portal and reassembled at the current location above the mine entrance portal west of the boxcut. The tank measures 25 feet high by 26 feet in diameter, with the walls sitting upon a concrete footer. The interior of the tank rests on sand. The tank is equipped with an overflow, level indicator, and valves to direct flow.

The water tank will serve as a surge tank for surface and underground water supplies. Water from underground is pumped to the tank through a bi-directional pipeline.

Surface drainage from the tank area will be directed to Pond 3.

Inserted 10/2016

Emery 2 Expansion Facilities (cont.)

Ventilation Shaft/Fan
Map Code: e13 Plate II-1
Status: Proposed 2016

A 16-foot diameter raise-bore shaft located west of the Emery 2 Portal boxcut is used for mine ventilation. Depth of the shaft is approximately 120 feet. The ventilation fan and housing previously utilized at 4th East Portal is constructed over the shaft.

Four 4-inch diameter boreholes are installed near the ventilation shaft to provide access for water and power to the mine.

Surface drainage from the ventilation shaft and fan area will be directed to Pond 3.

Powerline
Map Code: e14 Plate II-1
Status: Proposed 2016

An overhead electric powerline extends from the Mine Substation (Map Code e1) along the conveyor belt to Emery 2 Mine portal to provide power for the mine. A line also extends from the powerline in the boxcut to the Ventilation Fan (Map Code e13). The powerline will be 3600 feet in length and have 18 power poles.

Topsoil Stockpile
Identified on Plate II-1 as existing topsoil stockpile T-2
Status: Existing

This existing stockpile is located south of the coal mine waste pile. Salvaged soil from the Emery 2 Expansion area will be stockpiled here. The stockpile will be fully bermed to contain a 100-yr/24-hr rainfall event.

Excess Boxcut Material
Identified on Plate II-1 as Coal Stockpile Area
Status: Existing

This existing coal stockpile area will be used to store excess boxcut material (89,000 cubic yards) not used for fill. The coal stockpile area reports to an approved drainage basin.

Inserted 10/2016

UMC 784.18

Two (2) structures, associated with underground mining activities, are located within 100 ft. of the right-of-way of County Road 9-07. The location of Borehole Pump Facility #3 and the Northwest Coal Stockpile are shown on Plates VI-18 and II-1, respectively. They were approved by the Division and subsequently constructed according to the approved plan.

Four structures associated with the 4th East Portal site are located within 100 ft. of the right of way of County Road 9-15. These structures consist of cattle guard, berms, perimeter fencing, and the relocated haul road.

Other than future access or haul roads joining the public roads, Bronco~~Consol~~ does not propose any other facilities within 100 ft. of a right-of-way. To protect the general public the entrance gate will be posted with a stop sign prior to entering onto the county road from the mine property. The county road will be posted with warning signs as to the existence of the mine entrance. Flagman will be used to protect the general public and employees during construction activities where operation of large equipment or transportation of supplies may create a safety concern. The following pages 18a through 18d is the Emery County Encroachment Permit to upgrade county road 915 and to construct an access.

There will be no proposed coal mining and reclamation operations within 100 feet of the right-of-way line of any public road related to the Emery 2 expansion permit boundary.

No public road relocations are proposed for the permit area.

UMC 784.23(a), (b) (1 through 12)

This permit ~~renewal~~ application contains the necessary maps, plans and cross-sections to provide compliance with the appropriate regulations.

UMC 784.24

Descriptions for transportation facilities, specifically roads and conveyor systems, whether existing or proposed, have been provided previously in this part.

For the sake of continuity we are providing all design information in Chapter IV. Chapter IV also covers the designs for relocation of natural drainage ways.

UMC 786.21

All existing structures have been found by the Division to be in compliance with this regulation.

UMC 817.150 – 176

Detailed design information for all roads, to show compliance with these performance standards, is contained in Chapter IV.

Revised 10/2002
Revised 09/2003
Revised 01/2004
Revised 01/2017

II.B DRAINAGE CONTROLS

UMC 784.14(a), (b)

A response to (a) and (b) of this regulation is provided in Chapter VI in conjunction with part (c).

UMC 784.16 (a) (1) (i-iii), (v), (a), (2),(i-iii),(a) (3) (i), (iii), (b)(1), (b) (2), (c), (d), (e)

The location and plan views of all ponds, impoundments, and coal processing waste embankments are shown on Plates II-1, II-1A (Proposed Preparation Plant Detail), II-2, II-3, IV-3, and VI-18. This chapter (II), and Chapters IV and VI contain information to describe each structure, provide detailed design and operational criteria (including geotechnical information), and to assess hydrologic impacts. All designs are certified by a qualified, registered, professional engineer. This also applies to any structure which meets or exceeds MSHA requirements. Removal of structures is covered in the reclamation plan presented in Chapter III. As in other instances, this application attempts to consolidate information, where possible, for ease of location.

See Appendix VI-21 (Emery 2 Surface Facility Hydrologic Design Calculations) for a discussion and detailed drainage design.

UMC 784.22

Three (3) diversions have been designed for the permit area. Each intercepts overland flow from drainage areas of less than one (1) square mile. These diversions are shown on Plate VI-10 (500 scale) and individually on the following 100 scale maps:

Waste Disposal Site Diversion (constructed):	Plate II-2
4 East Portal Diversion:	Plate II-3 & Plate VI-10a
Preparation Plant Area Diversion:	Plate II-1

Each diversion is designed to achieve compliance with UMC 817.43 and UMC 817.44. This design information is contained in Chapter VI.

UMC 817.41-,50

Mining activities will be conducted so as to minimize changes to the prevailing hydrologic balance in both the permit and adjacent areas. This is accomplished through mine plan considerations and through the implementation of a water management plan as described in Section VI.B.

The mine has the portals located up dip of the mining areas which will prevent gravity drainage from the mine.

UMC 785.13

During the term of this permit, alternative, experimental mining practices which would require a variance from the environmental protection performance standards of Subchapter K, are not proposed.

UMC 785.17(b)(2), (b)(4), UMC 817.21-.23

Prior to the construction of any surface facility, topsoil and subsoil will be removed and stockpiled separately. The site will be visually inspected prior to disturbance for cryptogamic soils. If cryptogam's are found, effort will be made to harvest these structures. The cryptogam material will be stored in a dry place until the material can be respread on the completed topsoil stockpile. Following removal of cryptogam's, effort will be made to segregate the top crust (up to 2-inch) of the topsoil from the site. The crust which contains many of the fine roots and nutrients for the cryptogamic material will be respread over the completed topsoil stockpile following roughening and seeding. The cryptogam's will then be selectively respread on the stockpile in areas protected from the effects of wind and water erosion Removal depths will vary according to the soil classifier's recommendations. Soils will normally be picked up by scrapers but may also be removed by back hoes and/or front end loaders. If vegetation is of sufficient size to potentially cause stockpile instability, it will be removed prior to soil recovery.

Stockpiles will be constructed with a maximum side slope of 2:1 (horiz:vert.) to prevent wind and water erosion. These piles will also be vegetated to assist erosion control. To minimize the effects of wind and water erosion, stockpiled material should utilize surface roughening techniques prior to seeding and mulching. Surface roughening should be performed by a backhoe or excavator to form random depressions from 1 ft to 2 ft in depth. The roughening is to be performed over the entire surface area of the stockpile including side slopes. Berm structures should also utilize some roughening methods to enhance protection from wind and water erosion.

Plates II-1, II-1A (Proposed Preparation Plant Detail), II-2, II-3, IV-3 and VI-18 show the location of both existing and proposed preparation plant topsoil and subsoil stockpiles

Chapter VII contains the details of the soils plan and Chapter VIII covers vegetation, including temporary, contemporaneous, and final reclamation methods.

It should be noted that a portion of existing subsoil stockpile S-I overlaps the proposed clean coal storage area of the proposed preparation plant area on the operations plan map. This conflict will be resolved prior to construction of the preparation plant facility by utilizing the stockpile in reclamation at the earliest possible time. The respread depth and respread location will be provided to the Division prior to initiating any reclamation. If it is not possible to utilize the stockpile prior to construction of the preparation plant facility, final disposition of this stockpile will be determined in consultation with the Division.

UMC 817.61-.68

Surface blasting activities are not conducted by the applicant at the Emery Mine.

Surface blasting was ~~will however, be~~ performed by contractors in the development of the 4th East Portal during excavation of the boxcut per the approved blasting plan (Refer to CH IV, Appendix IV-12. Surface blasting will be conducted by contractors in the development of the Emery 2 portals and possibly an access road (Section 7) per an approved blasting plan (refer to CH IV, Appendix 12). The contractor will not store explosives on site. Refer to CH IV, Appendix IV-12a for blasting notifications, waivers and pre-blast surveys.

~~While use of explosives underground is very infrequent, a small amount is stored in an MSHA approved magazine (which is isolated from heavily traveled areas and is posted with warning signs.~~ Explosives are used and handled as directed by MSHA. Currently, explosive storage during mining is not contemplated. If an explosive magazine is required in the future, one will be permitted and bonded.

UMC 817.81 – .85

The requirements of these regulations, concerning disposal construction, inspections, and drainage for coal processing waste banks are covered in chapter IV (part IV.C.1)

UMC 817,86 – .88

While no coal processing waste is produced at the present time, this renewal application proposes a preparation plant in the future. At that time a plan for fire suppression, burned waste utilization, and storage in mine workings will be prepared for approval by the Division and MSHA.

UMC 817.91 – .92

The requirements of these regulations for waste dam and embankment design and construction are covered in Chapter IV (part IV.C.2)

UMC 823.12 – .13

During the term of this permit, Bronco~~Consol~~ does not plan to conduct any surface operations on prime farmland.

Revised 10/2002
Revised 01/2017

The Emery 2 expansion area~~mine~~ will pump~~s~~ approximately 141~~9~~,000,000 gallons of water per year (gpy) from the mine during the permit term (refer to CH VI Table VI-22). The water that is used for dust suppression is accounted for in the ventilation calculation and the coal moisture consumption calculation. Portions of the water sprayed on the coal are either evaporated by the ventilation process, drain back into the mine drainage system, or is carried out in the product. The consumed volume is accounted for in the ventilation evaporation calculation and the coal moisture consumption calculation.

Mining consumption:	See above explanation, and coal moisture consumption calculation
Ventilation consumption:	See Ventilation evaporation calculation
Coal producing consumption:	See coal moisture calculation

Ventilation evaporation: Using the Valley Camp of Utah, Inc. Belina Mine's estimate outlined in the Windy Gap Process document, the forecasted ~~active~~ maximum mine works being ventilated during the permit term is 200~~328~~ acres or 0.313~~514~~ sq.~~-~~mi. Using 8.6 ac-ft/yr/sq.mi., the current underground works account for~~8.6~~ ac-ft/yr/sq.mi. * 0.313~~514~~ sq.mi. = 2.7~~4.4~~ ac-ft of water evaporated.

Sediment pond evaporation: Pond 1 (3.1 ac.), pond 6 (1.8 ac.), and pond 9 (0.2 ac.) would evaporate 5.1 acres * 4.11= 21 ac-ft/yr consumed.

Surface Dust Control water consumption: Dust control on the surface facilities consumes 5,000 gallons per day 5000 gal/day * 251 operating days/yr = 1,255,000 gal/yr or 3.9 ac-ft/yr consumed.

Springs and seep effects from subsidence: There have been no reports of seeps from subsidence.

Alluvial aquifer abstractions into mines: There are no water infiltrations from alluvial systems into the mine.

Alluvial well pumpage:	There is zero pumpage from alluvial wells.
Deep aquifer pumpage:	There is zero pumpage from deep aquifer wells.
Post mining inflow to old workings:	There is zero post mining inflow to the old workings

Coal moisture consumption: The inherent moisture in the Emery coal is approximately 4 %. The as received moisture of the coal is approximately 6 %. The maximum Emery Mine production could be 1,300,000 tons of coal. Using these values, the consumption could be (0.02 * 1,300,000 tons * 2000 lbs/ton)/ 8.33 lbs per gal * 325,850 gal per ac-ft. = 19.2 ac-ft/yr consumed.

Direct diversion: There are no direct diversions at the Emery mine therefore zero consumption.

Adding the approximate consumptive losses together equals 46~~8~~.8~~5~~ ac-ft. ~~Historically (2002 thru 2005) the mine pumped and~~Emery 2 is forecasted to discharge~~d~~ approximately 141~~9~~,000,000 gallons (432~~57~~ ac-ft) of water per year. Doing the math, you arrive at a 385.2~~408.5.9~~ ac-ft. per year enhancement to the Colorado River Basin. ~~The predicted discharge under full extraction of 1.5 cfs (1086 ac-ft/yr), would be a 1037.5 ac-ft/yr enhancement.~~ Water consumption by the Emery mine will not jeopardize the existence of or adversely modify the critical habitat of the Colorado River endangered fish species.

Inserted 5/2005
Revised 3/2007
Revised 10/2016

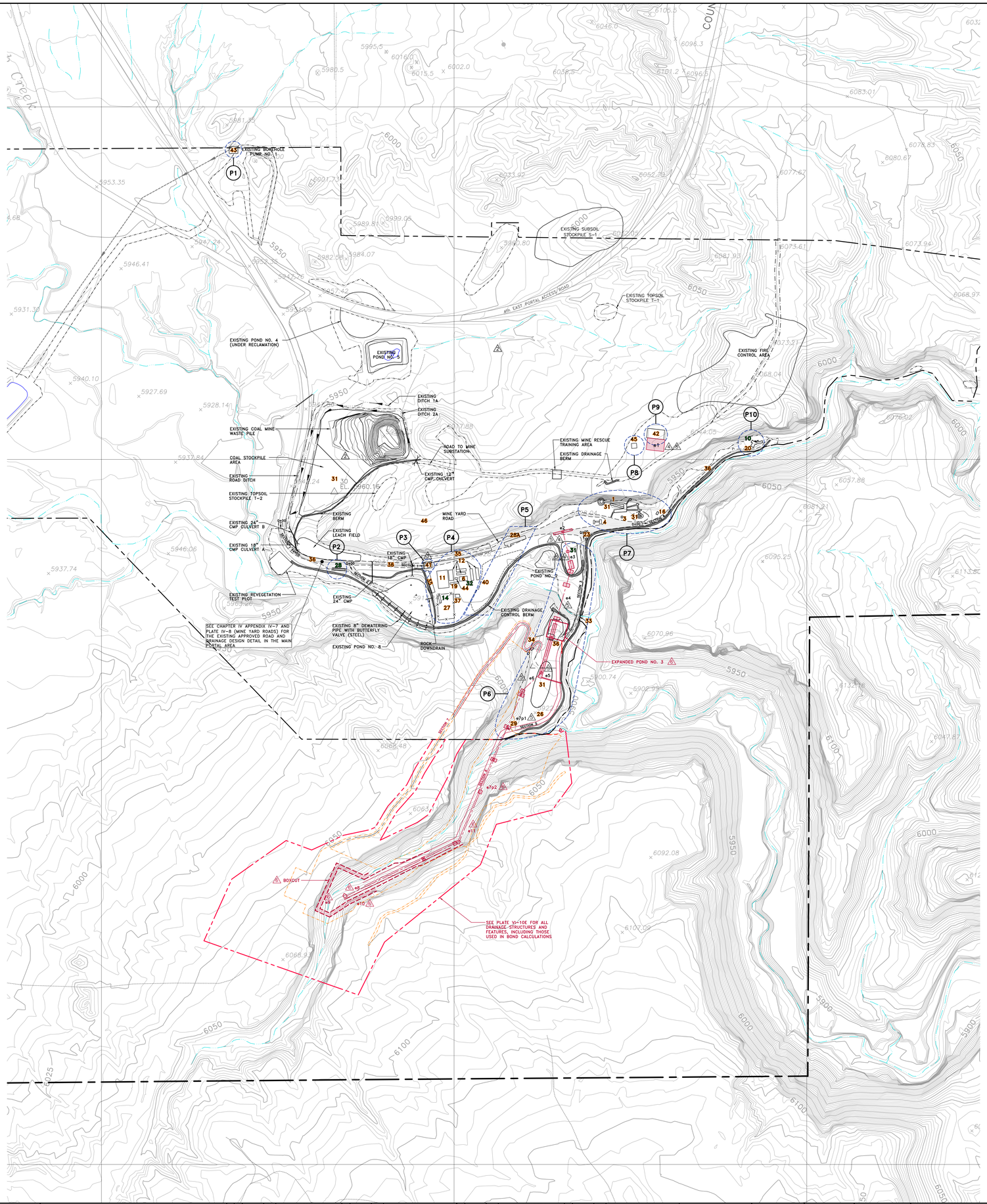
P1

P2

P3

P4

P5



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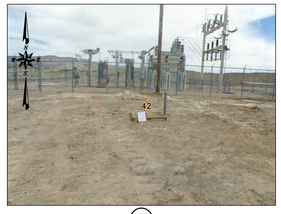

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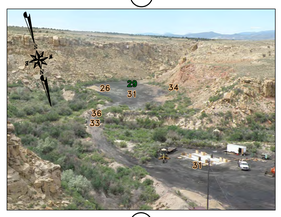


P6

LEGEND

- EXISTING FACILITIES
- PROPOSED FACILITIES
- EXISTING BOREHOLE PUMP WATER LINE
- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- APPROVED DISTURBED AREA BOUNDARY
- e2 PHASE II DISTURBED AREA BOUNDARY
- P11 PHOTOS TAKEN 9th–10th, JUNE 2016

EXISTING FACILITIES KEY

1	TIPPLE STACKER-RECLAIM SYSTEM
3	TIPPLE CONTROL STATION
4	SURFACE STORAGE TANK CONTAINMENT AREA
6	FOREMAN'S BATH HOUSE
10	RETURN AIR PORTAL
11	WAREHOUSE/OFFICE BUILDING
12	BATHHOUSES
14	STORAGE TRAILERS
16	TIPPLE TRANSFORMER BUILDING
19	FOREMAN'S/SHIFT CHANGE OFFICE
20	MINE FAN BUILDING
23	STEAM CLEANER BUILDING
26	SCRAP YARD
27	SUPPLY YARDS
28	OLD TRUCK SCALE FOUNDATION
28A	TRUCK SCALE
29	EXPLOSIVES STORAGE
31	COAL STOCKPILE AREA
32	SEWAGE TREATMENT SYSTEM
33	BRIDGE ON QUITCHUPAH CREEK
34	NON-COAL WASTE STORAGE AREA
35	PARKING AREA
36	MINE YARD ROADS
37	MINE RESCUE STORAGE AREA
40	MATERIAL STORAGE AREA
41	TRAINING SITE PAD
42	EXISTING MINE SUBSTATION
43	BOREHOLE PUMP FACILITY
44	SEWAGE PUMPING STATION
45	TRANSFORMER STORAGE PAD
46	POWER LINE

NOTE: FACILITIES SHOWN IN GREEN HAVE BEEN REMOVED.
FACILITIES SHOWN IN BLACK ARE EXISTING.

NEW FACILITIES KEY

e1	MINE SUBSTATION
e2	CONVEYOR 6/TRUCK LOADOUT
e3	SCREENING AND CRUSHING FACILITY
e4	CONVEYOR 5
e5	RECLAIM TUNNEL
e6	CONVEYOR 4/RADIAL STACKER
e7p1	CONVEYOR 2 P1
e7p2	CONVEYOR 2 P2
e8	CONVEYOR 1
e9	E2 PORTALS

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

BASE MAP:

EXTERNAL REFERENCE:

COORDINATE SYSTEM:
STATE PLANE COORDINATES
NAD 83 (CONUS)
UTAH CENTRAL ZONE, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88–US FEET

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	09/07	JAG	UPDATED MAP
2	01/08	JAG	N.O.V. 10005
3	07/08	JAG	TRAINING SITE PAD
4	05/16	JAG	e2–CONCRETE PAD (Tsk 5191)
5	06/16	JAG	e2 PHASE I PERMITTED (Tsk 5198)
6	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT

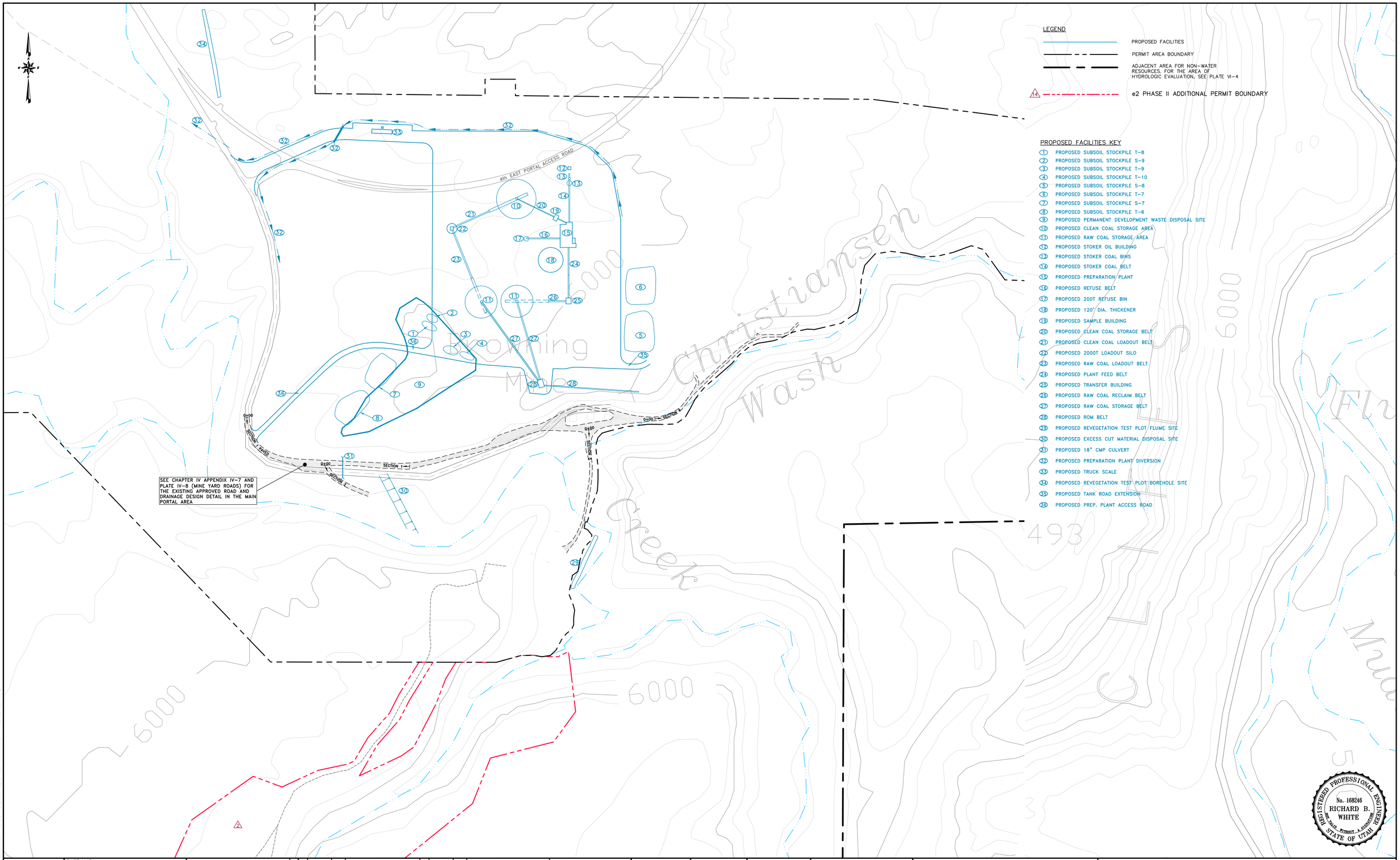
0' 200'
SCALE: 1" = 200'

DRAWN BY: SWF
ORIGINAL DATE: 8/90
RE-DRAWN DATE: 9/07
CHECKED BY: JAG
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
EMERY, UTAH 84522

PLATE II–1
STRUCTURES AND FACILITIES
MAIN PORTAL AREA



EarthFax	BASE MAP:	EXTERNAL REFERENCE:	REVISIONS	NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION	0' 200' SCALE: 1" = 200'	DRAWN BY: SWF	CHECKED BY: JAG	ORIGINAL DATE: 06/16 RE-DRAWN DATE:
	COORDINATE SYSTEM: STATE PLANE COORDINATES. NAD 83 CONUS ZONE 4302-UTAH, CENTRAL - US FEET VERTICAL DATUM - NAVD 88-US FEET			1	06/16	JAG	e2 PHASE I PERMITTED (TSK 5198)						APPROVED BY: JAG	DWG DATA: G:\UC1665\05\PHASE II DWGS PLATE II-1A.DWG	
				2	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT								

EMERY MINE
EMERY COUNTY, UTAH

PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 1
PRICE, UT 84501

PLATE II-1A
PROPOSED STRUCTURES AND FACILITIES
MAIN PORTAL AREA

CHAPTER III

RECLAMATION PLAN (cont.)

PLATES		PAGE
III-1	DISTURBANCE AREAS	Map Pocket
III-2	DISTURBANCE AREAS	Map Pocket
III-3	DISTURBANCE AREAS	Map Pocket
III-4	DISTURBANCE AREAS	Map Pocket
III-4A	DISTURBANCE AREAS	Map Pocket
III-5	POSTMINING TOPOGRAPHY	Map Pocket
III-6	POSTMINING TOPOGRAPHY	Map Pocket
III-7	POSTMINING TOPOGRAPHY	Map Pocket
III-8	POSTMINING TOPOGRAPHY	Map Pocket
III-9	PERMIT BOUNDARY AREAS	Map Pocket
III-10	4th East Portal Reclamation Plan Stream Restoration	Map Pocket
III-11	Emery 2 Reclamation Hydrology	Map Pocket

Revised 10/2003
Revised 10/2016

TABLE III-1

SURFACE OPERATIONS AREA
PRE- AND POST-MINING LAND USES

Land Use	Permit Acres Pre-Mining	Permit Acres Post-Mining
Grazing/Wildlife	419.5*	439.0
Grazing Wildlife (Emery 2 Expansion)	29.0	29.0
Industrial (Coal Mining)	19.5	0
Roads	5.8	5.8
TOTAL Permit Acres	473.8	473.8

**Minor permit boundary adjustment due to disturbed area survey*

TABLE III-2

EXISTING AND PROPOSED
SURFACE DISTURBANCE AREAS

	Acres
Prior to August 3, 1977 Area	23.4
Post August 3, 1977 Area	52.2
Proposed Surface Operations Area	375.8**
Emery 2 Expansion Disturbance Area	10.3
TOTAL Disturbed Acres	85.9

***Proposed Surface Operations Area not included in total*

Refer to Plate III-9 (Permit Boundaries and Bonding Map-Exhibit D) for surveyed boundaries.

The Emery disturbed areas depicted on Plate III-9 were surveyed on September 12, 2016. The areas were initially outlined on an aerial photograph using the original permit maps as a reference. Field verification was accomplished by identifying, as close as possible, physically disturbed soils where invasive plant species begin to appear.

Bronco utilized independent third party subject expert consultants to perform the field work.

Soils and vegetation support was provided by Patrick Collins, Ph.D., a botanist from Mt. Nebo Scientific, Inc. Dr. Collins has over 30 years experience with biological studies around the western U.S.

These areas were then surveyed by using a Trimble R8, survey grade, RTK,GPS/GNSS system with a TSC3 data collector.

Surveying was completed by a Utah registered Professional Engineer and registered Land Surveyor, license number 4940688. The coordinate system used is NAD 83, Utah Central Zone, US Survey feet.

Revised 10/2002
Revised 10/2003
Revised 1/2004
Replaced 12/2016

III.A.2 TIMING, SEQUENCE AND BONDING

UMC 784.13(b)(1), UMC 784.16(a)(2)(iv), UMC 784.16(a)(3)(iv)

The following reclamation schedule forecasts the timing of reclamation activities at the Emery Mine. The schedule is based on the assumption that mining will continue through the ~~year 2015~~permit term.

Contemporaneous Reclamation

1st Half, 1982	Reclaimed sections of road to Pond No. 1 and Pump No. 1
1986	Reclaimed old abandoned mine portals and associated borrow area for backfill
2006	Sealed and Reclaimed main portal entries
2016	Sealed 4th East Portals and shaft, reclamation ongoing
2017	4th East Portal demolition and reclamation ongoing. The 4th East Portal Permit area will remain in idle status and continue to be used as storage areas, potential future access to coal reserves, and possible additional ventilation openings.

Final Abandonment

12 months after cessation of use	Reclamation of development waste disposal site after wastes stored on the northwest coal stockpile area are buried or used in final reclamation.
12 months after cessation of use	Reclamation of development waste disposal site if newly generated wastes are disposed.
12 months after cessation of use	Reclamation of disposal site for excess cut material generated from initial development of the waste disposal site.
12 months after cessation of use	Reclamation of disposal site used for excess cut material.
~~From Construction~~	~~Ongoing reclamation of proposed coarse refuse disposal site following construction of this facility as newly generated wastes are disposed.~~
12 months after cessation of use	Removal of all non-earthen structures.
12 months after cessation of use	Surface debris removal, regrading, final covering of excess spoil and development waste disposal sites~~, final covering of coarse refuse disposal site~~. ~~Dewater freshwater cell of slurry pond, R~~removal of all ~~P~~ponds ~~No. 1, No. 4, and No. 6~~ and embankments, sealing of mine openings, backfilling and regrading, removal of culverts and bridges, regrading roads and parking areas, topsoil respreading, and revegetation.

Revised 02/2008
Revised 01/2017

The following reclamation schedule forecasts the timing of reclamation activities at the Emery Mine 2 Expansion area. Reclamation is anticipated to begin upon final removal of underground machinery.

Year	No. Work Days	Description of Reclamation Work
1	21	Seal Underground Entries and Backfill (3 Entries) – MSHA Approved Seals
1	30	Remove Surface Structures (conveyor, bins, scales, screens/crusher, fan)
1	5	Remove Footers and Foundation (concrete and/or steel)
1	5	Pick up coal stockpile and place in bottom of boxcut on opposite side of U/G entries
1	2	Clean out Sediment Pond – place sediment in boxcut
1	60	Backfill boxcut. Backfill to be placed in no more than 3-foot lifts. Material to be compacted with traversing of heavy equipment.
1	5	Backfill Airshaft – Non-toxic material
1	2	Remove gravel from site – use as backfill material in airshaft
1	20	Restoration of Ephemeral Channel and culvert removal approximately 1200 feet
1	2	Respread Berm material
1	2	Construct Silt Fences and/or other Alternate Sediment Control (temporary)
1	6	Respread and roughen topsoil
1	2	Seed and mulch affected surface
2 & 3	2	Refill Airshaft
2	3	Respread/roughen and seed/mulch topsoil of temporary diversion
4	5	Place Permanent Concrete Cap and Monument Marker
6	3	Remove Sediment Basin
6	2	Install silt fence at downstream toe of basin
6	2	Seed and mulch basin and topsoil pile locations
7	2	Remove Alternate Sediment Control (silt fence, straw bales, check dams)

Inserted 10/2016

III.B.1 STRUCTURE REMOVAL AND SITE CLEANUP

UMC 784.11(b), 817.132

All surface structures at the mine will be removed or razed upon either the completion of mining or after the useful life of these facilities has expired. The structure that are salvageable will be sold and removed; all other structures will be razed and disposed of in an environmentally sound manner. Please refer to Plates II-1, II-1A, II-2, II-3 and Chapter II.A for the location and description of existing and proposed facilities at the Emery mine.

Prior to regarding the affected surface areas, surface debris (coal fines, pavement material, etc.) will be removed. The material that is removed will be disposed in the permanent underground development waste disposal site, abandoned underground workings under a disposal plan developed at that time and approved by MSHA and DOGM, or sold as product. If the proposed coarse refuse disposal area has been constructed prior to completion of underground mining, the coal fines may be disposed of in that facility prior to commencing final reclamation of the disposal area.

UMC 784.23(b)13, 817.56

There are currently no existing facilities which will remain as permanent features upon cessation of underground mining activities. In addition, there are no existing facilities proposed as permanent. Therefore, no renovation of these structures will be required prior to final bond release. For details of the reclamation of these structures please refer to Chapter III.C.1 and III.D.1.

Emery 2 Expansion

Three primary roads are proposed for the Emery No. 2 Portal Site. Primary roads will be constructed to allow access to the site for construction. After portal construction is complete, primary roads will be used as a haul road, portal access road, and ventilation fan access road.

Identification	Classification	Reference MRP Section
Section 5	Primary	Plate IV-8a/b
Section 6	Primary	Plate IV-8 a/b
Section 7	Primary	Plate IV-8 a/c

Please note detailed drawings illustrating the plan view, profile, and cross sections for the above referenced roads are provided in above referenced permit sections of the MRP. As-built drawings and certifications will be submitted to the Division when construction is complete.

Inserted 10/2016

impoundment with the excavated dirt forming an embankment around the pond. Prior to reclamation, the accumulated sediment may be removed and disposed of in the same manner as the coal fines described in Chapter III.B.1. Reclamation grading will require the dozing of the embankment material back into the pond so that approximate original topography is replaced.

Pond No. 4 was also constructed prior to Aug 3, 1977. This structure is an evaporation lagoon for the waste produce of the reverse osmosis water treatment system. Reclamation of this site will include the removal of the embankment so that approximate original topography is achieved. Analysis of the soils in the bottom of this pond will be made to determine if evaporative salts have accumulated to a toxic level. Soils that are found to be toxic will be removed or covered with sufficient material to comply with UMC 817.103. This site is currently being used as a reclamation test site.

Existing ponds No. 5 (UPDES outfall 007) and No. 6 (UPDES outfall 004) and proposed pond No. 7 are all incised structures. Prior to reclamation, the accumulated sediment may be removed and disposed of in the same manner as the coal fines described in Chapter III.B.1. Reclamation grading will require the dozing of the embankment material back into the ponds so that approximate original topography is replaced. However, subsoil and topsoil which are removed and stockpiled from these sites will also be utilized in the reclamation of these ponds.

Existing sediment pond No.9 (UPDES outfall 009) collects and treats runoff from the 4 East Portal site. Reclamation of this site will include the removal of the embankment and filling the incised volume so that original topography is achieved. Analysis of the soils in the bottom of this pond will be made to determine if evaporative salts have accumulated to a toxic level. Soils that are found to be toxic will be removed or covered with sufficient material to comply with rules and regulations. However, subsoil and topsoil which are removed and stockpiled from this site will also be utilized in the reclamation of this pond.

Sediment pond No. 3 (UPDES outfall 005) currently collects affected runoff from the coal stockpile area. This pond will be enlarged to collect and treat runoff from the Emery 2 Portal site. Reclamation of this site will include removal of the embankment and filling the incised volume so the original topography is achieved.

For additional detail concerning the topsoil and revegetation of these sites, please refer to Chapter III.E.1 and Chapter III.F.1. Additional detail concerning the volume of material in the embankments and design information for Pond No. 1, 2, 3, 4, 5, 6 and 9 is contained in Chapter IV.B and Chapter VI.C respectively. The location of these structures may be found on Plates II-1, II-1A, II-2 and II-3 and on Plate VI-10. Refer to CH VI Appendix VI-21 (Emery 2 Surface Facility Hydrologic Design Calculations) for detailed design.

Revised 10/2002
Revised 10/2003
Revised 10/2016

III.C.2 Emery 2 Portal and Borehole Closure

UMC 784.13(b)(8), UMC 817.13-817.15, UMC 784.14(d)

No monitoring wells, boreholes, exploration drill holes, or other openings will be allowed to remain open following cessation of active use. Upon abandonment of these openings, the casing will be removed 3 feet below existing ground level and the hole backfilled to within 8 feet of the surface with non-toxic fill material or high-yield bentonitic mud. A 5-foot concrete plug will then be installed and the remaining top 3 feet will be filled with non-toxic soil. All casing and well completion material existing above the land surface associated with these openings will be removed. In addition, the land surface will be revegetated as outlined in Chapter III.F.1 following completion of sealing these openings. This procedure will be followed for all drilled holes or monitoring wells unless approved for transfer as a water well by the Division under UMC 817.53.

The location of the Emery 2 portal is shown on Plate II-1. Final reclamation of this portal will consist of backfilling and sealing the 3 entries as described in Method I Page 16 of this chapter for the permanent closure of drift openings. Approved MSHA seals will be constructed. Effort will be made to compact the backfill material in layers. Following complete closure of the entries, material from the excavation stockpile will be loaded into trucks, transported to the pit, and placed in 3-foot lifts. Large rock (3 feet diameter or larger) will be set aside during the backfilling process. This action will ensure appropriate sized material will be utilized to obtain the best possible compaction of the layered backfill. Compaction of the material will be achieved by heavy equipment as it travels over the backfilled material. The large rock salvaged during this backfilling operation will be used in the reestablished ephemeral stream channel as well as the slope reclamation and will provide surface structures for wildlife and enhance vegetation in the post-reclamation environment. The final reclaimed surface topography will be virtually similar to pre-mine topography. Excess material not used in reclamation will remain in the disposal site. This excess material may be sampled and if quality allows, may be used to enhance final reclamation of other areas. Refer to Chapter IV.C.2 for a discussion on Emery 2 closure. Refer to Table III-1A, pages 15g and 15h for calculation of excess material.

Information concerning the design and required volumes to backfill these portals may be found in Chapter IV.B. Please refer to Chapter III.E.1 and III.F.1 and Chapter VII, Appendix VII-5 for detail concerning topsoil and revegetation of these sites.

The ephemeral channel which was temporarily diverted for construction of the portal will be reconstructed in its approximate original location and grade. The portion of the reconstructed channel running over the backfilled boxcut area (Channel RD-1) will be backfilled to the appropriate grade and a rubber or other impervious liner placed within the channel. The liner will fully cover the bottom and side slopes. Riprap will then be installed in the channel as indicated on Plate III-11. Channel RD-2 will be constructed with a filter layer underlying riprap, as indicated on Plate III-10.

Inserted 12/2016

The ventilation fan will be removed and the airshaft's concrete collar broken up. The entire shaft will be backfilled with non-toxic, non-combustible material. The shaft will then be capped and marked in accordance with MSHA and State regulations in effect at that time. The 100,000 gallons of water will be removed and the concrete broken up.

The topsoil and subsoil will be respread and revegetated in accordance with practices delineated in Chapter III.E.1 and III.F.1 and Chapter VII, Appendix VII-5.

The switch back road (Section 7) will be graded to approximate original contour. The original topsoil and subsoil will be spread and revegetated in accordance with practices delineated in Chapter III.E.1 and III.F.1 and Chapter VII, Appendix VII-5. The original Jeep Trail that existed pre-mining will no longer exist.

Upper Berms 1 and 2 will be graded back into the approximate original contour.

Chapter IV, Appendix IV-14 (Emery 2 Expansion Slope Stability Analyses) presents the results of a slope stability analysis of reclaimed slopes associated with the Emery 2 portal. As indicated in that appendix, the minimum factor of safety for the reclamation fill slope is 1.38, which exceeds the regulatory requirement of 1.3 (R645-301-53.130).

TABLE III-1A

Boxcut Excavation Calculations

Project: Bronco Utah Mine
Location: Emery , Utah
Report Date: 9/28/2016
Report by: Doug Bennion P.E.

Volume Summary:

Name:	Cut Factor	Fill Factor	2D Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Finished Grade	1.0	1.0	272081.00	149501.99	79346.41	70155.58 (CUT)

Volume Detail by Station

Station	Cut Area (Sq.ft.)	Cut Volume (Cu.yd.)	Reusable Volume (Cu.yd.)	Fill Area (Sq.ft.)	Fill Volume (Cu.yd.)	Cum. Cut Vol. (Cu.yd.)	Cum. Reusable Vol. (Cu.yd.)	Cum. Fill Vol. (Cu.yd.)	Cum. Net Vol. (Cu.yd.)
-0+50.000	17737.6	0	0	0.01	0	0	0	0	0
0+00.000	12592.2	28083.1	28083.09	0	0.01	28083.09	28083.09	0.01	28083.08
0+50.000	14174.3	4455.19	4455.19	0	0	32538.28	32538.28	0.01	32538.27
1+00.000	7158.76	19752.9	19752.86	0.01	0.01	52291.14	52291.14	0.03	52291.12
1+50.000	4048.05	10376.7	10376.68	9.93	9.21	62667.82	62667.82	9.23	62658.59
2+00.000	3378.26	6876.21	6876.21	14.8	22.9	69544.03	69544.03	32.13	69511.9
2+50.000	3341.65	6222.14	6222.14	0	13.7	75766.17	75766.17	45.83	75720.34
3+00.000	2470.04	5381.2	5381.2	0	0	81147.37	81147.37	45.83	81101.54
3+50.000	1539.48	3712.52	3712.52	0	0	84859.89	84859.89	45.83	84814.06
4+00.000	1050.69	2398.3	2398.3	0	0	87258.2	87258.2	45.83	87212.36
4+50.000	602.35	1530.59	1530.59	0	0	88788.78	88788.78	45.83	88742.95
5+00.000	477.99	1000.31	1000.31	0.04	0.03	89789.1	89789.1	45.87	89743.23
5+50.000	806.98	1189.79	1189.79	10.12	9.41	90978.89	90978.89	55.27	90923.61
6+00.000	833.94	1519.37	1519.37	26.15	33.59	92498.25	92498.25	88.86	92409.39
6+50.000	759.67	1475.56	1475.56	141.15	154.91	93973.81	93973.81	243.77	93730.04
7+00.000	443.2	1113.77	1113.77	622.95	707.5	95087.58	95087.58	951.28	94136.3
7+50.000	23.34	480.36	480.36	817.67	406.39	95567.94	95567.94	1357.67	94210.27
8+00.000	144.78	155.67	155.67	378.37	1107.44	95723.61	95723.61	2465.11	93258.5
8+50.000	90.32	217.69	217.69	471.89	787.28	95941.3	95941.3	3252.39	92688.91
9+00.000	61.45	140.53	140.53	626.94	1017.44	96081.83	96081.83	4269.83	91812.01
9+50.000	13.01	68.94	68.94	1620.43	2080.9	96150.78	96150.78	6350.73	89800.05
10+00.000	2.61	14.47	14.47	2679.72	3981.63	96165.24	96165.24	10332.4	85832.88
10+50.000	172.18	161.84	161.84	3264.94	5504.31	96327.08	96327.08	15836.7	80490.41
11+00.000	268.92	408.42	408.42	3157.77	5946.95	96735.51	96735.51	21783.6	74951.89
11+50.000	35.46	281.83	281.83	3714.33	6363.06	97017.34	97017.34	28146.7	68870.67
12+00.000	15.18	46.89	46.89	3636.15	6806	97064.23	97064.23	34952.7	62111.56
12+50.000	32.23	43.9	43.9	3987.97	7059.37	97108.13	97108.13	42012	55096.09
13+00.000	6.39	35.76	35.76	4580.04	7933.34	97143.89	97143.89	49945.4	47198.51
13+50.000	7.87	13.2	13.2	4389.4	8305.04	97157.09	97157.09	58250.4	38906.68
14+00.000	56.42	59.53	59.53	3231.2	7056.11	97216.62	97216.62	65306.5	31910.09
14+50.000	15.23	66.34	66.34	1631.46	4502.46	97282.95	97282.95	69809	27473.97
15+00.000	245.56	241.47	241.47	1220.96	2641.13	97524.42	97524.42	72450.1	25074.31
15+50.000	5.39	232.36	232.36	1597.22	2609.43	97756.78	97756.78	75059.5	22697.24
16+00.000	0	4.99	4.99	1139.05	2533.59	97761.77	97761.77	77593.1	20168.65

Inserted 10/2016

Backfill Volumes

Assuming 30 percent swell on excavated boxcut material, reclamation backfill volumes are discussed below. Excess boxcut material not used as sit fill will be stored at the waste disposal site until reclamation.

Construction

Boxcut excavation bank cubic yards (Table III-1A)	149,000 cu.yd.
Total swelled yards (30%)	193,700 cu.yd.
Required site fill (Table III-1A)	79,350 cu.yd.
Material stored at waste disposal site (WDS)	114,350 cu.yd.

Reclamation

Reclamation cubic yards required	149,000 cu.yd.
Haul site fill to boxcut	79,350 cu.yd.
Haul material from WDS required to fill boxcut	69,650 cu.yd.
Original material remaining at WDS	44,700 cu.yd.

Inserted 10/2016

Emery 2 Portal Expansion

Within the Emery 2 Portal Expansion, pre-mine sandstone outcrop acres where no soil is present were delineated and the percent sandstone outcrop acres are discussed in Chapter VII, Appendix VII-5 (Table 4 in *Order 2 Soil Survey of Emery 2 Mine Permit Area* – Long 2016). The distribution and location of the sandstone outcrops on the reclaimed surface will be similar to the pre-mine distribution. The following estimation of replacement subsoil and topsoil depths is based on estimated salvage volumes, percent sandstone outcrop in the soil map units, and reclamation area:

Disturbance Area	=	10.3 acres
Sandstone Outcrop	=	1.7 acres
Reclamation Area	=	8.6 acres

Pre-mining condition of the canyon consisted of a large boulder field. Many of these boulders acted as depositional areas for subsoil and topsoil within the disturbed area. The final reclamation of the canyon will consist of reestablishing the original ephemeral channel and redistributing boulders in a similar configuration as the pre-mining condition. Prior to subsoil and topsoil placement, geotech fabric will be laid up against boulders to protect soil loss until vegetation is established. Then the subsoil and topsoil will be replaced over the reclamation area upstream of the replaced boulders. Therefore, the average depth of redistributed subsoil and topsoil shall be:

Area to be Re-subsoiled:	8.6 acres x 43,560 sq ft/acre = 374,616 sq ft
Volume of Material Available:	7,992 cu yds x 27 cu ft/cu yd = 215,784 cu ft
Depth of Cover (D in ft):	Area for Re-subsoiling (374,616 sq ft) x D = Available Subsoil (215,784 cu ft)
therefore,	D = 215,784 cu ft/374,616 sq ft = or D = 0.58 ft or 6.9 inches of subsoil
Area to be Re-topsoiled:	8.6 acres x 43,560 sq ft/acre = 374,616 sq ft
Volume of Material Available:	11,600 cu yds x 27 cu ft/cu yd = 313,200 cu ft
Depth of Cover (D in ft):	Area for Re-topsoiling (374,616 sq ft) x D = Available topsoil (313,200 cu ft)
therefore,	D = 313,200 cu ft/374,616 sq ft = or D = 0.84 ft or 10.0 inches of topsoil
Reclamation Soil Profile:	Topsoil = 10.0 inches Subsoil = 6.9 inches Total Profile = 16.9 inches or 1.4 feet

These estimated topsoil and subsoil replacement depths are based on estimated soil map unit salvage depths in Chapter VII, Appendix VII-5 (Table 18 in *Order 2 Soil Survey of Emery 2 Mine Permit Area* – Long 2016). Actual replacement depths will be based on surveyed stockpile volumes of topsoil and subsoil salvaged from the Emery 2 mine area.

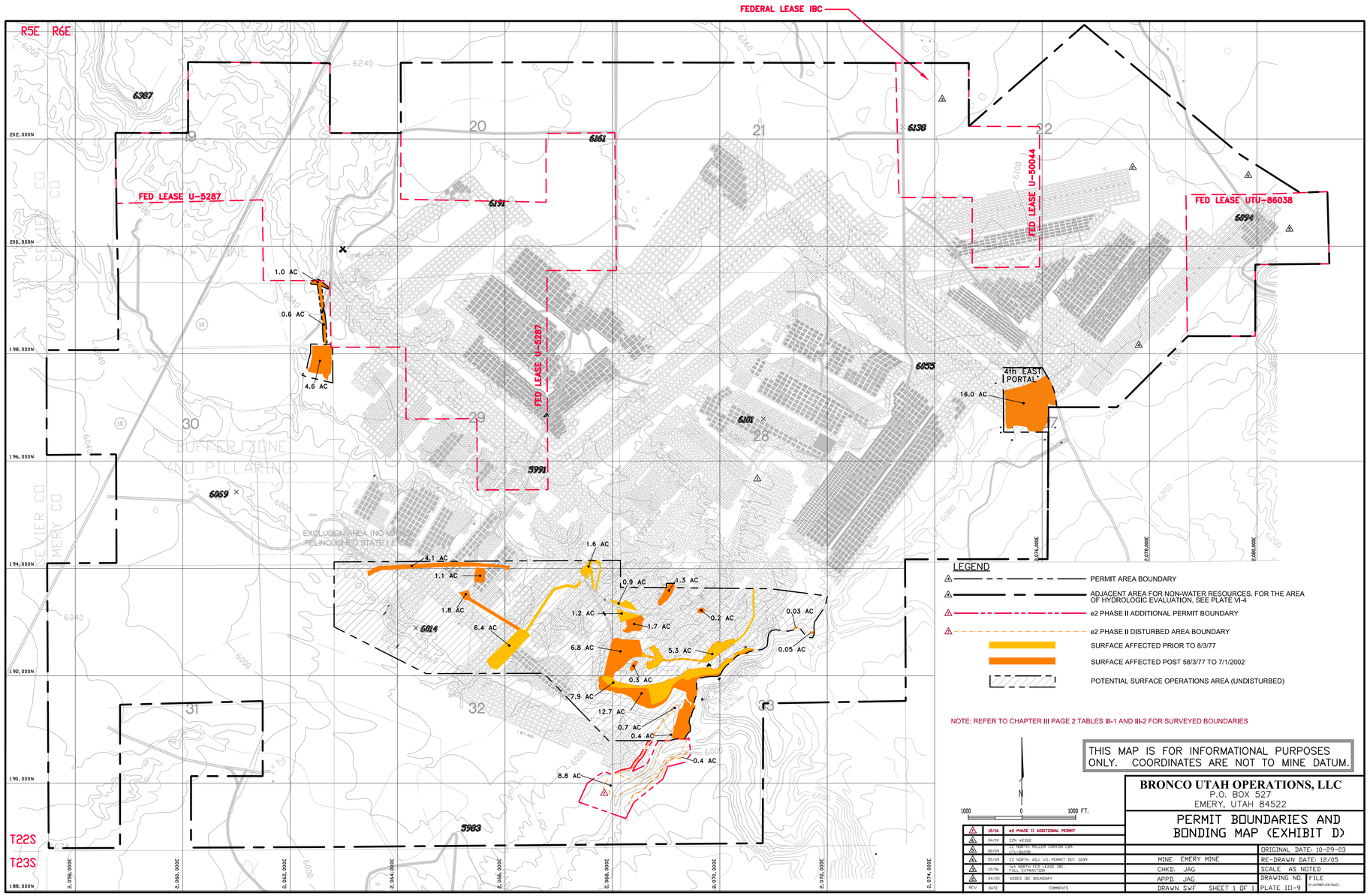
Inserted 12/2016

In some critical areas, it may be necessary to increase the depth of subsoil for establishment of vegetation that will minimize erosion potential. The use of additional subsoil will result in reduced subsoil application in non-critical erosion areas. The total depth of replaced subsoil and topsoil will not be less than 9 inches in any areas. Areas with either increased or reduced subsoil will be identified in conjunction with the DOGM soil scientist.

Upper Berms 1 and 2 will be graded to approximate original contour.

The topsoiled surface will be roughened (gouged) by pocking with a backhoe or excavator. Following the roughening, the site will be immediately seeded with the appropriate seed mixture and mulch as described in Chapter VIII.C.4 and VIII.C.7.

Inserted 12/2016


FEDERAL LEASE IBC
R5E R6E
T22S
T23S
FED LEASE U-5287
FED LEASE U-50044
FED LEASE UTU-86038
FED LEASE U-5287
4th EAST PORTAL
16.0 AC
1.0 AC
0.6 AC
4.6 AC
BUFFER ZONE
(NO PILLARING)
EXCLUSION AREA (NO WORK)
RELINQUISHED STATE LEASE
EMERY CO
SEVIER CO
1.6 AC
4.1 AC
1.1 AC
1.8 AC
6.4 AC
0.9 AC
1.3 AC
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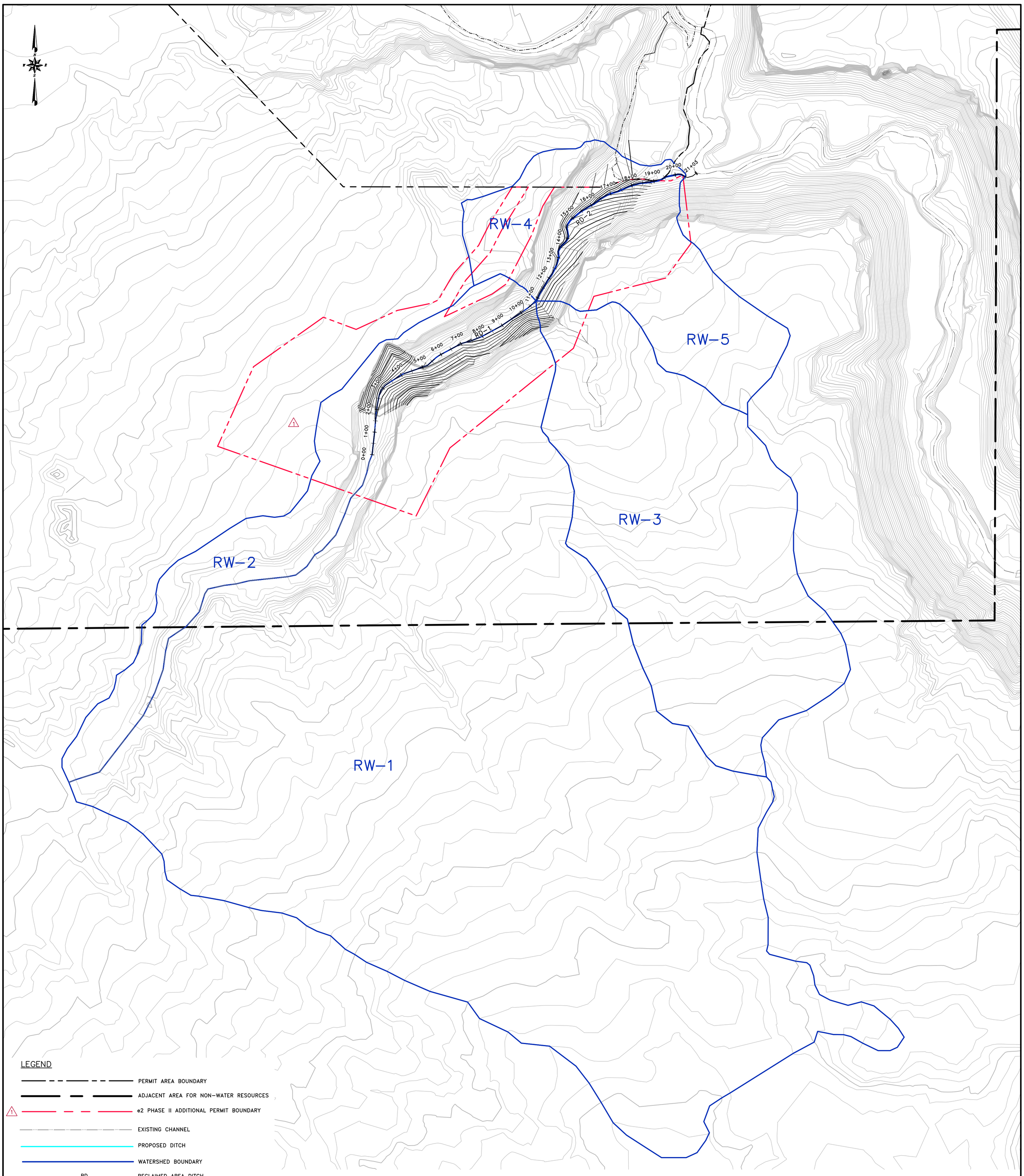
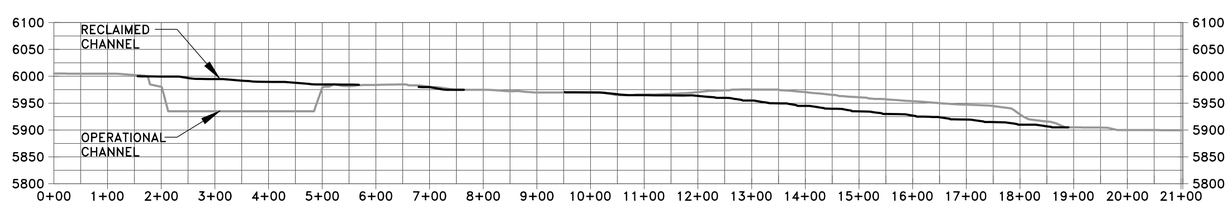
6387
6161
6136
6192
6094
6055
6101
5991
6069
6014
5963
LEGEND
PERMIT AREA BOUNDARY
ADJACENT AREA FOR NON-WATER RESOURCES, FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
e2 PHASE II ADDITIONAL PERMIT BOUNDARY
e2 PHASE II DISTURBED AREA BOUNDARY
SURFACE AFFECTED PRIOR TO 8/3/77
SURFACE AFFECTED POST 58/3/77 TO 7/1/2002
POTENTIAL SURFACE OPERATIONS AREA (UNDISTURBED)
NOTE: REFER TO CHAPTER III PAGE 2 TABLES III-1 AND III-2 FOR SURVEYED BOUNDARIES
N
1000 0 1000 FT.
THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. COORDINATES ARE NOT TO MINE DATUM.
BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
EMERY, UTAH 84522
PERMIT BOUNDARIES AND BONDING MAP (EXHIBIT D)
12/16 e2 PHASE II ADDITIONAL PERMIT
04/10 ZIN WEDGE
08/04 22 NORTH, MULLER CANYON LBA 22-NORTH
05/99 22 NORTH ADJ. VS. PERMIT DEF. 3099
12/96 1st NORTH FED LEASE IBC, FULL EXTRACTION
04/05 ADDED IBC BOUNDARY
REV. DATE COMMENTS
MINE EMERY MINE
CHKD. JAG
APPD. JAG
DRAWN SWF SHEET 1 OF 1
ORIGINAL DATE: 10-29-03
RE-DRAWN DATE: 12/05
SCALE AS NOTED
DRAWING NO. PLATE III-9
FILE

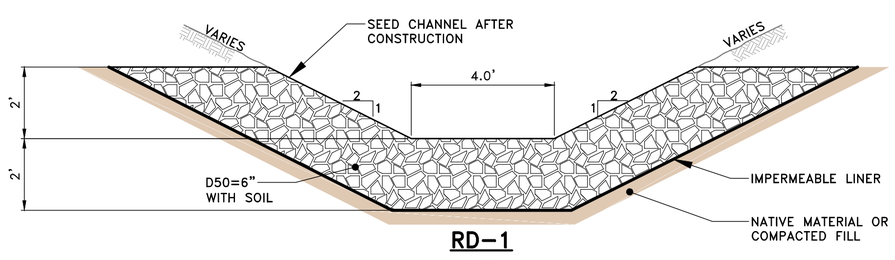
REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH



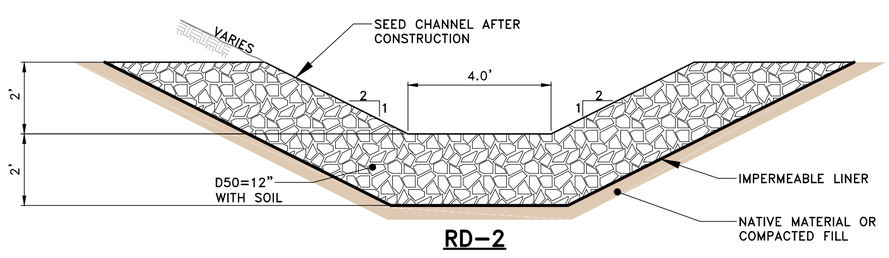


RECLAMATION CHANNEL

SCALE:1"=200'
HORZ. AND VERT.



RD-1
NTS



RD-2
NTS

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT				

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

0' 200'
SCALE: 1" = 200'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 10/16
RE-DRAWN DATE: 7/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE III-11
EMERY 2 RECLAMATION HYDROLOGY

G:\UC1665 - Bronco Utah Operations\05 - Emery Mine permit maps\PHASE II DWGS\PLATE III-11-e2P2-DEC 16.dwg

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ENGINEERING DESIGNS

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Revised 10/2002
Revised 2/2008
Revised 7/2016
Revised 01/2017

CHAPTER IV

ENGINEERING DESIGNS

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Revised 10/2002
Revised 9/2003
Revised 10/2016

CHAPTER IV ENGINEERING DESIGNS

IV.A UNDERGROUND MINE PLAN

This part covers the description of the underground mining operations to be conducted at the Emery Mine.

IV.A.1 UNDERGROUND MINE PLAN

UMC 783.12(a), 783.24(c),783.25(e), 783.25(h), 784.11(a), 784.23(a)

The Adjacent Area for the Emery Mine encompasses approximately 5,776 acres. The approved permit area for the Emery Mine encompasses approximately 44~~2~~.8~~5~~ acres. The additional Emery 2 expansion permit area encompasses approximately 29 acres, for a total of 473.8 acres. A minor permit area adjustment was done due to the disturbed area survey. The boundary of the Adjacent Area and permit area is shown on the Permit Boundaries and Bonding Map (Plate III-9). The description of the Adjacent area is as follows:

Township 22 South, Range 6 East

Section 19:	S/2NE/4, SE/4, E/2SW/4
Section 20:	S/2NE/4, SE/4NW/4, S/2
Section 21:	S/2N/2, S/2
Section 22:	S/2, SW/4NW/4, portions of the following E/2SE/4NW/4, SW/4SE/4NW/4, S/2NW/4NE/4, SW/4NE/4, SW/4SW/4NE/4NE/4, W/2SE/4NE/4, S/2NE/4SE/4NE/4, SE/4SE/4NE/4
Section 23:	S/2SW/4, portions of SW/4SW/4NW/4, NW/4SW/4, NE/4SW/4
~~Portions of the following SW/4NW/4, NW/4SW/4~~	
~~Section 23:~~	~~PS/2,SW1/4~~
Section 27:	W/2, W/2NE/4, NE/4NE/4, part of SE/4NE/4
Section 26:	NW1/4NW1/4
Section 28:	All
Section 29:	All
Section 30:	E/2, E/2NW/4, SW/4NW/4, N/2NW/4SW/4, E/2SW/4
Section 31:	N/2, W/2SW/4, E/2SE/4, SW/4SE/4
Section 32:	All
Section 33:	W/2, NE/4

The description of the Permit area is as follows:

Township 22 South, Range 6 East

Section 27:	SE/4NW/4, N/2NE/4SW/4, W/2SW/4NE/4, consisting of ~~Portions of NW/4, SW/4, NE/4~~ 4th East Portal
Section 30:	Part of the E/2NE/4 consisting of ~~Portions of NE/4~~ Borehole Pump No. 3
Section 32:	Part of the NW/4, NE/4, E/2~~4~~SE/4 consisting of ~~Portions of NW/4, NE/4, SE/4~~Main Portal
Section 33:	Part of the NW/4, NE/4, N/2SW/4 consisting of ~~Portions of NW/4, NE/4, SW/4~~ Main Portal and Emery 2 ~~e~~Expansion

Mining operations at the Emery Mine are conducted in the IJ Zone utilizing the room and pillar mining method. Plate IV-1 shows the layout, the present mine workings and the projected areas to be mined during the permit term. The existing workings have been marked to show the extent of underground mining operations (1) before August 3, 1977, (2) between August 3, 1977 and May 3, 1978, and (3) after May 3, 1978 up to the permit approval date of January 5, 1986. There are no surface mining operations at the Emery Mine. The projected mine workings are delineated by year for the next five year permit term. Plate IV-2 shows the same plan on a 1"=1000' map to show the extent of the projected life of mine plan in the IJ Zone. The Emery Mine operates under the General Safety Orders, Utah Coal Mines issued by the Industrial Commission of Utah and the applicable regulations issued by the Mine Health and Safety Administration (MSHA). The Emery 2 expansion will mine the same portions of the reserve that were intended to be mined from the Emery main portals and the 4th East portals.

Access to the underground workings is through the portals shown on Plate II-1. All of the present portals are drift openings at the outcrop of the seam. These openings consist of intake, return, and belt entries.

~~It may be necessary in the future to install ventilation raises in other areas of the property; however, these locations are not known at the present time. Future portals may consist of ramp excavations and shafts to access the coal seam. The new 4 East portal will use a ramp excavation down to the top of the IJ seam. A new set of portals will be installed for the southern main entries of the mine when production from the~~

~~southern part of the mine warrants it.~~

Revised 8/31/95
Revised 04/2005
Revised 03/2007
Revised 05/2009
Revised 09/2009
Revised 04/2010
Revised 01/2017

Development of the Emery 2 expansion area will consist of 6 or 7 ~~mine was~~~~is accomplished with seven or eight~~ entry mains with entries on 80-foot centers and crosscuts on 100-foot centers. The submains for panel development typically use a five entry system with similar entry centers. Panels are developed off the mains or submains with a 4 or 5 entry system with rooms driven on either side of the development entries.

The Emery Mine uses a partial extraction technique during secondary extraction (unplanned subsidence), which leaves the roof intact (see Chapter V Part B), except in areas designated as full extraction (planned subsidence) as depicted on Plate V-5.

During the term of this permit, the planned production for the Emery Mine will~~is~~ be 1.4~~37~~ million tons per year. The mine will produce this coal with 3~~five~~ continuous miner sections.~~Producing at this rate, the mine will continue operations until 2010 at which time the IJ Zone will be mined out. At that time final reclamation will begin as discussed in Chapter III.~~

4th EAST PORTAL

Site Description

The site is entirely within the surface area owned by Bronco Utah Operations, LLC ~~Consolidation Coal Company~~. Coal ownership is also in Bronco Utah Operations, LLC ~~Consolidation Coal Company~~'s name.

Geology

Drill hole FC 702, located on the site, was cored from the surface to below the IJ seam. It provides a detailed stratigraphic sequence and geochemical analyses to characterize the overburden to be stockpiled on the site. The following three pages show the lithology of the overburden and contain the geochemical test results on strata intervals. The portal excavation does not go any deeper than the top eleven (11) feet of the IJ seam.

Acid-Forming Potential

Sulphur values (PS, SO4S, OS, and TS) are low throughout the strata. Moreover, pyritic sulphur, a potential acid former, is present in very low concentrations (less than 0.01 percent), so the acid-forming potential is quite small. As a result, acid production is not anticipated to be a problem within the proposed construction area.

Alkalinity-Forming Potential

High pH and/or high SAR can cause piping, surface crusting, soil structure problems, and plant toxicities. The only samples with alkaline pH (8.1-8.3) occurred below the coal seams. Likewise the floor strata samples tested distinctly more sodic than the overburden. Since the excavation does not go this deep, alkaline material production is not anticipated.

Revised 8/2005
Revised 12/2006
Revised 10/2016

Soils and Vegetation – 4th East Portal

Refer to Chapter VII, Appendix VII-3 & Appendix VII-4 for narrative of soil resources at the 4 East Portal Area. Prior to portal and diversion excavation, the area will be checked for topsoil thickness. Once the thickness is determined, depth stakes, thickness maps or similar measures will be used to ensure total recovery. All topsoil designated on Plate III-1 for topsoil removal shall be removed and stockpiled in the topsoil stockpile location refer to Plate II-3 and/or IV-3.

Salvage of topsoil material from the 4th East Portal area will involve the following deviation from the topsoil handling plan outlined in Chapter III.E.1.

1. The topsoil which lies within the interior of the excavation material stockpile and topsoil stockpile will be preserved in-place.

2. The interface of the in-place original topsoil and the place material will be marcated with a 4" yellow tape. The tape shall be placed in a 10 ft by 10 ft. grid. and shall remain in place until final reclamation.

3. The topsoil stockpile will be roughened by pocking the surface.

4. Following seeding of the topsoil pile it will be irrigated and records kept as to date and amount of water applied.

The topsoil material from the excavation material and the topsoil stockpile will remain preserved in-place. This practice deviates from normal topsoil handling practices. This deviation is requested in an attempt to preserve the soil structures and cryptogam's within the area. Prior to placement of excavated overburden material on top of the in-place topsoil, the interface was delineated in the field with 4-inch wide yellow tape. The tape was applied in a 10 ft by 10 ft grid pattern. Material from the excavation will be placed over top the in-place topsoil. No toxic material will be placed within this excavation pile.

The topsoil stockpile interface between the in-place and placed topsoil was marked with the grid pattern utilizing the yellow tape.

Salvaging of the topsoil with the initial disturbance of the 4th East Portal was conducted under the direction of Jim Nyenhuis a qualified soil specialist under a contract with Mt. Nebo Scientific of Springville, Utah. Soil salvage from the site progressed from the north (Persayo-Chipeta map unit) to the south (Castle Valley & Montwell soil units), with the Castle Valley soils being placed on top of the stockpile. The surface of the topsoil_stockpile was roughened with a backhoe leaving undulating (pocked) surface. The topsoil stockpile was hydro-seeded and tactified on July 10,2002, with non-native seed_mixture defined in Chapter VIII.C.3. This seed mix involved Crested Wheatgrass, Fourwing Saltbush and Russian Wildrye. The southern edge of the topsoil berm was seeded with the native (interim) seed mix which included Shadscale, Fourwing Saltbush, Castle Valley Clover, Streambank Wheatgrass, Scarlet Globemallow, Winter Fat, Blue Grama, Indian Ricegrass and Alkali Sacaton.

The berm located along the northern half of the east fence line was removed in the spring of 2003. This material which consisted of topsoil was removed to protect it from fugitive coal fines. The relocated topsoil was placed on the western outside edge of the topsoil stockpile berm. This section of berm was hydro-seeded and tactified August 19, 2003. The seed mix utilized in the reseeding involved the native seed mix under Chapter VIII.C.3. Record of the applied seed mix was provided to DOGM at the time of reseeding for their records.

Revised 10/2002
Revised 10/2003
Revised 10/2016

Soils and Vegetation – 4th East Portal (cont.)

Irrigation of the south and west side of the topsoil berm (only) began on July 11,2002 by applying one-quarter inch of water. The following table represents the date and amount of water sprayed on the berm.

July 12 – 1/4"	July 18 – 3/4"	July 29 - 1/2"
July 15 – 1/2"	July 19 – 1/2"	Aug 1 - 1/2" Rain
July 16 – 1/4"	July 22 – 1/4"	Aug 2 - 1/2" Rain
July 17 – 1/4"	July 23 – 1/4"	Periodic Rains Have Continued No Further Manual Watering

The topsoil stockpile was not irrigated because of seeding with non-native mix.

Salvage of topsoil contaminated by wind blown coal fines at the 4th East Portal site will be handled in the following manner:

Prior to any topsoil salvage operation, coal fines will be vacuumed up to the best extent possible. This vacuuming operation will be done in a manner which attempts to minimize further disturbance of the topsoil and it's vegetation. On completion of the vacuuming operation, the one acre area of surface disturbance will be checked for cryptogamic matter prior to any topsoil removal. The Division of Oil, Gas and Mining will assist in determining the presence of cryptogams of this soil prior to removal. Should cryptogams be found within the area, the organic matter will be manually collected and immediately transplanted by hand on the topsoil stockpile. The location selected for transplanting of the cryptogams shall be a small confined area of the topsoil stockpile. The cryptogamic material shall be placed along the interior western edge of depressions (gouges) to protect it from prevailing winds. To prevent over saturation the material should be placed within the upper portion of the depression, not in the depression bottom. The depressions where transplanting of cryptogams took place shall be noted, staked and records kept of the area.

The existing west end of the topsoil stockpile berm will be crowded into the existing stockpile (see Figure IV-15). Topsoil currently in-place between the water tank and the topsoil stockpile will be picked up and placed in the topsoil stockpile. Topsoil from the additional 1 acre of disturbance associated with construction of the re-route road will be picked up under the direction of a qualified soil specialist. The excavated topsoil will be moved to the existing topsoil stockpile, where, it will be used to rebuild the berm. The stockpile and associated berm will be placed in a manner to allow for minimal side slope, but, still retains the runoff from the stockpile. The disturbed portions of the topsoil stockpile and berm will be randomly pocked and seeded with native seed mix defined in Chapter VIII.C.3. Seed tag will be saved and date of seeding recorded. Copy of seed tag will be forwarded to DOGM. The affected berm(s) and stockpile will be mulched with straw or hay applied at a rate of one to two tons per acre. The material used for mulching needs to be free of noxious weeds. All berms composted of topsoil will be clearly marked as topsoil storage area.

Soils and Vegetation – Emery 2 Expansion

Refer to CH VII Appendix VII-5 (Order 2 Soil Survey of Emery 2 Mine Permit Area, December 2016) for a discussion of topsoil/subsoil salvage quantity and quality as well as reclamation parameters.

Inserted 10/2002
Revised 10/2003
Revised 12/2016

Wildlife – Main Portal

The disturbance area was inspected on April 11, 1989 by Mr. L. B. Dalton of the Division of Wildlife Resources, Department of Natural Resources, State of Utah. Mr. Dalton finds that "the portal development will have minimal impacts on the wildlife resource." These findings, in letter form, are attached for reference.

Wildlife – 4th East Portal

The 4th East portal site was resurveyed in May 2002 by Mt. Nebo Scientific Consultants. The survey was performed by request from the Division of Oil Gas and Mining. The report in contained as Appendix VIII-3 in Chapter VII.

The vegetation map and T&E survey for the extension area of 1.5 acres at the 4th East Portal was modified by Patrick Collins, Ph.D. of Mt. Nebo Consultants. Mr. Collins letter is located in Chapter VII, Appendice VII-4.

Wildlife – Emery 2 Expansion

Vegetation and Wildlife information for the Emery 2 expansion area can be found at CH VIII Appendix VIII-8 (Vegetation, Wildlife & Sensitive Species of the Emery 2 Area, Mt. Nebo Scientific, Inc., December 2016).

Sampling of fish and macro invertebrates were conducted in September 2002 by JBR Environmental Consultants. The survey was conducted in Quitchupah Creek and Christiansen Wash. The sampling was performed to provide new baseline data for the reactivation of mining operations. Because of the minimal number of samples taken, a second sampling will be performed in September of 2003. The process methods and final report of the 2002 sampling is contained as Appendix IX-2. In accordance with DOGM requirements for perennial streams the micro invertebrate sampling will be performed every three years following the 2003 sampling. Results of these sampling's will be included as part of the annual report for that year.

Inserted 10/2002
Revised 10/2003
Revised 12/2016

Cultural Resources – Main Portal

The area of disturbance was surveyed in 1975, as part of an 880 acre area of investigation, by Mr. Michael S. Berry, Assistant Utah State Archaeologist. After traversing the entire area on 50 to 75 foot intervals, three (3) sites were located and recorded. The nearest of these sites is approximately 0.5 miles to the southwest of the proposed 4 East Portal Site. As a result, we do not anticipate any cultural resource impacts from this development. Mr. Berry's report on this investigation is contained in Chapter X.

Cultural Resources – 4th East Portal

The 4th East portal site was resurveyed in May 2002 by Montgomery Archaeological Consultants. The survey was performed by request from the Division of Oil Gas and Mining. The report is contained as Appendix 5-5 in Chapter X. In March 2003, Montgomery Archaeological Consultants extended the cultural resource survey of the 4th East Portal site. This report is "Confidential", Appendix 5-7 in Chapter X, Vol 2, and should be placed in DOGM's confidential files.

Cultural Resources – Emery 2 Expansion

The Emery 2 Expansion area was surveyed on September 25, 2009 by Montgomery Archeological Consultants, Inc. (Chapter X, Appendix 5-12 MOAC Report 09-152 Emery 2 Expansion. A mitigation plan (Chapter X, Appendix 5-13 MOAC 16-021 Emery 2 Expansion Monitoring and Discovery Plan site 42Em1314) was submitted on April 29, 2016 to address revised Emery 2 expansion plans.

Inserted 10/2016

Emery 2 Portal Excavation, Airshaft, and Stockpiles

This 3-entry portal is designed to provide access to the Emery 2 Expansion operating sections of the mine and for future reserve development. The entries will be established at the bottom of an open boxcut located at the southern edge of the permit area in Section 33. The majority of the excavated material will be used as fill to establish grade to support the conveyor system, powerline, mine, and fan access road. The excess material from the boxcut will be stockpiled at the Development Waste Disposal Site and used in future reclamation. A ramp on a grade of approximately 10% will lead to the bottom of the portal boxcut. This portal excavation is designed to access three 8-foot high by 20-foot wide entries and will be driven on 60-foot centers located at the southeast end of the West Main mining section. The excavation is designed around 2.5H:10V side slopes with a 20-foot safety bench at approximately the halfway point and a 230-foot bottom width. Refer to Appendix IV-13 (Emery 2 Expansion Civil Design Drawing- R & M Engineering Consultants) for Plan, Profile, Cross Sections, and volumes. Once established, the portal will be utilized for three purposes: 1) to allow access of rubber-tired vehicles for transportation of men and supplies into the mine, 2) to serve as a coal haulage portal via conveyor belt, and 3) provide intake air to the mine.

Prior to rock excavation, salvaged subsoil and topsoil identified in Chapter VII, Appendix VII-5 (*Order 2 Soil Survey of Emery 2 Mine Permit Area* – Long 2016) will be removed and stockpiled at the existing approved topsoil pile T-2 for use in final reclamation. The topsoil stockpile will be bermed and seeded for stabilization. The topsoil pile will be surveyed to determine the yardage and an average respread depth can then be determined. The subsoil and topsoil from the fan and 100,000-gallon water tank pad area above the boxcut will be used as berm to prevent undisturbed drainage from entering this area. Upper berms 1 and 2 will be constructed out of topsoil utilizing a small dozer and are designed to divert unaffected drainage to Quitchupah Creek. All topsoil piles and berms will be posted per R645-301-521.270. Topsoil pile T-2 will be increased in size and shape and will be constructed with maximum slopes of 1.5:1. Some topsoil and subsoil will be used as berms adjacent to the disturbed area (refer to Plate VI-11B). Any topsoil/subsoil berms will be 1 to 5 feet high with maximum slopes of 1.5:1.

The excavation work will be performed by a licensed contractor who will be required by contract to comply with all applicable Federal and State laws in the use of explosives per Appendix IV-12 (Construction Blasting Plan). Portal excavation will remove approximately 149,000 bank cubic yards of rock. A swell factor of 30% was used for this material. The contractor will place approximately 79,350 cubic yards of fill per the design and haul approximately 114,350 cubic yards of the remaining material to the Development Waste Disposal Site. The majority of this material will be hauled back to the boxcut in reclamation (Refer to Chapter III pages 15d-g). Table IV-1A, Pages 8e and 8f represents boxcut, fill, and stockpile volumes. Appendix IV-13 contains a plan, cross-section views, and tables with cut and fill volumes which detail the design of this facility.

Upon encountering the minable coal seam, the remaining excavation will be performed by Bronco's work force utilizing a continuous miner. Approximately 8,500 tons of coal will be excavated from the portal development. It is the intention that by using the continuous miner, the coal will remain clean and marketable. The coal will be stored on Bronco's coal stockpile until sold.

We anticipate very little if any refuse to be generated through this portal. The reason for this is the current mine plan dictates that coal shall be left in place in the roof and floor. Therefore, no out of seam dilution is expected to be generated.

Inserted 12/2016

An airshaft is proposed to be located in the southwest portion of the permit. The 16-foot outside diameter shaft will be equipped with an exhaust fan. The airshaft is required to supply ventilation to the south and west sides of the mine. The shaft will be approximately 120 feet in depth and 16 feet in diameter. Construction of this airshaft will result in approximately 893 bank cubic yards of material to be placed and stored in the Development Waste Disposal Site. The 100,000-gallon water tank from the 4th East Portal will be moved and located in the southwest portion of the permit.

Refer to Plates IV-a, b, c for road detail and Part VI Hydrology for construction drainage control. A portion of road Section 7 (Switchback Road) will be constructed over a pre-mine jeep trail (Plate V-2) that has been previously disturbed. Prior to construction, identified topsoil and subsoil will be removed and stockpiled for reclamation. The pre-mine jeep trails are on Bronco controlled surface and do not allow for public access. Per CH V Appendix V-3, these types of pre-mine jeep trails and dirt roads consist of a 2-track, single lane road on natural base, compacted by historic vehicular traffic with no improvements.

The coal storage stockpile will be a 19,500-ton pile ready to be processed through the screening and crushing system and loaded into haul trucks for transportation from the site.

Perimeter berms are proposed to be constructed along the disturbance boundary in some areas. The berm is to protect against affected surface water leaving the site prior to reporting through the sedimentation control or silt fence. Berms will also redirect unaffected drainage around the site.

TABLE IV-1A

Emery 2 Portal Boxcut Excavation Calculations

Project: Bronco Utah Mine
Location: Emery , Utah
Report Date: 9/28/2016
Report by: Doug Bennion P.E.

Volume Summary:						
Name:	Cut Factor	Fill Factor	2D Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Finished Grade	1.0	1.0	272081.00	149501.99	79346.41	70155.58 (CUT)

Volume Detail by Station									
Station	Cut Area (Sq.ft.)	Cut Volume (Cu.yd.)	Reusable Volume (Cu.yd.)	Fill Area (Sq.ft.)	Fill Volume (Cu.yd.)	Cum. Cut Vol. (Cu.yd.)	Cum. Reusable Vol. (Cu.yd.)	Cum. Fill Vol. (Cu.yd.)	Cum. Net Vol. (Cu.yd.)
-0+50.000	17737.6	0	0	0.01	0	0	0	0	0
0+00.000	12592.2	28083.1	28083.09	0	0.01	28083.09	28083.09	0.01	28083.08
0+50.000	14174.3	4455.19	4455.19	0	0	32538.28	32538.28	0.01	32538.27
1+00.000	7158.76	19752.9	19752.86	0.01	0.01	52291.14	52291.14	0.03	52291.12
1+50.000	4048.05	10376.7	10376.68	9.93	9.21	62667.82	62667.82	9.23	62658.59
2+00.000	3378.26	6876.21	6876.21	14.8	22.9	69544.03	69544.03	32.13	69511.9
2+50.000	3341.65	6222.14	6222.14	0	13.7	75766.17	75766.17	45.83	75720.34
3+00.000	2470.04	5381.2	5381.2	0	0	81147.37	81147.37	45.83	81101.54
3+50.000	1539.48	3712.52	3712.52	0	0	84859.89	84859.89	45.83	84814.06
4+00.000	1050.69	2398.3	2398.3	0	0	87258.2	87258.2	45.83	87212.36
4+50.000	602.35	1530.59	1530.59	0	0	88788.78	88788.78	45.83	88742.95
5+00.000	477.99	1000.31	1000.31	0.04	0.03	89789.1	89789.1	45.87	89743.23
5+50.000	806.98	1189.79	1189.79	10.12	9.41	90978.89	90978.89	55.27	90923.61
6+00.000	833.94	1519.37	1519.37	26.15	33.59	92498.25	92498.25	88.86	92409.39
6+50.000	759.67	1475.56	1475.56	141.15	154.91	93973.81	93973.81	243.77	93730.04
7+00.000	443.2	1113.77	1113.77	622.95	707.5	95087.58	95087.58	951.28	94136.3
7+50.000	23.34	480.36	480.36	817.67	406.39	95567.94	95567.94	1357.67	94210.27
8+00.000	144.78	155.67	155.67	378.37	1107.44	95723.61	95723.61	2465.11	93258.5
8+50.000	90.32	217.69	217.69	471.89	787.28	95941.3	95941.3	3252.39	92688.91
9+00.000	61.45	140.53	140.53	626.94	1017.44	96081.83	96081.83	4269.83	91812.01
9+50.000	13.01	68.94	68.94	1620.43	2080.9	96150.78	96150.78	6350.73	89800.05
10+00.000	2.61	14.47	14.47	2679.72	3981.63	96165.24	96165.24	10332.4	85832.88
10+50.000	172.18	161.84	161.84	3264.94	5504.31	96327.08	96327.08	15836.7	80490.41
11+00.000	268.92	408.42	408.42	3157.77	5946.95	96735.51	96735.51	21783.6	74951.89
11+50.000	35.46	281.83	281.83	3714.33	6363.06	97017.34	97017.34	28146.7	68870.67
12+00.000	15.18	46.89	46.89	3636.15	6806	97064.23	97064.23	34952.7	62111.56
12+50.000	32.23	43.9	43.9	3987.97	7059.37	97108.13	97108.13	42012	55096.09
13+00.000	6.39	35.76	35.76	4580.04	7933.34	97143.89	97143.89	49945.4	47198.51
13+50.000	7.87	13.2	13.2	4389.4	8305.04	97157.09	97157.09	58250.4	38906.68
14+00.000	56.42	59.53	59.53	3231.2	7056.11	97216.62	97216.62	65306.5	31910.09
14+50.000	15.23	66.34	66.34	1631.46	4502.46	97282.95	97282.95	69809	27473.97
15+00.000	245.56	241.47	241.47	1220.96	2641.13	97524.42	97524.42	72450.1	25074.31
15+50.000	5.39	232.36	232.36	1597.22	2609.43	97756.78	97756.78	75059.5	22697.24
16+00.000	0	4.99	4.99	1139.05	2533.59	97761.77	97761.77	77593.1	20168.65

Inserted 10/2016

Boxcut Excavation Volumes

Assume 30 percent swell on excavated boxcut material.

Construction

Boxcut excavation bank cubic yards (Table IV-1A)	149,000 cu.yd.
Ventilation Shaft bank cubic yards	893 cu.yd.
Total swelled yards (30%)	193,700 cu.yd.
Required site fill (Table IV-1A)	79,350 cu.yd.
Material stored at waste disposal site (WDS)	114,350 cu.yd.

Inserted 10/2016

IV.A.4 USE OF EXPLOSIVES

UMC 817.61-817.68

Mining and reclamation activities at the Emery Mine may require the use of blasting or explosives on the surface during construction of surface facilities or new portals. Blasting will be carried out per R645-524 (Blasting and Explosives). Bronco~~Consol~~ will comply with all local, State, and Federal laws in the use of explosives during construction of the site and at any other times when blasting is required at the Emery Mine. Prior to any surface blasting, Bronco~~Consol~~ will obtain approval of the blasting plan from the Division. A copy of blasting plans using more than five pounds of explosives is included in Appendix~~.~~ IV-12~~9~~. Pre-blast notifications will be sen~~d~~t to landowners within ½ mile of the permit area. Refer to CH IV, Appendix IV-12a for blasting notifications, waivers and pre-blast surveys. Pre-blast surveys, if requestet~~t~~d by a landowner, will be conducted and forwarded to the Division.

~~While use of explosives underground is very infrequent, a small amount is stored in an MSHA approved magazine which is isolated from heavily traveled areas and is posted with warning signs.~~ Explosives are used and handled as directed by MSHA. Currently, explosive storage during mining is not contemplated. If an explosive magazine is required in the future, one will be permitted and bonded.

Revised 01/2017

Bonding Calculations

Direct Costs		
Subtotal Demolition and Removal	$475,379.00	
Subtotal Backfilling and Grading	$2,526,678.00	
Subtotal Revegetation	$577,553.00	
Direct Costs	$3,579,610.00	
Indirect Costs		
Mob/Demob	$357,961.00	10.0%
Contingency	$178,981.00	5.0%
Engineering Redesign	$89,490.00	2.5%
Main Office Expense	$243,413.00	6.8%
Project Mainagement Fee	$89,490.00	2.5%
Subtotal Indirect Costs	$959,335.00	26.8%
Total Cost	$4,538,945.00	
Escalation factor		0.007
Number of years (Mid-Term Review 2018)		0
Escalation	$52,763.00	
Reclamation Cost Escalated	$4,591,708.00	
Bond Amount (rounded to nearest $1,000) 2016 Dollars	$4,592,000.00	
Bond Posted 2016 dollars	$3,808,000.00	
Difference Between Cost Estimate and Bond	-$784,000.00	
Percent Difference	-17.07%	

CHAPTER IV~~. B~~RECLAMATION COST ESTIMATES

Chapter IV Part IV~~.B~~ pages 14~~,~~ through 18 have been left blank due to the revised bond calculation.

The revised bond calculations and bond calculation backup are renumbered as follows:

Bond Calculation Backup – Pages 1 through 17

Demo – Pages 1 through ~~49~~55

Earthwork – Pages 1 through ~~18~~23

Reveg – Pages 1 through ~~3~~4

Revised 4/2008
Revised 12/2008
Revised 12/2016

All surface drainage from the site reports to existing sedimentation control structures (see CH CI, Pond 8 design).

Slope Stability Analysis

Please refer to CH IV Appendix IV-10 for slope stability analysis of the Existing Coal Mine Waste Disposal Site. Based on this report, the existing coal mine waste disposal site conforms to the stability criteria mandated by R645-301-536.110 and 120. All slopes have a factor of safety of at least 1.5. The area is underlain by abandoned room and pillar mine workings that were mined in the 1940s, and old mine maps show that 40% of the coal has been removed, with no secondary pillar extraction. The mining method did not contemplate subsidence and the low recovery ratio and pillar size would indicate that the foundation will remain stable.

Excess waste rock generated from construction of the Emery 2 portal will be placed on existing mine waste disposal site (see Map Code 31 on Plate II-1). In accordance with currently approved plans, this rock will be placed in 2-foot compacted lifts. Based on an outslope angle of 2H:1V and a total height of 40 feet (the height of the waste rock pile shown on Plate II-1), sufficient space is available within the waste rock site southwest of the pile shown on Plate II-1 to store 115,260 cubic yards of waste rock without impinging on the existing pile. If the waste rock is placed against the existing pile, sufficient capacity is available to place substantially more excess rock at the site.

The stability analyses presented in Appendix IV-10 were based on coal overlying native soil and bedrock. The excess rock generated from construction of the Emery 2 portal will consist of angular sandstone and siltstone together with finer particles generated from the handling of this rock. The angular nature of this material will create a greater resistance to slope failure than is exhibited by the coal that comprised the bulk of the waste rock pile evaluated in Appendix IV-10. Therefore, excess rock placed at the waste rock site will exhibit a greater factor of safety against slope failure than the material evaluated in Appendix IV-10, thus also meeting the minimum safety factor of 1.5 required by R645-301-536.110.

Inserted 2/2008
Revised 12/2016

IV.D Roads

This part of Chapter IV provides design information pertaining to the mine roads within the permit boundary.

UMC 817.150 – .166

The design and construction or reconstruction of the following roads, proposed in this permit, are based on the above referenced regulations.

Identification	*Classification*	*Status*
Emery 2 ~~e~~Expansion	Sections 5, 6, & 7 Primary	Proposed
Mine Yard Roads	Sections 1 & 3 – ~~Class I~~Primary	Existing
Mine Yard Roads	Sections 2 & 4 – ~~Class II~~Ancillary	Existing
Borehole Pump Road	~~Class II~~Ancillary	Existing
Prep plant Access Road	~~Class II~~Ancillary	Proposed Upgrading
Prep Plant Main Entrance Road	~~Class I~~Ancillary	Proposed
Coarse Refuse Haulage Road	~~Class II~~Ancillary	Proposed

Please note that detailed designs, drawings illustrating the plan view, profile and cross-sections for the above referenced roads are provided in Appendix IV-7.

Roads are designed to control or minimize erosion and siltation, air and water pollution, and damage to public or private property. Roads will not cause damage to fish, wildlife, and related environmental values and will not cause additional suspended solids to streamflow or to runoff outside the permit area.

The design criteria for the roads in this permit, as adopted from the above referenced regulations are as follows:

1. Location of roads are designed to follow the existing topography or on the most stable available slopes. Roads are located to minimize downstream sedimentation and flooding. Culverts, bridges or other structures are proposed for stream crossings.

~~1.~~ A report discussing the stability of the Section 7 road is provided in Chapter IV, Appendix IV-14 (Emery 2 Expansion Slope Stability Analyses). As indicated therein, the minimum factors of safety against failure of the Section 7 road embankment are 1.70 on the cut slope and 3.37 on the fill slope. These factors of safety exceed the minimum of 1.3 required by R645-~~-~~301-534.130.

Bond Calculation Backup

The following are screenshots of RS Means rates used in Demo, Reveg, and Earth bond calculations, Chapter IV, Part IV.

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2 | Search

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 0232 Geotechnical Investigations
- 0241 Demolition
  - 024113 Selective Site Demolition
    - 024113.15 Hydrodemolition
    - 024113.17 Demolish, Remove Pave
    - 024113.20 Selective Demolition, He
    - 024113.23 Utility Line Removal
    - 024113.30 Minor Site Demolition
    - 024113.33 Railtrack Removal
    - 024113.34 Selective Demolition, Ut
    - 024113.36 Selective Demolition, Ut
    - 024113.38 Selective Demolition, W
    - 024113.40 Selective Demolition,
    - 024113.42 Selective Demolition, Ma

024113.40 Selective Demolition, Metal Drainage Piping — Total 29 records foun

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
024113400150	12" dia	L.F.	B11M	600.00	0.027		1.06	0.63	1.69
024113400160	18" dia	L.F.	B11M	400.00	0.040		1.59	0.94	2.53
024113400170	24" dia	L.F.	B13	300.00	0.187		6.91	2.37	9.28
024113400180	30" - 36" dia	L.F.	B13	250.00	0.224		8.25	2.84	11.09
024113400190	48" - 60" dia	L.F.	B13	200.00	0.280		10.35	3.55	13.90
024113400200	72" dia	L.F.	B13B	100.00	0.560		20.52	10.68	31.20
024113400210	CMP end sections, steel, 10"-18" dia	Ea.	B11M	40.00	0.400		15.88	9.40	25.28
024113400220	24"-36" dia	Ea.	B13	30.00	1.867		69.13	23.73	92.86
024113400230	48" dia	Ea.	B13	20.00	2.800		103.47	35.59	139.06
024113400240	60" dia	Ea.	B13	10.00	5.600		206.94	71.18	278.12
024113400250	72" dia	Ea.	B13B	10.00	5.600		206.94	106.29	313.23
024113400260	CMP fittings, 8"-12" dia	Ea.	B11M	60.00	0.267		10.57	6.26	16.83

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2 | Search

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 024113.48 Selective Demolition, Ga
- 024113.50 Selective Demolition, Na
- 024113.51 Selective Demolition, Na
- 024113.52 Selective Demo, Natural
- 024113.54 Selective Demolition, El
- 024113.56 Selective Demolition, El
- 024113.60 Selective Demolition
- 024113.62 Selective Demolition, Ch

024113.60 Selective Demolition Fencing — Total 7 records fou

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
024113600010	SELECTIVE DEMOLITION FENCING								
024113600700	Snow fence, 4' high	L.F.	B6	1000.00	0.024		0.89	0.35	1.24
024113601600	Fencing, barbed wire, 3 strand	L.F.	2 Clab	430.00	0.037		1.26		1.26
024113601650	5 strand	L.F.	2 Clab	280.00	0.057		1.94		1.94
024113601700	Chain link, posts & fabric, 8' to 10' high, remove only	L.F.	B6	445.00	0.054		2.01	0.78	2.79
024113601775	Fencing, wood, average all types, 4' to 6' high	L.F.	2 Clab	432.00	0.037		1.25		1.25
024113601790	Remove and store	L.F.	B80	235.00	0.136		5.13	2.94	8.07

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 024113.76 Selective Demolition, W
- 024113.78 Selective Demolition, Ra
- 024113.80 Selective Demolition,
- 024113.82 Selective Removal, Pave
- 024113.84 Selective Demolition, W
- 024113.86 Selective Demolition, At
- 024113.88 Selective Demolition, La

024113.80 Selective Demolition, Utility Poles & Cross Arms

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
024113800010	SELECTIVE DEMOLITION, UTILITY POLES & CROSS ARM								
024113800100	Utility poles, wood, 20' - 30' high	Ea.	R3	6.00	3.333		162.34	22.30	184.64
024113800200	35' - 45' high	Ea.	R3	5.00	4.000		195.35	26.57	221.92
024113800300	Cross arms, wood, 4' - 6' long	Ea.	1 Elec	5.00	1.600		78.50		78.50

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 1 General Requirements
- 2 Existing Conditions
  - 0221 Surveys
  - 0232 Geotechnical Investigations
  - 0241 Demolition
    - 024113 Selective Site Demolition
    - 024116 Structure Demolition
      - 024116.13 Building Demolition
      - 024116.15 Explosive/Implosive Dem
      - 024116.17 Building Demolition Foot
      - 024116.33 Bridge Demolition

024116.13 Building Demolition

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
024116130020	Steel	C.F.	B8	21500.00	0.003		0.12	0.14	0.26
024116130050	Concrete	C.F.	B8	15300.00	0.004		0.16	0.21	0.37
024116130080	Masonry	C.F.	B8	20100.00	0.003		0.12	0.16	0.28
024116130100	Mixture of types	C.F.	B8	20100.00	0.003		0.12	0.16	0.28
024116130500	Small bldgs, or single bldgs, no salvage included, steel	C.F.	B3	14800.00	0.003		0.12	0.16	0.28
024116130600	Concrete	C.F.	B3	11300.00	0.004		0.16	0.22	0.38
024116130650	Masonry	C.F.	B3	14800.00	0.003		0.12	0.16	0.28
024116130700	Wood	C.F.	B3	14800.00	0.003		0.12	0.16	0.28
024116130750	For buildings with no interior walls, deduct	C.F.							30.00%
024116131000	Demoliton single family house, one story, wood 1600 S.F.	Ea.	B3	1.00	48.000		1806.30	2443.68	4249.98

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 0232 Geotechnical Investigations
- 0241 Demolition
  - 024113 Selective Site Demolition
  - 024116 Structure Demolition
    - 024116.13 Building Demolition
    - 024116.15 Explosive/Implosive Dem
    - 024116.17 Building Demolition F
    - 024116.33 Bridge Demolition
  - 024119 Selective Demolition
- 0243 Structure Moving
- 0258 Snow Control

024116.17 Building Demolition Footings And Foundations

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
024116172400	Concrete, plain concrete, 6" thick	S.F.	B13L	4000.00	0.004		0.19	0.48	0.67
024116172420	8" thick	S.F.	B13L	3500.00	0.005		0.21	0.56	0.77
024116172440	10" thick	S.F.	B13L	3000.00	0.005		0.25	0.65	0.90
024116172500	12" thick	S.F.	B13L	2500.00	0.006		0.29	0.78	1.07
024116172600	For average reinforcing, add	S.F.							10.00%
024116172620	For heavy reinforcing, add	S.F.							20.00%
024116174000	For congested sites or small quantities, add up to	S.F.							200.00%
024116174200	Add for disposal, on site	C.Y.	B11A	232.00	0.069		2.74	5.69	8.43
024116174250	To five miles	C.Y.	B30	220.00	0.109		4.46	10.39	14.85

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 22 Plumbing
- 23 Heating, Ventilating, and Air Conditioning
- 26 Electrical
  - 2605 Common Work Results For Electrica
    - 260505 Selective Demolition For Elec
      - 260505.10 Electrical Demolition
    - 260513 Medium-Voltage Cables
    - 260519 Low-Voltage Electrical Power
    - 260533 Raceway And Boxes For Elec

260505.10 Electrical Demolition

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
260505101880	#4	C.L.F.	2 Elec	53.00	0.302		12.60		12.60
260505101890	#3	C.L.F.	2 Elec	50.00	0.320		13.36		13.36
260505101900	#2	C.L.F.	2 Elec	44.60	0.359		14.95		14.95
260505101910	1/0	C.L.F.	2 Elec	33.20	0.482		20.06		20.06
260505101920	2/0	C.L.F.	2 Elec	29.20	0.548		22.71		22.71
260505101930	3/0	C.L.F.	2 Elec	25.00	0.640		26.87		26.87
260505101940	4/0	C.L.F.	2 Elec	22.00	0.727		30.28		30.28
260505101950	250 kcmil	C.L.F.	2 Elec	20.00	0.800		33.31		33.31

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3122 Grading
- 3123 Excavation And Fill
  - 312316 Excavation
    - 312316.13 Excavating, Trench
    - 312316.14 Excavating, Utility Trenc
    - 312316.15 Excavating, Utility Trenc
    - 312316.16 Structural Excavation
    - 312316.26 Rock Removal
    - 312316.30 Drilling And Blasting Roc

312316.16 Structural Excavation For Minor Structures

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
312316166001	and small building foundations								
312316166030	Common earth, hydraulic backhoe, 1/2 C.Y. bucket	B.C.Y.	B12E	55.00	0.291		11.69	7.69	19.38
312316166035	3/4 C.Y. bucket	B.C.Y.	B12F	90.00	0.178		7.14	6.88	14.02
312316166040	1 C.Y. bucket	B.C.Y.	B12A	108.00	0.148		5.98	7.16	13.14
312316166050	1-1/2 C.Y. bucket	B.C.Y.	B12B	144.00	0.111		4.46	6.79	11.25
312316166060	2 C.Y. bucket	B.C.Y.	B12C	200.00	0.080		3.22	5.60	8.82
312316166070	Sand and gravel, 3/4 C.Y. bucket	B.C.Y.	B12F	100.00	0.160		6.42	6.22	12.64
312316166080	1 C.Y. bucket	B.C.Y.	B12A	120.00	0.133		5.35	6.41	11.76

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 312316.16 Structural Excavation Fo
- 312316.26 Rock Removal
- 312316.30 Drilling And Blasting Roc
- 312316.32 Ripping
- 312316.35 Hydraulic Rock Breaking
- 312316.42 Excavating, Bulk Bank
- 312316.43 Excavating, Large Volur
- 312316.46 Excavating, Bulk, Dozer
- 312316.48 Excavation, Bulk, Dragli
- 312316.50 Excavation, Bulk, Scrape
- 312319 Dewatering
- 312323 Fill
  - 312323.13 Backfill
  - 312323.14 Backfill, Structural
  - 312323.15 Borrow, Loading And/O

312316.42 Excavating, Bulk Bank Measure

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
312316420250	1-1/2 C.Y. cap. = 125 C.Y./hr.	B.C.Y.	B12B	1000.00	0.016		0.64	0.98	1.62
312316420260	2 C.Y. cap. = 165 C.Y./hr.	B.C.Y.	B12C	1320.00	0.012		0.49	0.84	1.33
312316420300	3 C.Y. cap. = 260 C.Y./hr.	B.C.Y.	B12D	2080.00	0.008		0.31	1.11	1.42
312316420305	3-1/2 C.Y. cap. = 300 C.Y./hr.	B.C.Y.	B12D	2400.00	0.007		0.27	0.97	1.24
312316420310	Wheel mounted, 1/2 C.Y. cap. = 40 C.Y./hr.	B.C.Y.	B12E	320.00	0.050		2.01	1.32	3.33
312316420360	3/4 C.Y. cap. = 60 C.Y./hr.	B.C.Y.	B12F	480.00	0.033		1.34	1.29	2.63
312316420500	Clamshell, 1/2 C.Y. cap. = 20 C.Y./hr.	B.C.Y.	B12G	160.00	0.100		4.02	4.35	8.37
312316420550	1 C.Y. cap. = 35 C.Y./hr.	B.C.Y.	B12H	280.00	0.057		2.30	4.20	6.50
312316420950	Dragline, 1/2 C.Y. cap. = 30 C.Y./hr.	B.C.Y.	B12I	240.00	0.067		2.68	3.63	6.31
312316421000	3/4 C.Y. cap. = 35 C.Y./hr.	B.C.Y.	B12I	280.00	0.057		2.30	3.10	5.40
312316421050	1-1/2 C.Y. cap. = 65 C.Y./hr.	B.C.Y.	B12P	520.00	0.031		1.24	2.26	3.50
312316421100	3 C.Y. cap. = 112 C.Y./hr.	B.C.Y.	B12V	900.00	0.018		0.71	1.64	2.35
312316421200	Front end loader, track mtd., 1-1/2 C.Y. cap. = 70 C.Y./h	B.C.Y.	B10N	560.00	0.021		0.89	0.89	1.78
312316421250	2-1/2 C.Y. cap. = 95 C.Y./hr.	B.C.Y.	B10O	760.00	0.016		0.66	1.21	1.87
312316421300	3 C.Y. cap. = 130 C.Y./hr.	B.C.Y.	B10P	1040.00	0.012		0.48	1.09	1.57

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 312323.16 Fill By Borrow And Utility
- 312323.17 General Fill
- 312323.20 Hauling
- 312323.23 Compaction
- 312323.25 Compaction, Airports
- 3125 Erosion And Sedimentation Control
- 3131 Soil Treatment
- 3132 Soil Stabilization

312323.20 Hauling

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Tota
312323200550	30 MPH ave, cycle 4 miles	L.C.Y.	B34A	88.00	0.091		3.51	4.50	8.01	
312323200552	cycle 6 miles	L.C.Y.	B34A	80.00	0.100		3.85	4.93	8.78	
312323200554	cycle 8 miles	L.C.Y.	B34A	72.00	0.111		4.28	5.50	9.78	
312323201014	12 C.Y. truck, cycle 0.5 mile, 15 MPH ave, 15 min. wait/L	L.C.Y.	B34B	336.00	0.024		0.92	1.95	2.87	
312323201016	cycle 1 mile	L.C.Y.	B34B	300.00	0.027		1.03	2.18	3.21	
312323201018	cycle 2 miles	L.C.Y.	B34B	252.00	0.032		1.22	2.60	3.82	
312323201020	cycle 4 miles	L.C.Y.	B34B	180.00	0.044		1.71	3.64	5.35	
312323201022	cycle 6 miles	L.C.Y.	B34B	144.00	0.056		2.14	4.56	6.70	

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3331 Sanitary Utility Sewerage Piping
- 333113 Public Sanitary Utility Sewera
- 333113.13 Sewage Collection, Ven
- 333113.15 Sewage Collection, Con
- 333113.20 Sewage Collection, Plas
- 333113.25 Sewage Collection, P

333113.25 Sewage Collection, Polyvinyl Chloride Pipe

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Tot
333113252160	12" diameter	L.F.	B21	320.00	0.088	14.63	2.34	0.42	17.39	
333113252200	15" diameter	L.F.	B21	240.00	0.117	14.98	3.13	0.55	18.66	
333113252300	18" diameter	L.F.	B21	200.00	0.140	17.28	3.74	0.66	21.68	
333113252400	21" diameter	L.F.	B21	190.00	0.147	24.19	3.95	0.70	28.84	
333113252500	24" diameter	L.F.	B21	180.00	0.156	31.10	4.16	0.74	36.00	
333113253040	Fittings, bends or elbows, 4" diameter	Ea.	2 Skwk	24.00	0.667	11.29	20.37		31.66	

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 024113.30 Minor Site Demolition
- 024113.33 Railtrack Removal
- 024113.34 Selective Demolition, Ut
- 024113.36 Selective Demolition, Ut
- 024113.38 Selective Demolition,
- 024113.40 Selective Demolition, Me
- 024113.42 Selective Demolition, Ma

024113.38 Selective Demolition, Water & Sewer Piping And Fittings

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
024113381600	Plastic pipe 3/4"-4" diameter	L.F.	B6	700.00	0.034		1.28	0.49	1.77
024113381700	6"-8" diameter	L.F.	B6	500.00	0.048		1.78	0.69	2.47
024113381800	10"-18" diameter	L.F.	B6	300.00	0.080		2.97	1.16	4.13
024113381900	20"-36" diameter	L.F.	B6	200.00	0.120		4.46	1.74	6.20
024113381910	42"-48" diameter	L.F.	B6	180.00	0.133		4.95	1.93	6.88
024113381920	54"-60" diameter	L.F.	B6	160.00	0.150		5.58	2.16	7.74

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 23 Heating, Ventilating, and Air Conditioning
- 2305 Common Work Results For HVAC
  - 230505 Selective Demolition For HVA
    - 230505.10 HVAC Demolition
    - 230523 General-Duty Valves For HVA
    - 230593 Testing, Adjusting, And Bala
  - 2313 Facility Fuel-Storage Tanks
- 26 Electrical

230505.10 HVAC Demolition

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
230505101300	12"-14" high, 16"-18" wide	L.F.	1 Clab	85.00	0.094		2.42		2.42
230505101400	18" high, 24" wide	L.F.	1 Clab	67.00	0.119		3.08		3.08
230505101500	30" high, 36" wide	L.F.	1 Clab	56.00	0.143		3.67		3.67
230505101540	72" wide	L.F.	1 Clab	50.00	0.160		4.11		4.11
230505103000	Mechanical equipment, light items. Unit is weight, not coo	Ton	Q5	0.90	17.778		658.63		658.63
230505103600	Heavy items	Ton	Q5	1.10	14.545		539.81		539.81
230505105090	Remove refrigerant from system	Lb.	1 Stpi	40.00	0.200		8.25		8.25

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3346 Subdrainage
- 3347 Ponds And Reservoirs
  - 334713 Pond And Reservoir Liners
    - 334713.53 Reservoir Liners HDPE
- 3349 Storm Drainage Structures
- 3351 Natural-Gas Distribution

334713.53 Reservoir Liners HDPE

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Tot
334713530010	RESERVOIR LINERS HDPE									
334713530011	Membrane lining									
334713531100	30 mil thick	S.F.	3 Skwk	1850.00	0.013	0.60	0.40		1.00	
334713531200	60 mil thick	S.F.	3 Skwk	1600.00	0.015	0.74	0.46		1.20	
334713531300	120 mil thick	S.F.	3 Skwk	1440.00	0.017	0.86	0.50		1.36	

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2 | Search

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3218 Athletic And Recreational Surfacing
- 3231 Fences And Gates
- 3232 Retaining Walls
- 3233 Site Furnishings
- 3234 Fabricated Bridges
- 3235 Screening Devices
- 3284 Planting Irrigation
- 3291 Planting Preparation
  - 329113 Soil Preparation
    - 329113.16 Mulching
    - 329113.23 Structural Soil Mixing

329113.23 Structural Soil Mixing — Total 67 records found

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
329113232710	180 H.P. grader with scarifier	M.S.F.	B11L	40.00	0.400		15.29	16.94	32.23
329113233000	Scarify subsoil, residential, skid steer loader w/scarifiers, 50 HP	M.S.F.	B66	32.00	0.250		10.57	7.83	18.40
329113233050	Municipal, skid steer loader w/scarifiers, 50 HP	M.S.F.	B66	120.00	0.067		2.82	2.09	4.91
329113233100	Large commercial, 75 HP, dozer w/scarifier	M.S.F.	B10L	240.00	0.050		2.01	1.86	3.87
329113233200	Grader with scarifier, 135 H.P.	M.S.F.	B11L	280.00	0.057		2.18	2.42	4.60
329113233500	Screen topsoil from stockpile, vibrating screen, wet material (organic)	C.Y.	B10P	200.00	0.060		2.41	5.69	8.10
329113233550	Dry material	C.Y.	B10P	300.00	0.040		1.61	3.79	5.40
329113233600	Mixing with conditioners, manure and peat	C.Y.	B10R	550.00	0.022		0.88	0.51	1.39
329113233650	Mobilization add for 2 days or less operation	Job	B34K	3.00	2.667		98.79	298.94	397.73
329113233800	Spread conditioned topsoil, 6" deep, by hand	S.Y.	B1	360.00	0.067	4.83	2.21		7.04

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2 | Search

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3218 Athletic And Recreational Surfacing
- 3231 Fences And Gates
- 3232 Retaining Walls
- 3233 Site Furnishings
- 3234 Fabricated Bridges
- 3235 Screening Devices
- 3284 Planting Irrigation
- 3291 Planting Preparation
  - 329113 Soil Preparation
    - 329113.16 Mulching
    - 329113.23 Structural Soil Mixing

329113.16 Mulching — Total 29 records found

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
329113160010	MULCHING								
329113160200	Hay, 1" deep, hand spread	S.Y.	1 Clab	475.00	0.017	0.44	0.55		0.99
329113160250	Power mulcher, small	M.S.F.	B64	180.00	0.089	49.17	3.05	2.11	54.33
329113160350	Large	M.S.F.	B65	530.00	0.030	49.17	1.04	1.02	51.23
329113160400	Humus peat, 1" deep, hand spread	S.Y.	1 Clab	700.00	0.011	2.30	0.37		2.67
329113160450	Push spreader	S.Y.	1 Clab	2500.00	0.003	2.30	0.10		2.40
329113160550	Tractor spreader	M.S.F.	B66	700.00	0.011	256.05	0.48	0.36	256.89
329113160600	Oat straw, 1" deep, hand spread	S.Y.	1 Clab	475.00	0.017	0.44	0.55		0.99
329113160650	Power mulcher, small	M.S.F.	B64	180.00	0.089	49.17	3.05	2.11	54.33

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2 | Search

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3235 Screening Devices
- 3284 Planting Irrigation
- 3291 Planting Preparation
- 3292 Turf And Grasses
  - 329219 Seeding
    - 329219.14 Seeding, Athletic Fiel
  - 329223 Sodding
  - 329226 Sprigging
- 3293 Plants

329219.14 Seeding, Athletic Fields — Total 52 records foun

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
329219145000	Hydro or air seeding, with mulch and fertilizer	M.S.F.	B81	80.00	0.300	24.81	11.34	8.21	44.36
329219145200	Utility mix, 7#/M.S.F., push spreader	M.S.F.	1 Clab	8.00	1.000	8.42	32.64		41.06
329219145300	Tractor spreader	M.S.F.	B66	52.00	0.154	8.42	6.49	4.79	19.70
329219145400	Hydro or air seeding, with mulch and fertilizer	M.S.F.	B81	80.00	0.300	31.45	11.34	8.21	51.00
329219145600	Wildflower, .10#/M.S.F., push spreader	M.S.F.	1 Clab	8.00	1.000	1.68	32.64		34.32
329219145700	Tractor spreader	M.S.F.	B66	52.00	0.154	1.68	6.49	4.79	12.96
329219145800	Hydro or air seeding, with mulch and fertilizer	M.S.F.	B81	80.00	0.300	9.26	11.34	8.21	28.81
329219147000	Apply fertilizer, 800 lb./acre	Ton	B66	4.00	2.000	868.28	84.61	62.63	1015.52

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2 | Search

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 320117 Flexible Paving Repair
- 320129 Rigid Paving Repair
- 320130 Operation And Maintenance
- 320190 Operation And Maintenance
  - 320190.13 Fertilizing
  - 320190.19 Mowing
  - 320190.23 Pruning
  - 320190.24 Shrub Pruning
  - 320190.26 Watering

320190.13 Fertilizing — Total 9 records foun

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
320190130100	Dry granular, 4#/M.S.F., hand spread	M.S.F.	1 Clab	24.00	0.333	1.97	11.28		13.25
320190130110	Push rotary	M.S.F.	1 Clab	140.00	0.057	1.97	1.94		3.91
320190130112	Push rotary, per 1076 feet squared	Ea.	1 Clab	130.00	0.062	1.97	2.08		4.05
320190130120	Tractor towed spreader, 8'	M.S.F.	B66	500.00	0.016	1.97	0.70	0.50	3.17
320190130130	12' spread	M.S.F.	B66	800.00	0.010	1.97	0.44	0.31	2.72
320190130140	Truck whirlwind spreader	M.S.F.	B66	1200.00	0.007	1.97	0.29	0.21	2.47
320190130180	Water soluable, hydro spread, 1.5#/M.S.F.	M.S.F.	B64	600.00	0.027	2.37	0.95	0.64	3.96
320190130190	Add for weed control	M.S.F.				0.25			0.25

Inserted 12/2016

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3111 Clearing And Grubbing
- 3113 Selective Tree And Shrub Removal
- 3114 Earth Stripping And Stockpiling
- 3122 Grading
- 3123 Excavation And Fill
- 3125 Erosion And Sedimentation Control
  - 312514 Stabilization Measures For
    - 312514.16 Rolled Erosion Control M
- 3131 Soil Treatment
- 3132 Soil Stabilization

312514 Stabilization Measures For Erosion And Sedimentation Control — Total 18 records four

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
312514160120	Revegetation mat, webbed	S.Y.	2 Clab	1000.00	0.016	1.61	0.54		2.15
312514160200	Polypropylene mesh, stapled, 6.5 oz./S.Y.	S.Y.	B1	2500.00	0.010	1.69	0.33		2.02
312514160300	Tobacco netting, or jute mesh #2, stapled	S.Y.	B1	2500.00	0.010	0.21	0.33		0.54
312514160400	Soil sealant, liquid sprayed from truck	S.Y.	B81	5000.00	0.005	0.39	0.19	0.13	0.71
312514161000	Silt fence, install and maintain, remove	L.F.	B62	1300.00	0.018	0.26	0.69	0.12	1.07
312514161100	**Allow 25% per month for maintenance; 6-month max life**								
312514161130	Cellular confinement, poly, 3-dimen, 8' x 20' panels, 4" deep cell	S.F.	B6	1600.00	0.015	1.34	0.55	0.22	2.11
312514161140	8" deep cells	S.F.	B6	1200.00	0.020	2.53	0.74	0.28	3.55
312514161200	Place and remove hay bales	Ton	A2	3.00	8.000	267.00	280.98	78.29	626.27
312514161250	Hay bales, staked	L.F.	A2	2500.00	0.010	3.56	0.34	0.09	3.99

Search Data | Manage Estimates | Square Foot Estimator | Life Cycle Cost | Cost Alerts and Trends | Reference Items | My Favorites

Cost Data: .....Heavy Construction | Type: Unit | Labor Type: Standard Union | Location: PRICE (845) | Release: Year 2016 Quarter 2

Search: What are you searching for? | All | Search | Include My Custom Data

MasterFormat 2014

- 3122 Grading
- 3123 Excavation And Fill
  - 312316 Excavation
  - 312319 Dewatering
  - 312323 Fill
    - 312323.13 Backfill
    - 312323.14 Backfill, Structural
    - 312323.15 Borrow, Loading And/O
    - 312323.16 Fill By Borrow And Utility
    - 312323.17 General Fill

312323.14 Backfill, Structural — Total 54 records fou

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total
312323145210	Sandy clay & loam	L.C.Y.	B10M	2150.00	0.006		0.23	0.84	1.07
312323145220	Common earth	L.C.Y.	B10M	1950.00	0.006		0.26	0.92	1.18
312323145240	Clay	L.C.Y.	B10M	1700.00	0.007		0.29	1.05	1.34
312323145400	300' haul, sand & gravel	L.C.Y.	B10M	1500.00	0.008		0.33	1.20	1.53
312323145410	Sandy clay & loam	L.C.Y.	B10M	1470.00	0.008		0.34	1.21	1.55
312323145420	Common earth	L.C.Y.	B10M	1350.00	0.009		0.37	1.33	1.70
312323145440	Clay	L.C.Y.	B10M	1225.00	0.010		0.41	1.46	1.87
312323146000	**For compaction, see Section 31 23 23.23**								
312323146010	**For trench backfill, see Sections 31 23 16.13 and 31 23 16.14**								

Inserted 12/2016

The following are screenshots of NDEP Standardized Reclamation Cost Estimator v 1.4 used to calculate borehole abandonment costs in Demo bond calculations, Chapter IV, Part IV.B.

STANDARDIZED RECLAMATION COST ESTIMATOR

Version 1.4.1
Build 017a (revised to work with Excel 2013 - 01 Aug 2014)
Approved for use in Nevada, August 1, 2012

COST DATA FILE INFORMATION

File Name:	borehole Emery Mine__SRCE_Version_1_4_1_017_NV.xlsm
Cost Data File:	SRCE_Cost_Data_File_1_12_Std_2015.xlsm
Cost Data Date:	August 1, 2015
Cost Data Basis:	User Data — Data Cost Units: Imperial
Author/Source:	Nevada Division of Environmental Protection (NDEP) & NV BLM

PROJECT INFORMATION

Property/Mine Name:	Emery Mine — Property Code:
Project Name:	Emery Mine
Date of Submittal:	July 8, 2016 — Average Altitude: 5930 ft.
Select One:	○ Notice or Sm Exploration Plan ○ Lg Exploration Plan ● Mine Operation
Select One:	○ Private Land ● Public or Public/Private
Cost Estimate Type:	Surety
Cost Basis Category:	S. Nevada Notice Level
Cost Basis Description:	Clark, Esmeralda, Lincoln and Nye Counties

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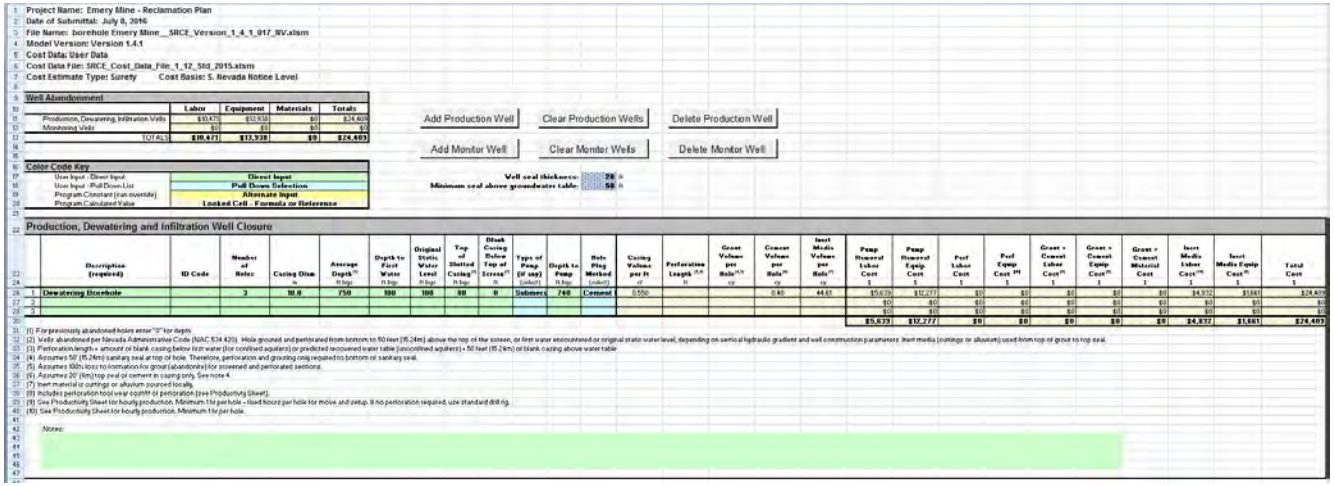
Inserted 12/2016



Project Name: Emery Mine - Reclamation Plan
Date of Submittal: July 8, 2016
File Name: borehole Emery Mine__SRCE_Version_1_4_1_017_NV.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_Data_File_1_12_Std_2015.xlsm
Cost Estimate Type: Surety Cost Basis: S. Nevada Notice Level

Well Abandonment

	Labor	Equipment	Materials	Totals
Production, Dewatering, Infiltration Wells	$10,471	$13,938	$0	$24,409
Monitoring Wells	$0	$0	$0	$0
TOTALS	$10,471	$13,938	$0	$24,409

Add Production Well | Clear Production Wells | Delete Production Well
Add Monitor Well | Clear Monitor Wells | Delete Monitor Well

Color Code Key

User Input - Direct Input	Direct Input
User Input - Pull Down List	Pull Down Selection
Program Constant (can override)	Alternate Input
Program Calculated Value	Locked Cell - Formula or Reference

Well seal thickness: 20 ft
Minimum seal above groundwater table: 50 ft

Production, Dewatering and Infiltration Well Closure

	Description (required)	ID Code	Number of Holes	Casing Diam in	Average Depth (1) ft bgs	Depth to First Water ft bgs	Original Static Water Level ft bgs	Top of Slotted Casing (2) ft bgs	Blank Casing Below Top of Screen (3) ft	Type of Pump (if any) (select)	Depth to Pump ft bgs	Hole Plug Method (select)	Casing Volume per ft cf	Perforation Length (3,4) ft	Grout Volume per Hole (5,6) cy	Cement Volume per Hole (6) cy	Inert Media Volume per Hole (7) cy	Pump Removal Labor Cost $	Pump Removal Equip Cost $	Perf Labor Cost $	Perf Equip Cost (8) $	Grout + Cement Labor Cost (9) $	Grout + Cement Equip Cost (9) $	Grout + Cement Material Cost $	Inert Media Labor Cost (10) $	Inert Media Equip Cost (10) $	Total Cost $
1	Dewatering Borehole		3	10.0	750	500	100	50	0	Submerc	740	Cement	0.550			0.40	44.61	$5,639	$12,277	$0	$0	$0	$0	$0	$4,832	$1,661	$24,409
2																		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3																		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
																		$5,639	$12,277	$0	$0	$0	$0	$0	$4,832	$1,661	$24,409

(1) For previously abandoned holes enter "0" for depth
(2) Wells abandoned per Nevada Administrative Code (NAC 534.420). Hole grouted and perforated from bottom to 50 feet (15.24m) above the top of the screen, or first water encountered or original static water level, depending on vertical hydraulic gradient and well construction parameters. Inert media (cuttings or alluvium) used from top of grout to top seal.
(3) Perforation length = amount of blank casing below first water (for confined aquifers) or predicted recovered water table (unconfined aquifers) + 50 feet (15.24m) of blank casing above water table
(4) Assumes 50' (15.24m) sanitary seal at top of hole. Therefore, perforation and grouting only required to bottom of sanitary seal.
(5) Assumes 500% loss to formation for grout (abandoned) for screened and perforated sections.
(6) Assumes 20' (6m) top seal of cement in casing only. See note 4.
(7) Inert material is cuttings or alluvium sourced locally.
(8) Includes perforation tool wear cost/ft of perforation (see Productivity Sheet).
(9) See Productivity Sheet for hourly production. Minimum 1 hr per hole - fixed hours per hole for move and setup. If no perforation required, use standard drill rig.
(10) See Productivity Sheet for hourly production. Minimum 1 hr per hole.

Notes:

Project Name: Emery Mine
Project Date: July 8, 2016
Model Version: Version 1.4.1
File Name: borehole Emery Mine__SRCE_Version_1_4_1_017_NV.xlsm
Data Cost File: SRCE_Cost_Data_File_1_12_Std_2015.xlsm
Cost Basis: S. Nevada Notice Level

	A. Earthwork/Recontouring	Labor (1)	Equipment (2)	Materials	Total
10	Exploration	$0	$0	$0	$0
11	Exploration Roads & Drill Pads	$0	$0	$0	$0
12	Roads	$0	$0	$0	$0
13	Well Abandonment	$10,471	$13,938	$0	$24,409
14	Pits	$0	$0	N/A	$0
15	Quarries & Borrow Areas	$0	$0	$0	$0
16	Underground Openings	$0	$0	$0	$0
17	Process Ponds	$0	$0	$0	$0
18	Heaps	$0	$0	$0	$0
19	Waste Rock Dumps	$0	$0	$0	$0
20	Landfills	$0	$0	$0	$0
21	Tailings	$0	$0	$0	$0
22	Foundation & Buildings Areas	$0	$0	$0	$0
23	Yards, Etc.	$0	$0	$0	$0
24	Drainage & Sediment Control	$0	$0	$0	$0
25	Generic Material Hauling	$0	$0	$0	$0
26	Other User Costs (from Other User sheet)	$0	$0	$0	$0
27	Other**				$0
28	**Subtotal**	**$10,471**	**$13,938**	**$0**	**$24,409**
29					
30	Mob/Demob if included in Other User sheet	$0	$0	$0	$0
31	Mob/Demob				$0
32	**Subtotal "A"**	**$10,471**	**$13,938**	**$0**	**$24,409**
33					

Inserted 12/2016

STANDARDIZED RECLAMATION COST ESTIMATOR

Version 1.4.1
Build 017a (revised to work with Excel 2013 - 01 Aug 2014)
Approved for use in Nevada, August 1, 2012

COST DATA FILE INFORMATION

File Name:	Emery 2 Mine__SRCE_Version_1_4_1_017_NV.xlsm
Cost Data File:	SRCE_Cost_Data_File_1_12_Std_2015.xlsm
Cost Data Date:	August 1, 2015
Cost Data Basis:	User Data — Data Cost Units: Imperial
Author/Source:	Nevada Division of Environmental Protection (NDEP) & NV BLM

PROJECT INFORMATION

Property/Mine Name:	Emery 2 Mine — Property Code:
Project Name:	Emery 2 Mine Borehole Seal
Date of Submittal:	September 14, 2016 — Average Altitude: 5930 ft.
Select One:	○ Notice or Sm Exploration Plan ○ Lg Exploration Plan ● Mine Operation
Select One:	○ Private Land ● Public or Public/Private
Cost Estimate Type:	Surety
Cost Basis Category:	S. Nevada Notice Level
Cost Basis Description:	Clark, Esmeralda, Lincoln and Nye Counties

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Project Name: Emery 2 Mine Borehole Seal
Project Date: September 14, 2016
Model Version: Version 1.4.1
File Name: Emery 2 Mine__SRCE_Version_1_4_1_017_NV.xlsm
Data Cost File: SRCE_Cost_Data_File_1_12_Std_2015.xlsm
Cost Basis: S. Nevada Notice Level

A. Earthwork/Recontouring	Labor (1)	Equipment (2)	Materials	Total
Exploration	$0	$0	$0	$0
Exploration Roads & Drill Pads	$0	$0	$0	$0
Roads	$0	$0	$0	$0
Well Abandonment	$379	$130	$0	$509
Pits	$0	$0	N/A	$0
Quarries & Borrow Areas	$0	$0	$0	$0
Underground Openings	$0	$0	$0	$0
Process Ponds	$0	$0	$0	$0
Heaps	$0	$0	$0	$0
Waste Rock Dumps	$0	$0	$0	$0
Landfills	$0	$0	$0	$0
Tailings	$0	$0	$0	$0
Foundation & Buildings Areas	$0	$0	$0	$0
Yards, Etc.	$0	$0	$0	$0
Drainage & Sediment Control	$0	$0	$0	$0
Generic Material Hauling	$0	$0	$0	$0
Other User Costs (from Other User sheet)	$0	$0	$0	$0
Other**				$0
Subtotal	**$379**	**$130**	**$0**	**$509**
Mob/Demob if included in Other User sheet	$0	$0	$0	$0
Mob/Demob				$0
Subtotal "A"	**$379**	**$130**	**$0**	**$509**

Inserted 12/2016

Project Name: Emery 2 Mine Borehole Seal - Reclamation Plan
Date of Submittal: September 14, 2016
File Name: Emery 2 Mine__SRCE_Version_1_4_1_017_NV.xlsm
Model Version: Version 1.4.1
Cost Data: User Data
Cost Data File: SRCE_Cost_Data_File_1_12_Std_2015.xlsm
Cost Estimate Type: Surety Cost Basis: S. Nevada Notice Level

Well Abandonment

	Labor	Equipment	Materials	Totals
Production, Dewatering, Infiltration Wells	$379	$130	$0	$509
Monitoring Wells	$0	$0	$0	$0
TOTALS	$379	$130	$0	$509

Add Production Well | Clear Production Wells | Delete Production Well

Add Monitor Well | Clear Monitor Wells | Delete Monitor Well

Color Code Key

User Input - Direct Input	Direct Input
User Input - Pull Down List	Pull Down Selection
Program Constant (can override)	Alternate Input
Program Calculated Value	Locked Cell - Formula or Reference

Well seal thickness: 20 ft
Minimum seal above groundwater table: 50 ft

Production, Dewatering and Infiltration Well Closure

	Description (required)	ID Code	Number of Holes	Casing Diam	Average Depth (1)	Depth to First Water	Original Static Water Level	Top of Slotted Casing (2)	Blank Casing Below Top of Screen (2)	Type of Pump (if any)	Depth to Pump	Hole Plug Method	Casing Volume per ft	Perforation Length (3,4)	Grout Volume per Hole (4,5)	Cement Volume per Hole (6)	Inert Media Volume per Hole (7)	Pump Removal Labor Cost	Pump Removal Equip Cost	Perf Labor Cost	Perf Equip Cost (8)	Grout + Cement Labor Cost (9)	Grout + Cement Equip Cost (9)	Grout + Cement Material Cost	Inert Media Labor Cost (10)	Inert Media Equip Cost (9)	Total Cost
				in	ft bgs	ft bgs	ft bgs	ft bgs	ft	(select)	ft bgs	(select)	cf	ft	cy	cy	cy	$	$	$	$	$	$	$	$	$	$
1	Dewatering Borehole		1	4.0	150	0	0	0	0		150	Cement	0.090			0.10	0.43	$0	$0	$0	$0	$0	$0	$0	$379	$130	$509
2																		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3																		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
																		$0	$0	$0	$0	$0	$0	$0	$379	$130	$509

(1) For previously abandoned holes enter "0" for depth
(2) Wells abandoned per Nevada Administrative Code (NAC 534.420). Hole grouted and perforated from bottom to 50 feet (15.24m) above the top of the screen, or first water encountered or original static water level, depending on vertical hydraulic gradient and well construction parameters. Inert media (cuttings or alluvium) used from top of grout to top seal.
(3) Perforation length = amount of blank casing below first water (for confined aquifers) or predicted recovered water table (unconfined aquifers) + 50 feet (15.24m) of blank casing above water table
(4) Assumes 50' (15.24m) sanitary seal at top of hole. Therefore, perforation and grouting only required to bottom of sanitary seal.
(5) Assumes 100% loss to formation for grout (abandonite) for screened and perforated sections.
(6) Assumes 20' (6m) top seal of cement in casing only. See note 4.
(7) Inert material is cuttings or alluvium sourced locally.
(8) Includes perforation tool wear cost/ft of perforation (see Productivty Sheet).
(9) See Productivity Sheet for hourly production. Minimum 1 hr per hole + fixed hours per hole for move and setup. If no perforation required, use standard drill rig.
(10) See Productivity Sheet for hourly production. Minimum 1 hr per hole.

Notes:

Inserted 12/2016

The following documents the Emery County Landfill fees used to calculate construction debris disposal costs in Demo bond calculations, Chapter IV, Part IV.B.

RESOLUTION NO. 12-15-15F

A RESOLUTION SETTING A TIPPAGE FEE FOR MATERIALS BROUGHT TO THE EMERY COUNTY LANDFILL

WHEREAS, the Emery County Commission finds it necessary to set a tippage fee for materials brought to the Emery County Landfill, and,

WHEREAS, Emery County Resolution No. 02-24-09 setting a tippage fee at the Emery County Landfill is difficult to regulate:

WHEREAS, the Emery County Commission held a public hearing to receive input from the citizens of Emery County on December 17, 2013 regarding landfill tippage fees; and

WHEREAS, public notice of the hearing was published according to law.

NOW, THEREFORE, BE IT RESOLVED by the Emery County Commission as follows:

1. Effective March 1, 2016, all loads in excess of 1,000 pounds, crossing the scales at the Emery County Landfill will be charged a fee of $10.00 per ton. Contaminated Soil will be charged a fee of $15.00 per ton. There will be no fee for the Emery County Cities and Towns roll-offs/container. See attached Exhibit

2. This fee may be waived ONLY by consent of the Emery County Commission in a regularly scheduled commission meeting if a hardship can be shown by those requesting such waiver.

3. Emery County Resolution No. 02-24-09 is hereby revoked in its entirety upon signing of this resolution.

DATED this 15th day of December, 2015.

Ethan Miglori, Chairman
Emery County Commission

ATTEST:

Brenda Tuttle, Emery County Clerk/Auditor

Inserted 12/2016

EXHIBIT

EMERY COUNTY LANDFILL TIPPAGE FEES

All loads crossing the scale 1,000 lbs. and under	No Charge
All load crossing the scale 1,00l lbs. and over	$10.00/ton
Contaminated soil	$15.00/ton
City/Town roll offs	No Charge

Effective date: March 1, 2016

Inserted 12/2016

A conversion rate of 0.24 tons/cubic yard is used to calculate tons of debris from known volumes.

Converting C&D Debris from Volume to Weight
A Fact Sheet for C&D Debris Facility Operators

Background: Florida regulations require that permitted C&D facilities in the State report to the Florida Department of Environmental Protection (FDEP), by April 1 of each year, the amounts and types of wastes managed during the previous year. This requirement for C&D facilities was developed, as with the certification of recyclers program, to help determine if Counties over a population of 75,000 will meet the 30 percent waste reduction goal set forth in the law.

Problem: The FDEP tracks the amount of waste managed by weight (in tons). Many C&D facilities do not have scales though and only measure their waste by volume (in cubic yards).

Solution: A simple equation can be used to convert the volume of C&D debris (in cubic yards or yd^3) to weight (in tons):

$$\textit{Weight of C\&D Debris} = \textit{Volume of C\&D Debris} \times 0.24\ tons/yd^3$$

Example Calculation:

A C&D disposal facility receives 100,000 cubic yards of C&D debris in one year. The number of tons of C&D debris is calculated as follows:

Weight of C&D Debris = 100,000 yd^3 **X** 0.24 tons/yd^3 of C&D

Weight of C&D Debris = 24,000 tons

How was the conversion factor calculated?

The conversion factor, or average bulk density, was calculated by measuring the actual weights of loads of mixed C&D from facilities in Florida and comparing those weights to the volumes of the loads. Specifically, researchers at the University of Florida measured the weights, in tons, of 171 different loads of C&D debris at 10 facilities in the State and recorded the volume, in cubic yards, of each truck or container weighed. The conversion factor was then calculated by dividing the total weight by the total volume. For mixed C&D loads in Florida, the average bulk density was measured to be 484 pounds per cubic yard or approximately 0.24 tons of C&D per cubic yard. The graph on the back shows the distribution of C&D bulk densities that were measured by the researchers.

Inserted 12/2016

Map Ref.	Description	Cost
1	Tipple Stacker-Reclaim System 01	$ 26,725
3	Tipple Control Station 03	$ 314
4	Surface Storage Tank Containment Area 04	$ 1,429
6	Foreman's Bath House 06	$ 5,052
11	Warehouse/Office Building 11	$ 61,964
12	Bathhouses 12	$ 12,015
16	Tipple Transformer Building 16	$ 651
19	Foreman's/Shift Change Office 19	$ 1,922
20	Mine Fan Building 20	$ 5,123
23	Steam Cleaner Building 23	$ 464
27	Supply Yards 27	$ 1,604
28A	Truck Scale 28A	$ 3,751
33	Bridge On Quitchupah Creek 33	$ 1,837
37	Mine Rescue Storage Area 37	$ 2,107
41	Training Site Pad 41	$ 557
42	Existing Mine Substation 42	$ 3,506
43	Borehole Pump Facility 43	$ 24,699
44	Sewage Pumping Station 44	$ 384
45	Transformer Storage Pad 45	$ 512
46	Power Line 46	$ 3,739
4E01	Crusher/Screen Building 4E01	$ 1,808
4E05	Radial Stacker 4E05	$ 1,232
4E10	Sediment Basin #9_4E10	$ 493
4E13	Rock Dust Bin 4E13	$ 111
4E15	Truck Scale 4E14 & Truck Loadout 4E15	$ 7,870
4E16	Coal Feed Hopper_4E16	$ 1,604
4E17	Beltline Transfer Point_4E17	$ 1,069
4E18	Powerline_4E18	$ 5,299
4E19	Water Tank_4E19	$ 5,359
4E20	VentilationFan_4E20	$ 9,227
4E22	Corrugated Metal Pipe Culvert_4E22	$ 302
4E23	Corrugated Metal Pipe Culvert_4E23	$ 173
4E25	CattleGuard_4E25	$ 247
4E28	Oil Storage Building_4E28	$ 3,083
4E29	RecessedFeeder_4E29	$ 87
4E32	Wind Fence 4E32	$ 2,641
4E33	Perimeter Fence_4E33	$ 8,673
4E34	Substation Pad & Compressor Shed_4E34	$ 3,414
e1	e2 Mine Substation e1	$ 5,250
e2	e2 Conveyor6-Truck Loadout_e2	$ 4,449
e3	e2 Screening&CrushFacility_e3	$ 16,073
e4	e2 Conveyor 5_e4	$ 30,163
e5	e2 Reclaim Tunnel_e5	$ 34,875
e6	e2 Conveyor4-Radial Stacker_e6	$ 1,243
e7p1	e2 Conveyor2 P1_e7p1	$ 19,079
e7p2	e2 Conveyor2 P2_e7p2	$ 26,254
e8	e2 Conveyor1_e8	$ 18,661
e9	e2 SealPortals_e9	$ 34,900
e10	e2 Culvert_e10	$ 7,456
e11	e2 Culvert_e11	$ 7,081
e12	e2_WaterTank_e12	$ 3,723
e13	e2_VentFan_e13	$ 51,263
e14	e2_Powerline_e14	$ 3,862
	Total	$ 475,379

Work Description	Materials	Means Reference Number	Unit Cost	Unit	Comments
Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	Footnote 2
Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	Footnote 2
Dismantling Cost	Mechanical equipment heavy	23 05 05 10 3600	$ 539.81	/ton	Footnote 1
Dismantling Cost	Powerpole	02 41 13 80 0100	$ 184.64	EA	Footnote 1
Dismantling Cost	Wire Removal	26 05 05 10 1900	$ 14.95	CLF	Footnote 1
Demolition Cost	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%	Footnote 1
Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	Footnote 1
Structure's Demolition Cost	Wood Bldg Small	02 41 16 13 0700	$ 0.28	/CF	Footnote 1
Structure's Demolition Cost	Plug Well	Nevada Mine Cost Estimate	$ 8,200.00	EA.	Footnote 3
Structure's Demolition Cost	Plug Small Borehole	Nevada Mine Cost Estimate	$ 509.00	EA.	Footnote 3
Structure's Demolition Cost	Reclaim Tunnel Demolition	02 41 13 40 0200	$ 31.20	LF	Footnote 1
Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY	Footnote 1
Culvert Removal	CMP - 12-inch	02 41 13 40 0150	$ 1.69	/LF	Footnote 1
Culvert Removal	Plasic Pipe - 30-inch	02 41 13 38 1900	$ 6.20	/LF	Footnote 1
Culvert Removal Excavate & Backfill	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	Footnote 1
Tunnel Removal Excavate & Backfill	Machine Excavation 1.5 CY	31 23 16 42 0250	$ 1.62	/BCY	Footnote 1
Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY	Footnote 1
Transportation Cost Non Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	$ 690.80	/day	Footnote 4
Disposal Costs	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY	Footnote 3
Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY	Footnote 1
Pipe Removal	PVC Pipe 18 inch	33 31 13 25 2300	21.68	LF	Footnote 1
Fill to Grade	Backfill structural 200 HP 300' Dirt	31 23 23 14 5420	$ 1.70	/CY	Footnote 1
Supply Yard Fence	Chain link remove 8'-10'	02 41 13 60 1700	$ 2.79	/LF	Footnote 1
Silt Fence	Silt fence	31 25 14 16 1000	$ 1.07	LF	Footnote 1
Seal 3 Portals	Seal Portals	Confidential Bid	$ 34,900.00	EA.	Footnote 2
Seal Shafts	Seal Shaft	Confidential Invoice	$ 40,000.00	EA.	Footnote 2
		Look Up Table Limits			

1) Using Bare Labor + Equipment rates from RS Means, 2nd Qtr. 2016, See Chapter IV, Part IV
2) Confidential Bid, see Chapter IV, Appendix IV-11
3) See Chapter IV, Part IV

Ref. ORIG:	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Tipple Stacker Reclaim 01																			
	Tipple Stacker-Reclaim System 01																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						996					CY		26892	CF	$ 4,894
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						697					CY		18824	CF	
	Rubble's Weight (exclude steel)															Ton/CY		0		
	Truck's Capacity															Ton				
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,531
	Steel's Weight															Ton/CY		0	Ton/CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 7,425
	Equipment 's Disposal Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	754	5	3			419							11310	CF	$ 2,941
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						293					CY		7917	CF	
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DAY	
	Transport Costs	Truck dump 16 ton payload	01 54 33 20 5300	$ 690.80	/day											TON		0	TON	
	Disposal Costs	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,064
	Subtotal																			$ 4,005
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						305					CY		305	CY	$ 3,050
	Concrete's Vol. Demolished																1.3	397	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													397	CY	$ 623
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													397	CY	$ 1,139
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													397	CY	$ 3,347
	Subtotal																			$ 8,159
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						150					CY		150	CY	$ 1,500
	Concrete's Vol. Demolished																1.3	195	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													195	CY	$ 306
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													195	CY	$ 560
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													195	CY	$ 1,644
	Subtotal																			$ 4,010
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						117					CY		117	CY	$ 1,170
	Concrete's Vol. Demolished																1.3	152	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													152	CY	$ 239
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													152	CY	$ 436
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													152	CY	$ 1,281
	Subtotal																			$ 3,126
	Total																			$ 26,725

Ref. ORIG:	Description Tipple Control Station 02	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Tipple Control Station 03																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						23					CY		621	CF	$ 113
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						16					CY		435	CF	
	Rubble's Weight (exclude steel)												1.4			TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY											CY				$ 58
	Steel's Weight																	0	0	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 171
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						5.25					CY		5.25	CY	$ 53
	Concrete's Vol. Demolished																1.3	7	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													7	CY	$ 11
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													7	CY	$ 20
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													7	CY	$ 59
	Subtotal																			$ 143
	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																			$ 314

Ref. ORIG:	Description Storage Tank Containment Area 21	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Surface Storage Tank Containment Area 04																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						106					CY		2862	CF	$ 521
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30%	%						74					CY		2003	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63																$ 269
	Steel's Weight															TON				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 790
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						24					CY		24	CY	$ 240
	Concrete's Vol. Demolished																1.3	31	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													31	CY	$ 49
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													31	CY	$ 89
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													31	CY	$ 261
	Subtotal																			$ 639
	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																			$ 1,429

Ref. ORIG:	Description No Spreadsheet	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Foreman's Bath House 06																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	48.375	24	9			387.0					CY		10449	CF	$ 2,717
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	0%	%						387					CY		10449	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63																$ 1,405
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 4,122
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Light Floor's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	48	28	0.33			16.4					CY		16.4	CY	$ 164
	Concrete's Vol. Demolished																1.3	21	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													21	CY	$ 33
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													21	CY	$ 60
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													21	CY	$ 177
	Subtotal																			$ 434
	Heavy Wall's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	2.5	1.4	144			18.7					CY		18.7	CY	$ 187
	Concrete's Vol. Demolished																1.3	24	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													24	CY	$ 38
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													24	CY	$ 69
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													24	CY	$ 202
	Subtotal																			$ 496
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 5,052

Ref. ORIG:	Description Warehouse Office Bld 10	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Warehouse/Office Building 11																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	120	60	20			5333					CY		144000	CF	$ 37,440
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	0.00%	%						5333					CY		144000	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck													0		HR			Day	
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 19,360
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck													0		HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 56,800
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Light Floor's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	120	60	0.5			133.3					CY		133.3	CY	$ 1,333
	Concrete's Vol. Demolished																1.3	173	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													173	CY	$ 272
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													173	CY	$ 497
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													173	CY	$ 1,458
	Subtotal																			$ 3,560
	Heavy Wall's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	360	1.5	3			60					CY		60	CY	$ 600
	Concrete's Vol. Demolished																1.3	78	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													78	CY	$ 122
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													78	CY	$ 224
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													78	CY	$ 658
	Subtotal																			$ 1,604
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 61,964

Ref. ORIG:	Description Bathhouse 6 Trailers 13	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Bathhouses 12																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	50	12	10			222				5	CF		30000	CF	$ 7,800
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	0.00%	%						222					CY		30000	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 4,033
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 11,833
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	60	9	0.33			6.6				1	CY		7	CY	$ 66
	Concrete's Vol. Demolished																1.3	9		
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													9	CY	$ 14
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													9	CY	$ 26
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													9	CY	$ 76
	Subtotal																			$ 182
	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																			$ 12,015

Ref. ORIG:	Description Tipple Transformer Bld 03	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Tipple Transformer Building 16																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	20	10	8			59.3					CY		1600	CF	$ 291
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						41					CY		1120	CF	
	Rubble's Weight (exclude steel)												1.4			TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																		TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 151
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 442
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						8					CY		8	CY	$ 80
	Concrete's Vol. Demolished																1.3	10	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													10	CY	$ 16
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													10	CY	$ 29
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													10	CY	$ 84
	Subtotal																			$ 209
	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																			$ 651

Ref. ORIG:	Description Foreman Office Trailer 09	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Foreman's/Shift Change Office 19																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	58	12	10			258					CY		6960	CF	$ 1,267
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						180					CY		4872	CF	
	Rubble's Weight (exclude steel)															TON/CY			TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR			Day	
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 655
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 1,922
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,922

Ref. ORIG:	Description Mine Fan Bld 08	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Fan Building 20																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						525					CY		14175	CF	$ 2,580
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						368					CY		9923	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,334
	Steel's Weight															TON				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 3,914
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						45					CY		45	CY	$ 450
	Concrete's Vol. Demolished																1.3	59	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													59	CY	$ 93
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													59	CY	$ 169
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													59	CY	$ 497
	Subtotal																			$ 1,209
	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																			$ 5,123

Ref. ORIG:	Description Steam Cleaner Bld 04	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Steam Cleaner Building 23																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	8	10	10			29.6					CY		800	CF	$ 146
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						21					CY		560	CF	
	Rubble's Weight (exclude steel)															TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																		TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 75
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 221
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	8	10	3			8.9					CY		8.9	CY	$ 89
	Concrete's Vol. Demolished																1.3	12	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													12	CY	$ 19
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													12	CY	$ 34
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													12	CY	$ 101
	Subtotal																			$ 243
	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																			$ 464

Ref. ORIG:	Description Fence 26	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Supply Yards 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																			
	Silt Fence Disposal Cost																			
	Silt Fence																			
	Supply Yard Fence	Chain link remove 8'-10'	02 41 13 60 1700	$ 2.79	/LF	575										FT		575	FT	$ 1,604
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 1,604
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 1,604

Ref. ORIG:	Description Truck Scale New 15	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Truck Scale 28A																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	8	6	8			14.2					CY		384	CF	$ 70
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						10					CY		269	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 36
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 106
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	130	12	0.67			38.5					CY		38.5	CY	$ 385
	Concrete's Vol. Demolished																1.3	50	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													50	CY	$ 79
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													50	CY	$ 144
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													50	CY	$ 422
	Subtotal																			$ 1,030
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	12	12	0.33			1.8					CY		1.8	CY	$ 18
	Concrete's Vol. Demolished																1.3	2	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													2	CY	$ 3
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													2	CY	$ 6
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													2	CY	$ 17
	Subtotal																			$ 44
	Footer's Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						70					CY		70.0	CY	$ 1,400
	Footer's Vol. Demolished																1.3	91	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													91	CY	$ 143
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													91	CY	$ 261
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													91	CY	$ 767
	Subtotal																			$ 2,571
	Total																			$ 3,751

Ref. ORIG:	Description Bridge Quitchupah Creek 16	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Bridge On Quitchupah Creek 33																			
	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 Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						50					CY		50	CY	$ 1,000
	Concrete's Vol. Demolished																1.3	65	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													65	CY	$ 102
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													65	CY	$ 187
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													65	CY	$ 548
	Subtotal																			$ 1,837
	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																			$ 1,837

Ref. ORIG:	Description No Spreadsheet	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Rescue Storage Area 37																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	24	20	12			213					CY		5760	CF	$ 1,048
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						149					CY		4032	CF	
	Rubble's Weight (exclude steel)															TON/CY		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																	0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 542
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 1,590
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Light Floor's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	24	18	0.5			8.0					CY		8.0	CY	$ 80
	Concrete's Vol. Demolished																1.3	10	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													10	CY	$ 16
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													10	CY	$ 29
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													10	CY	$ 84
	Subtotal																			$ 209
	Heavy Wall's																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	64	1.5	2.33			8.3					CY		8.3	CY	$ 166
	Concrete's Vol. Demolished																1.3	11	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													11	CY	$ 17
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													11	CY	$ 32
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													11	CY	$ 93
	Subtotal																			$ 308
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 2,107

Ref. ORIG:	Description Rescue Training Pad 47	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Training Site Pad 41																			
	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 Demolition-Floor	Confidential Bid	$ 10.00	/CY	37	47	0.33								ft		21	CY	$ 210
	Concrete's Vol. Demolished																1.3	27	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													27	CY	$ 42
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													27	CY	$ 77
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													27	CY	$ 228
	Subtotal																			$ 557
	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																			$ 557

Ref. ORIG:	Description Mine Substation 06	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Existing Mine Substation 42																			
	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																			
	Remove Substation																			
	Equipment 's Disposal Cost																			
	Dismantling Cost	Mechanical equipment heavy	23 05 05 10 3600	$ 539.81	/ton							2			3	TON		6	TON	$ 3,239
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 3,239
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						10					CY		10	CY	$ 100
	Footer's Vol. Demolished																1.3	13	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													13	CY	$ 20
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													13	CY	$ 37
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													13	CY	$ 110
	Subtotal																			$ 267
	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																			$ 3,506

Ref. ORIG:	Description Borehole Pump Facility 18	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Borehole Pump Facility 43																			
	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	Plug Well	Nevada Mine Cost E	$ 8,200	EA.										3	EA		3	EA	$ 24,600
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 24,600
	Footer's Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						3.5					CY		3.5	CY	$ 35
	Footer's Vol. Demolished																1.3	5	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													5	CY	$ 8
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													5	CY	$ 14
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													5	CY	$ 42
	Subtotal																			$ 99
	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																			$ 24,699

Ref. ORIG:	Description Sewage Pumping Station 17	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Sewage Pumping Station 44																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	8	8	9			21.3					CY		576	CF	$ 105
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						15					CY		403	CF	
	Rubble's Weight (exclude steel)															TON/CY				
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck															HR				
	Transportation Cost Non Steel Drive																		TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 54
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 159
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	8	8	3.5			8.3					CY		8.3	CY	$ 83
	Concrete's Vol. Demolished																1.3	11	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													11	CY	$ 17
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													11	CY	$ 32
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													11	CY	$ 93
	Subtotal																			$ 225
	Wall's 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																			$ 384

Ref. ORIG:	Description Transformer Storage Pad 05	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Transformer Storage Pad 45																			
	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 Demolition-Floor	Confidential Bid	$ 10.00	/CY	32	32	0.5			19.0					CY		18.96296	CY	$ 190
	Concrete's Vol. Demolished																1.3	25	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													25	CY	$ 39
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													25	CY	$ 72
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													25	CY	$ 211
	Subtotal																			$ 512
	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																			$ 512

Ref. ORIG:	Description Power Line 19	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Power Line 46																			
	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	Powerpole	02 41 13 80 0100	$ 184.64	EA										17	EA		17	EA	$ 3,139
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 3,139
	Equipment 's Disposal Cost	Wire Removal	26 05 05 10 1900	$ 14.95	CLF	4012										feet		40.12	CLF	$ 600
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 600
	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																			$ 3,739

Ref. ORIG:	Description Crusher Screen Building 28	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
28	Crusher/Screen Building 4E01																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	10	12	10			44.4					CY		1200	CF	$ 218
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						31					CY		840	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	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 113
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 331
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						55					CY		55	CY	$ 550
	Concrete's Vol. Demolished																1.3	72	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													72	CY	$ 113
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													72	CY	$ 207
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													72	CY	$ 607
	Subtotal																			$ 1,477
	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																			$ 1,808

Ref. ORIG:	Description Radial Stacker 30	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Radial Stacker 4E05																			
	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 Demolition-Floor	Confidential Bid	$ 10.00	/CY						46					CY		46	CY	$ 460
	Concrete's Vol. Demolished																1.3	60	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													60	CY	$ 94
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													60	CY	$ 172
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													60	CY	$ 506
	Subtotal																			$ 1,232
	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																			$ 1,232

Ref. ORIG:	Description NPDES Outfalls 24	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Sediment Basin #9_4E10																			
	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	PVC Pipe 18 inch	33 31 13 25 2300	$ 21.68	/LF	20												20	LF	$ 434
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 434
	Footer's Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						2					CY		2	CY	$ 20
	Footer's Vol. Demolished																1.3	3	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													3	CY	$ 5
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													3	CY	$ 9
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													3	CY	$ 25
	Subtotal																			$ 59
	Wall's Demolition																			
	Demolition Cost																			
	Wall'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																			$ 493

Ref. ORIG:	Description Rock Dust Bin 32	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Rock Dust Bin 4E13																			
	Structure's Demolition Cost															CF		0	CF	$ -
	Structure's Vol. Demolished																	0	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															HR		0	Day	$ -
	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 Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						3					CY		3	CY	$ 60
	Concrete's Vol. Demolished																1.3	4	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													4	CY	$ 6
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													4	CY	$ 11
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													4	CY	$ 34
	Subtotal																			$ 111
	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																			$ 111

Ref. ORIG:	Description Loadout 35	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Truck Scale 4E14 & Truck Loadout 4E15																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						23660					CF		23660	CF	$ 4,306
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						613					CY		16562	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	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,227
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 6,533
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						50					CY		50	CY	$ 500
	Concrete's Vol. Demolished																1.3	65	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													65	CY	$ 102
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													65	CY	$ 187
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													65	CY	$ 548
	Subtotal																			$ 1,337
	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																			$ 7,870

Ref. ORIG:	Description Concrete Barriers 40	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Coal Feed Hopper_4E16																			
	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 Demolition-Floor	Confidential Bid	$ 10.00	/CY						60.0					CY		60.0	CY	$ 600
	Concrete's Vol. Demolished																1.3	78	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													78	CY	$ 122
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													78	CY	$ 224
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													78	CY	$ 658
	Subtotal																			$ 1,604
	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																			$ 1,604

Ref. ORIG:	Description No Spreadsheet	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Beltline Transfer Point_4E17																			
	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 Demolition-Floor	Confidential Bid	$ 10.00	/CY	10	8	1.5			4.4				9	CY		40.0	CY	$ 400
	Concrete's Vol. Demolished																1.3	52	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													52	CY	$ 82
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													52	CY	$ 149
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													52	CY	$ 438
	Subtotal																			$ 1,069
	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																			$ 1,069

Ref. ORIG:	Description Powerline 36	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Powerline_4E18																			
	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	Powerpole	02 41 13 80 0100	$ 184.64	EA										27	EA		27	EA	$ 4,985
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 4,985
	Equipment 's Disposal Cost																			
	Dismantling Cost	Wire Removal	26 05 05 10 1900	$ 14.95	CLF	2132										LF		21	CLF	$ 314
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 314
	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																			$ 5,299

Ref. ORIG:	Description Water Tank 31	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Water Tank_4E19																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						17177					CF		17177	CF	$ 3,126
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						445							12024	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,617
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 4,743
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						23					CY		23	CY	$ 230
	Concrete's Vol. Demolished																1.3	30	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													30	CY	$ 47
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													30	CY	$ 86
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													30	CY	$ 253
	Subtotal																			$ 616
	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																			$ 5,359

Ref. ORIG:	Description Ventilation Fan 33	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	VentilationFan_4E20																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						29167					CF		29167	CF	$ 5,308
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						756							20417	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	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,745
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 8,053
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						44					CY		44	CY	$ 440
	Concrete's Vol. Demolished																1.3	57	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													57	CY	$ 89
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													57	CY	$ 164
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													57	CY	$ 481
	Subtotal																			$ 1,174
	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																			$ 9,227

Ref. ORIG:	Description Corrugated Metal Pipe Culvert_4E22	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Corrugated Metal Pipe Culvert_4E22																			
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	63	3	2			14					BCY		14	BCY	$ 196
	Structure's Vol. Demolished																	0	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																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 196
	Equipment 's Disposal Cost	CMP - 12-inch	02 41 13 40 0150	$ 1.69	/LF	63										LF		63	LF	$ 106
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 106
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 302

Ref. ORIG:	Description Corrugated Metal Pipe Culvert_4E23	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Corrugated Metal Pipe Culvert_4E23																			
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	36	3	2			8					BCY		8	BCY	$ 112
	Structure's Vol. Demolished																	0	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																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 112
	Equipment 's Disposal Cost	CMP - 12-inch	02 41 13 40 0150	$ 1.69	/LF	36										LF		36	LF	$ 61
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 61
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 173

Ref. ORIG:	Description Cattle Guard 39	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	CattleGuard_4E25																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						96					CF		96	CF	$ 17
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						67					CF		2.00	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	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 7
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 24
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						6					CY		6	CY	$ 120
	Concrete's Vol. Demolished																1.3	8	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													8	CY	$ 13
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													8	CY	$ 23
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													8	CY	$ 67
	Subtotal																			$ 223
	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																			$ 247

Ref. ORIG:	Description Oil Storage Building 42	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Oil Storage Building_4E28																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	60	18	8			320					CY		8640	CF	$ 1,572
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						224					CY		6048	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 813
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 2,385
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	60	18	0.66								CY		26	CY	$ 260
	Concrete's Vol. Demolished																1.3	34	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													34	CY	$ 53
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													34	CY	$ 98
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													34	CY	$ 287
	Subtotal																			$ 698
	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																			$ 3,083

Ref. ORIG:	Description Recessed Feeder 43	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	RecessedFeeder_4E29																			
	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 Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	8	1	8			2.4					CY		2.4	CY	$ 48
	Concrete's Vol. Demolished																1.3	3	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													3	CY	$ 5
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													3	CY	$ 9
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													3	CY	$ 25
	Subtotal																			$ 87
	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																			$ 87

Ref. ORIG:	Description Wind Fence 38	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Wind Fence 4E32																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						48					CY		1300	CF	$ 237
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						34					CY		910	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	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 122
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 359
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						62					CY		62	CY	$ 1,240
	Concrete's Vol. Demolished																1.3	81	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													81	CY	$ 127
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													81	CY	$ 232
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													81	CY	$ 683
	Subtotal																			$ 2,282
	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																			$ 2,641

Ref. ORIG:	Description Task2929 Forth East Fence 45	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Perimeter Fence_4E33																			
	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	Chain link remove 8'-10'	02 41 13 60 1700	$ 2.79	/LF	3068										FT		3068	FT	$ 8,560
	Dismantling Cost																			
	Equipment 's Vol. Demolished												100			FT/CY				
	Loading Costs																			
	Transport Costs																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY						31					CY		31	CY	$ 113
	Subtotal																			$ 8,673
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 8,673

Ref. ORIG:	Description Task3103 Substation concrete and compressor shed 48	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Substation Pad & Compressor Shed_4E34																			
	Structure's Demolition Cost	Wood Bldg Small	02 41 16 13 0700	$ 0.28	/CF	12	16	8			57					CY		1536	CF	$ 430
	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	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 207
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 637
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						104					CY		104	CY	$ 1,040
	Concrete's Vol. Demolished																1.3	135	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													135	CY	$ 212
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													135	CY	$ 387
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													135	CY	$ 1,138
	Subtotal																			$ 2,777
	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																			$ 3,414

Ref.	Description **e2 Mine Substation e1**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	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	Mechanical equipment heavy	23 05 05 10 3600	$ 539.81	/ton							2			3	TON		6	TON	$ 3,239
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 3,239
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						75					CY		75	CY	$ 750
	Concrete's Vol. Demolished																1.3	98	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													98	CY	$ 154
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													98	CY	$ 281
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													98	CY	$ 826
	Subtotal																			$ 2,011
	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																			$ 5,250

Ref.	Description **e2 Conveyor6-Truck Loadout_e2**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	217	6	9			434.0					CY		11718	CF	$ 2,133
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						304							8203	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,103
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 3,236
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																		DY	
	Transport Costs																	0	0	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Pier C6-1																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	16	12	3			21					CY		21	CY	$ 420
	Concrete's Vol. Demolished																1.3	27	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													27	CY	$ 42
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													27	CY	$ 77
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													27	CY	$ 228
	Subtotal																			$ 767
	Pier C6-2																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	12	9	3			12					CY		12	CY	$ 240
	Concrete's Vol. Demolished																1.3	16	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													16	CY	$ 25
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													16	CY	$ 46
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													16	CY	$ 135
	Subtotal																			$ 446
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Total																			$ 4,449

Ref.	Description **e2 Screening&CrushFacility_e3**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	40	20	55			1629.6					CY		44000	CF	$ 8,008
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1141							30800		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 4,141
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 12,149
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																		DY	
	Transport Costs																	0	0	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Pad																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	46	26	3			133					CY		133	CY	$ 1,330
	Concrete's Vol. Demolished																1.3	173	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													173	CY	$ 272
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													173	CY	$ 497
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													173	CY	$ 1,458
	Subtotal																			$ 3,557
	Piers - 10																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	3	3	3			10					CY		10	CY	$ 200
	Concrete's Vol. Demolished																1.3	13	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													13	CY	$ 20
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													13	CY	$ 37
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													13	CY	$ 110
	Subtotal																			$ 367
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Total																			$ 16,073

Ref.	Description **e2 Conveyor 5_e4**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Elevated Belt																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	420	14	12			2613.3					CY		70560	CF	$ 12,842
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1829							49392		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 6,640
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 19,482
	On-grade Belt																			
	Equipment 's Disposal Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	213	6	5			236.7					CY		6390	CF	$ 1,163
	Dismantling Cost	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						166							4473		
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ 1,163
	Pier C5-1																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	20	20	3			53					CY		53	CY	$ 1,060
	Concrete's Vol. Demolished							4.5	8								1.3	69	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													69	CY	$ 108
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													69	CY	$ 198
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													69	CY	$ 582
	Subtotal																			$ 1,948
	Piers C5-2, 5-3																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	35	19	3			174					CY		174	CY	$ 3,480
	Concrete's Vol. Demolished							4.5	10								1.3	226	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													226	CY	$ 355
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													226	CY	$ 649
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													226	CY	$ 1,905
	Subtotal																			$ 6,389
	Pier C5-4																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY						32					CY		32	CY	$ 640
	Concrete's Vol. Demolished																1.3	42	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													42	CY	$ 66
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													42	CY	$ 121
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													42	CY	$ 354
	Subtotal																			$ 1,181
	Total																			$ 30,163

Ref.	Description **e2 Reclaim Tunnel_e5**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Reclaim Tunnel Demolition	02 41 13 40 0200	$ 31.20	LF	440			12		1842.1					LF		440	LF	$ 13,728
	Structure's Vol. Demolished	Reduction in Volume	Estimate	10%	%						184					CY		4974	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 669
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 14,397
	Tunnel																			
	Equipment 's Disposal Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						0.0							0	CF	$ -
	Dismantling Cost	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						0									
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	320				19	225					CY		225	CY	$ 2,250
	Concrete's Vol. Demolished																1.3	293	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													293	CY	$ 460
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													293	CY	$ 841
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													293	CY	$ 2,470
	Subtotal																			$ 6,021
	Tunnel Cover Excavation																			
	Main Tunnel Excavation Cost	Machine Excavation 1.5 CY	31 23 16 42 0250	$ 1.62	/BCY	320				666	7893					CY		7893	CY	$ 12,787
	Escape Tunnel Excavation Cost	Machine Excavation 1.5 CY	31 23 16 42 0250	$ 1.62	/BCY	120				232	1031					CY		1031	CY	$ 1,670
	Loading Cost																		CY	$ -
	Transportation Cost																		CY	$ -
	Disposal Costs																		CY	$ -
	Subtotal																			$ 14,457
	Concrete Demolition																			
	Demolition Cost															CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost																	0	CY	$ -
	Transportation Cost																	0	CY	$ -
	Disposal Costs																	0	CY	$ -
	Subtotal																			$ -
	Total																			$ 34,875

Ref.	Description **e2 Conveyor4-Radial Stacker_e6**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	150	6	5			166.7					CY		4500	CF	$ 819
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						117							3150		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 424
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 1,243
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Travel Pad																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																1.3	0	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													0	CY	$ -
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													0	CY	$ -
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													0	CY	$ -
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost				/CY											CY		0	CY	$ -
	Concrete's Vol. Demolished																	0	CY	
	Loading Cost				/CY													0	CY	$ -
	Transportation Cost				/CY													0	CY	$ -
	Disposal Costs				/CF													0	CY	$ -
	Subtotal																			$ -
	Total																			$ 1,243

Ref.	Description **e2 Conveyor2 P1_e7p1**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	260	13	12			1502.2					CY		40560	CF	$ 7,382
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1052							28392		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 3,817
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 11,199
	Equipment 's Disposal Cost																	0	CF	$ -
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Costs																			
	Subtotal																			$ -
	Pier C2-3																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	36	20	3			93					CY		93	CY	$ 1,860
	Concrete's Vol. Demolished							4.5	10								1.3	121	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													121	CY	$ 190
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													121	CY	$ 347
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													121	CY	$ 1,020
	Subtotal																			$ 3,417
	Pier C2-4																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	36	20	3			93					CY		93	CY	$ 1,860
	Concrete's Vol. Demolished							4.5	10								1.3	121	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													121	CY	$ 190
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													121	CY	$ 347
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													121	CY	$ 1,020
	Subtotal																			$ 3,417
	Drop Chute Pad																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY	22	16	3			39					CY		39	CY	$ 390
	Concrete's Vol. Demolished																1.3	51	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													51	CY	$ 80
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													51	CY	$ 146
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													51	CY	$ 430
	Subtotal																			$ 1,046
	Total																			$ 19,079

Ref.	Description **e2 Conveyor2 P2_e7p2**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	13+80 to 10+15																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	365	13	12			2109					CY		56940	CF	$ 10,363
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						1476							39858		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 5,359
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 15,722
	10+15 to 7+00																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	315	6	5			350					CY		9450	CF	$ 1,720
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						245							6615		
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 889
	Subtotal																			$ 2,609
	Bent C2-2 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost - Pad	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	34	18	3			68					CY		81	CY	$ 1,622
	Concrete's Vol. Demolished							4.5	10		13						1.3	105	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													105	CY	$ 165
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													105	CY	$ 301
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													105	CY	$ 885
	Subtotal																			$ 2,973
	Bent C2-1 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	36	20	3			80					CY		93	CY	$ 1,862
	Concrete's Vol. Demolished							4.5	10		13						1.3	121	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													121	CY	$ 190
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													121	CY	$ 347
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													121	CY	$ 1,020
	Subtotal																			$ 3,419
	Conv 1 - Conv 2 Transition																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	23.5	16	3			42					CY		42	CY	$ 836
	Concrete's Vol. Demolished																1.3	54	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													54	CY	$ 85
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													54	CY	$ 155
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													54	CY	$ 455
	Subtotal																			$ 1,531
	Total																			$ 26,254

Ref.	Description **e2 Conveyor1_e8**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	4+85 to 7+00																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	215	13	12			1242					CY		33540	CF	$ 6,104
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						870							23478		
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 3,156
	Steel's Weight															TON		0	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck															HR				
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 9,260
	0+00 to 4+85																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF	485	6	5			539					CY		14550	CF	$ 2,648
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						377							10185		
	Equipment 's Vol. Demolished																			
	Loading Costs															HR			DY	
	Transport Costs															TON		0	TON	$ -
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,369
	Subtotal																			$ 4,017
	Bent C1-2 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	20	20	3			44					CY		58	CY	$ 1,151
	Concrete's Vol. Demolished							4.5	10		13						1.3	75	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													75	CY	$ 118
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													75	CY	$ 215
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													75	CY	$ 632
	Subtotal																			$ 2,116
	Bent C1-1 (Pad and pier)																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	18	18	3			36					CY		44	CY	$ 887
	Concrete's Vol. Demolished							4.5	8		8						1.3	58	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													58	CY	$ 91
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													58	CY	$ 166
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													58	CY	$ 489
	Subtotal																			$ 1,633
	Mine Belt to Conveyor 1 Transition																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Footer/Foundation	Confidential Bid	$ 20.00	/CY	25	16	3			44					CY		44	CY	$ 889
	Concrete's Vol. Demolished																1.3	58	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													58	CY	$ 91
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													58	CY	$ 166
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													58	CY	$ 489
	Subtotal																			$ 1,635
	Total																			$ 18,661

Ref.	Description **e2 SealPortals_e9**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Seal Portals	Confidential Bid	$ 34,900	/EA										1	EA		1	EA	$ 34,900
	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																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 34,900
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Cost, Non Steel & Steel																			
	Subtotal																			$ -
	Abandon Borehole																			
	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																			$ -
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			$ 34,900

Ref. ORIG:	Description **e2 Culvert_e10**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	800	3	2			178					BCY		178	LF	$ 2,496
	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																			$ 2,496
	Equipment 's Disposal Cost	Plasic Pipe - 30-inch	02 41 13 38 1900	$ 6.20	/LF	800										LF		800	LF	$ 4,960
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 4,960
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 7,456

Ref. ORIG:	Description **e2 Culvert_e11**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Machine Excavation 3/4 CY	31 23 16 16 6035	$ 14.02	/BCY	760	3	2			169					BCY		169	LF	$ 2,369
	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																			$ 2,369
	Equipment 's Disposal Cost	Plasic Pipe - 30-inch	02 41 13 38 1900	$ 6.20	/LF	760										LF		760	LF	$ 4,712
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 4,712
	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																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 7,081

Ref. ORIG:	Description **e2_WaterTank_e12**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF			25	26		491					CY		13257	CF	$ 2,415
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						344					CY		9287	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 1,249
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck				/day															$ -
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 3,664
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY		0.5	1	26		1.5					CY		2	CY	$ 20
	Concrete's Vol. Demolished																1.3	3	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													3	CY	$ 5
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													3	CY	$ 9
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CY													3	CY	$ 25
	Subtotal																			$ 59
	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																			$ 3,723

Ref. ORIG:	Description **e2_VentFan_e13**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	$ 0.26	/CF						29167					CF		29167	CF	$ 5,308
	Structure's Vol. Demolished	Reduction due to no interior walls	02 41 16 13 0750	30.00%	%						756					CY		20417	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost, Non Steel & Steel	Disposal at Landfill	Emery CO Landfill	$ 3.63	/CY															$ 2,745
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 8,053
	Equipment 's Disposal Cost	Seal Shaft	Confidential Invoice	$ 40,000	/EA										1					$ 40,000
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 40,000
	Concrete Demolition																			
	Demolition Cost	Concrete Demolition-Floor	Confidential Bid	$ 10.00	/CY						44					CY		44	CY	$ 440
	Concrete's Vol. Demolished																1.3	57	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1300	$ 1.57	/CY													57	CY	$ 89
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23 20 1014	$ 2.87	/CY													57	CY	$ 164
	Disposal Costs	Disposal on site	02 41 16 17 4200	$ 8.43	/CF													57	CY	$ 481
	Subtotal																			$ 1,174
	Borehole Abandonment	Plug Small Borehole	Nevada Mine Cost E	$ 509.00	/EA										4					$ 2,036
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ 2,036
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			$ 51,263

Ref. ORIG:	Description **e2_Powerline_e14**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	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	Powerpole	02 41 13 80 0100	$ 184.64	EA										18	EA		18	EA	$ 3,324
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 3,324
	Equipment 's Disposal Cost																			
	Dismantling Cost	Wire Removal	26 05 05 10 1900	$ 14.95	CLF	3600										LF		36	CLF	$ 538
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 538
	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																			$ 3,862

Map Ref.	Description	Cost
	Backfill and Grade Portal Area 01	$ 229,234
	Coal Fines Removal 02	$ 168,634
	Coal Mine Waste 03	$ 249,128
	Coal Mine Waste 03a	$ 423,577
	Roadside Berms 04	$ 10,100
	Dike Improvements 05	$ 19,588
	Pond No One 06	$ 115,993
	Pond No Two 07	$ 19,588
	Pond No Three 08	$ 2,143
	Pond No Four 09	$ 22,648
	Pond No Five 10	$ 9,488
	Pond No Six 11	$ 56,619
	Pond No 1 Road 12	$ 919
	Pump No 1 Road 13	$ 1,224
	Tank Road 14	$ 1,224
	MineYardRoads15	$ 11,630
	The 4th East Portal 16	$ 585,565
	Emery 2 Boxcut_17	$ 569,324
	Pond No 3_18	$ 9,793
	Berms UB1-UB2_19	$ 1,010
	Switchback Road_20	$ 19,249
	Total	$ 2,526,678

description	Cost Reference Year	Cost Reference Page	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate
627G EROPS	2016	§9-32	24470	137.25	0.1	51.1
D7R DS Series II	2016	§9-33	13930	61.65	0.1	51.1
D8R Semi	2016	§9-33	19320	79.6	0.1	51.1
14M EROPS	2016	§9-11	13455	54.75	0.1	51.1
5,000 gal H2O truck Diesel	2016	§20-15	5440	39.4	0.1	43.2
Pickup Crew 4x4 1 ton 340 hp	2016	§20-16	960	14	0.1	37.9
CLAB	RSMeans 2016	Back Cover				37.9
Foreman Average, Outside	RSMeans 2016	Back Cover				51.9
D6T XL Semi-U EROPS	2016	§9-37	12385	53.55	0.1	51.1
Multi-Shank Ripper 190-259 P	2016	§9-39	1970	6.9	0.1	51.1
988H EROPS	2016	§9-26	18835	90.6	0.1	51.1
776d	2016	§20-13	26090	125.6	0.1	51.1
450e	2016	§9-22	1860	32.2	0.1	51.1
6X4 45,000lbs 8-10 CY	2016	§20-14	3490	35.15	0.1	37.9

			Bare Rate			
Line Channel	RS Means 2Q 2016	334713531300	$1.36/sq ft			

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Backfill and Grade Portal Area 01															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	52600	CY	702	CY/HR	74.9	HR	$ 159,543
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					74.9	HR	$ 15,428
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					74.9	HR	$ 19,430
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					74.9	HR	$ 14,637
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					74.9	HR	$ 9,028
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					74.9	HR	$ 4,442
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					74.9	HR	$ 2,839
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					74.9	HR	$ 3,887
Subtotal															$ 229,234

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Coal Fines Removal 02															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	38700	CY	702	CY/HR	55.1	HR	$ 117,367
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					55.1	HR	$ 11,349
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					55.1	HR	$ 14,293
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					55.1	HR	$ 10,768
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					55.1	HR	$ 6,642
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					55.1	HR	$ 3,267
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					55.1	HR	$ 2,088
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					55.1	HR	$ 2,860
Subtotal															$ 168,634

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Backfilling and Regrading															
Coal Mine Waste 03															
Task 2929															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	57110	CY	702	CY/HR	81.4	HR	$ 173,389
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					81.4	HR	$ 16,767
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					81.4	HR	$ 21,116
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					81.4	HR	$ 15,907
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					81.4	HR	$ 9,812
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					81.4	HR	$ 4,827
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					81.4	HR	$ 3,085
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					81.4	HR	$ 4,225
Subtotal															$ 249,128

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Excavate Coal Mine Waste Site															
Coal Mine Waste 03a															
Task 2929															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	97130	CY	702	CY/HR	138.4	HR	$ 294,803
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					138.4	HR	$ 28,508
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					138.4	HR	$ 35,902
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					138.4	HR	$ 27,046
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					138.4	HR	$ 16,683
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					138.4	HR	$ 8,207
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					138.4	HR	$ 5,245
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					138.4	HR	$ 7,183
Subtotal															$ 423,577

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Roadside Berms 04															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	2300	CY	702	CY/HR	3.3	HR	$ 7,029
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					3.3	HR	$ 680
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					3.3	HR	$ 856
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					3.3	HR	$ 645
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					3.3	HR	$ 398
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					3.3	HR	$ 196
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					3.3	HR	$ 125
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					3.3	HR	$ 171
Subtotal															$ 10,100

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Dike Improvements 05															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	4500	CY	702	CY/HR	6.4	HR	$ 13,633
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					6.4	HR	$ 1,318
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					6.4	HR	$ 1,660
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					6.4	HR	$ 1,251
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					6.4	HR	$ 771
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					6.4	HR	$ 380
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					6.4	HR	$ 243
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					6.4	HR	$ 332
Subtotal															$ 19,588

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No One 06															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	26600	CY	702	CY/HR	37.9	HR	$ 80,730
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					37.9	HR	$ 7,807
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					37.9	HR	$ 9,832
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					37.9	HR	$ 7,406
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					37.9	HR	$ 4,568
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					37.9	HR	$ 2,247
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					37.9	HR	$ 1,436
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					37.9	HR	$ 1,967
Subtotal															$ 115,993

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Two 07															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	4500	CY	702	CY/HR	6.4	HR	$ 13,633
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					6.4	HR	$ 1,318
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					6.4	HR	$ 1,660
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					6.4	HR	$ 1,251
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					6.4	HR	$ 771
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					6.4	HR	$ 380
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					6.4	HR	$ 243
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					6.4	HR	$ 332
Subtotal															$ 19,588

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Three 08															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	500	CY	702	CY/HR	0.7	HR	$ 1,491
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					0.7	HR	$ 144
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					0.7	HR	$ 182
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					0.7	HR	$ 137
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					0.7	HR	$ 84
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					0.7	HR	$ 42
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					0.7	HR	$ 27
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					0.7	HR	$ 36
Subtotal															$ 2,143

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Four 09															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	5200	CY	702	CY/HR	7.4	HR	$ 15,763
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					7.4	HR	$ 1,524
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					7.4	HR	$ 1,920
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					7.4	HR	$ 1,446
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					7.4	HR	$ 892
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					7.4	HR	$ 439
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					7.4	HR	$ 280
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					7.4	HR	$ 384
Subtotal															$ 22,648

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Five 10															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	2200	CY	702	CY/HR	3.1	HR	$ 6,603
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					3.1	HR	$ 639
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					3.1	HR	$ 804
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					3.1	HR	$ 606
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					3.1	HR	$ 374
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					3.1	HR	$ 184
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					3.1	HR	$ 117
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					3.1	HR	$ 161
Subtotal															$ 9,488

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No Six 11															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	13000	CY	702	CY/HR	18.5	HR	$ 39,406
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					18.5	HR	$ 3,811
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					18.5	HR	$ 4,799
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					18.5	HR	$ 3,615
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					18.5	HR	$ 2,230
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					18.5	HR	$ 1,097
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					18.5	HR	$ 701
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					18.5	HR	$ 960
Subtotal															$ 56,619

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pond No 1 Road 12															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	200	CY	702	CY/HR	0.3	HR	$ 639
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					0.3	HR	$ 62
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					0.3	HR	$ 78
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					0.3	HR	$ 59
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					0.3	HR	$ 36
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					0.3	HR	$ 18
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					0.3	HR	$ 11
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					0.3	HR	$ 16
Subtotal															$ 919

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Pump No 1 Road 13															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	300	CY	702	CY/HR	0.4	HR	$ 852
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					0.4	HR	$ 82
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					0.4	HR	$ 104
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					0.4	HR	$ 78
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					0.4	HR	$ 48
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					0.4	HR	$ 24
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					0.4	HR	$ 15
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					0.4	HR	$ 21
Subtotal															$ 1,224

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading Tank Road 14															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	300	CY	702	CY/HR	0.4	HR	$ 852
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					0.4	HR	$ 82
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					0.4	HR	$ 104
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					0.4	HR	$ 78
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					0.4	HR	$ 48
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					0.4	HR	$ 24
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					0.4	HR	$ 15
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					0.4	HR	$ 21
Subtotal															$ 1,224

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery Deep Mine Backfilling and Grading MineYardRoads15															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	2700	CY	702	CY/HR	3.8	HR	$ 8,094
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					3.8	HR	$ 783
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					3.8	HR	$ 986
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					3.8	HR	$ 743
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					3.8	HR	$ 458
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					3.8	HR	$ 225
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					3.8	HR	$ 144
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					3.8	HR	$ 197
Subtotal															$ 11,630

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
The 4th East Portal 16															
Grade berm into surrounding area															
D6T XL Semi-U EROPS	$ 12,385	$ 53.55	10%	$ 51.10	$ 187.41	1	$ 187.41	$/HR	3721	CY	189	CY/HR	19.7	HR	$ 3,692
Partial Backfilling of Portal Boxcut															
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR	34277	CY	287	CY/HR	119.4	HR	$ 30,974
Reclamation of In Place Topsoil															
D6T XL Semi-U EROPS	$ 12,385	$ 53.55	10%	$ 51.10	$ 187.41	1	$ 187.41	$/HR	12100	CY	1455	CY/HR	8.3	HR	$ 1,556
Multi-Shank Ripper 190-259 P	$ 1,970	$ 6.90	10%	$ 51.10	$ 71.00	1	$ 71.00	$/HR					8.3	HR	$ 589
Material Stock Pile															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	113711	CY	349	CY/HR	325.8	HR	$ 87,471
776d	$ 26,090	$ 125.60	10%	$ 51.10	$ 352.32	2	$ 704.65	$/HR					325.8	HR	$ 229,575
Topsoil															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	100911	CY	465	CY/HR	217	HR	$ 58,260
6X4 45,000lbs 8-10 CY	$ 3,490	$ 35.15	10%	$ 37.90	$ 98.38	3	$ 295.13	$/HR					217	HR	$ 64,043
Pocking															
450e	$ 1,860	$ 32.20	10%	$ 51.10	$ 98.15	1	$ 98.15	$/HR	8873	CY	192	CY/HR	46.2	HR	$ 4,535
Support Personel and Equipment															
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					353	HR	$ 18,321
CLAB				$ 37.90	$ 37.90	2	$ 75.80	$/HR					353	HR	$ 26,757
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					353	HR	$ 20,933
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					353	HR	$ 42,551
Subtotal															$ 585,565

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Emery 2 Boxcut_17															
Trucked to Boxcut from Emery 2 Fill															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	79350	CY	349	CY/HR	227.4	HR	$ 61,052
776d	$ 26,090	$ 125.60	10%	$ 51.10	$ 352.32	2	$ 704.65	$/HR					227.4	HR	$ 160,237
Trucked to Vent Shaft from Waste Disposal Site															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	900	CY	349	CY/HR	2.6	HR	$ 698
776d	$ 26,090	$ 125.60	10%	$ 51.10	$ 352.32	2	$ 704.65	$/HR					2.6	HR	$ 1,832
Trucked to Boxcut from Waste Disposal Site															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	69650	CY	349	CY/HR	199.6	HR	$ 53,589
776d	$ 26,090	$ 125.60	10%	$ 51.10	$ 352.32	2	$ 704.65	$/HR					199.6	HR	$ 140,648
Topsoil/Subsoil - Entire Permit															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	18500	CY	465	CY/HR	39.8	HR	$ 10,686
6X4 45,000lbs 8-10 CY	$ 3,490	$ 35.15	10%	$ 37.90	$ 98.38	3	$ 295.13	$/HR					39.8	HR	$ 11,746
Channel Lining Installation															
RS Means 33 47 13 53 1300							$ 1.36	$/SF	6000	SF					$ 8,160
Pocking															
450e	$ 1,860	$ 32.20	10%	$ 51.10	$ 98.15	1	$ 98.15	$/HR	5040	CY	192	CY/HR	26.3	HR	$ 2,581
Support Personel and Equipment															
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					384	HR	$ 19,930
CLAB				$ 37.90	$ 37.90	2	$ 75.80	$/HR					384	HR	$ 29,107
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					384	HR	$ 22,771
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					384	HR	$ 46,287
Subtotal															$ 569,324

Volume calculation: 150,600 bcy Cut @ 30%swell = 193,700 lcy
Fill Volume Required = 79,350 cy
Balance to WDS = 114,350 cy
Reclamation:
From Fill to Boxcut = 79,350 cy
Fill Required to Complete Boxcut Backfill = 149,000 - 79,350 = 69,650 cy (Trucked from WDS)
Balance of Fill Remaining in WDS = 114,350 - 69,350 = 44,700 cy

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Pond No 3_18 Backfilling and Grading Pond 3 (Outfall 005)															
627G EROPS	$ 24,470	$ 137.25	10%	$ 51.10	$ 355.01	6	$ 2,130.08	$/HR	2250	CY	702	CY/HR	3.2	HR	$ 6,816
D7R DS Series II	$ 13,930	$ 61.65	10%	$ 51.10	$ 205.98	1	$ 205.98	$/HR					3.2	HR	$ 659
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR					3.2	HR	$ 830
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					3.2	HR	$ 625
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					3.2	HR	$ 386
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					3.2	HR	$ 190
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					3.2	HR	$ 121
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					3.2	HR	$ 166
Subtotal															$ 9,793

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Berms UB1-UB2_19 Backfilling and Grading Undisturbed Berms UB-1 & UB-2															
D6T XL Semi-U EROPS	$ 12,385	$ 53.55	10%	$ 51.10	$ 187.41	1	$ 187.41	$/HR	563	CY	189	CY/HR	3	HR	$ 562
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					3	HR	$ 178
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					3	HR	$ 114
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					3	HR	$ 156
Subtotal															$ 1,010

	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	Cost
Switchback Road_20 Backfilling and Grading Switchback Road															
Trucked to Road from Stockpile															
988H EROPS	$ 18,835	$ 90.60	10%	$ 51.10	$ 268.48	1	$ 268.48	$/HR	3630	CY	349	CY/HR	10.4	HR	$ 2,792
776d	$ 26,090	$ 125.60	10%	$ 51.10	$ 352.32	2	$ 704.65	$/HR					10.4	HR	$ 7,328
D8R Semi	$ 19,320	$ 79.60	10%	$ 51.10	$ 259.41	1	$ 259.41	$/HR	3630	CY	287	CY/HR	12.6	HR	$ 3,269
14M EROPS	$ 13,455	$ 54.75	10%	$ 51.10	$ 195.42	1	$ 195.42	$/HR					12.6	HR	$ 2,462
5,000 gal H2O truck Diesel	$ 5,440	$ 39.40	10%	$ 43.20	$ 120.54	1	$ 120.54	$/HR					12.6	HR	$ 1,519
Pickup Crew 4x4 1 ton 340 hp	$ 960	$ 14.00	10%	$ 37.90	$ 59.30	1	$ 59.30	$/HR					12.6	HR	$ 747
CLAB				$ 37.90	$ 37.90	1	$ 37.90	$/HR					12.6	HR	$ 478
Foreman Average, Outside				$ 51.90	$ 51.90	1	$ 51.90	$/HR					12.6	HR	$ 654
Subtotal															$ 19,249

Ref.	Description	Cost
	Vegetation	
	Main Facilities 01	$ 441,028
	The 4th East Portals 02	$ 89,666
	Emery 2 03	$ 46,859
	Total	$ 577,553

Ref.	Description **Main Facilities 01**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Main Facilities 01																			
	Vegetation																			
	Spread Topsoil	Backfill structural 200 HP 300' Dirt	31 23 23 14 5420	$ 1.70	/CY						47800					CY		47800	CY	$ 81,260
	Till Soil	75 HP Dozerw/scarifiers	32 91 13 23 3100	$ 3.87	MSF						59.2					AC		2579	MSF	$ 9,981
	Seeding	Wildflower Seed Mix	32 92 19 14 5800	$ 28.81	MSF						59.2					AC		2579	MSF	$ 74,301
	Mulch	Hay 1 inch small power mulcher	32 91 13 16 0250	$ 54.33	/MSF						59.2					AC		2579	MSF	$ 140,117
	Fertilizer	Fetilizer Hydro Spread	32 01 90 13 0180	$ 3.96	/MSF						59.2					AC		2579	MSF	$ 10,213
	Erosion Control	Hay bale	31 25 14 16 1200	$ 626.27	/ton							59.2				Ton		59	TON	$ 36,950
	Subtotal																			$ 352,822
	Reseeding																			
	25% of Vegetation Cost																			$ 88,206
	Subtotal																			$ 88,206
	Total																			$ 441,028

Hay coverage based on Chapter III, page 4b.

Ref.	Description **The 4th East Portals 02**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	The 4th East Portals 02																			
	Vegetation																			
	Seeding	Wildflower Seed Mix	32 92 19 14 5800	$ 28.81	MSF						16					AC		697	MSF	$ 20,081
	Mulch	Hay 1 inch small power mulcher	32 91 13 16 0250	$ 54.33	/MSF						16					AC		697	MSF	$ 37,868
	Fertilizer	Fetilizer Hydro Spread	32 01 90 13 0180	$ 3.96	/MSF						16					AC		697	MSF	$ 2,760
	Erosion Control	Hay bale	31 25 14 16 1200	$ 626.27	/ton							16				Ton		16	TON	$ 10,020
		Revegetation mat, webbed	31 25 14 16 0120	$ 2.15	SY	300	14									FT		467	SY	$ 1,004
	Subtotal																			$ 71,733
	Reseeding																			
	25% of Vegetation Cost																			$ 17,933
	Subtotal																			$ 17,933
	Total																			$ 89,666

Hay coverage based on Chapter III, page 4b.

Ref.	Description **Emery 2 03**	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Main Facilities 01																			
	Vegetation																			
	Till Soil	75 HP Dozerw/scarifiers	32 91 13 23 3100	$ 3.87	MSF						8.2					AC		357	MSF	$ 1,382
	Seeding	Wildflower Seed Mix	32 92 19 14 5800	$ 28.81	MSF						8.2					AC		357	MSF	$ 10,285
	Mulch	Hay 1 inch small power mulcher	32 91 13 16 0250	$ 54.33	/MSF						8.2					AC		357	MSF	$ 19,396
	Fertilizer	Fetilizer Hydro Spread	32 01 90 13 0180	$ 3.96	/MSF						8.2					AC		357	MSF	$ 1,414
	Erosion Control	Hay bale	31 25 14 16 1200	$ 626.27	/ton							8.2				Ton		8	TON	$ 5,010
	Subtotal																			$ 37,487
	Reseeding																			
	25% of Vegetation Cost																			$ 9,372
	Subtotal																			$ 9,372
	Total																			$ 46,859

Hay coverage based on Chapter III, page 4b.

APPENDIX IV-7-H EMERY 2 EXPANSION ROADS

The existing Section 3 Mine Yard Road will be extended as Sections 5 and 6 to facilitate access to the Emery 2 portal area. Sections 5 and 6 are Primary roads and will be utilized to enter the mine and maintain the conveyor system on a daily basis. Refer to Plate IV-8a and Plate IV-8b for plan, profile, and cross section.

In general, Section 5 will follow the existing terrain to approximately 7+00 with similar grade and construction as Section 3. From 7+00 to 9+50, Section 5 will be constructed on boxcut fill. Section 6 begins at 9+50 and continues on boxcut fill to approximately 16+00. Section 6 continues from 16+00 to the Emery 2 portal area through the cut area incline to the mine entrance.

Section 7 will be a Primary road to access the ventilation fan and water tank above the boxcut. Access to the site will be light truck to perform daily fan checks. Refer to Plate IV-8c for plan, profile, and cross section.

The road base on these sections will consist of either bedrock (sandstone) or compacted granular material.

Dust suppressant will be utilized to control fugitive dust. For further detail on the road and use of chemical suppressants, refer to Appendix X.C-3 in Chapter X.

As-built drawings will be filed upon final construction. Refer to VI-21 for road drainage design.

Inserted 10/2016

CHAPTER IV, APPENDIX IV-11
Bond Calculation Competitive Bid Support

CONFIDENTIAL FOLDER

Appendix IV-12

Emery 2 Expansion Portal Excavation Blasting Plan

Emery Deep Mine

Emery 2 expansion Portal Excavation Blasting Plan

Location: Emery Deep Mine, approximately 3 miles south of Emery, Utah

Type of Operation: Underground Coal Mine

Type of Blasting Activity: Excavation for new portals

524. Blasting and Explosives. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, R645-301-524.100 through R645-301-524.700 apply to surface blasting activities incident to underground coal mining, including, but not limited to, initial rounds of slopes and shafts.

524.100. Blaster Certification. The steps taken to achieve compliance with the blaster certification program must be described in the permit application.

Blaster will have a valid Utah Blaster Certification from the Division. A copy of the Blaster's certificate will be obtained prior to blasting activities.

524.110. After July 28, 1987, all surface blasting operations incident to underground mining in Utah will be conducted under the direction of a certified blaster.

Yes, the operator will comply.

524.120. Certificates of blaster certification will be carried by blasters or will be on file at the permit area during blasting operations.

A copy of the blaster's certification will be on file at the permit area.

524.130. A blaster and at least one other person will be present at the firing of a blast.

Yes, the operator will comply.

524.140. Persons responsible for blasting operations at a blasting site will be familiar with the blasting plan and site-specific performance standards and give on-the-job training to persons who are not certified and who are assigned to the blasting crew or assist in the use of explosives.

Proper training will be given to persons associated with the blast or explosives.

524.200. Unless approved by the Division under R645-301-524.220, the blast design must be described in the permit application. The design requirements are:

524.210. An anticipated blast design will be submitted for all blasts if blasting operations will be conducted within:

524.211. 1,000 feet of any building used as a dwelling, public building, school, church, or community or institutional building outside the permit area; or

524.212. 500 feet of an active or abandoned underground mine;

524.220. The blast design may be presented as part of a permit application or at a time, before the blast, if approved by the Division;

524.230. The blast design will contain sketches of the drill patterns, delay periods, and decking and will indicate the type and amount of explosives to be used, critical dimensions, and the location and general description of structures to be protected, as well as a discussion of design factors to be used which protect the public and meet the applicable airblast, flyrock, and ground-vibration standards in R645-301-524.600;

524.240. The blast design will be prepared and signed by a certified blaster; and

524.250. The Division may require changes to the design submitted.

A site-specific blasting plan is attached that is based on the conditions and location of the blasting site. A certified blaster has provided an initial blast design prior to blasting that includes the criteria as described in R645-301.524.230 and submitted to the Division for approval.

524.300. The preblasting survey must be described in the permit application. For the purpose of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, preblasting surveys are required for blasts that use more than five pounds of blasting agent or explosives. The requirements are:

524.310. At least 30 days before initiation of blasting, the operator will notify, in writing, all residents or owners of dwellings or other structures located within one-half mile of the permit area how to request a preblasting survey;

Copies of the pre-blast survey notification and waivers are available for review at the mine office.

524.320. A resident or owner of a dwelling or structure within one-half mile of any part of the permit area may request a preblasting survey. This request will be made, in writing, directly to the operator or to the Division, who will promptly notify the operator. The operator will promptly conduct a preblasting survey of the dwelling or structure and promptly prepare a written report of the survey. An updated survey of any additions, modifications, or renovations will be performed by the operator if requested by the resident or owner;

See response to 524.350.

524.330. The operator will determine the condition of the dwelling or structure and will document any preblasting damage and other physical factors that could reasonably be affected by the blasting. Structures such as pipelines, cables, transmission lines, and cisterns, wells, and other water systems warrant special attention; however, the assessment of these structures may be limited to surface conditions and other readily available data;

See response to 524.350.

524.340. The written report of the survey will be signed by the person who conducted the survey. Copies of the report will be promptly provided to the Division and to the person requesting the survey. If the person requesting the survey disagrees with the contents and/or recommendations contained therein, he or she may submit to both the operator and the Division a detailed description of the specific areas of disagreement; and

See response to 524.350.

524.350. Any surveys requested more than 10 days before the planned initiation of blasting will be completed by the operator before the initiation of blasting.

Whenever using more than 5 pounds of blasting agents or explosives, residents or owners of dwellings or structures within one-half mile of the permit area will be notified on how to request a preblast survey. However, in this case, the residents and owners have waived their right to a preblast survey prior to 30 days. Signed copies of the waivers will be on file at the mine office. If a request is made for a pre-blast survey, Bronco will comply with the regulations as set forth in R645-524.320 through R645-524.350, conduct a pre-blast survey, and forward a copy to the landowner and the Division.

524.400. The schedule of blasts will be described in the permit application:

524.410. Unscheduled blasts may be conducted only where public or operator health and safety so requires and for emergency blasting actions. When an operator conducts an unscheduled surface blast incidental to coal mining and reclamation operations, the operator, using audible signals, will notify residents within one-half mile of the blasting site and document the reason in accordance with R645-301-524.760;

Yes, operator will comply.

524.420. All blasting will be conducted between sunrise and sunset unless nighttime blasting is approved by the Division based upon a showing by the operator that the public will be protected from adverse noise and other impacts. The Division may specify more restrictive time periods for blasting;

Yes, operator will comply.

524.430. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, the operator will notify, in writing, residents within one-half mile of the blasting site and local governments of the proposed times and locations of blasting operations. Such notice of times that blasting is to be conducted may be announced weekly, but in no case less than 24 hours before blasting will occur;

A blasting schedule will be posted at the Emery Deep Mine and copies sent to Local Governments weekly. The blasting schedule for Emery 2 expansion Portal excavation will be:

Monday–Sunday, Starting at permit approval and lasting 4 months

Between the hours of 8:00 a.m. and 6:00 p.m.

There are no residents within one-half mile of the blasting site.

524.440. For the purpose of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, the operator will conduct blasting operations at times approved by the Division and announced in the blasting schedule. The Division may limit the area covered, timing, and sequence of blasting as listed in the schedule, if such limitations are necessary and reasonable in order to protect the public health and safety or welfare;

Not Applicable

524.450. Blasting Schedule Publication and Distribution. For the purpose of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, the operator will:

524.451. Publish the blasting schedule in a newspaper of general circulation in the locality of the blasting site at least 10 days, but not more than 30 days, before beginning a blasting program;

Not Applicable

524.452. Distribute copies of the schedule to local governments and public utilities and to each local residence within one-half mile of the proposed blasting site described in the schedule; and

Not Applicable

524.453. Republish and redistribute the schedule at least every 12 months and revise and republish the schedule at least 10 days, but not more than 30 days, before blasting whenever the area covered by the schedule changes or actual time periods for blasting significantly differ from the prior announcement; and

Not Applicable

524.460. Blasting Schedule Contents. For the purpose of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, the blasting schedule will contain, at a minimum:

524.461. Name, address, and telephone number of operator;
524.462. Identification of the specific areas in which blasting will take place;
524.463. Dates and time periods when explosives are to be detonated;
524.464. Methods to be used to control access to the blasting area; and
524.465. Type and patterns of audible warning and all-clear signals to be used before and after blasting.

Regulations R645-524.460 through R645-524.465 are not applicable.

524.500. The blasting signs, warnings, and access control must be described in the permit application.

524.510. Blasting Signs. Blasting signs will meet the specifications of R645-301-521.200. The operator will:

524.511. Conspicuously place signs reading "Blasting Area" along the edge of any blasting area that comes within 100 feet of any public road right-of-way and at the point where any other road provides access to the blasting area; and

524.512. At all entrances to the permit area from public roads or highways, place Conspicuous signs which state "Warning! Explosives in Use", which clearly list and describe the meaning of the audible blast warning and all-clear signals that are in use and which explain the marking of blasting areas and charged holes awaiting firing within the permit area.

Blasting signs will be conspicuously placed along the edge of the blasting area. Signs will be placed at all accessible entrances to the blasting area that are within the permit area from the public road stating "Blasting Area" and "Warning! Explosives in Use". Access control (flag personnel) will be exercised preventing anyone from entering the blasting area.

524.520. Warnings. Warning and all-clear signals of different character or pattern that are audible within a range of one-half mile from the point of the blast will be given. Each person within the permit area and each person who resides or regularly works within one-half mile of the permit area will be notified of the meaning of the signals in the blasting schedule for the purpose of SURFACE COAL MINING AND RECLAMATION ACTIVITIES and blasting notification required by R645-301-524.430 for the purpose of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES.

Clear signals that are of different character or pattern and are audible within a one-half mile range shall be used during blasting operations.

R645-301-524.430 requires that the operator notify, in writing, residents within one-half mile of the blasting site of times and locations of blasting operations. There are no residents within one-half mile of the blasting site.

524.530. Access Control. Access within the blasting areas will be controlled to prevent presence of livestock or unauthorized persons during blasting and until an authorized representative of the operator has reasonably determined that:

524.531. No unusual hazards, such as imminent slides or undetonated charges, exist; and

During blasting operations, the area shall be inspected for hazards and unsafe conditions. Slopes will be inspected for stability and loose material. Following a blast, an authorized representative of the operator will inspect the site for undetonated charges. If undetonated charges are found, they will be disposed of safely.

524.532. Access to and travel within the blasting area can be safely resumed.

Access to and within the blasting site will be restricted to prevent unauthorized access of persons by monitoring and patrolling the blast site.

524.600. The control of adverse blasting effects must be described in the permit application. The requirements are:

524.610. General Requirements. Blasting will be conducted to prevent injury to persons, damage to public or private property outside the permit area, adverse impacts on any underground mine, and change in the course, channel, or availability of surface or groundwater outside the permit area.

Blasting operations will take all precautionary measures to prevent injury to the public such as: securing the area during blasting operations, signs that identify the blast site, and audible warning devices. No structures exist within one-half mile of the blast site that would present concerns from airblast or ground vibration. Blasting mats will be used to prevent flyrock when necessary. No adverse effects are anticipated to the inactive underground mine workings. Until 1975, the method of coal extraction was conventional drill and blast. No adverse effects were encountered as a result of using this mining method.

524.620. Airblast Limits.

524.621. Airblast will not exceed the maximum limits listed below at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area, except as provided in R645-301-524.690.

TABLE

Lower Frequency Limit of Measuring System, HZ(+3dB)	Maximum Level dB
0.1 Hz or lower - flat response (1)	134 peak
2 Hz or lower – flat response	133 peak
6 Hz or lower – flat response	129 peak
C-weighted – slow response (1)	105 peak dBC

(1) Only when approved by the Division.

There are no buildings or structures within one-half mile of the blast site. The nearest private building to the blast site is approximately 1.7 miles. No impact due to air blast is expected at this distance.

524.622. If necessary to prevent damage, the Division may specify lower maximum allowable airblast levels than those of R645-301-524.621 for use in the vicinity of a specific blasting operation.

524.630. Monitoring.

524.631. The operator will conduct periodic monitoring to ensure compliance with the airblast standards. The Division may require airblast measurement of any or all blasts and may specify the locations at which such measurements are taken.

Not applicable. The location of the blast sites is such that there will not be an effected building or structure and periodic testing is not necessary. In the event the Division requires monitoring of airblast, the operator will comply with the Division's decision.

524.632. The measuring systems used will have an upper-end flat-frequency response of at least 200 Hz.

Not Applicable

524.633. Flyrock. Flyrock traveling in the air or along the ground will not be cast from the blasting site – more than one-half the distance to the nearest dwelling or other occupied structure; beyond the area of control required under R645-301-524.530; or beyond the permit boundary.

Operator will comply. Blasting design will take into account measures such as blasting mats to prevent flyrock from being cast beyond the permit boundary. There are no dwellings or occupied structures within one-half mile of the blast site.

524.640. Ground Vibration.

524.641. General. In all blasting operations, except as otherwise authorized in R645-301-524.690, the maximum ground vibration will not exceed the values approved by the Division. The maximum ground vibration for protected structures listed in R645-301-524.642 will be established in accordance with either the maximum peak-particle-velocity limits of R645-301-524.642 and R645-301-524.643, the scaled-distance equation of R645-301-524.650, the blasting-level chart of R645-301-524.660, or by the Division under R645-301-524.670. All structures in the vicinity of the blasting area, not listed in R645-301-524.642, such as water towers, pipelines and other utilities, tunnels, dams, impoundments, and underground mines will be protected from damage by establishment of a maximum allowable limit on the ground vibration, submitted by the operator and approved by the Division before the initiation of blasting.

The maximum allowable limit on ground vibration to protect structures in the vicinity of the blast is based on the method described in R645-301.524650 (scaled distance equation). The nearest occupied dwelling is 1.7 miles from the blast site. Ground vibration will not exceed the maximum allowable limit established to prevent damage to these structures. The underground mine workings will not apply under R645-301-524.690 since it is a structure owned by the permittee.

524.642. Maximum Peak-Particle Velocity. The maximum ground vibration will not exceed the following limits at the location of any dwelling, public building, school, church, or community or institutional building outside the permit area:

TABLE
EXPLOSIVES

Distance (D) from Blast Site in feet	Maximum allowable Particle Velocity (Vmax) for ground vibration, in inches/second (1)	Scaled distance factor to be applied without seismic monitoring (2) (Ds)
0 to 300	1.25	50
301 to 5,000	1.00	55
5,001 and beyond	0.75	65

(1) Ground vibration will be measured as the particle velocity. Particle velocity will be recorded in three mutually perpendicular directions. The maximum allowable peak particle velocity will apply to each of the three measurements.
(2) Applicable in the scaled-distance equation of R645-301-524.651.

Table is used for Ds in calculations for the scaled distance equation of R645-301-524.651.

524.643. A seismographic record will be provided for each blast.

Not applicable.

524.650. Scaled-distance equation.

524.651. An operator may use the scaled-distance equation, W=(D/Ds)2, to determine the allowable charge weight of explosives to be detonated in any eight-millisecond period, without seismic monitoring: where W=the maximum weight of explosives, in pounds: D=the distance, in feet, from the blasting site to the nearest protected structure: and Ds=the scaled-distance factor, which may initially be approved by the Division using the values for scaled-distance factor listed in R645-301-524.642.

Based on the scaled-distance equation and using the scaled distance factor listed in R645-301-524.642, the following maximum weight of explosives will apply:

Occupied Dwelling*:*

$$W = (8{,}976\ ft./65)^2$$

$$W = 19{,}069\ lbs.$$

524.652. The development of a modified scaled-distance factor may be authorized by the Division on receipt of a written request by the operator, supported by seismographic records of blasting at the mine site. The modified scaled-distance factor will be determined such that the particle velocity of the predicted ground vibration will not exceed the prescribed maximum allowable peak particle velocity of R645-301-524.642, at a 95-percent confidence level.

Not applicable

524.660. Blasting-Level-Chart.

524.661. An operator may use the ground-vibration limits in Figure 1 to determine the maximum allowable ground vibration.

Not applicable

(Figure 1, showing maximum allowable ground particle velocity at specified frequencies, is incorporated by reference. Figure 1 may be viewed at 30 CFR 817.67 or at the Division of Oil, Gas and Mining State Office.)

524.662. If the Figure 1 limits are used, a seismographic record including both particle velocity and vibration-frequency levels will be provided for each blast. The method for the analysis of the predominant frequency contained in the blasting records will be approved by the Division before application of this alternative blasting criterion.

Not applicable

524.670. The maximum allowable ground vibration will be reduced by the Division beyond the limits otherwise provided in R645-301-524.640, if determined necessary to provide damage protection.

Yes, operator will comply if the Division determines a reduced maximum allowable charge weight of explosives is necessary.

524.680. The Division may require an operator to conduct seismic monitoring of any or all blasts and may specify the location at which the measurements are taken and the degree of detail necessary in the measurement.

Not using seismic monitoring; will use peak particle velocity table of R645-301.524.642.

524.690. The maximum airblast and ground-vibration standards of R645-301-524.620 through R645-301-524.632 and R645-301-524.640 through R645-301-524.680 will not apply at the following locations: At structures owned by the permittee and not leased to another person; and at structures owned by the permittee and leased to another person, if a written waiver by the lessee is submitted to the Division before blasting.

The maximum airblast and ground vibration standards of R645-301-524.620 through R645-301-524.632 and R645-301-524.640 through R645-301-524.680 will not apply to structures owned by the permittee, including the underground coal mine.

524.700. Records of Blasting Operations. The permit application will incorporate a description of the blasting records to be maintained at the mine site for at least three years and upon request, make blasting records available for inspection by the Division or the public. Blasting records will contain the following information:

524.710. A record, including:
524.711. Name of the operator conducting the blast;
524.712. Location, date, and time of the blast; and
524.713. Name, signature, and certification number of the blaster conducting the blast; and
524.720. Identification, direction, and distance, in feet, from the nearest blast hole to the nearest dwelling, public building, school, church, community or institutional building outside the permit area, except those described in R645-301-524.690;
524.730. Weather conditions, including those which may cause possible adverse blasting effects;
524.740. A record of the blast, including:
524.741. Type of material blasted;
524.742. Sketches of the blast pattern including number of holes, burden, spacing, decks, and delay pattern;
524.743. Diameter and depth of holes;
524.744. Types of explosives used;
524.745. Total weight of explosives used per hole;

524.746. The maximum weight of explosives detonated in an eight-millisecond period;

524.747. Initiation system;

524.748. Type and length of stemming; and

524.749. Mats or other protections used;

524.750. If required, a record of seismographic and airblast information, which will include:

524.751. Type of instrument, sensitivity, and calibration signal or certification of annual calibration;

524.752. Exact location of instrument and the date, time, and distance from the blast;

524.753. Name of the person and firm taking the reading;

524.754. Name of the person and firm analyzing the seismographic record; and

524.755. The vibration and/or airblast level recorded; and

524.760. The reasons and conditions for each unscheduled blast.

Operator will keep records of all blasting operations and maintain them at the site for 3 years as specified in R645-301-524.700 through R645-301-524.760. These records will be available for inspection by the Division and the public. A copy of the Record of Blasting Operations is included in this application.

524.800. Each operator will comply with all appropriate Utah and federal laws and regulations in the use of explosives.

Operator will comply with all appropriate Utah and Federal laws and regulations in the handling, use, and storage of explosives.

3-RIVERS DRILLING & BLASTING

BLAST PLANNING FORM

PROJECT:

Blaster-in-Charge:		Planning Date:	
License No. :	DOPL: 344280-5501 ATF: 9-UT-021-20-6E-00493	Planned Date of Blast:	☐AM ☐PM
Location:	Bench:	Lots:	
Rock Type(s) and Conditions:			
Type of Blast:	Average Bench Height: (ft)	Hole Diameter: (in) Hole Diameter: (in)	No. Holes Each Shot:
Average Burden: (ft)	Average Spacing: (ft)	PRODUCTS:	

Planned Design Summary

Volume Blasted: (cy)	Total Explosives:
Powder Factor	Blast Location Stations: to

Design and Inspection Checklist

Item #	Type of Inspection:	Date:	Blaster-in-Charge:
1)	Pre-work blast bench inspection incl. Well evaluation and geological conditions from all view points -		
2)	Blasthole layout based on observed conditions and exposed rock faces and layout plan showing hole numbers has been given to the driller -		
3)	Inspect area for pipes, conduits or utilities requiring special protection -		
4)	Final review and approval of fully completed blast plan -		

Vibration & Overpressure Monitoring Plans

Closest Control Structure:		Distance: 0 (ft)	Max. Charge per 8-MS Delay: (lb)
Scaled Distance:	Distance Method:	Approximate Measured☐ Grip Map☐ GPS☐ Other: _____	
Planned Monitoring Locations:		NOTES:	
1			
2			
3			

51 East 400 North, Suite 4-B
P.O. Box 987
Cedar City, UT 84721-0987
License # 97-344280-5501

3-RIVERS
DRILLING & BLASTING

Phone: (435) 865-6980
Fax: (435) 865-1280
e-mail: 3rivers@infowest.com
Web Site: 3riversdrillingandblasting.com

Customer		Seismograph MiniMate Plus		Conditions	
Company Name		Unit Number		Wind Direction	
Job Name/Location		Date Calibrated		Wind Conditions	
Blaster in Charge		Distance From Shot		Weather	
Bulk Truck Operator		Peak Particle Velocity		Type of Rock	
Date of Shot		Peak Sound Pressure		Temperature	
Blast Time					
Shot Number					

Loading Information

	Area 1	Area 2	Area 3	Area 4	
Number of Holes					
Decks Per Hole					
Hole Diameter					
Stemming					
Burden					
Spacing					
Avg Hole Dpth					Totals
Total BCY's	0.00	0.00	0.00	0.00	0.00
Drill Footage	0.00	0.00	0.00	0.00	0.00
Trench Footage					0.00

Explosives

Primers - (Each)	lbs each	Number Used	Date Code	Detonators and Caps	Number Used	Date Code
Total LBS		0.00				

Blasting Agent or Explosives	lbs each	Number Used	Date Code	Surface Delays	Number Used	Date Code
AN			NA			
DIESEL FUEL	7.00		NA			
ANFO BAGS - 50 lb	50.00					
Total LBS		0.00				
Wet Hole Product	**lbs each**	**Number Used**	**Date Code**			
Total LBS						

Totals

Total BCY's	0.00	Total Dets	0.00
Powder Factor	#DIV/0!	Total Pounds in Shot	0.00
Secondary Yardage		Max. Holes per Delay	1.00
Gross Cubic Yards	0.00	Max Charge per 8 ms Delay in Lbs	

Distance and direction from nearest hole to closest structure:

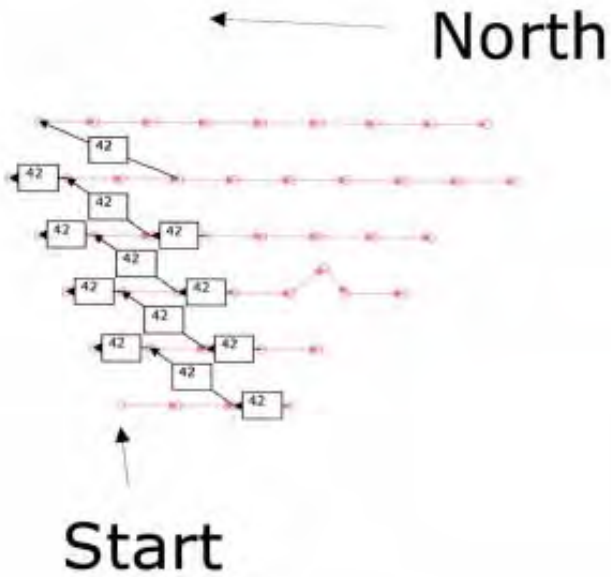
Crew including Blaster in Charge:

Blaster's Signature

Date of Report:

Notes:

SHOTPlus 5 Plan



ORICA

Not to scale

ShotPlus5 5.3.6.0	
Mine	
Location	
Title/author	
Filename	

CHAPTER IV, APPENDIX IV-12A
Blasting Notifications, Waivers, and Pre-Blast Surveys

Inserted 01/2017

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

William Boyd Stansfield Jr. ETAL
P.O. Box 553
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods.

Pre-blast survey request and waiver forms are included below. If you want to have a pre-blast survey, at no cost to you, please complete the "request" form. If you do not want a pre-blast survey, please fill out the "waiver" form. A stamped addressed envelope is included for your convenience. If we do not receive one of the forms back from you within ten days, we will assume that you do not want a pre-blast survey.

A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I BILL STANSFIELD waive my right to a Pre-Blast Survey

Signature Bill Stansfield Date: 12-15-16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Derek Beagley
P.O. Box 106
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I _____ waive my right to a Pre-Blast Survey

Signature _____ Date: 12-21-16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Rainbow Glass Ranch
P.O. Box 485
Orangeville, UT 84537

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Carlow Glass Ranch by Ross Hunt waive my right to a Pre-Blast Survey

Signature Ross Hunt managing Partner Date: 12-16-16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Kenneth and Earlene Christiansen
P.O. Box 552
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I _____ waive my right to a Pre-Blast Survey

Signature _____ Date: Dec 15 - 2016

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Michael and Jodi Christensen
P.O. Box 14
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Michael Christensen Jodi Christensen waive my right to a Pre-Blast Survey

Signature Michael Christensen Jodi Christensen Date: 12/27/16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Josiah K. Eardley
P.O. Box 554
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Josiah K Eardley waive my right to a Pre-Blast Survey

Signature Josiah K Eardley Date: 12-27-16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Josiah K. and Etta Marie Eardley
P.O. Box 554
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Josiah K Eardley waive my right to a Pre-Blast Survey

Signature Etta Marie Eardley Josiah K Eardley Etta Marie Eardley. Date: 12-27-16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 16, 2016

CERTIFIED MAIL #

Emery County Road Department
300 West State Route 29
Castle Dale, UT 84513
Attn.: Wayde Nielsen

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods.

Pre-blast survey request and waiver forms are included below. If you want to have a pre-blast survey, at no cost to you, please complete the "request" form. If you do not want a pre-blast survey, please fill out the "waiver" form. A stamped addressed envelope is included for your convenience. If we do not receive one of the forms back from you within ten days, we will assume that you do not want a pre-blast survey.

A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Gary S. Takenaka

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Wayde S. Nielsen waive my right to a Pre-Blast Survey

Signature _____ Date: 1-11-17

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Jesse L. and Megan Allan
P.O. Box 43
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

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A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Jesse Allan Megan Allan waive my right to a Pre-Blast Survey

Signature Megan Allan Date: 12/27/16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 8, 2016

CERTIFIED MAIL #

Osburn Bret Carter ETAL
P.O. Box 24
Emery, UT 84522

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Nielsen:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods.

Pre-blast survey request and waiver forms are included below. If you want to have a pre-blast survey, at no cost to you, please complete the "request" form. If you do not want a pre-blast survey, please fill out the "waiver" form. A stamped addressed envelope is included for your convenience. If we do not receive one of the forms back from you within ten days, we will assume that you do not want a pre-blast survey.

A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Bret Carter waive my right to a Pre-Blast Survey

Signature Bret Carter Date: 12-28-16

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

December 16, 2016

CERTIFIED MAIL #

Utah Power & Light dba
Rocky Mountain Power
2011 S. Highway 10
Price, UT 84501
Attn.: Jesse Barker

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Barker:

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods.

Pre-blast survey request and waiver forms are included below. If you want to have a pre-blast survey, at no cost to you, please complete the "request" form. If you do not want a pre-blast survey, please fill out the "waiver" form. A stamped addressed envelope is included for your convenience. If we do not receive one of the forms back from you within ten days, we will assume that you do not want a pre-blast survey.

A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Seth McCourt

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Jesse Barker waive my right to a Pre-Blast Survey

Signature _____ Date: 1-6-17

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

Bronco Utah Operations LLC
PO Box 527
Emery Utah, 84522
801-286-2301

January 30, 2017

CERTIFIED MAIL #

Horace A. Petty Trustee
P.O. Box 144
Orangeville, UT 84537

RE: Bronco Utah Operations LLC
Emery Mine, Emery County Utah
Blasting Operations Notification
Permit Number 015/0015

Mr. Petty,

Per Utah Administrative Code Title R645-301-524-300, you are being contacted as a resident or owner of a dwelling or other structure located within one-half mile of the above-mentioned Utah Division of Oil, Gas, and Mining Permit (DOGM) 015/0015 permit area. This letter is to notify you that you have the right to a pre-blast survey. The site is located in SE ¼ of Section 32 T22S, R6E at the Emery Mine. Bronco Utah Operations will be conducting construction blasting over a period of two months in 2017 to facilitate construction of a new mine portal.

The law requires that we offer a pre-blast survey to every resident and owner of a building within the pre-blast survey radius for this mine permit. The pre-blast survey will record and document the physical condition of your dwelling or structure prior to blasting on this permit. The pre-blast surveyor will look at each room in your home as well as each outside wall and document the current condition using one or more of the following: a camera, sketches, drawings, narrative descriptions or a combination of methods. **Bronco assumes all responsibility if the blasting described above causes any cracks, craters or settling on the property located at: NE ¼, NE ¼ , SW ¼, SECTION 30 T22 S, R6 E on the east side of Highway SR 10.**

Pre-blast survey request and waiver forms are included below. If you want to have a pre-blast survey, at no cost to you, please complete the "request" form. If you do not want a pre-blast survey, please fill out the "waiver" form. A stamped addressed envelope is included for your convenience. If we do not receive one of the forms back from you within ten days, we will assume that you do not want a pre-blast survey.

A copy of the pre-blast survey, if requested will be sent to DOGM.

If you have any questions about the blasting, please contact me at 435-286-2029 or 970-560-2827.

Sincerely,

Dan R. Baker

President & CEO

Bronco Utah Operations, LLC

WAIVER of Pre-Blast Survey per R645-301-524-300:

I Horace Petty waive my right to a Pre-Blast Survey

Signature Horace Petty Date: 1-30-17

REQUEST for Pre-Blast Survey per R645-301-524-300:

I _____ request a Pre-Blast Survey

Signature _____ Date: _____

Please contact me to schedule a survey.

CHAPTER IV, APPENDIX IV-13

Emery 2 Expansion Civil Design Drawings, R & M Consultants

BRONCO UTAH MINE

CIVIL DRAWING SET

FOR

BRONCO UTAH OPERATIONS, LLC

DRAWING INDEX	
C-1	SHEET INDEX/VICINITY MAP/NOTES
C-2	STANDARD CROSS SECTIONS
C-3	BOX CUT/CONV. 1 PLAN + PROFILE
C-4	CONVEYOR 2 PLAN + PROFILE
C-5	CROSS SECTIONS
C-6	CROSS SECTIONS
C-7	CROSS SECTIONS

GENERAL CIVIL NOTES:

1. DESIGN ELEVATIONS WITHIN THE EXISTING DISTURBED AREA ARE BASED ON SURVEY BY WARE SURVEYING RECEIVED 3/21/16. DESIGN ELEVATIONS OUTSIDE THE EXISTING DISTURBED AREA ARE BASED ON AN AERIAL SURVEY PROVIDED BY BRONCO UTAH OPERATIONS, LLC.
2. WORK THESE DRAWINGS WITH THE DRAINAGE DRAWINGS PREPARED BY EARTHFAX ENGINEERING.
3. ALL CONSTRUCTION ACTIVITY SHALL BE COORDINATED WITH THE OWNER PRIOR TO ANY DISTURBANCE.
4. CONSTRUCTION COORDINATE & DIMENSION ARE SHOWN IN DETAIL IN THE AUTOCAD DRAWING PROVIDED BY R&M ENGINEERING TO BRONCO UTAH OPERATIONS, LLC.
5. ACCESS TO THE SITE SHALL BE PROVIDED BY AND COORDINATED WITH THE OWNER. ALL DAMAGE TO PROPERTY SHALL BE REPAIRED TO MATCH EXISTING CONDITIONS.
6. ALL CONSTRUCTION SHALL BE DONE IN COMPLIANCE WITH MSHA GUIDELINES. THESE DRAWINGS DO NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY.
7. THE CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS, LAYOUT DIMENSIONS, AND CLEARANCES THAT ARE SHOWN ON THE DRAWINGS. ANY DISCREPANCIES WITHIN THE DRAWINGS, EXISTING FIELD CONDITION, SPECIFICATION, CODES OR REGULATIONS ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO SUBMITTING BIDS. FIELD REVISIONS REQUIRE ENGINEERING REVIEW AND WRITTEN CONFIRMATION FROM THE OWNER.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING ALL EROSION AND SEDIMENTATION CONTROL MEASURES AND STORMWATER MANAGEMENT PRACTICES NECESSARY TO COMPLY WITH THE STATE OF UTAH AND EMERY COUNTY REGULATIONS UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED.
9. SLOPES WITHIN THE BOX CUT NEED TO BE VERIFIED FOR STABILITY BY A GEOTECHNICAL ENGINEERING CONSULTANT PRIOR TO & DURING CONSTRUCTION OF THE CUTS TO CONFIRM THE STABILITY AND SAFETY OF THE FINISHED PROJECT INCLUDING OVERHANGING ROCKS & DEBRIS.
10. CLEARING & GRUBBING: THE CONTRACTOR SHALL REMOVE ANY OBSTRUCTIONS ALONG THIS PROJECT SUCH AS SHRUBS, BRUSH AND ANY OTHER EXTRANEOUS MATERIALS WITHIN THE RIGHT OF WAY.
11. ALL UNDERCUTTING OF ROCK OR UNSUITABLE MATERIALS SHALL BE BACKFILLED WITH SUITABLE MATERIAL AS DIRECTED BY THE ENGINEER.
12. IN CUT AREAS ALONG ROAD AND CONVEYOR CORRIDOR:
    - 12.1. CLEAR & GRUB ALL VEGETATION & DEBRIS.
    - 12.2. OVER EXCAVATE 12" BELOW FINISHED GRADE
    - 12.3. ROADWAYS SHOULD HAVE 12" MIN. UDOT APPROVED ROAD BASE WITH MAX. ¾" ROCK PLACED, MOISTURE CONDITIONED, AND COMPACTED TO AT LEAST 90 PERCENT OF THE MODIFIED PROCTOR DENSITY.
13. IN FILL AREAS ALONG ROAD AND CONVEYOR CORRIDOR:
    - 13.1. CLEAR & GRUB ALL VEGETATION & DEBRIS.
    - 13.2. ON SITE EXCAVATED MATERIAL CAN BE PLACED IN MAX. 12" LOOSE LIFTS AND COMPACTED.
    - 13.3. ROADWAYS SHOULD HAVE 12" MIN. UDOT APPROVED ROAD BASE WITH MAX. ¾" ROCK PLACED, MOISTURE CONDITIONED, AND COMPACTED TO AT LEAST 90 PERCENT OF THE MODIFIED PROCTOR DENSITY.
14. CONTRACTOR TO FIELD ADJUST THE ACTUAL START OF SURFACE DITCHES SHOW ON THE PLANS AS NEEDED FOR LOCALIZED ELEVATIONS.

DLB	
DLB	
NLB	
NLB	

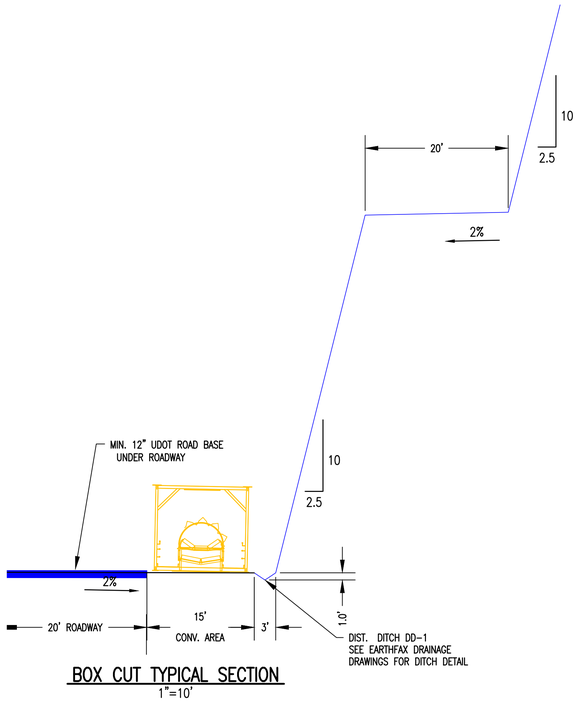
BRONCO UTAH MINE
EMERY, UTAH
BRONCO UTAH OPERATIONS, LLC

R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

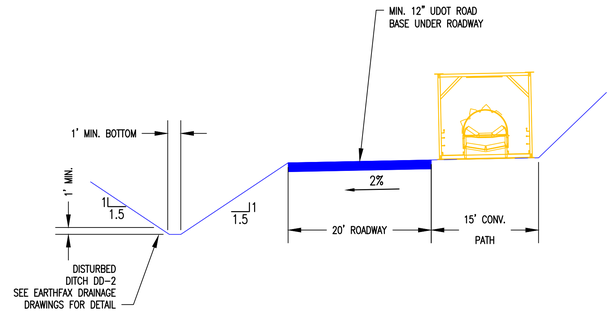
COVER SHEET,
VICINITY MAP, AND GENERAL NOTES

DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

DWG. NO.	REV.
C-1	2



BOX CUT TYPICAL SECTION
1"=10'



TYPICAL SECTION ALONG CONV. 2
1"=10'

NOTES:
1. WORK THIS DRAWING WITH DRAWINGS C-1 TO C-7.
2. SEE DWG. C-1 FOR GENERAL NOTES.
3. SURFACE SHOWN IN PLANS IS FINISHED GRADE.
4. DRAWING SCALE IS BASED ON 24x36 SIZED DRAWINGS.

1"=10' 0 5' 10' 20' 30' 40'

DLB	
DLB	
NLB	
NLB	

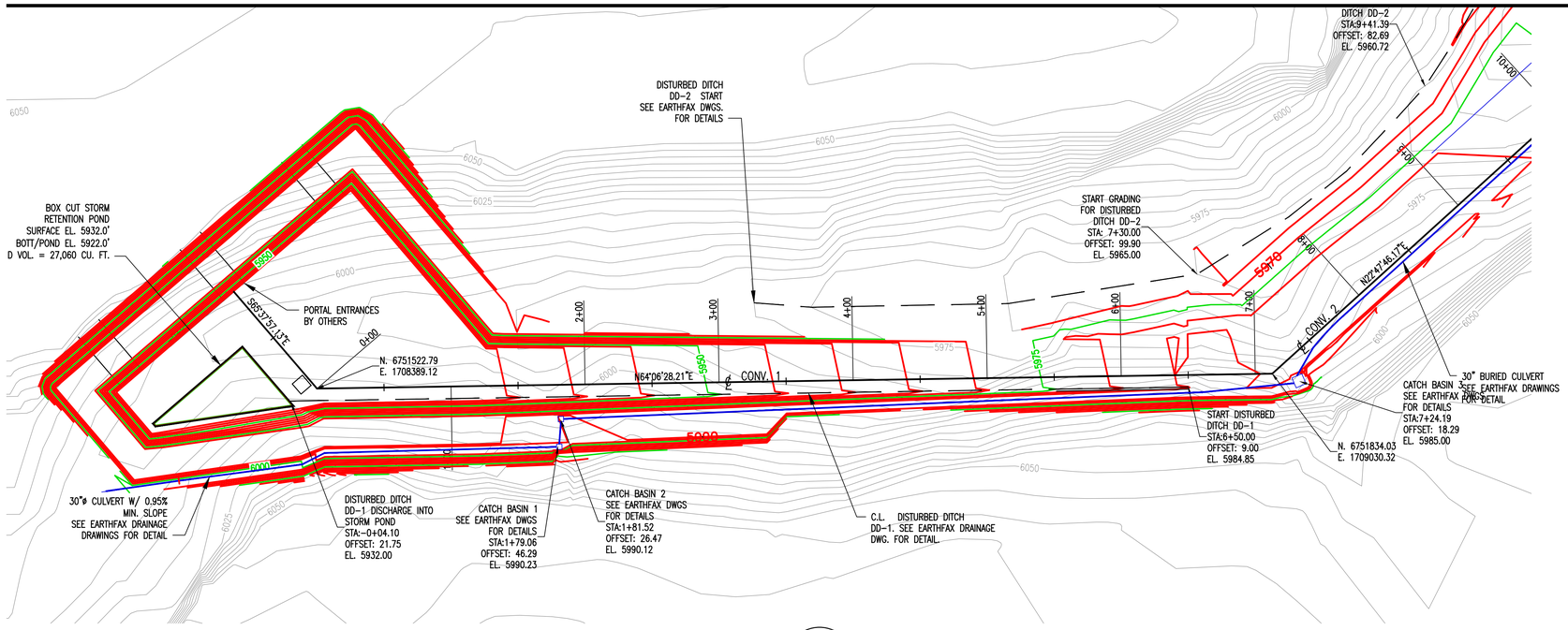
BRONCO UTAH MINE
EMERY, UTAH
BRONCO UTAH OPERATIONS, LLC

R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

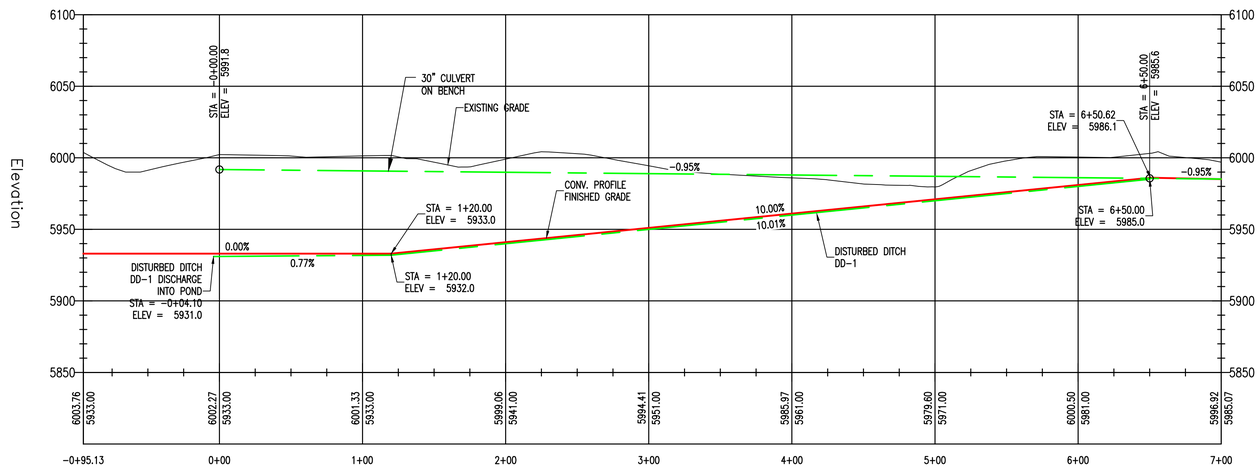
TYPICAL CROSS SECTIONS

DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

DWG. NO.	REV.
C-2	2



PLAN VIEW – BOX CUT/CONVEYOR 1
1"=50'



PROFILE VIEW – BOX CUT/CONVEYOR 1
1"=50'

NOTES:
1. WORK THIS DRAWING WITH DRAWINGS C-1 TO C-7.
2. SEE DWG. C-1 FOR GENERAL NOTES.
3. SURFACE SHOWN IN PLANS IS FINISHED GRADE.
4. DRAWING SCALE IS BASED ON 24x36 SIZED DRAWINGS.

1"=50': 0 25' 50' 100' 150' 200'

1"=10': 0 5' 10' 20' 30' 40'

DLB	
DLB	
NLB	
NLB	

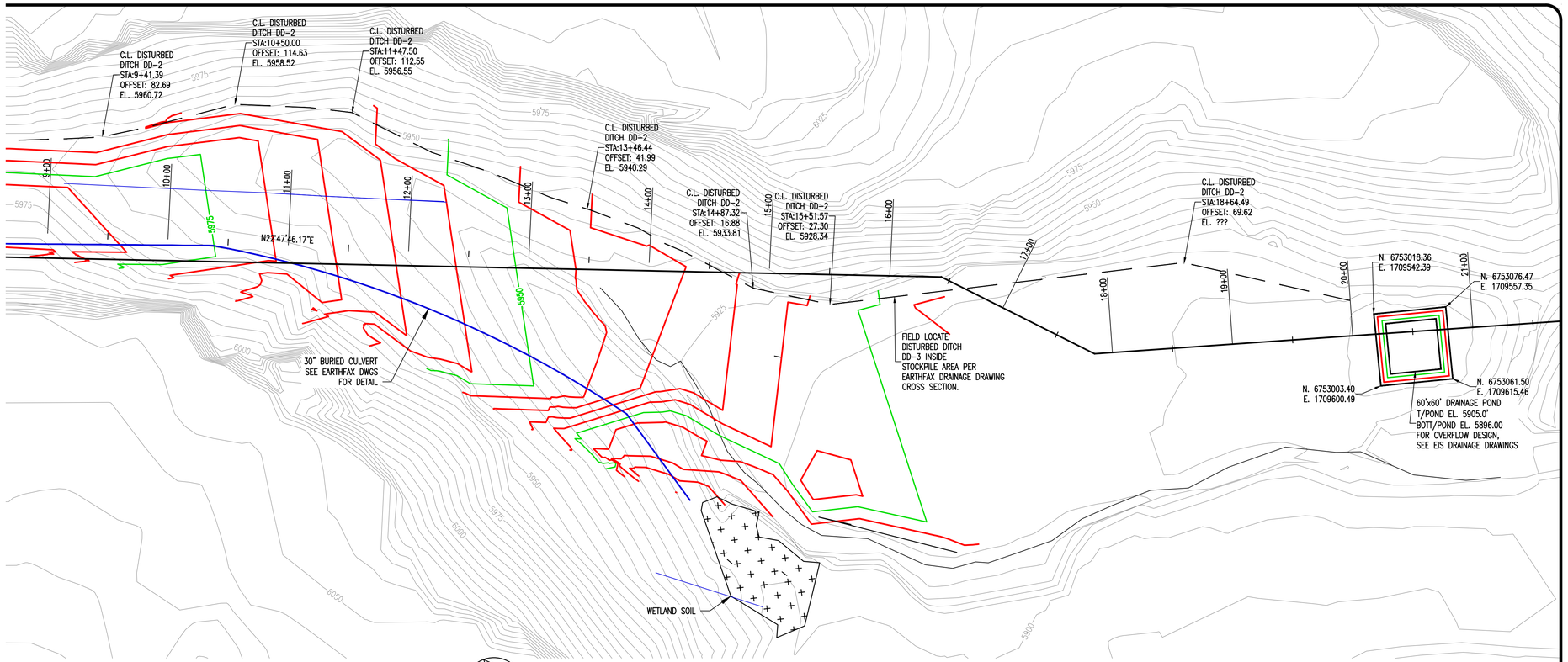
BRONCO UTAH MINE
EMERY, UTAH
BRONCO UTAH OPERATIONS, LLC

R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

BOX CUT & CONV. 1
CIVIL PLAN & PROFILE

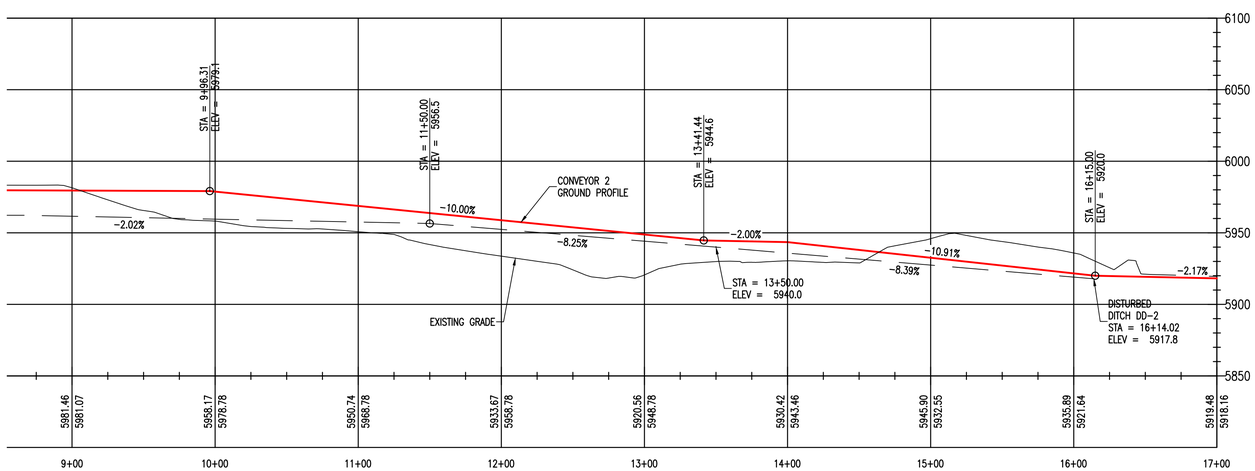
DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

DWG. NO.	REV.
C-3	2



PLAN VIEW – CONVEYOR 2
1"=50'

N



PROFILE VIEW – CONVEYOR 2
1"=50'

NOTES:
1. WORK THIS DRAWING WITH DRAWINGS C-1 TO C-7.
2. SEE DWG. C-1 FOR GENERAL NOTES.
3. SURFACE SHOWN IN PLANS IS FINISHED GRADE.
4. DRAWING SCALE IS BASED ON 24x36 SIZED DRAWINGS.

DLB	
DLB	
NLB	
NLB	

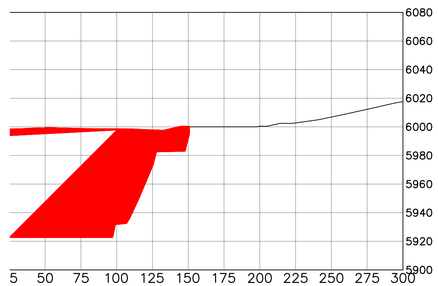
BRONCO UTAH MINE
EMERY, UTAH
BRONCO UTAH OPERATIONS, LLC

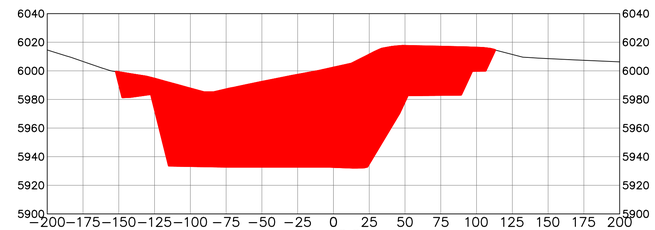
R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

CONVEYOR 2
CIVIL PLAN & PROFILE

DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

DWG. NO.	REV.
C-4	2





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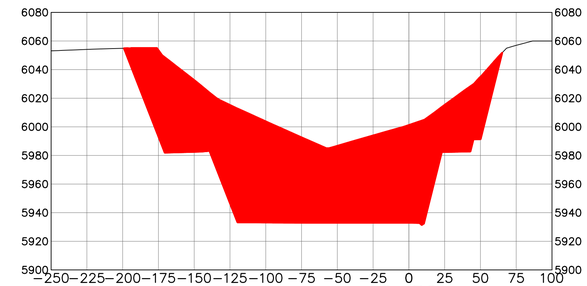

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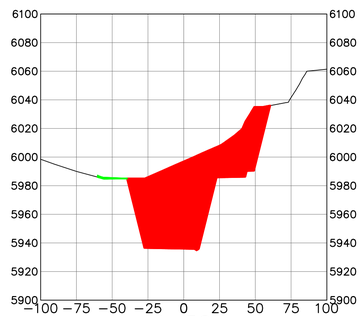

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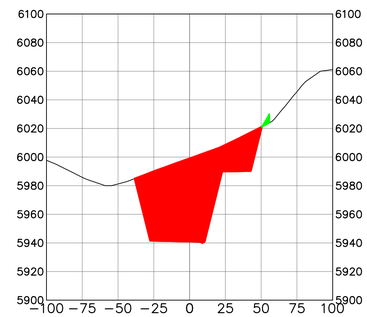

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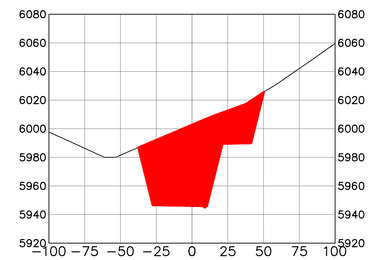

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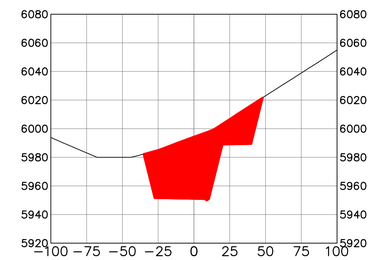

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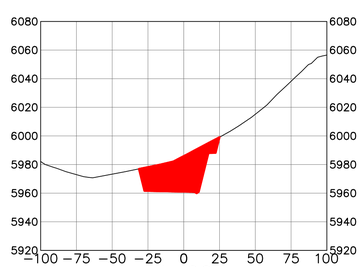
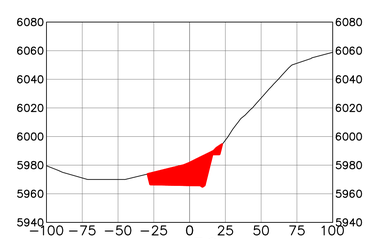


4+00



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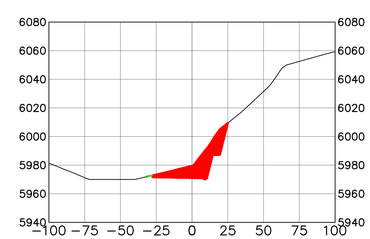

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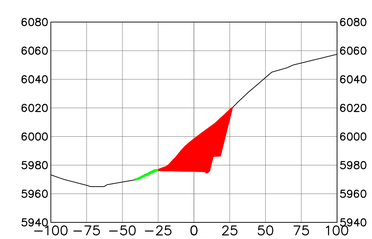


5+50

CROSS SECTIONS

1"=50'

NOTES:
1. WORK THIS DRAWING WITH DRAWINGS C-1 TO C-7.
2. SEE DWG. C-1 FOR GENERAL NOTES.
3. SURFACE SHOWN IN PLANS IS FINISHED GRADE.
4. DRAWING SCALE IS BASED ON 24x36 SIZED DRAWINGS.

1"=50' 0 25' 50' 100' 150' 200'

DLB	
DLB	
NLB	
NLB	

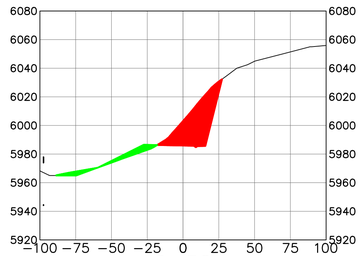
BRONCO MINE
EMERY COUNTY, UT
BRONCO UTAH OPERATIONS, LLC

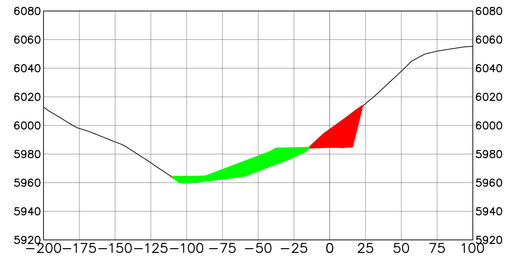
R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

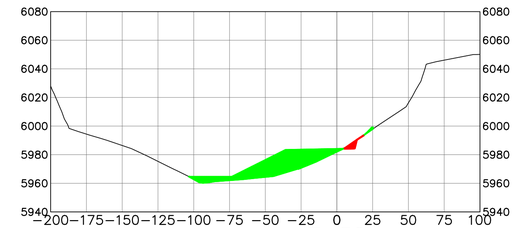
CROSS SECTIONS

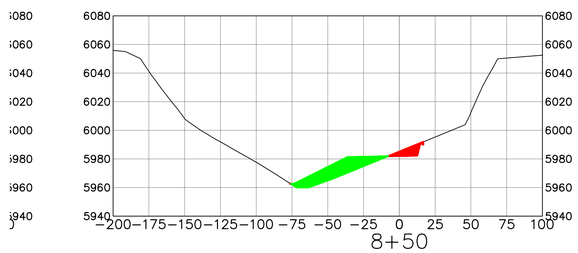
DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

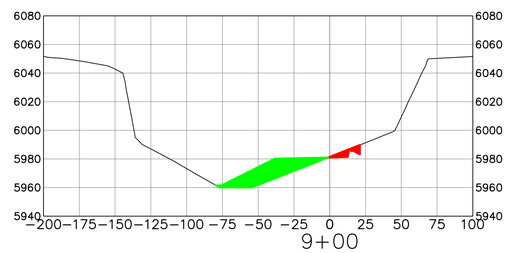
DWG. NO.	REV.
C-5	2

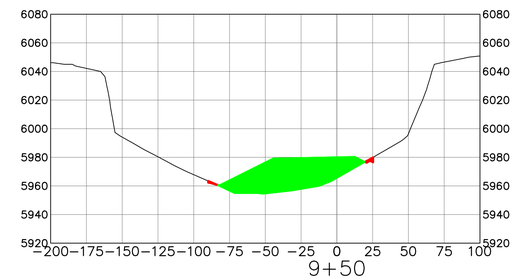


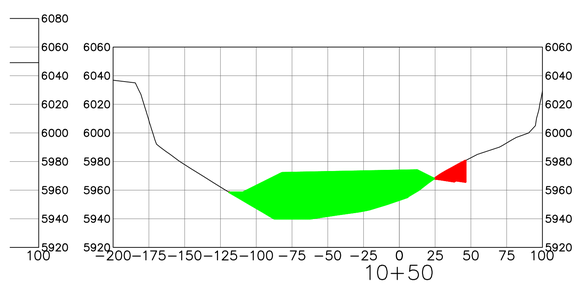


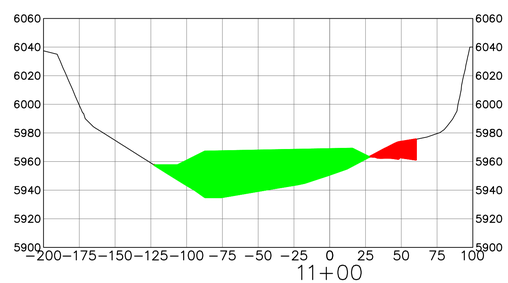


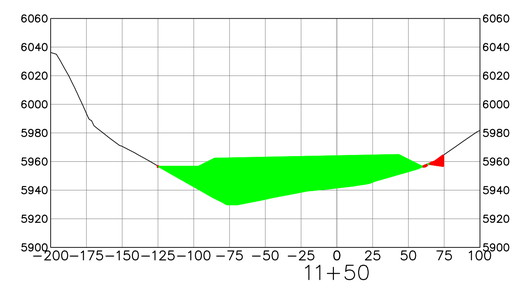












CROSS SECTIONS
1"=50'

NOTES:
1. WORK THIS DRAWING WITH DRAWINGS C-1 TO C-7.
2. SEE DWG. C-1 FOR GENERAL NOTES.
3. SURFACE SHOWN IN PLANS IS FINISHED GRADE.
4. DRAWING SCALE IS BASED ON 24x36 SIZED DRAWINGS.

1"=50' 0 25' 50' 100' 150' 200'

DLB
DLB
NLB
NLB

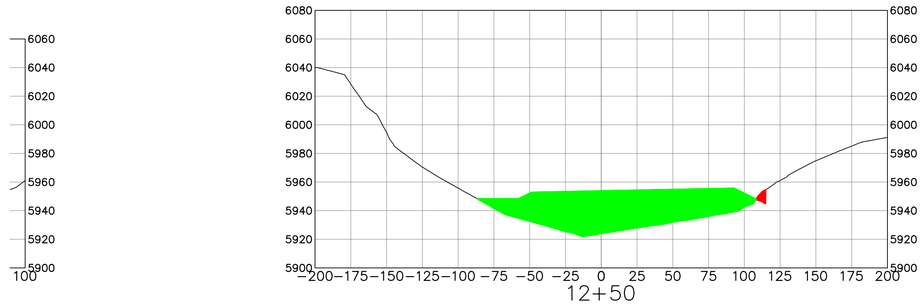
BRONCO MINE
EMERY COUNTY, UT
BRONCO UTAH OPERATIONS, LLC

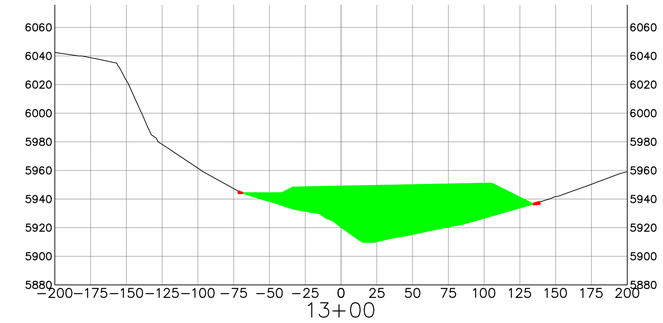
R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

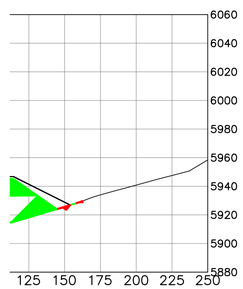
CROSS SECTIONS

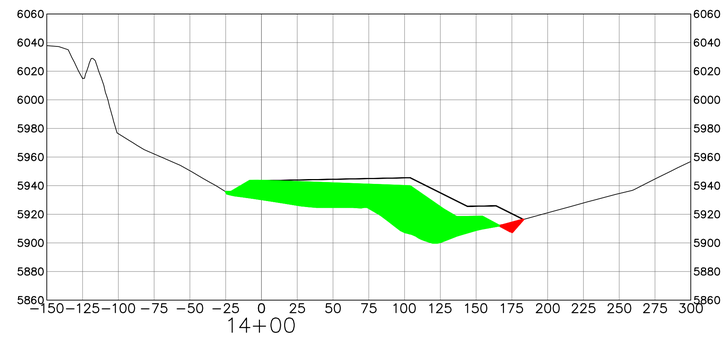
DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

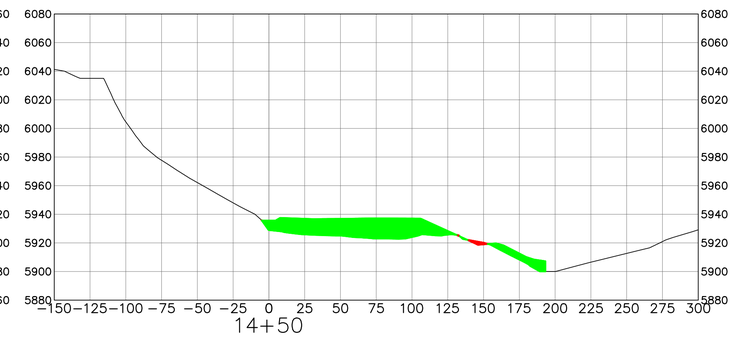
DWG. NO.	REV.
C-6	2

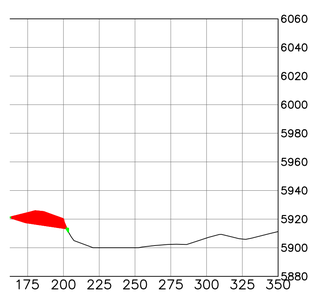


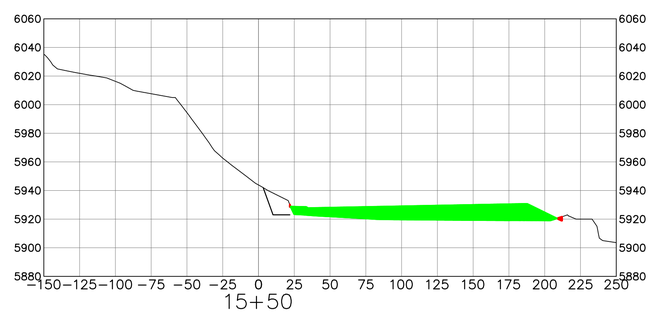


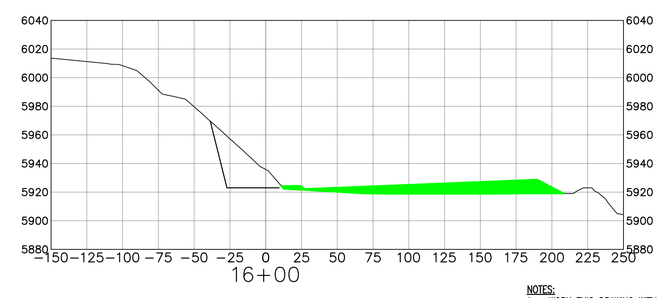












CROSS SECTIONS
1"=50'

NOTES:
1. WORK THIS DRAWING WITH DRAWINGS C-1 TO C-7.
2. SEE DWG. C-1 FOR GENERAL NOTES.
3. SURFACE SHOWN IN PLANS IS FINISHED GRADE.
4. DRAWING SCALE IS BASED ON 24x36 SIZED DRAWINGS.

1"=50' 0 25' 50' 100' 150' 200'

DLB	
DLB	
NLB	
NLB	

BRONCO MINE
EMERY COUNTY, UT
BRONCO UTAH OPERATIONS, LLC

R&M ENGINEERING CONSULTANTS
SALT LAKE CITY, UTAH
(801)263-3419

CROSS SECTIONS

DATE: 9/28/2016
R&M NO.: 16006
SCALE: AS NOTED

DWG. NO.	REV.
C-7	2

Project: Bronco Utah Mine
Location: Emery , Utah
Report Date: 9/28/2016
Report by: Doug Bennion P.E.

Volume Summary:

Name:	Cut Factor	Fill Factor	2D Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Finished Grade	1.0	1.0	272081.00	149501.99	79346.41	70155.58 (CUT)

Volume Detail by Station

Station	Cut Area (Sq.ft.)	Cut Volume (Cu.yd.)	Reusable Volume (Cu.yd.)	Fill Area (Sq.ft.)	Fill Volume (Cu.yd.)	Cum. Cut Vol. (Cu.yd.)	Cum. Reusable Vol. (Cu.yd.)	Cum. Fill Vol. (Cu.yd.)	Cum. Net Vol. (Cu.yd.)
-0+50.000	17737.6	0	0	0.01	0	0	0	0	0
0+00.000	12592.2	28083.1	28083.09	0	0.01	28083.09	28083.09	0.01	28083.08
0+50.000	14174.3	4455.19	4455.19	0	0	32538.28	32538.28	0.01	32538.27
1+00.000	7158.76	19752.9	19752.86	0.01	0.01	52291.14	52291.14	0.03	52291.12
1+50.000	4048.05	10376.7	10376.68	9.93	9.21	62667.82	62667.82	9.23	62658.59
2+00.000	3378.26	6876.21	6876.21	14.8	22.9	69544.03	69544.03	32.13	69511.9
2+50.000	3341.65	6222.14	6222.14	0	13.7	75766.17	75766.17	45.83	75720.34
3+00.000	2470.04	5381.2	5381.2	0	0	81147.37	81147.37	45.83	81101.54
3+50.000	1539.48	3712.52	3712.52	0	0	84859.89	84859.89	45.83	84814.06
4+00.000	1050.69	2398.3	2398.3	0	0	87258.2	87258.2	45.83	87212.36
4+50.000	602.35	1530.59	1530.59	0	0	88788.78	88788.78	45.83	88742.95
5+00.000	477.99	1000.31	1000.31	0.04	0.03	89789.1	89789.1	45.87	89743.23
5+50.000	806.98	1189.79	1189.79	10.12	9.41	90978.89	90978.89	55.27	90923.61
6+00.000	833.94	1519.37	1519.37	26.15	33.59	92498.25	92498.25	88.86	92409.39
6+50.000	759.67	1475.56	1475.56	141.15	154.91	93973.81	93973.81	243.77	93730.04
7+00.000	443.2	1113.77	1113.77	622.95	707.5	95087.58	95087.58	951.28	94136.3
7+50.000	23.34	480.36	480.36	817.67	406.39	95567.94	95567.94	1357.67	94210.27
8+00.000	144.78	155.67	155.67	378.37	1107.44	95723.61	95723.61	2465.11	93258.5
8+50.000	90.32	217.69	217.69	471.89	787.28	95941.3	95941.3	3252.39	92688.91
9+00.000	61.45	140.53	140.53	626.94	1017.44	96081.83	96081.83	4269.83	91812.01
9+50.000	13.01	68.94	68.94	1620.43	2080.9	96150.78	96150.78	6350.73	89800.05
10+00.000	2.61	14.47	14.47	2679.72	3981.63	96165.24	96165.24	10332.4	85832.88
10+50.000	172.18	161.84	161.84	3264.94	5504.31	96327.08	96327.08	15836.7	80490.41
11+00.000	268.92	408.42	408.42	3157.77	5946.95	96735.51	96735.51	21783.6	74951.89
11+50.000	35.46	281.83	281.83	3714.33	6363.06	97017.34	97017.34	28146.7	68870.67
12+00.000	15.18	46.89	46.89	3636.15	6806	97064.23	97064.23	34952.7	62111.56
12+50.000	32.23	43.9	43.9	3987.97	7059.37	97108.13	97108.13	42012	55096.09
13+00.000	6.39	35.76	35.76	4580.04	7933.34	97143.89	97143.89	49945.4	47198.51
13+50.000	7.87	13.2	13.2	4389.4	8305.04	97157.09	97157.09	58250.4	38906.68
14+00.000	56.42	59.53	59.53	3231.2	7056.11	97216.62	97216.62	65306.5	31910.09
14+50.000	15.23	66.34	66.34	1631.46	4502.46	97282.95	97282.95	69809	27473.97
15+00.000	245.56	241.47	241.47	1220.96	2641.13	97524.42	97524.42	72450.1	25074.31
15+50.000	5.39	232.36	232.36	1597.22	2609.43	97756.78	97756.78	75059.5	22697.24
16+00.000	0	4.99	4.99	1139.05	2533.59	97761.77	97761.77	77593.1	20168.65

CHAPTER IV, APPENDIX IV-14
Emery 2 Expansion Slope Stability Analyses

Emery 2 Expansion
Slope Stability Analyses

Bronco Utah Operations, LLC
Emery Mine
Emery County, Utah

October 2016

PROFESSIONAL ENGINEER
10-23-16
8235244
SCOTT A.
MURPHY
Scott Murphy
STATE OF UTAH

EarthFax EarthFax Engineering Group, LLC

Engineers / Scientists
www.earthfax.com

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APPENDIX B Order 2 Soil Survey Map
APPENDIX C Laboratory Test Reports
APPENDIX D *Slide* Geometry and Output

EMERY 2 EXPANSION
SLOPE STABILITY ANALYSES

1.0 INTRODUCTION

The purpose of this report is to summarize the methods and findings of slope stability analyses performed for the Emery 2 expansion of the Emery Mine, Emery County, Utah. This includes analyses of the reclamation fill slopes shown on Plate III-11 in Appendix A and analyses for both cut and fill slopes along the proposed Section 7 roadway (see Plate IV-8c in Appendix A).

2.0 SITE SOILS AND BEDROCK

Soils to be used for reclamation fill slopes and construction of the Section 7 roadway embankments will consist primarily of silty sands identified as soils Ca and Cb on the soil survey map included as Appendix B. Near-surface samples from both soil units were collected by EarthFax personnel and submitted to Intermountain GeoEnvironmental Services, Inc. ("IGES", Salt Lake City, Utah) for laboratory analyses of soil properties. Laboratory test reports are included in Appendix C.

Based on observations of outcrops at the site and data provided by the Utah Geological Survey's Online Interactive Geologic Map (2016), cut slopes for the Section 7 roadway will take place within the Ferron Sandstone geologic unit. This unit consists of alternating layers of sandstone, shale, and coal with an overall thickness ranging between 400 and 700 feet. Fill slopes for the roadway embankment will consist of soils "Ca" and "Cb" discussed in the previous paragraph.

3.0 EVALUATION METHODS

3.1 STABILITY MODEL

Slope stability analyses were performed using the slope stability software *Slide 5.0* ("*Slide*") by RocScience. This program uses an iterative procedure to evaluate the factor of safety against rotational shear failure for tens of thousands of potential failure surfaces that may develop within a given slope. Each trial failure surface is discretized into small slices and the driving and resisting forces/moments are calculated for each according to Bishop's Simplified Method of Slices. These forces are then summed over the entire failure surface to obtain a factor of safety defined as the sum of the resisting forces divided by the sum of the driving forces. Therefore, a factor of safety less than 1.0 indicates the potential for slope failure.

3.2 RECLAMATION FILL SLOPES

Stability of the proposed reclamation fill slopes was analyzed at the cross sections shown on Plate III-11 in Appendix A. These cross sections were selected as those having the most critical combination of slope height and gradient within the reclamation area. The following soil properties were used as input for the *Slide* analyses based on results of the laboratory testing performed by IGES:

- Unit Weight: 120 pounds per cubic foot
- Friction Angle: 33 degrees
- Cohesion: 150 pounds per square foot

The friction angle and cohesion presented above define the soil's "Mohr-Coulomb" strength envelope and were determined using direct-shear laboratory tests (see Appendix C). These tests were performed on remolded (disturbed) samples compacted to 90% of their standard proctor maximum dry density within two percent of the soil's optimum moisture content. This was done in order to represent the field strength of the soils compacted to the minimum specified compaction for reclamation. If actual field compaction is higher than this specified minimum, the soil strengths and slope stability would both be higher. Stability analyses also assumed that the entire cross section was comprised of the fill soils; this is a conservative assumption since existing native slopes are likely to contain higher-strength bedrock within the cross section analyzed.

3.3 SECTION 7 ROADWAY

Stability of the Section 7 roadway cut section was analyzed at the cross sections shown on Plate IV-8c in Appendix A. As above, these cross sections were selected as those having the most critical combination of slope height and gradient along the roadway. Bedrock strengths were defined using conservatively-estimated typical values for sandstone based on the generalized Hoek-Brown strength criterion. This strength model was developed specifically for rock applications and defines the rock mass strength based on the following inputs (RocScience, 2002):

- **Uniaxial Compressive Strength (UCS).** The compressive strength of the intact rock. Typically ranges from 1,000 to 2,000 kips per square foot ("ksf") for sandstone. 900 ksf was used in the analyses as a conservative measure and to account for the potential for some interbedded shale.

- **Geologic Strength Index (GSI).** A factor ranging from 0 to 100 (higher is better) that is used to account for the overall structure of the rock mass, ranging from massive to disintegrated or sheared. This index also accounts for the rock's surface conditions, ranging from very good to very poor. A GSI of 25 was used in the analyses to represent a disintegrated rock structure in poor condition.

- **Rock Group Factor (m_i).** A factor used to account for the rock type and its crystalline structure. Typically ranges from 13 to 21 for sandstone (higher is better). A factor of 10 was used in the analyses as a conservative measure and to account for the potential for some interbedded shale.

- **Disturbance Factor (D).** A factor used to account for the degree of disturbance to a rock mass due to blasting or excavation. This factor also accounts for the strength loss due to the stress relief that occurs after removing the overburden from a rock. The factor ranges from 0.7 for

small-scale blasting or excavation to 1.0 for large-scale production blasting. A factor of 0.7 was used in the slope stability analyses.

As shown on Plate IV-8c (Appendix A), the maximum fill embankment for the Section 7 roadway is less than 5 feet. As a result, the stability of the roadway embankment was analyzed for an embankment height of 5 feet constructed to the typical geometry shown on Plate IV-8c. Since soil used to construct the fill embankments will utilize similar soils as those used for the reclamation fill slopes (see Section 3.2), the same soil properties were assumed for the roadway embankment analysis.

3.4 GROUNDWATER

Slope stability analyses for the reclamation fill slopes and Section 7 road assume that the slopes are dry (i.e., free from groundwater that would negatively affect slope stability). This assumption is based on observations and previous investigations at the project site (see Chapter VI of the Emery mining and reclamation plan). If groundwater seepage is ever observed daylighting within cut or fill slopes, the slope stability should be re-evaluated on a case-by-case basis and slope stabilization measures such as slope flattening or reinforcement be taken as appropriate.

4.0 RESULTS

The calculated minimum factors of safety for the various scenarios described above are summarized in Table 1 with output from the *Slide* analyses included in Appendix D. As shown in this table, the minimum factor of safety for cut and fill slopes of the Section 7 roadway are 1.70 and 3.37, respectively. The minimum factor of safety for the reclamation fill slope is 1.38.

The minimum acceptable factor of safety promulgated by the Utah Division of Oil, Gas, and Mining ("DOGM") for roadway embankments (R645-301-534.130) and reclaimed slopes (R645-301-55.130) is 1.3. The minimum calculated factors of safety presented above are therefore considered acceptable and slopes are expected to remain stable under the geometry and loading conditions presented herein.

As with any slope stability analysis, if loading conditions, slope geometry, or field conditions encountered differ from those assumed within this report, stability analyses should be re-evaluated and slope stabilization measures taken as appropriate.

5.0 REFERENCES CITED

Rocscience Inc., 2002. RocLab Version 1.0 – Rock Mass Strength Analysis Using the Generalized Hoek-Brown Failure Criterion. www.rocscience.com, Toronto, Ontario, Canada.

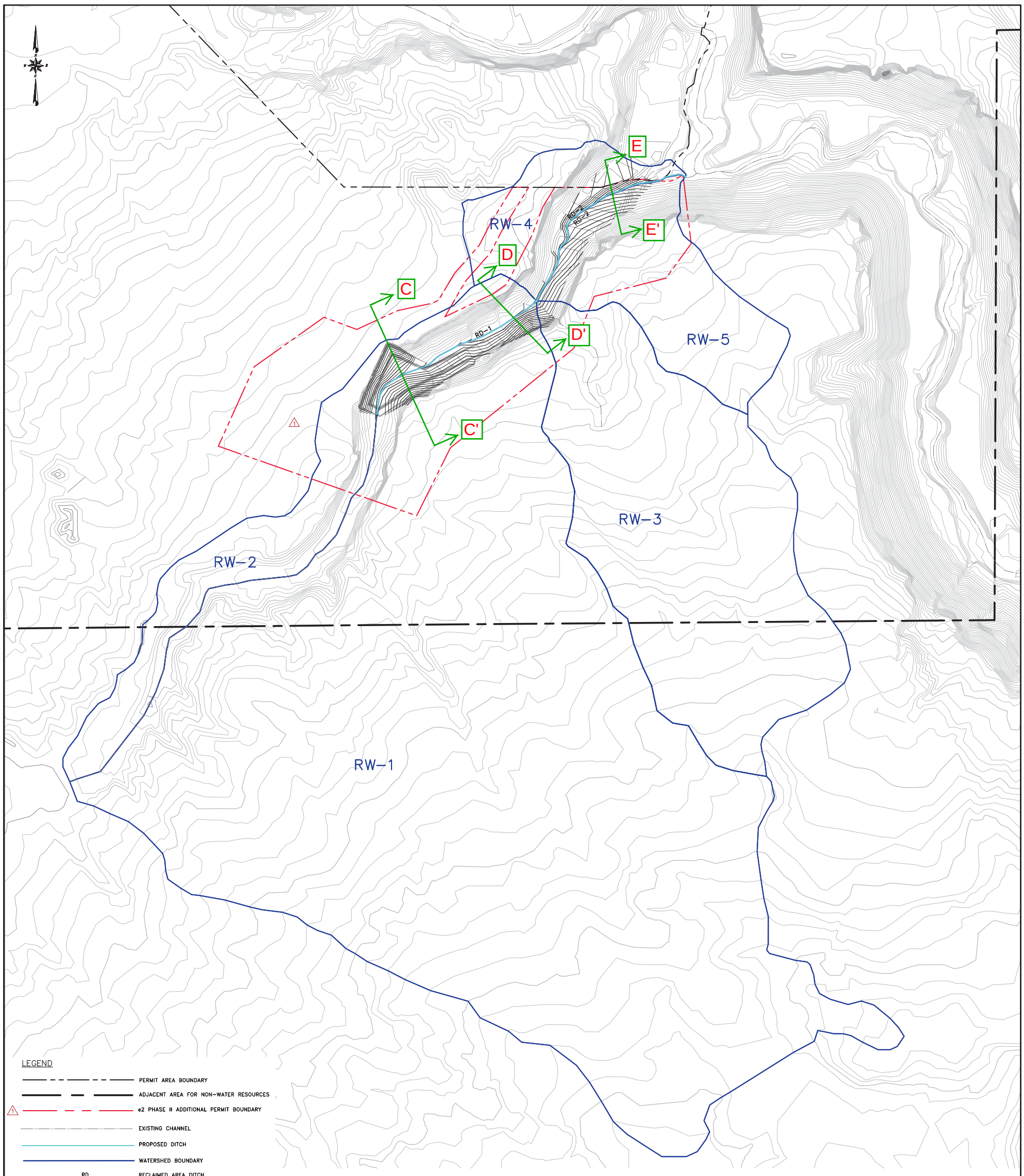
Utah Geological Survey. Accessed October 23, 2016. Utah Geological Map Portal. Available online at http://geology.utah.gov/apps/intgeomap/

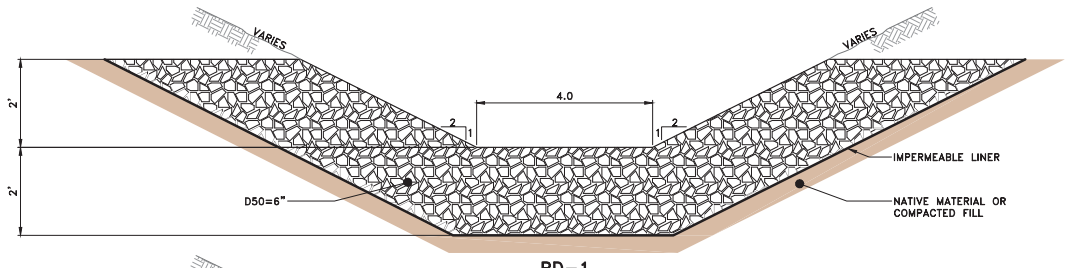
TABLES

TABLE 1 **Results of *Slide* Analyses**		
Location	**Fill Soil or Bedrock?**	**Minimum Calculated Factor of Safety**
Section 7 Roadway Section A-A'	Bedrock	1.70
Section 7 Roadway Section B-B'	Bedrock	1.72
Section 7 Roadway Maximum Embankment Fill	Fill Soil	3.37
Reclamation Fill Slope Section C-C'	Fill Soil	1.59
Reclamation Fill Slope Section D-D'	Fill Soil	1.38
Reclamation Fill Slope Section E-E'	Fill Soil	2.43

APPENDIX A

Site Maps (Markup of Plates III-11 and IV-8c)





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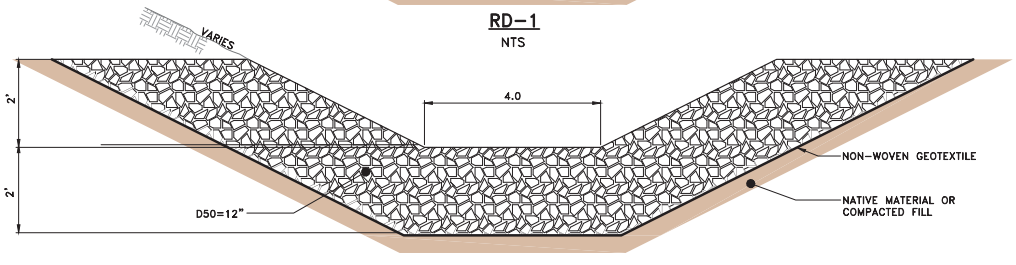
NTS



RD-2
NTS

EarthFax

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT				

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

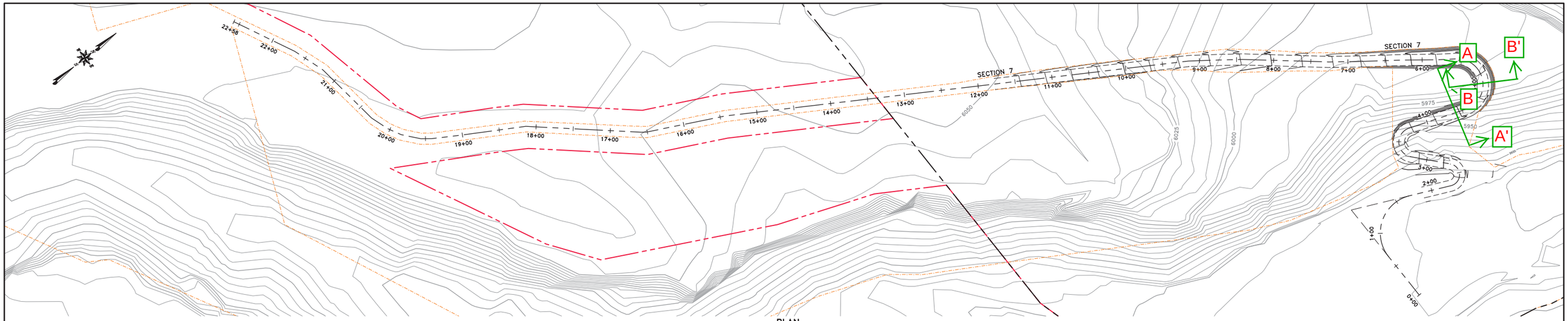
0' 200'
SCALE: 1" = 200'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 10/16
RE-DRAWN DATE: 7/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

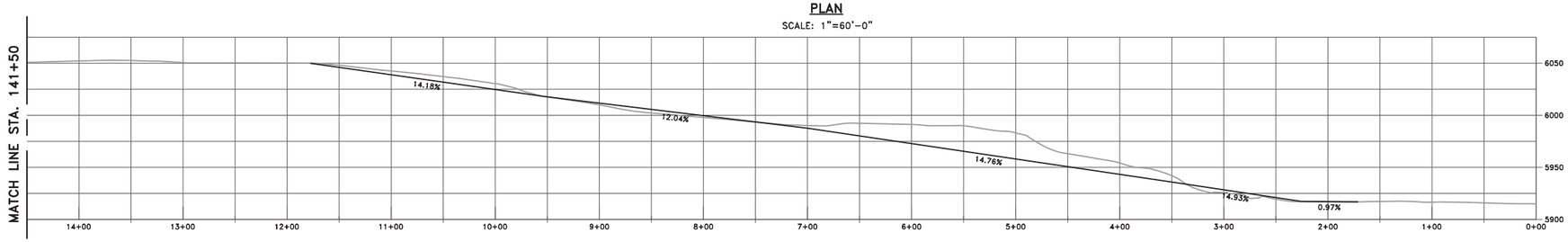
BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE III-11
EMERY 2 RECLAMATION HYDROLOGY



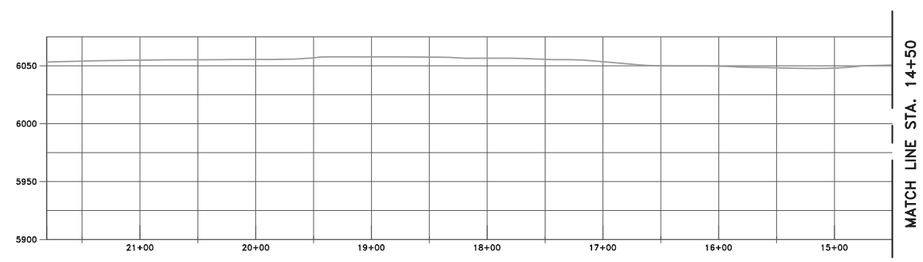
PLAN

SCALE: 1"=60'-0"



LEGEND

- APPROVED PERMIT AREA BOUNDARY
- PROPOSED E2 PERMIT BOUNDARY
- APPROVED DISTURBANCE BOUNDARY
- PROPOSED DISTURBANCE BOUNDARY

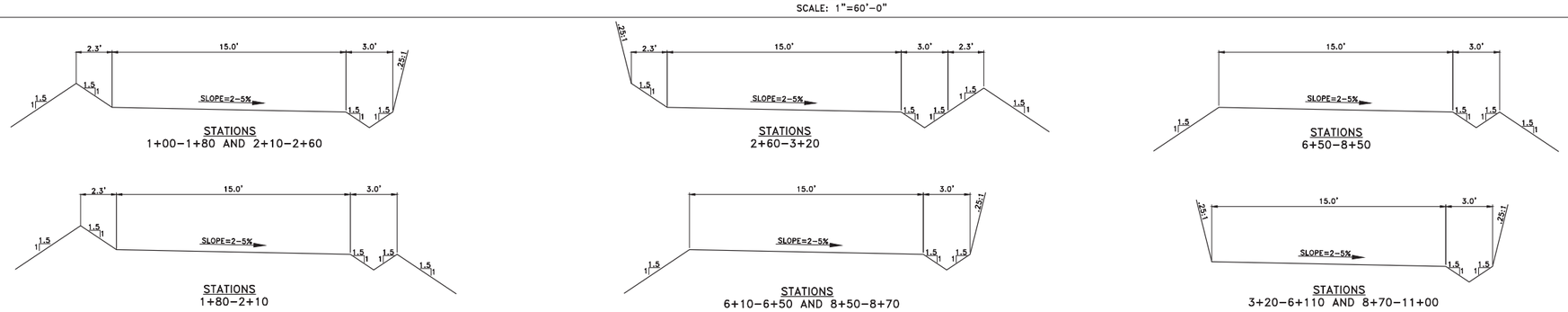


PROFILE

SCALE: 1"=60'-0"

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
ROAD 7 VOLUME	1.000	1.000	23587.06 Sq. Ft.	5247.39 Cu. Yd.	548.78 Cu. Yd.	4698.61 Cu. Yd.<Cut>



STATIONS
1+00–1+80 AND 2+10–2+60

STATIONS
2+60–3+20

STATIONS
6+50–8+50

STATIONS
1+80–2+10

STATIONS
6+10–6+50 AND 8+50–8+70

STATIONS
3+20–6+110 AND 8+70–11+00

TYPICAL ROAD SECTIONS

SCALE: 1"=4'-0"

EarthFax

BASE MAP:

COORDINATE SYSTEM:
STATE PLANE COORDINATES:
NAD 83 CONUS
ZONE 4302–UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88–US FEET

EXTERNAL REFERENCE:

REVISIONS NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	10/16	JAG	R2 PHASE II ADDITIONAL PERMIT				

SCALE: AS SHOWN

DRAWN BY: SWF | CHECKED BY: JAG | ORIGINAL DATE: 09/16 | RE-DRAWN DATE:

APPROVED BY: JAG | DWG DATA: G:\

EMERY MINE
EMERY COUNTY, UTAH

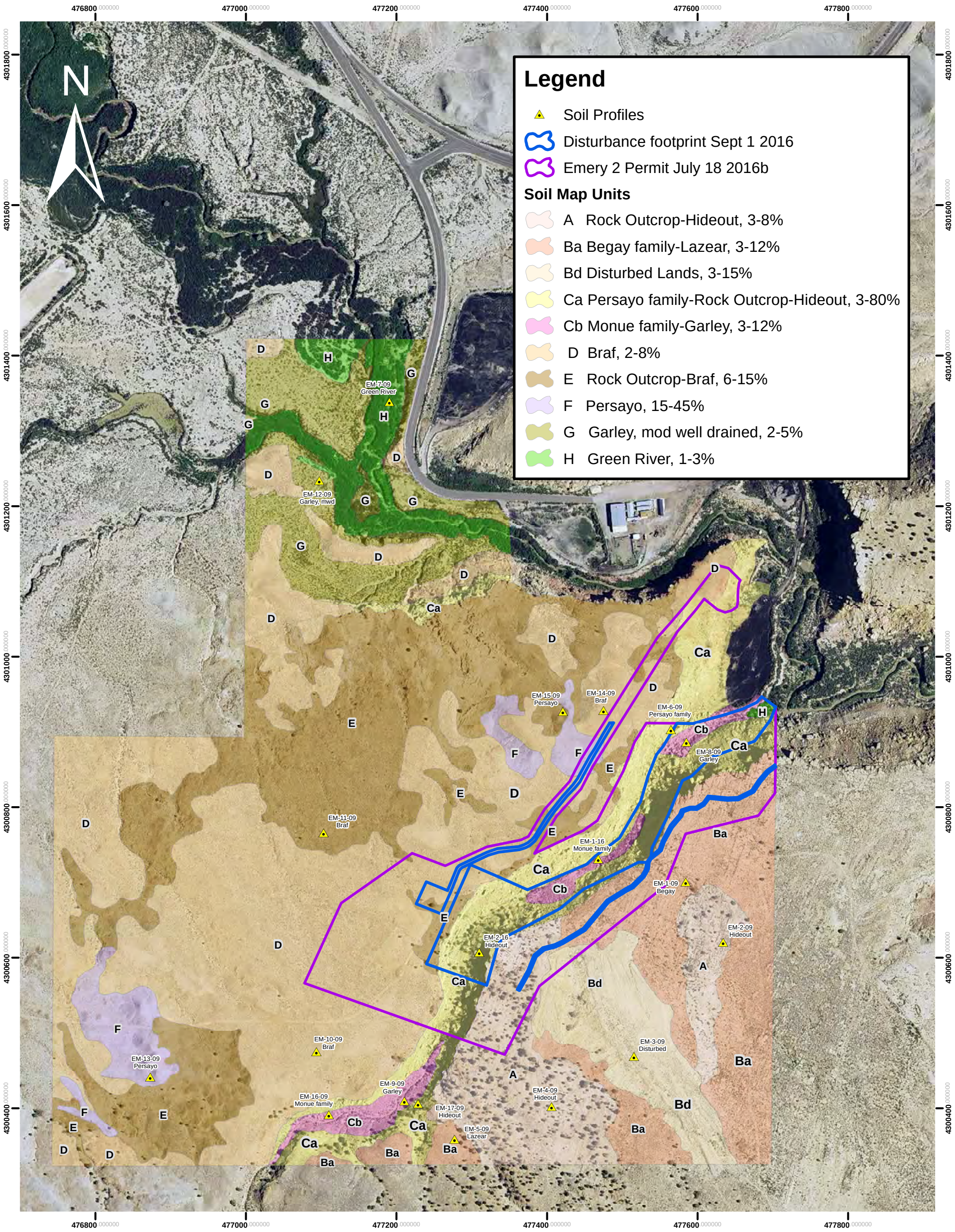
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE IV–8c
EMERY 2 EXPANSION
ROADS–PLAN/PROFILE/CROSS SECTIONS
SECTION 7 ROAD

APPENDIX B

Order 2 Soil Survey Map



Bronco UTAH OPERATIONS, LLC

Figure 3. Emery 2 Mine
Order 2 Soil Survey Map

Rev. July 18, 2016
June 30, 2016 Base map NAIP 2014 UTM NAD 83 1 inch = 400 feet

Prepared By:
Long Resource Consultants, Inc.
Morgan, Utah

0 200 400 600 800 Feet

APPENDIX C

Laboratory Test Reports

Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

© IGES 2004, 2016

Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/21/2016
By: NB

Boring No.:
Sample: Ca-1
Depth:
Description: SILT, brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)

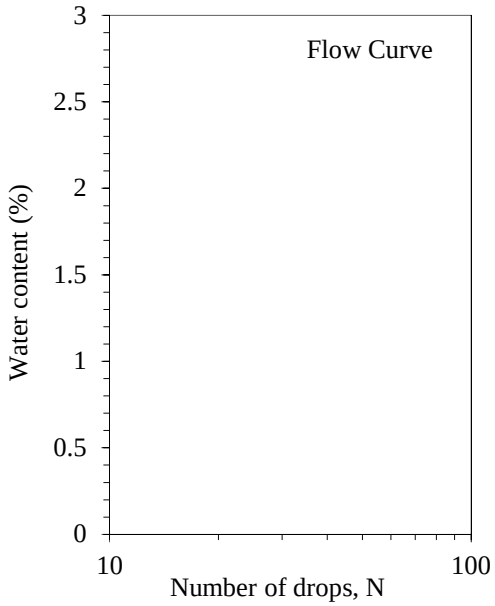
Plastic Limit

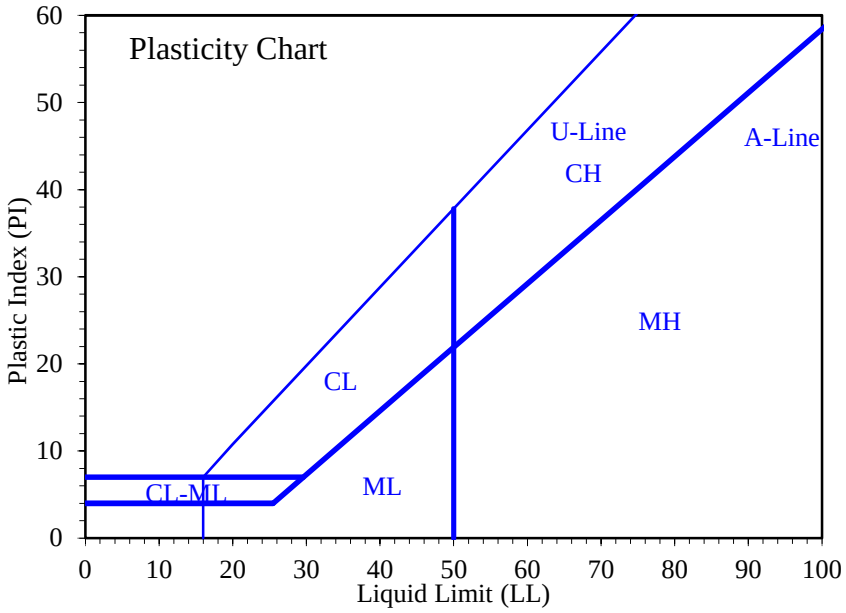
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Reviewed:_____

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Liquid Limit, Plastic Limit, and Plasticity Index of Soils

(ASTM D4318)

© IGES 2004, 2016

Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/21/2016
By: NB

Boring No.:
Sample: Cb-1
Depth:
Description: SILT, brown

Preparation method: Wet
Liquid Limit: Could not be determined (N.P.)

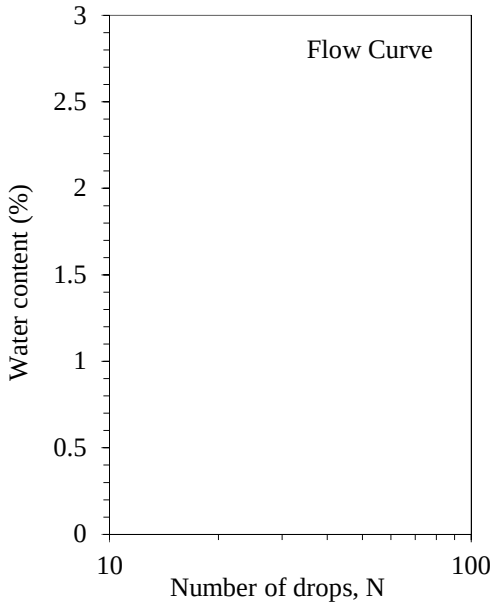
Plastic Limit

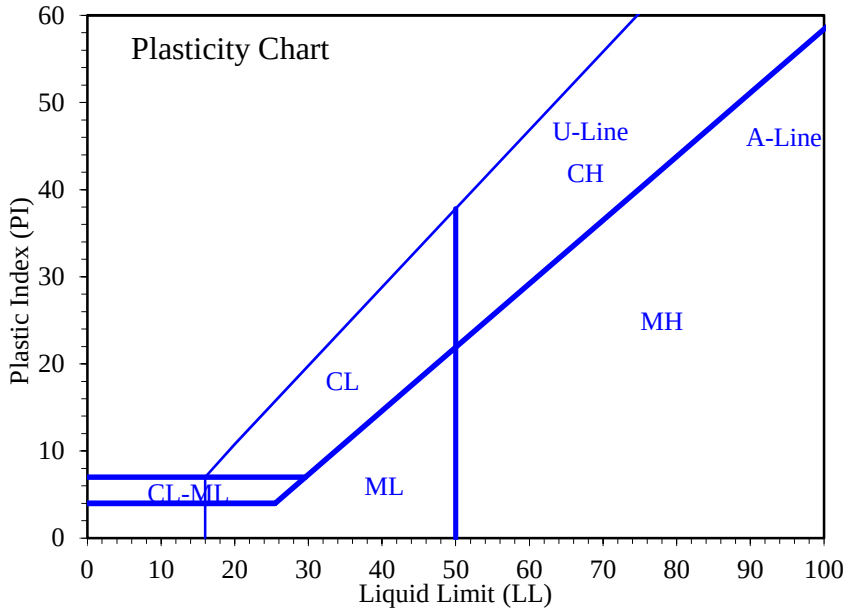
Determination No						
Wet Soil + Tare (g)						
Dry Soil + Tare (g)		Difficult to thread.				
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						

Liquid Limit: Could not be determined (N.P.)

Determination No						
Number of Drops, N						
Wet Soil + Tare (g)	Unable to obtain an adequate blow count.					
Dry Soil + Tare (g)						
Water Loss (g)						
Tare (g)						
Dry Soil (g)						
Water Content, w (%)						
One-Point LL (%)						

Liquid Limit, LL (%)	**Nonplastic (N.P.)**
Plastic Limit, PL (%)	
Plasticity Index, PI (%)	





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Reviewed:_____

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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

IGES

© IGES 2004, 2016

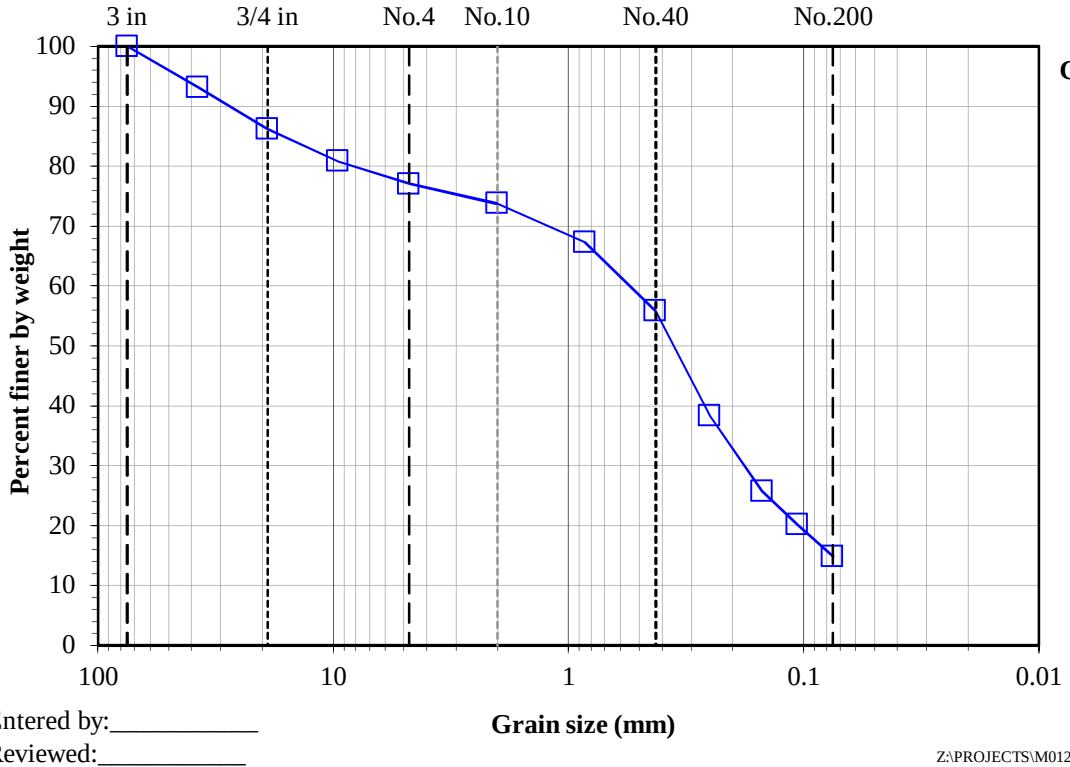
Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/21/2016
By: DS/NB

Boring No.:
Sample: Ca-1
Depth:
Description: Silty SAND with gravel, brown

	Moist	Dry
Split:	Yes	
Split sieve:	3/4"	
Total sample wt. (g):	24897.20	24668.71
+3/4" Coarse fraction (g):	3424.40	3409.00
-3/4" Split fraction (g):	1916.58	1897.56
Split fraction:	0.862	

Water content data	C.F.(+3/4")	S.F.(-3/4")
Moist soil + tare (g):	4190.30	2229.41
Dry soil + tare (g):	4174.90	2210.39
Tare (g):	765.98	312.83
Water content (%):	0.5	1.0

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	100.0	
1.5"	1692.45	37.5	93.1	
3/4"	3409.00	19	86.2	←Split
3/8"	118.61	9.5	80.8	
No.4	201.93	4.75	77.0	
No.10	273.99	2	73.7	
No.20	416.44	0.85	67.3	
No.40	668.77	0.425	55.8	
No.60	1054.52	0.25	38.3	
No.100	1331.71	0.15	25.7	
No.140	1455.00	0.106	20.1	
No.200	1571.61	0.075	14.8	



Gravel (%): 23.0
Sand (%): 62.2
Fines (%): 14.8

Entered by:_____
Reviewed:_____

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Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

(ASTM D6913)

IGES

© IGES 2004, 2016

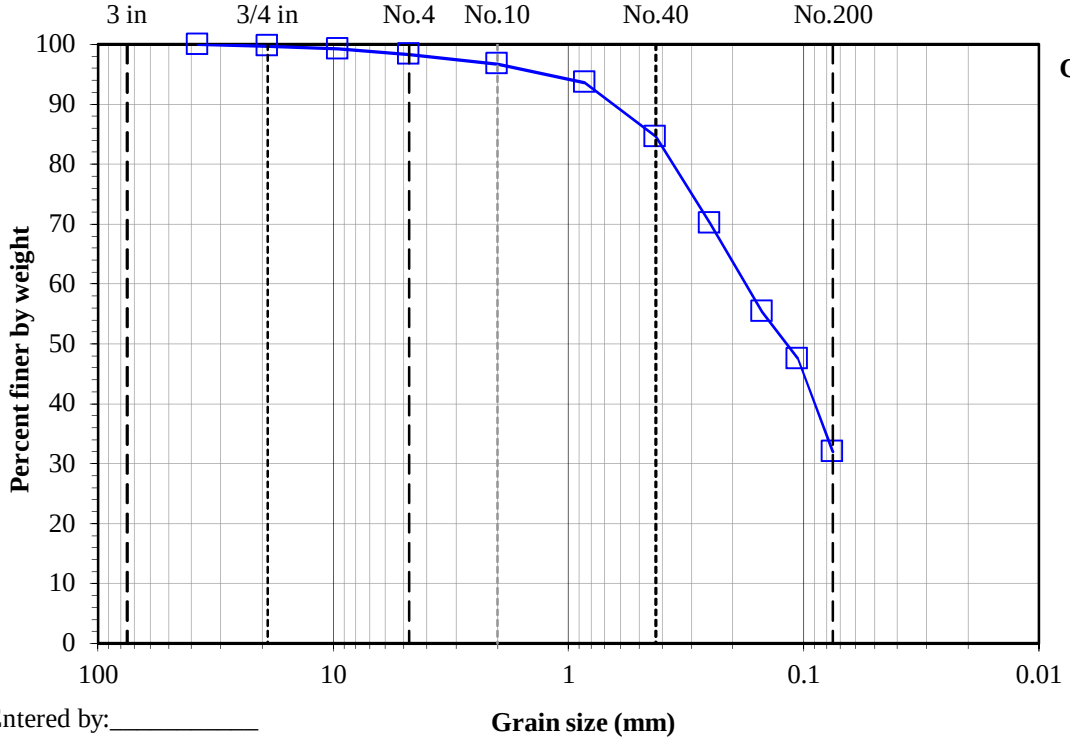
Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/21/2016
By: DS/NB

Boring No.:
Sample: Cb-1
Depth:
Description: Silty SAND, brown

Split:	Yes	
Split sieve:	3/8"	
	Moist	Dry
Total sample wt. (g):	22504.04	22254.47
+3/8" Coarse fraction (g):	168.44	167.69
-3/8" Split fraction (g):	527.83	521.95
Split fraction:	0.992	

Water content data	C.F.(+3/8")	S.F.(-3/8")
Moist soil + tare (g):	292.98	656.22
Dry soil + tare (g):	292.23	650.34
Tare (g):	124.60	128.39
Water content (%):	0.4	1.1

Sieve	Accum. Wt. Ret. (g)	Grain Size (mm)	Percent Finer	
8"	-	200	-	
6"	-	150	-	
4"	-	100	-	
3"	-	75	-	
1.5"	-	37.5	100.0	
3/4"	68.53	19	99.7	
3/8"	167.69	9.5	99.2	←Split
No.4	4.90	4.75	98.3	
No.10	13.36	2	96.7	
No.20	29.50	0.85	93.6	
No.40	77.22	0.425	84.6	
No.60	153.29	0.25	70.1	
No.100	230.74	0.15	55.4	
No.140	272.12	0.106	47.5	
No.200	353.74	0.075	32.0	



Gravel (%): 1.7
Sand (%): 66.3
Fines (%): 32.0

Entered by:_____
Reviewed:_____

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Classification of Soils for Engineering Purposes

(ASTM D2487)

© IGES 2005, 2016

Project: **EarthFax Engineering**
No: **M01292-026 (PO# UC-1665-10)**
Location:
Date: 9/21/2016
By: NB

Sample Info.	Boring No.								
	Sample:	Ca-1	Cb-1						
	Depth:								
Liquid Limit (%):		NP	NP						
Plastic Limit (%):		NP	NP						
Plastic Index (%):		NP	NP						
Gravel (%):		23	1.7						
Sand (%):		62.2	66.3						
Fines (%):		14.8	32						
D_{60} (mm):									
D_{30} (mm):									
D_{10} (mm):									
Cu:									
Cc:									
Group Symbol:		**SM**	**SM**						
Group Name:		**Silty SAND with gravel**	**Silty SAND**						

Entered by:_____

Reviewed:_____

Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

© IGES 2004, 2016

Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/21/2016
By: DKS

Method: ASTM D698 C
Mold Id. Inc 6
Mold volume (ft^3): 0.0748

Boring No.:
Sample: Ca-1
Depth:
Sample Description: Silty SAND with gravel, brown
Engineering Classification: SM
As-received water content (%): Not requested
Preparation method: Moist
Rammer: Mechanical-sector face
Rock Correction: Yes * See results below
Percent fraction retained, Pc (%) 13.8
Percent fraction passing, Pf (%) 86.2

Optimum water content (%): 10.2
Maximum dry unit weight (pcf): 116.7

Point Number	+6%	+8%	+10%	+12%				
Wt. Sample + Mold (g)	10743.1	10843.6	10915.6	10917.1				
Wt. of Mold (g)	6534.5	6534.5	6534.5	6534.5				
Wet Unit Wt., γ_m (pcf)	124.0	127.0	129.1	129.2				
Wet Soil + Tare (g)	2493.40	2444.14	2311.24	2505.88				
Dry Soil + Tare (g)	2353.57	2269.18	2112.95	2264.75				
Tare (g)	310.20	328.03	316.57	333.15				
Water Content, w (%)	**6.8**	**9.0**	**11.0**	**12.5**				
Dry Unit Wt., γ_d (pcf)	**116.1**	**116.5**	**116.3**	**114.8**				

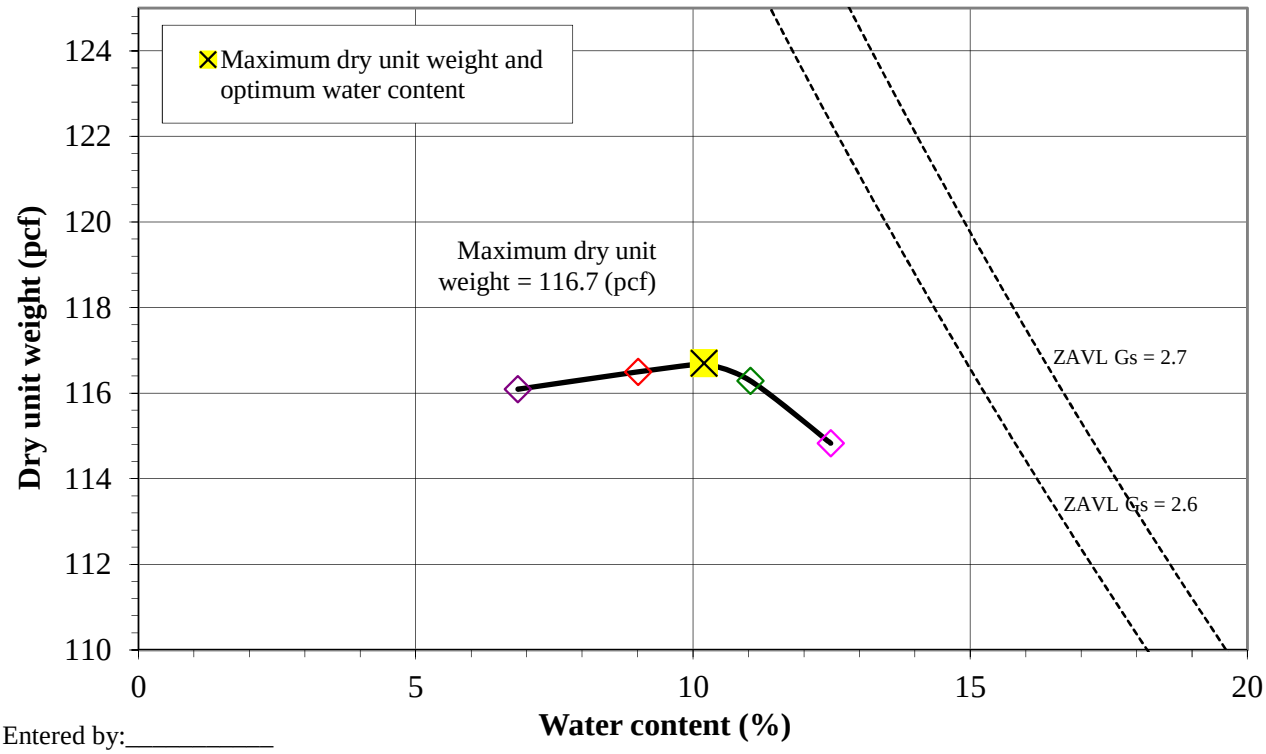
*Correction of Unit Weight and Water Content for Soils Containing Oversize Particles

(ASTM D4718)

Oversized fraction, +3/4-in. (%): 13.8
Water content, +3/4-in. (%): 0.5
Sieve for oversized fraction: 3/4-in.
Bulk specific gravity, Gs: 2.65 Assumed

Corrected water content (%): 8.9
Corrected dry unit weight (pcf): 121.7

Comments:
Due to insufficient sample, point +12% contained previously compacted material.



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Reviewed:_____

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Laboratory Compaction Characteristics of Soil

(ASTM D698 / D1557)

© IGES 2004, 2016

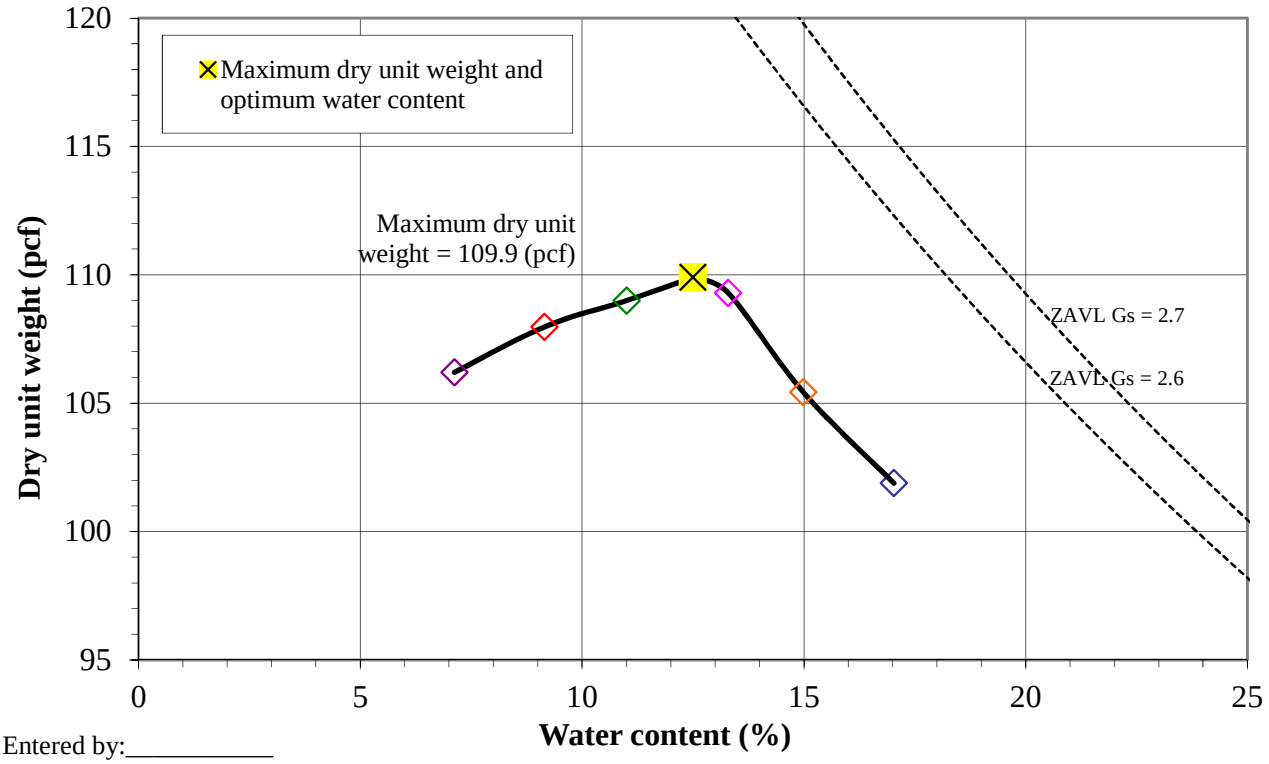
Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/22/2016
By: DKS

Method: ASTM D698 B
Mold Id. Inc 3
Mold volume (ft^3): 0.0331

Boring No.:
Sample: Cb-1
Depth:
Sample Description: Silty SAND, brown
Engineering Classification: SM
As-received water content (%): Not requested
Preparation method: Moist
Rammer: Mechanical-circular face
Rock Correction: No

Optimum water content (%): 12.5
Maximum dry unit weight (pcf): 109.9

Point Number	+6%	+8%	+10%	+12%	+14%	+16%		
Wt. Sample + Mold (g)	5868.5	5929.8	5976.9	6019.6	5980.6	5950.7		
Wt. of Mold (g)	4159.1	4159.1	4159.1	4159.1	4159.1	4159.1		
Wet Unit Wt., γ_m (pcf)	113.8	117.9	121.0	123.8	121.2	119.2		
Wet Soil + Tare (g)	1591.90	1333.24	1171.34	1149.73	1113.83	1118.24		
Dry Soil + Tare (g)	1500.91	1239.53	1077.26	1040.05	997.57	988.05		
Tare (g)	223.35	215.34	222.02	215.00	221.73	223.53		
Water Content, w (%)	**7.1**	**9.1**	**11.0**	**13.3**	**15.0**	**17.0**		
Dry Unit Wt., γ_d (pcf)	**106.2**	**108.0**	**109.0**	**109.3**	**105.4**	**101.9**		



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Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2016

Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/22/2016
By: JDF

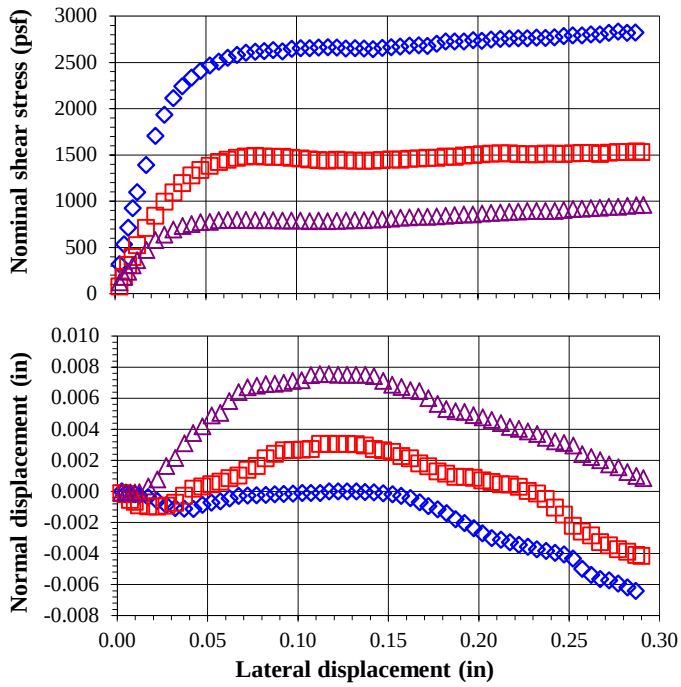
Boring No.:
Sample: Ca-1
Depth:
Sample Description: Silty SAND, brown
Sample type: Laboratory compacted
Dry unit weight 105 pcf
at 10.2 (%) w
Compaction specifications: 90% of ASTM D698C

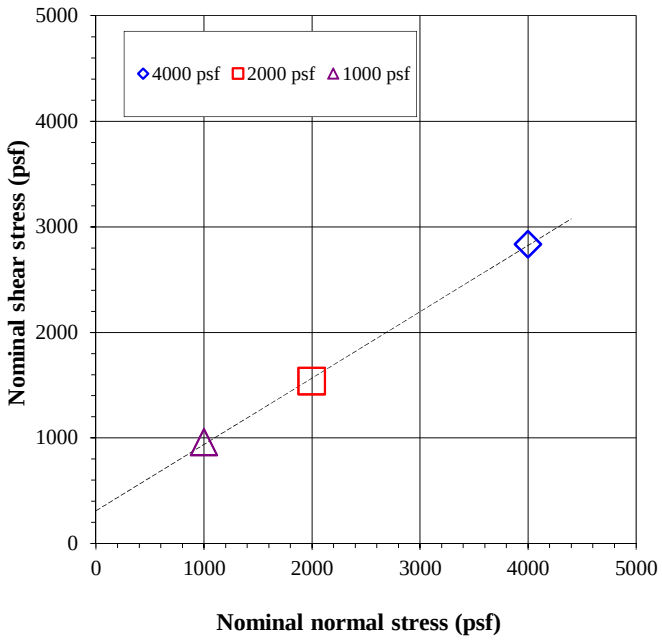
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0200
Specific gravity, Gs: 2.65 Assumed

	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	4000		2000		1000	
Peak shear stress (psf)	2835		1536		960	
Lateral displacement at peak (in)	0.277		0.287		0.291	
Load Duration (min)	902		915		903	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	1.0000	0.9763	1.0000	0.9783	1.0000	0.9859
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	181.59	194.36	184.69	197.60	184.49	197.97
Wt. rings (g)	42.18	42.18	45.28	45.28	45.08	45.08
Wet soil + tare (g)	357.06		357.06		357.06	
Dry soil + tare (g)	336.12		336.12		336.12	
Tare (g)	129.04		129.04		129.04	
Water content (%)	10.1	20.2	10.1	20.3	10.1	20.8
Dry unit weight (pcf)	105.2	107.7	105.2	107.5	105.2	106.7
Void ratio, e, for assumed Gs	0.57	0.54	0.57	0.54	0.57	0.55
Saturation (%)*	46.8	100.0	46.8	100.0	46.8	100.0

		Average of 3 samples	Initial	Pre-shear
ϕ' (deg)	32	Water content (%)	10.1	20.4
c' (psf)	311	Dry unit weight (pcf)	105.2	107.3

*Pre-shear saturation set to 100% for phase calculations





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Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2016

Project: EarthFax Engineering **Boring No.:**

No: M01292-026 (PO# UC-1665-10) **Sample:** Ca-1

Location: **Depth:**

Nominal normal stress = 4000 psf			Nominal normal stress = 2000 psf			Nominal normal stress = 1000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.002	320	0.000	0.002	78	0.000	0.002	123	0.000
0.005	534	0.000	0.005	182	0.000	0.005	180	0.000
0.007	712	0.000	0.007	308	-0.001	0.007	237	0.000
0.010	924	0.000	0.010	394	-0.001	0.010	307	0.000
0.012	1099	0.000	0.012	524	-0.001	0.012	362	0.000
0.017	1390	0.000	0.017	710	-0.001	0.017	471	0.000
0.022	1705	-0.001	0.022	840	-0.001	0.022	577	0.001
0.027	1935	-0.001	0.027	993	-0.001	0.027	638	0.002
0.032	2115	-0.001	0.032	1094	-0.001	0.032	693	0.002
0.037	2242	-0.001	0.037	1195	0.000	0.037	731	0.003
0.042	2335	-0.001	0.042	1277	0.000	0.042	752	0.004
0.047	2409	-0.001	0.047	1336	0.000	0.047	772	0.004
0.052	2466	-0.001	0.052	1382	0.000	0.052	776	0.005
0.057	2510	-0.001	0.057	1422	0.001	0.057	793	0.005
0.062	2549	0.000	0.062	1446	0.001	0.062	796	0.006
0.067	2580	0.000	0.067	1469	0.001	0.067	798	0.006
0.072	2606	0.000	0.072	1483	0.001	0.072	795	0.007
0.077	2616	0.000	0.077	1489	0.002	0.077	793	0.007
0.082	2624	0.000	0.082	1483	0.002	0.082	793	0.007
0.087	2634	0.000	0.087	1477	0.002	0.087	793	0.007
0.092	2621	0.000	0.092	1478	0.003	0.092	790	0.007
0.097	2647	0.000	0.097	1468	0.003	0.097	791	0.007
0.102	2655	0.000	0.102	1461	0.003	0.102	788	0.007
0.107	2655	0.000	0.107	1451	0.003	0.107	784	0.007
0.112	2660	0.000	0.112	1443	0.003	0.112	788	0.008
0.117	2665	0.000	0.117	1438	0.003	0.117	783	0.008
0.122	2660	0.000	0.122	1446	0.003	0.122	787	0.008
0.127	2652	0.000	0.127	1441	0.003	0.127	788	0.008
0.132	2655	0.000	0.132	1437	0.003	0.132	793	0.008
0.137	2649	0.000	0.137	1438	0.003	0.137	794	0.008
0.142	2644	0.000	0.142	1438	0.003	0.142	801	0.007
0.147	2657	0.000	0.147	1444	0.003	0.147	804	0.007
0.152	2665	0.000	0.152	1451	0.003	0.152	811	0.007
0.157	2670	0.000	0.157	1447	0.002	0.157	820	0.007
0.162	2680	0.000	0.162	1457	0.002	0.162	823	0.007
0.167	2686	-0.001	0.167	1459	0.002	0.167	833	0.006
0.172	2678	-0.001	0.172	1466	0.002	0.172	830	0.006
0.177	2704	-0.001	0.177	1469	0.001	0.177	835	0.006
0.182	2727	-0.001	0.182	1480	0.001	0.182	841	0.005
0.187	2727	-0.002	0.187	1479	0.001	0.187	848	0.005
0.192	2727	-0.002	0.192	1492	0.001	0.192	855	0.005
0.197	2742	-0.002	0.197	1499	0.001	0.197	856	0.005
0.202	2735	-0.003	0.202	1505	0.001	0.202	866	0.005
0.207	2747	-0.003	0.207	1512	0.001	0.207	871	0.005
0.212	2755	-0.003	0.212	1515	0.000	0.212	877	0.004
0.217	2758	-0.003	0.217	1516	0.000	0.217	882	0.004
0.222	2760	-0.003	0.222	1510	0.000	0.222	887	0.004
0.227	2760	-0.004	0.227	1506	0.000	0.227	894	0.004
0.232	2768	-0.004	0.232	1506	0.000	0.232	893	0.004
0.237	2763	-0.004	0.237	1511	0.000	0.237	893	0.003
0.242	2773	-0.004	0.242	1511	-0.001	0.242	894	0.003
0.247	2786	-0.004	0.247	1509	-0.002	0.247	903	0.003
0.252	2794	-0.004	0.252	1517	-0.002	0.252	914	0.003
0.257	2794	-0.005	0.257	1518	-0.003	0.257	917	0.002
0.262	2802	-0.005	0.262	1521	-0.003	0.262	926	0.002
0.267	2804	-0.006	0.267	1508	-0.003	0.267	929	0.002
0.272	2820	-0.006	0.272	1523	-0.003	0.272	937	0.002
0.277	2835	-0.006	0.277	1529	-0.004	0.277	939	0.002
0.282	2820	-0.006	0.282	1530	-0.004	0.282	949	0.001
0.287	2822	-0.006	0.287	1536	-0.004	0.287	955	0.001
			0.290	1529	-0.004	0.291	960	0.001

Direct Shear Test for Soils Under Drained Conditions

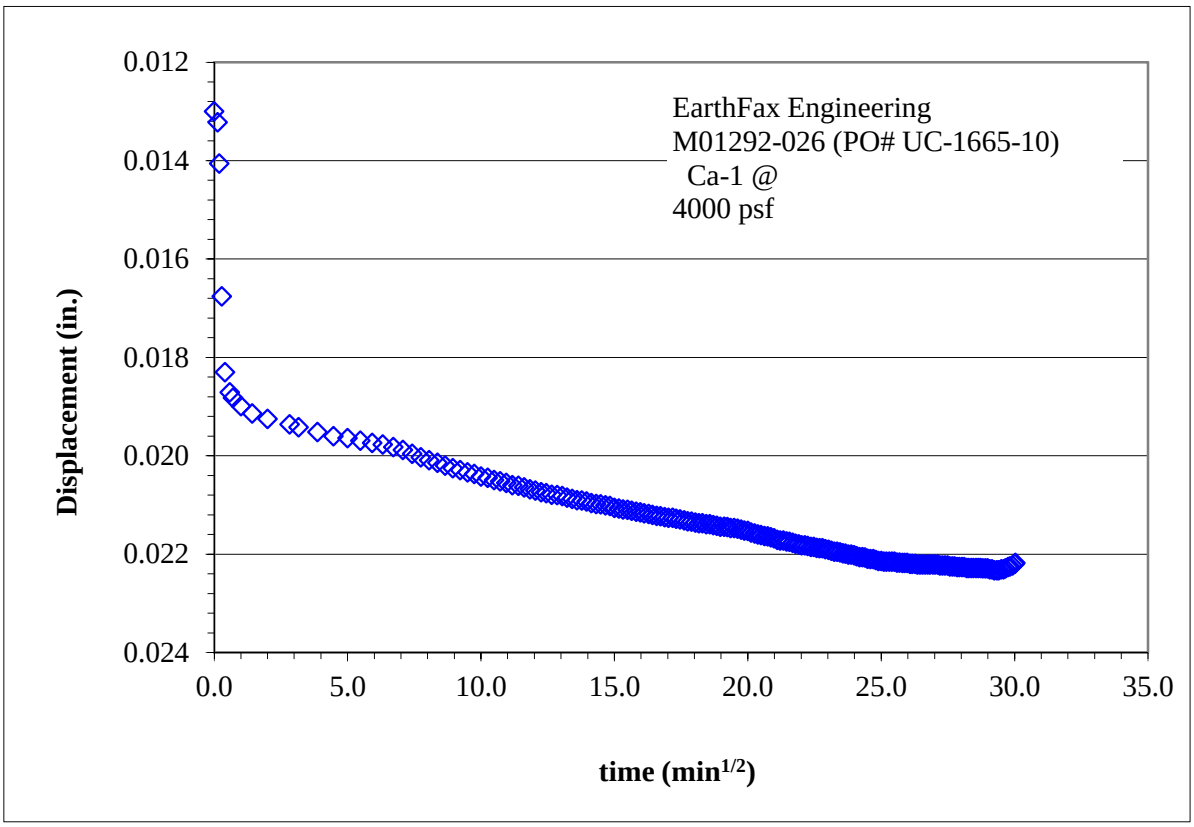
(ASTM D3080)

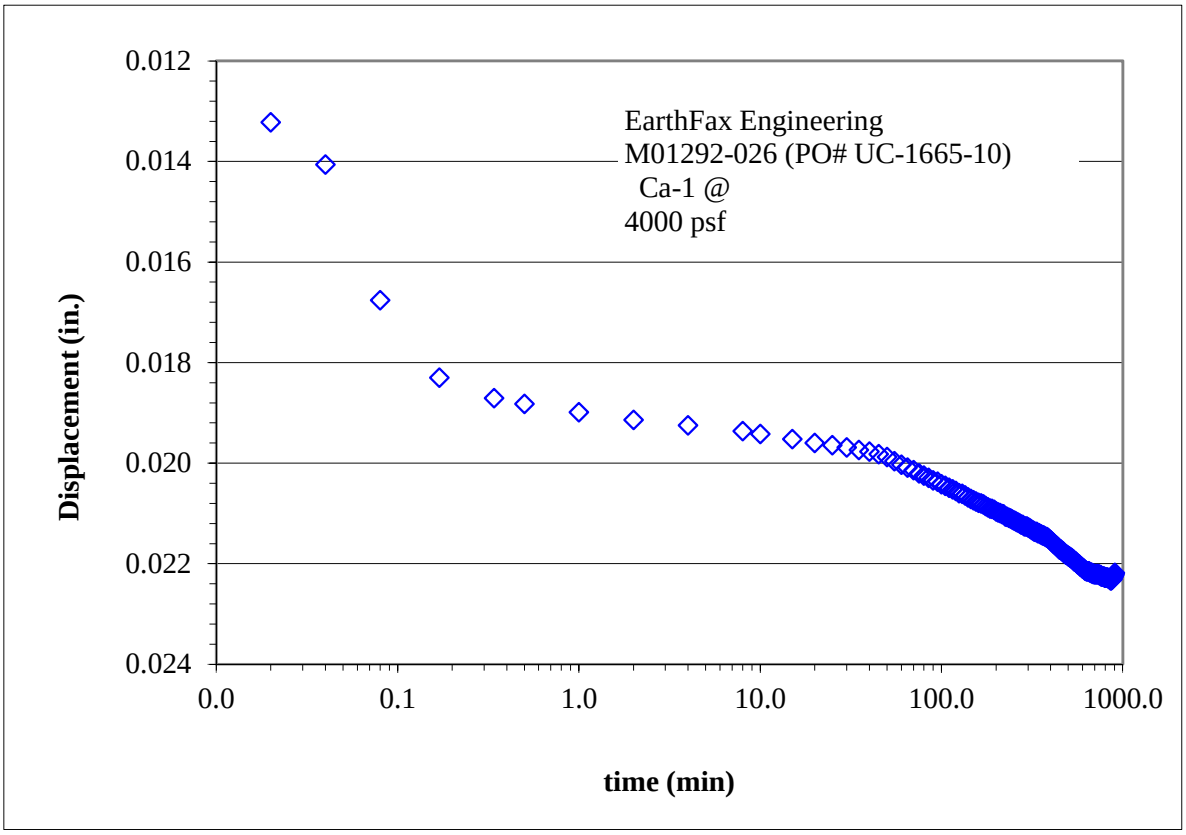
© IGES 2009, 2016

Project: EarthFax Engineering **Boring No.:**

No: M01292-026 (PO# UC-1665-10) **Sample:** Ca-1

Location: **Depth:**





Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2016

Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:
Date: 9/23/2016
By: JDF

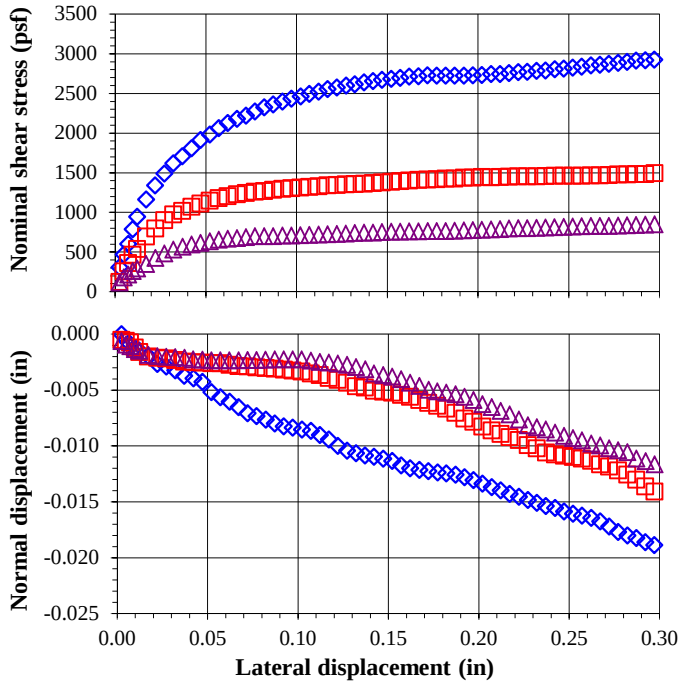
Boring No.:
Sample: Cb-1
Depth:
Sample Description: Silty SAND, brown
Sample type: Laboratory compacted
Dry unit weight 105 pcf
at 10.2 (%) w
Compaction specifications: 90% of ASTM D698B

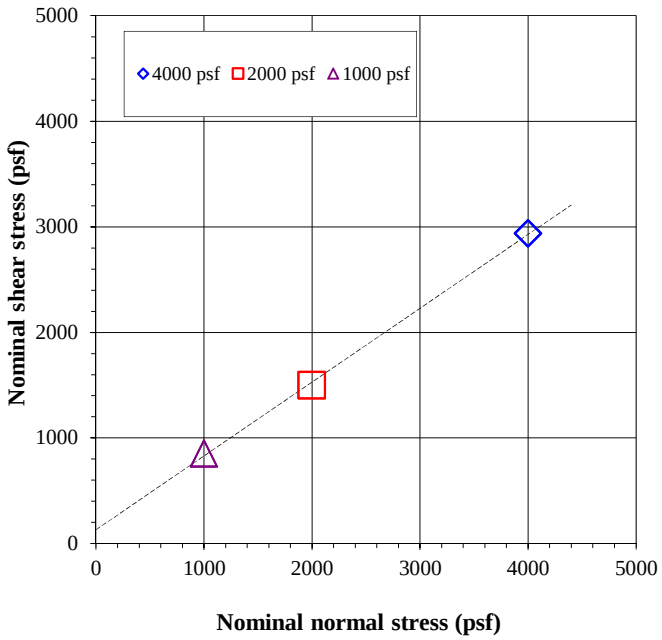
Test type: Inundated
Lateral displacement (in.): 0.3
Shear rate (in./min): 0.0086
Specific gravity, Gs: 2.65 Assumed

	Sample 1		Sample 2		Sample 3	
Nominal normal stress (psf)	4000		2000		1000	
Peak shear stress (psf)	2938		1498		851	
Lateral displacement at peak (in)	0.302		0.302		0.302	
Load Duration (min)	984		1011		1027	
	Initial	Pre-shear	Initial	Pre-shear	Initial	Pre-shear
Sample height (in)	1.0000	0.9709	1.0000	0.9797	1.0000	0.9860
Sample diameter (in)	2.416	2.416	2.416	2.416	2.416	2.416
Wt. rings + wet soil (g)	177.52	190.70	178.59	192.43	179.02	193.33
Wt. rings (g)	43.49	43.49	44.56	44.56	44.99	44.99
Wet soil + tare (g)	404.96		404.96		404.96	
Dry soil + tare (g)	374.42		374.42		374.42	
Tare (g)	127.50		127.50		127.50	
Water content (%)	12.4	23.4	12.4	24.0	12.4	24.4
Dry unit weight (pcf)	99.1	102.0	99.1	101.1	99.1	100.5
Void ratio, e, for assumed Gs	0.67	0.62	0.67	0.64	0.67	0.65
Saturation (%)*	49.0	100.0	49.0	100.0	49.0	100.0

		Average of 3 samples	Initial	Pre-shear
ϕ' (deg)	35	Water content (%)	12.4	23.9
c' (psf)	131	Dry unit weight (pcf)	99.1	101.2

*Pre-shear saturation set to 100% for phase calculations





Entered by:_____
Reviewed:_____

Z:\PROJECTS\M01292_EarthFax\026_Ca_Cb\[DS_GCv4.xlsm]2

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

© IGES 2009, 2016

Project: EarthFax Engineering **Boring No.:**

No: M01292-026 (PO# UC-1665-10) **Sample:** Cb-1

Location: **Depth:**

Nominal normal stress = 4000 psf			Nominal normal stress = 2000 psf			Nominal normal stress = 1000 psf		
Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)	Lateral Displacement (in.)	Nominal Shear Stress (psf)	Normal Displacement (in.)
0.002	307	0.000	0.002	123	-0.001	0.002	115	-0.001
0.005	470	-0.001	0.005	257	-0.001	0.005	180	-0.001
0.007	601	-0.001	0.007	359	-0.001	0.007	215	-0.001
0.010	789	-0.001	0.010	464	-0.001	0.010	261	-0.001
0.012	944	-0.001	0.012	537	-0.002	0.012	290	-0.001
0.017	1163	-0.002	0.017	694	-0.002	0.017	350	-0.002
0.022	1341	-0.003	0.022	795	-0.002	0.022	425	-0.002
0.027	1489	-0.003	0.027	902	-0.002	0.027	482	-0.002
0.032	1618	-0.003	0.032	973	-0.002	0.032	528	-0.002
0.037	1708	-0.004	0.037	1020	-0.002	0.037	564	-0.002
0.042	1808	-0.004	0.042	1072	-0.003	0.042	595	-0.002
0.047	1912	-0.004	0.047	1110	-0.003	0.047	616	-0.002
0.052	1984	-0.005	0.052	1148	-0.003	0.052	636	-0.002
0.057	2064	-0.006	0.057	1180	-0.003	0.057	653	-0.002
0.062	2128	-0.006	0.062	1205	-0.003	0.062	667	-0.002
0.067	2180	-0.007	0.067	1226	-0.003	0.067	677	-0.002
0.072	2219	-0.007	0.072	1243	-0.003	0.072	687	-0.002
0.077	2275	-0.007	0.077	1260	-0.003	0.077	698	-0.002
0.082	2324	-0.008	0.082	1269	-0.003	0.082	700	-0.002
0.087	2360	-0.008	0.087	1286	-0.003	0.087	701	-0.002
0.092	2397	-0.008	0.092	1296	-0.003	0.092	705	-0.002
0.097	2433	-0.008	0.097	1306	-0.003	0.097	708	-0.002
0.102	2461	-0.009	0.102	1312	-0.003	0.102	710	-0.002
0.107	2495	-0.009	0.107	1319	-0.004	0.107	715	-0.002
0.112	2523	-0.009	0.112	1329	-0.004	0.112	719	-0.002
0.117	2554	-0.009	0.117	1339	-0.004	0.117	723	-0.003
0.122	2577	-0.010	0.122	1345	-0.004	0.122	727	-0.003
0.127	2598	-0.010	0.127	1351	-0.004	0.127	732	-0.003
0.132	2616	-0.011	0.132	1358	-0.005	0.132	738	-0.003
0.137	2642	-0.011	0.137	1363	-0.005	0.137	746	-0.003
0.142	2657	-0.011	0.142	1370	-0.005	0.142	744	-0.004
0.147	2673	-0.011	0.147	1378	-0.005	0.147	750	-0.004
0.152	2686	-0.011	0.152	1385	-0.005	0.152	756	-0.004
0.157	2698	-0.012	0.157	1393	-0.005	0.157	757	-0.004
0.162	2711	-0.012	0.162	1401	-0.006	0.162	758	-0.004
0.167	2719	-0.012	0.167	1411	-0.006	0.167	762	-0.005
0.172	2729	-0.012	0.172	1413	-0.006	0.172	762	-0.005
0.177	2727	-0.012	0.177	1416	-0.006	0.177	765	-0.005
0.182	2727	-0.012	0.182	1424	-0.007	0.182	765	-0.005
0.187	2727	-0.013	0.187	1426	-0.007	0.187	767	-0.005
0.192	2727	-0.013	0.192	1436	-0.008	0.192	771	-0.006
0.197	2729	-0.013	0.197	1436	-0.008	0.197	777	-0.006
0.202	2735	-0.013	0.202	1444	-0.008	0.202	781	-0.006
0.207	2745	-0.014	0.207	1443	-0.009	0.207	784	-0.007
0.212	2747	-0.014	0.212	1447	-0.009	0.212	788	-0.007
0.217	2758	-0.014	0.217	1449	-0.009	0.217	794	-0.007
0.222	2768	-0.015	0.222	1453	-0.009	0.222	800	-0.008
0.227	2773	-0.015	0.227	1453	-0.010	0.227	802	-0.008
0.232	2784	-0.015	0.232	1453	-0.010	0.232	805	-0.008
0.237	2789	-0.015	0.237	1458	-0.011	0.237	809	-0.009
0.242	2804	-0.016	0.242	1461	-0.011	0.242	813	-0.009
0.247	2815	-0.016	0.247	1462	-0.011	0.247	817	-0.009
0.252	2827	-0.016	0.252	1461	-0.011	0.252	821	-0.009
0.257	2838	-0.016	0.257	1462	-0.011	0.257	823	-0.010
0.262	2853	-0.016	0.262	1466	-0.011	0.262	827	-0.010
0.267	2861	-0.017	0.267	1467	-0.012	0.267	828	-0.010
0.272	2876	-0.017	0.272	1471	-0.012	0.272	829	-0.010
0.277	2887	-0.018	0.277	1479	-0.012	0.277	832	-0.010
0.282	2900	-0.018	0.282	1479	-0.013	0.282	835	-0.011
0.287	2915	-0.018	0.287	1482	-0.013	0.287	842	-0.011
0.292	2918	-0.019	0.292	1484	-0.014	0.292	845	-0.011
0.297	2928	-0.019	0.297	1495	-0.014	0.297	849	-0.012
0.302	2938	-0.019	0.302	1498	-0.014	0.302	851	-0.012

Direct Shear Test for Soils Under Drained Conditions

(ASTM D3080)

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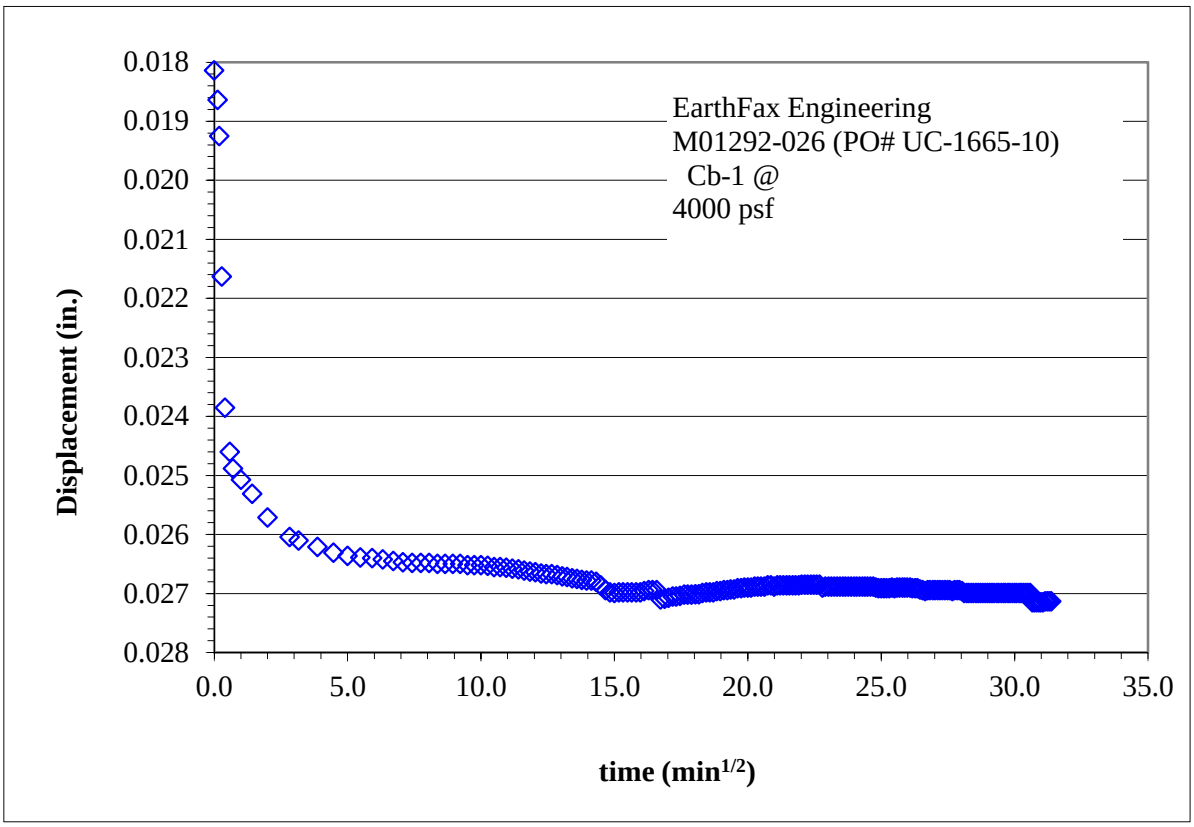
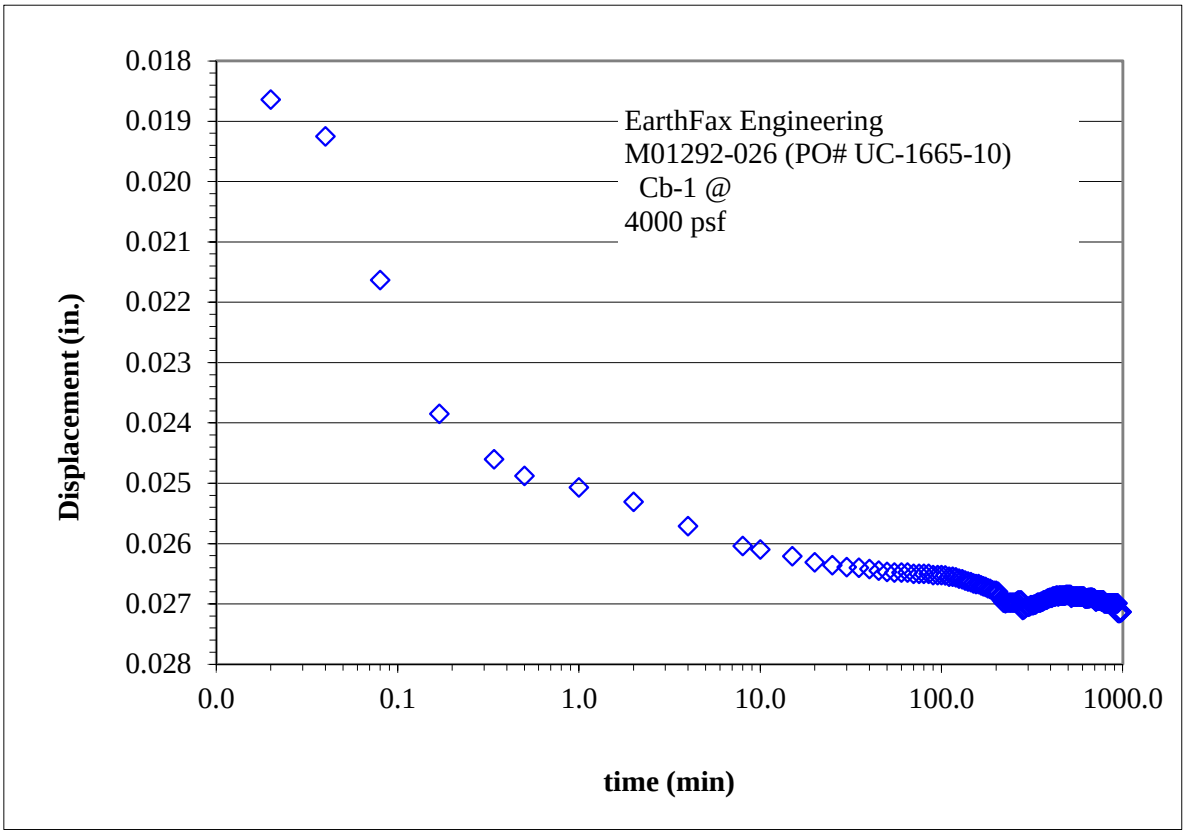
Project: EarthFax Engineering
No: M01292-026 (PO# UC-1665-10)
Location:

Boring No.:
Sample: Cb-1
Depth:





APPENDIX D

Slide Geometry and Output

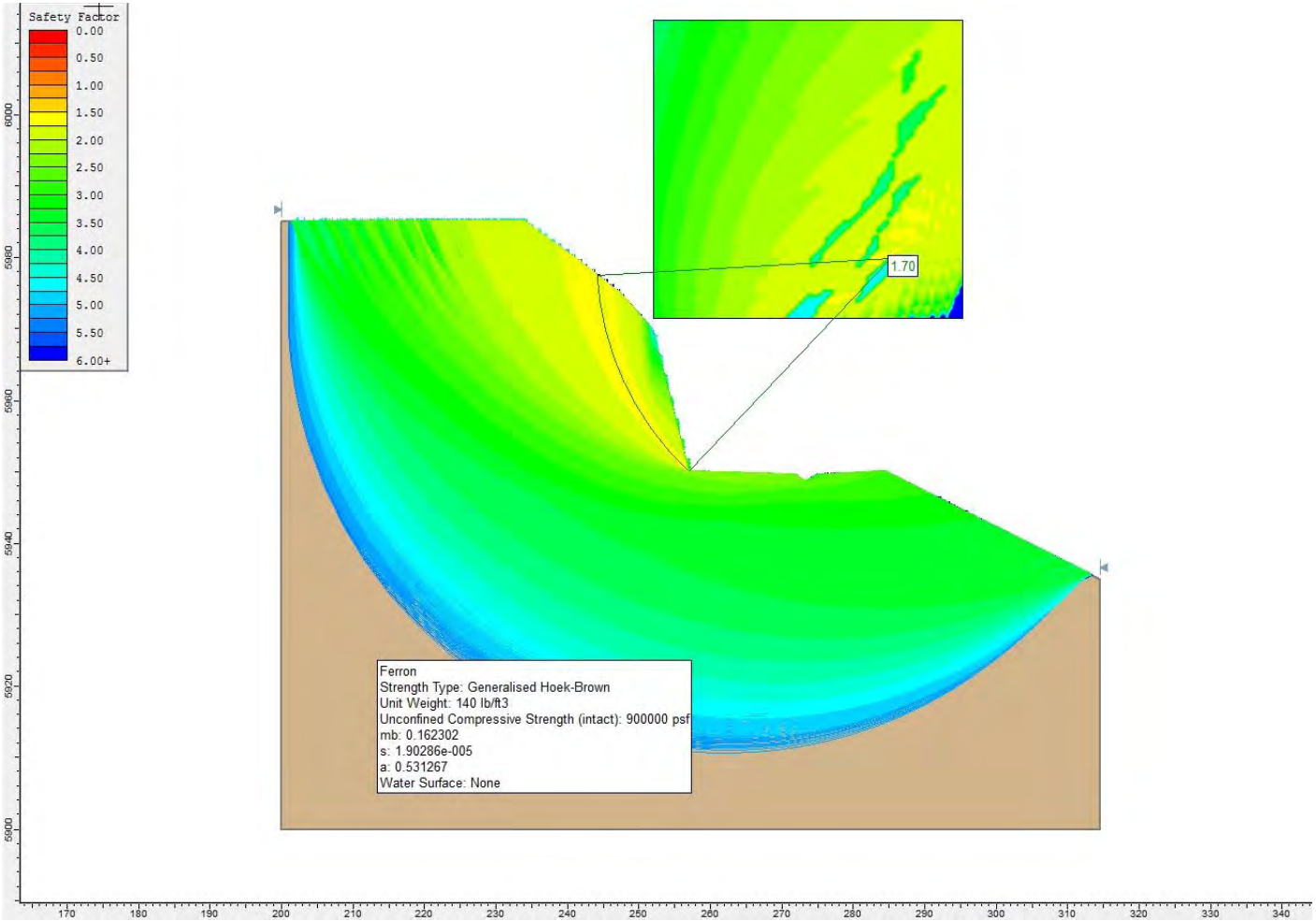


Figure D-1: Slide Geometry and Output for Section 7 Roadway Section A-A'

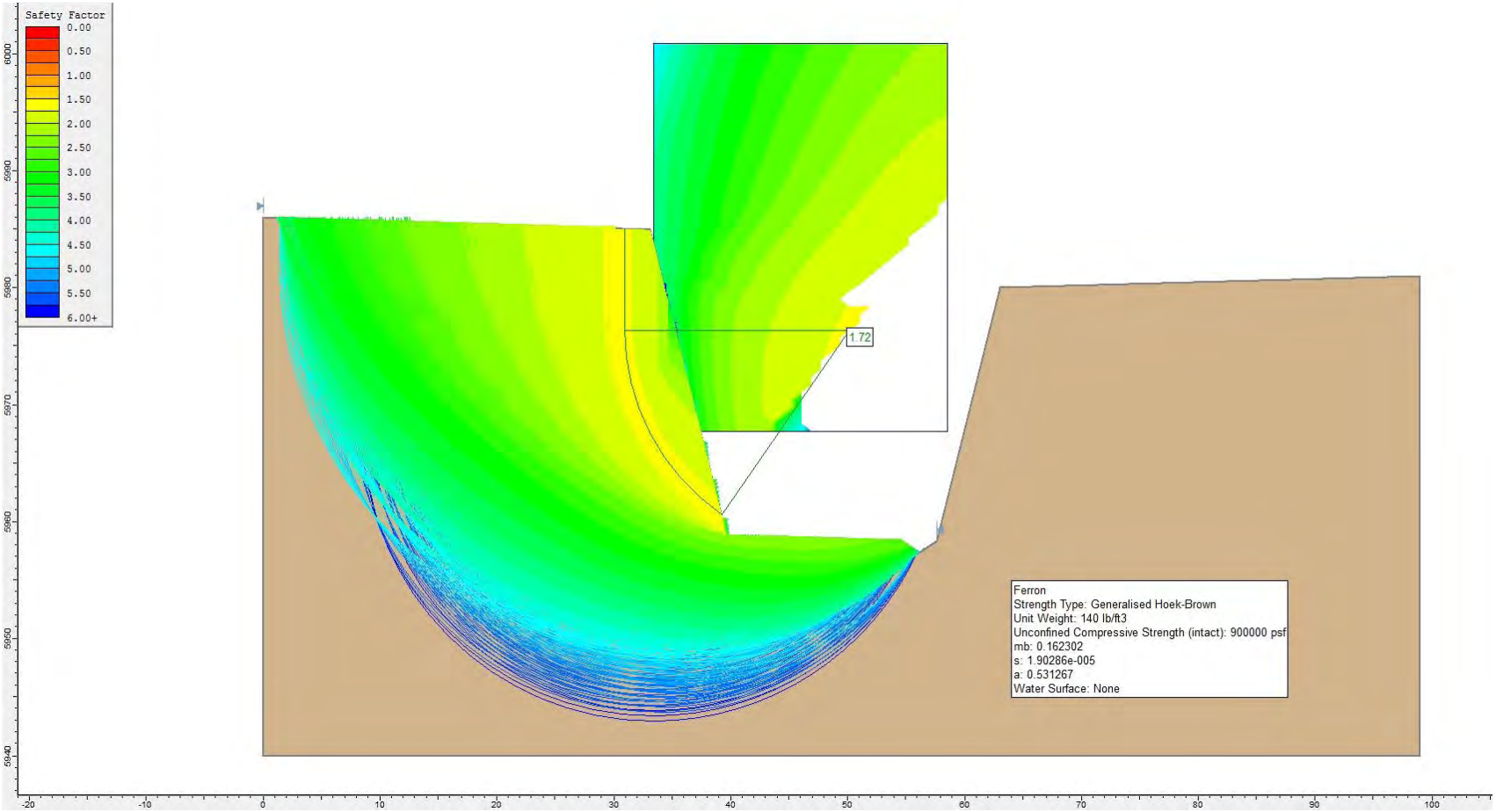


Figure D-2: Slide Geometry and Output for Section 7 Roadway Section B-B'

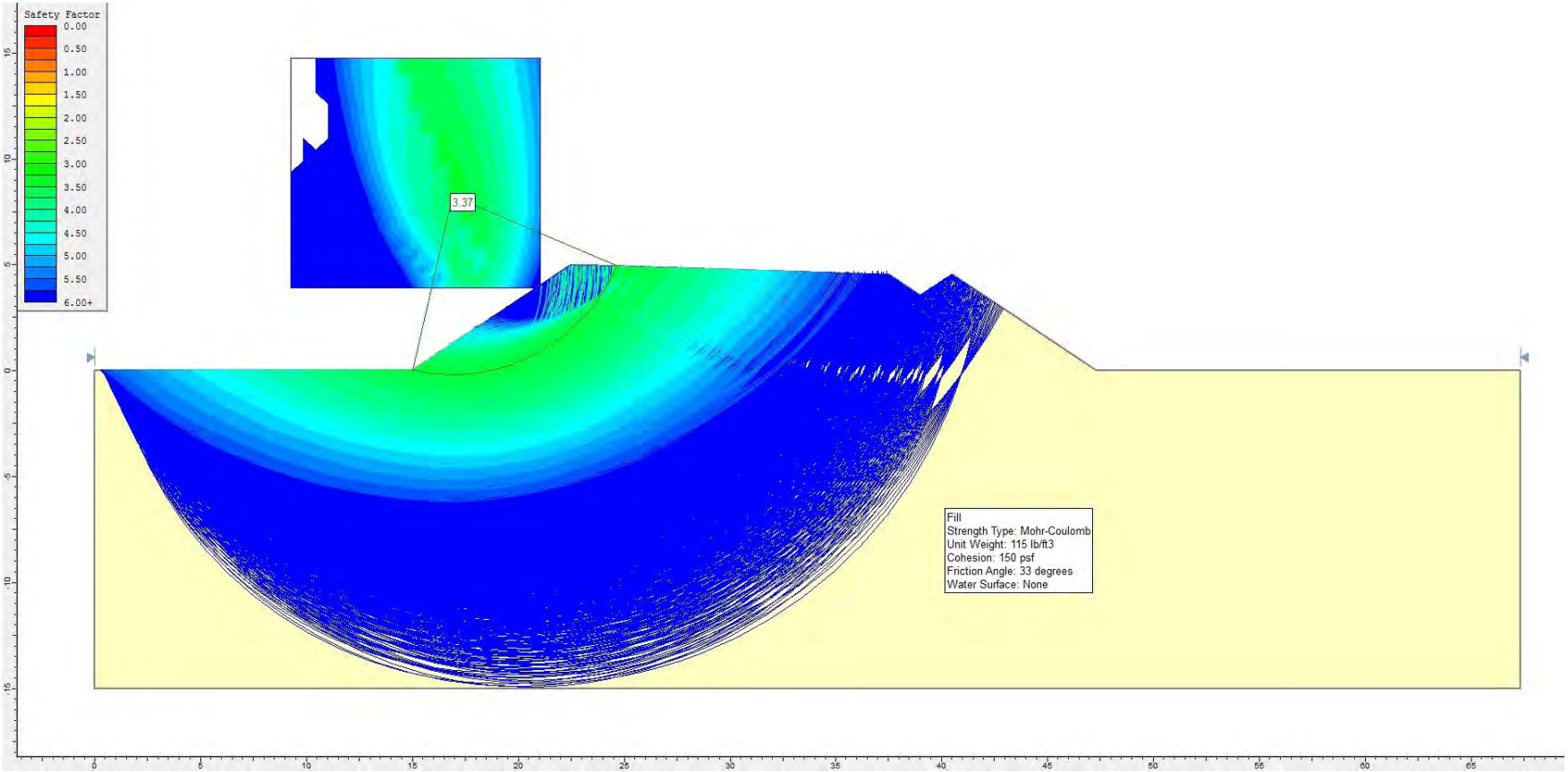


Figure D-3: Slide Geometry and Output for Section 7 Roadway Maximum Embankment Fill

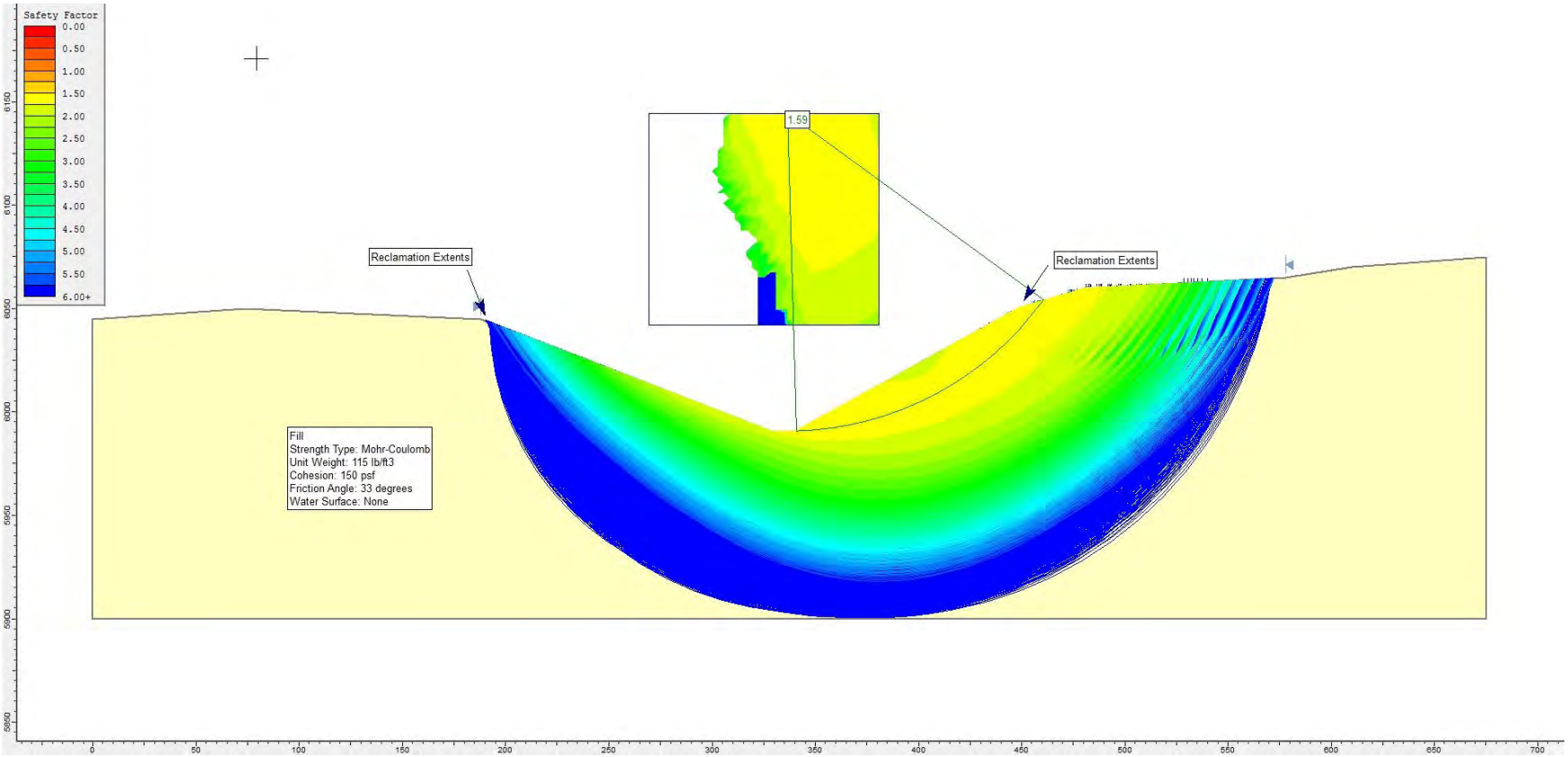


Figure D-4: Slide Geometry and Output for Reclamation Fill Slope Section C-C'

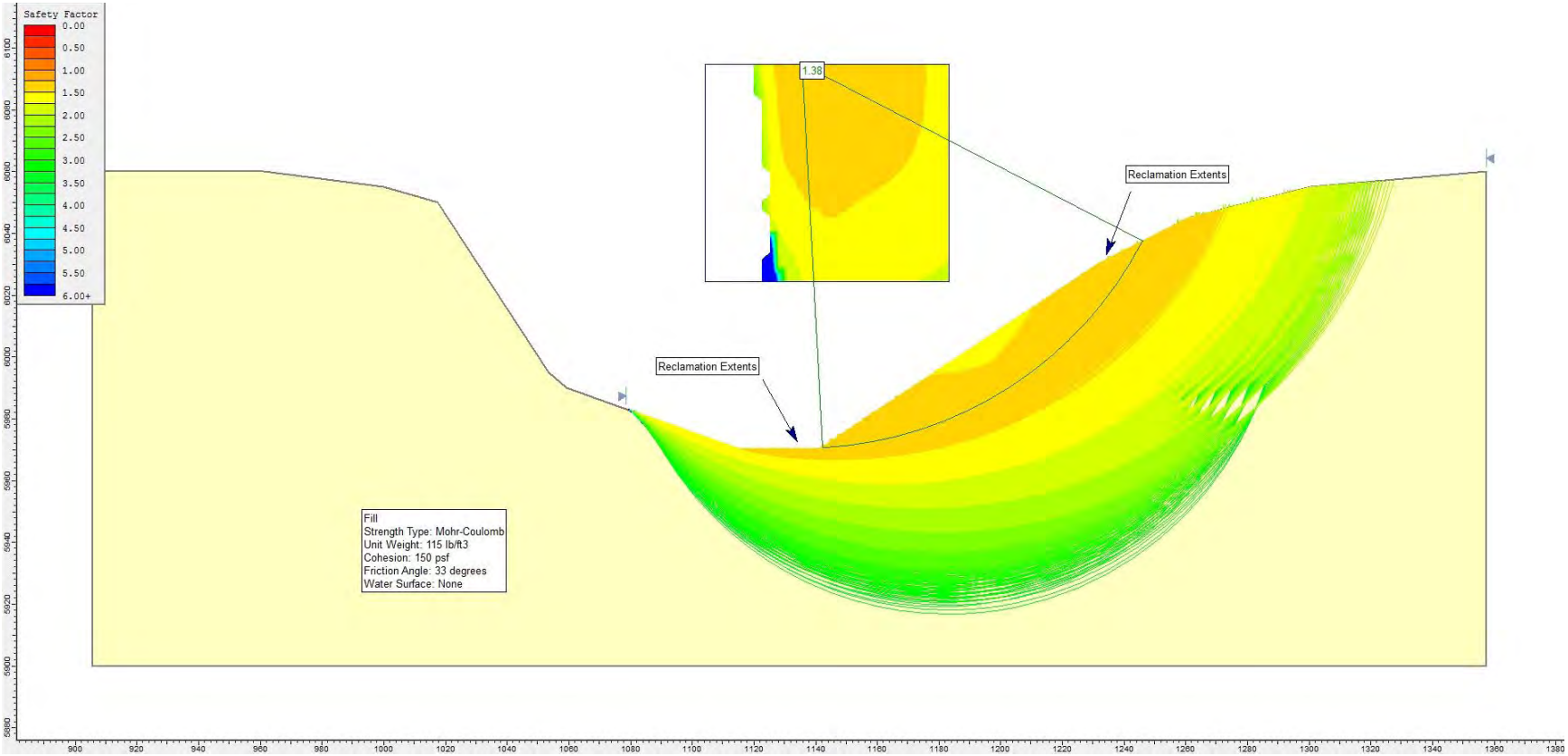


Figure D-5: Slide Geometry and Output for Reclamation Fill Slope Section D-D'

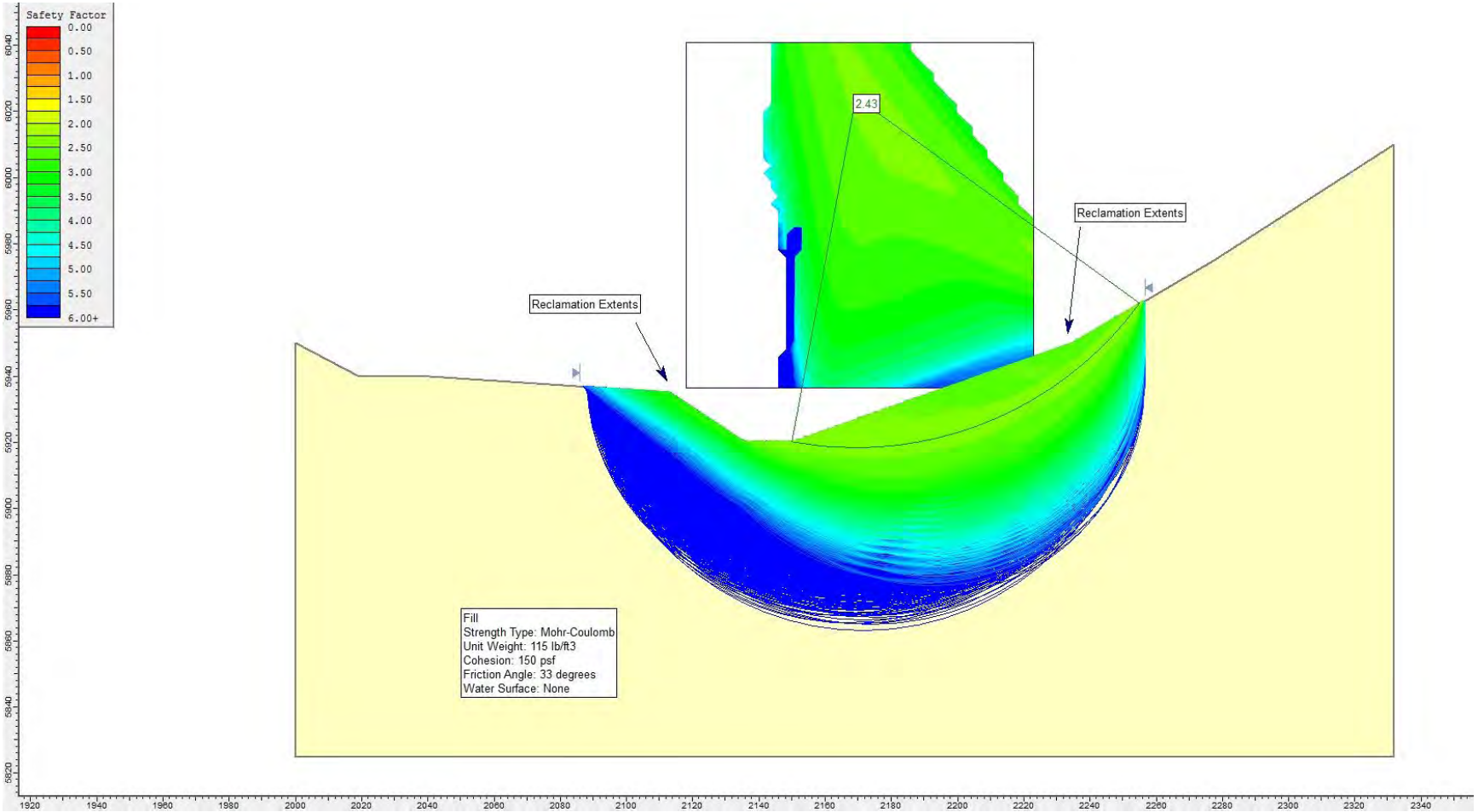
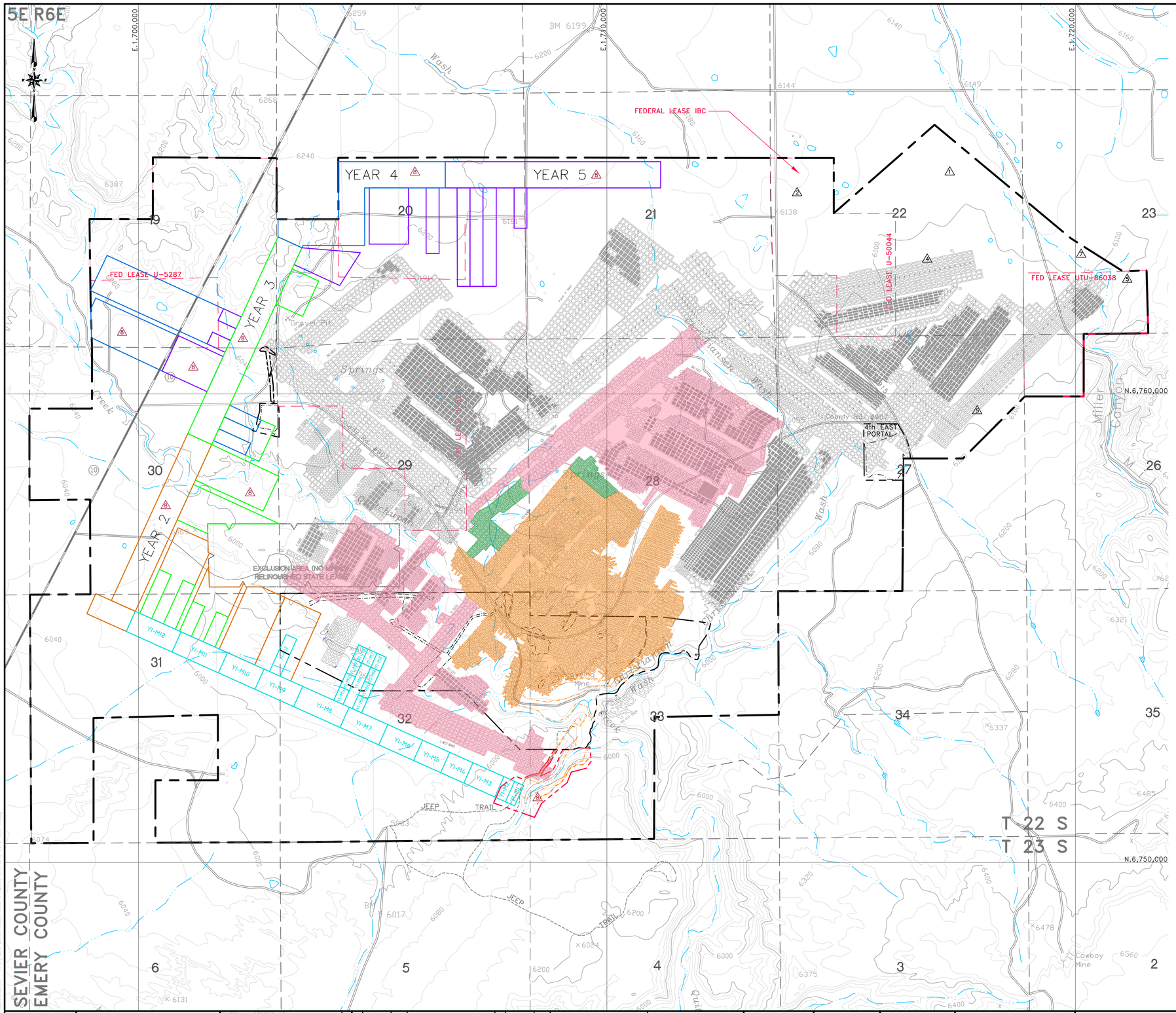


Figure D-6: Slide Geometry and Output for Reclamation Fill Slope Section E-E'



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- DISTURBED AREA BOUNDARY
- PRIOR TO AUG. 3, 1977
- MAY. 3, 1977 TO AUG 3, 1977
- MAY 3, 1978 TO JAN. 5, 1986
- EXCLUSION AREA (NO MINING) RELINQUISHED STATE LEASE
- FORCASTED PANEL YEAR 1
- FORCASTED PANEL YEAR 2
- FORCASTED PANEL YEAR 3
- FORCASTED PANEL YEAR 4
- FORCASTED PANEL YEAR 5

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATS 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
G:\UC982\XREF-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREF-CURRENT\XREF-SECTION.DWG
G:\UC982\XREF-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREF-CURRENT\XREF-WORKS-ZZNLBA.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.
2	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION
3	04/7	JAG	UPDATE MINING PLAN
4	09/08	JAG	LIFE OF MINE FULL EXTRACTION
5	05/09	JAG	ZZ NORTH ADJ. VS. PERMIT OFF 1000'
6	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
7	04/10	JAG	ZZN WEDGE
8	12/16	JAG	P2 PHASE II ADDITIONAL PERMIT & FORCASTED PANELS

0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 1/03
RE-DRAWN DATE:12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE IV-2
UG OPERATIONS PLAN

Mine Yard & Section 5, 6 , 7 Roads
Plan View
1" = 100'

Existing Emery 2 Disturbed Boundary

Approved Permit Boundary

Proposed Emery 2 Permit Boundary

Proposed Emery 2 Disturbed Boundary

Phase I

Phase II

Refer to Plate IV-8c for Plan, Profile and Cross Sections for Road Section 7

Emery 2 Mine Portal

Emery 2 Conveyor System

Conveyor 1

Conveyor 2

Conveyor 4 / Radial Stacker

Reclaim Tunnel

Conveyor 5

Conveyor 6 / Truck Loadout

Screening / Crushing Facility

Existing Pond 3

Proposed Pond 3 Expansion

Existing Drainage Control Berm

Quitchupah Creek Bridge

Mine Yard Road

Quitchupah Creek

Christiansen Wash

Section 1 (Paved)

Section 2

Section 3

Section 4

Section 5

Section 6

Section 7

Graphic Scale in Feet

0 100' 200'

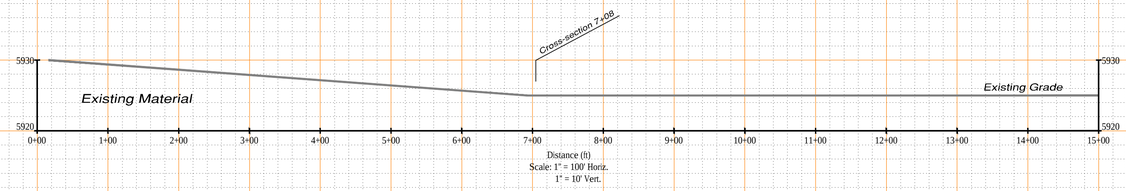
Drawing Revisions			
1	07/16	JAG	Emery 2 Phase II Expansion
NO.	DATE	BY	DESCRIPTION

NPN ENVIRONMENTAL

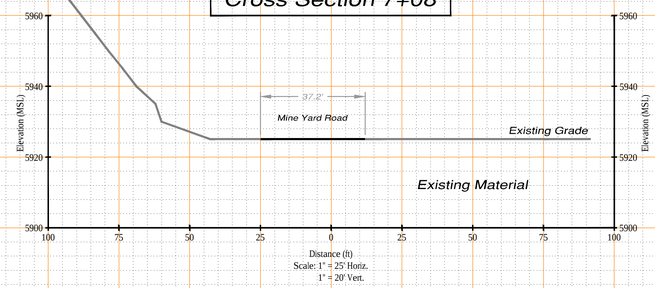
Emery 2 Phase I & II Expansion
Roads - Plan View

SITE: EMERY MINE		DATE: JULY 2016	
LOCATION: EMERY, UTAH		SCALE: AS SHOWN	
PROJECT NO: C-16141		FILE: Road Profile - Cross Sections.dwg	PLATE NO. IV-8a
DRAWN BY: SRR	SHEET 1 OF 1		

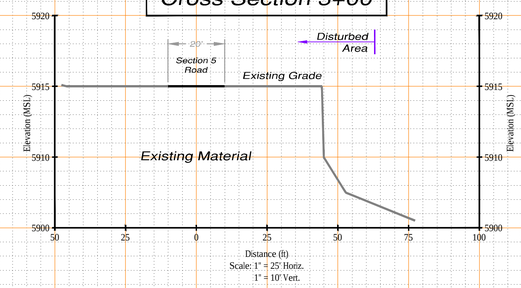
Mine Yard Road Profile Phase I



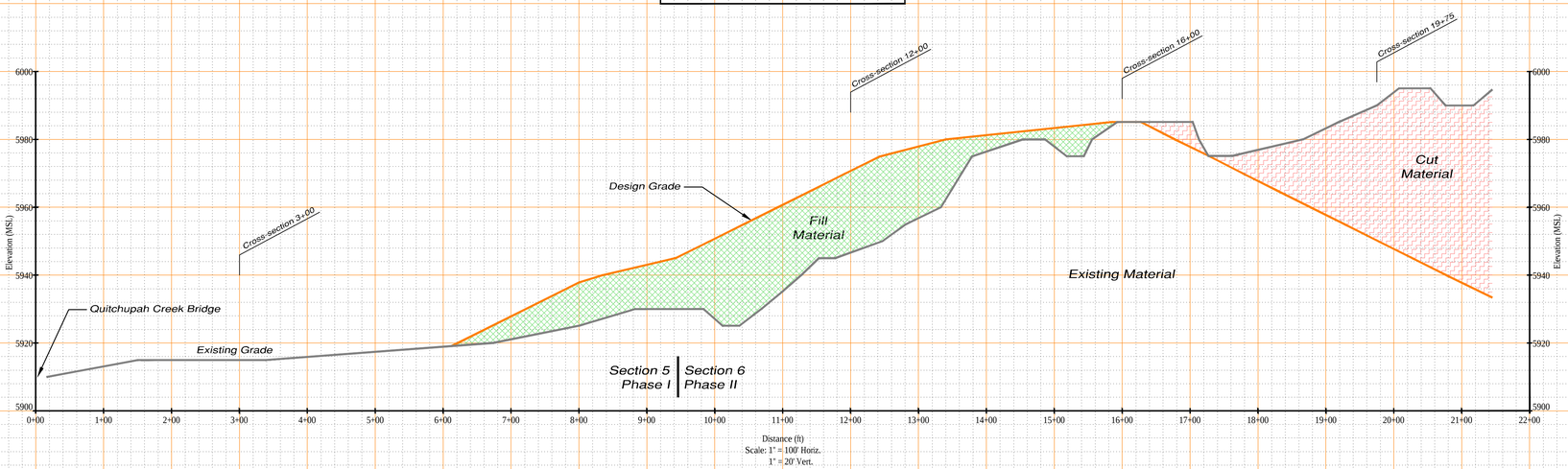
Mine Yard Road Cross Section 7+08



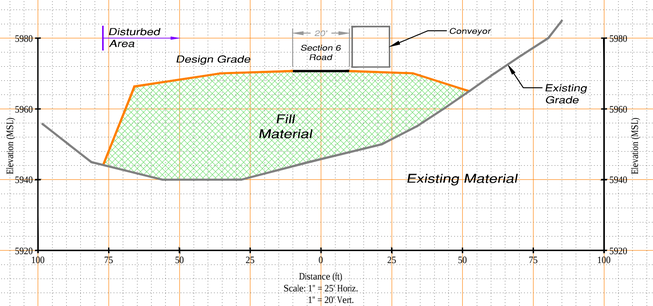
Section 5 Road Cross Section 3+00



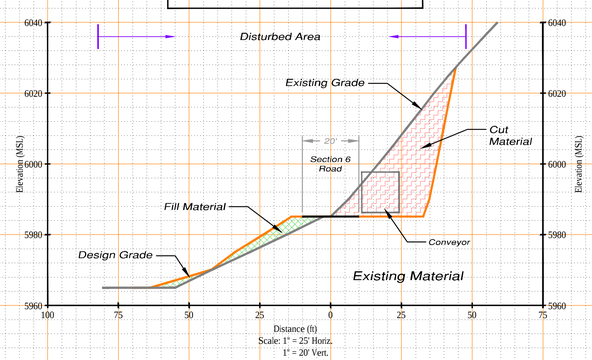
Section 5 & Section 6 Road Profile



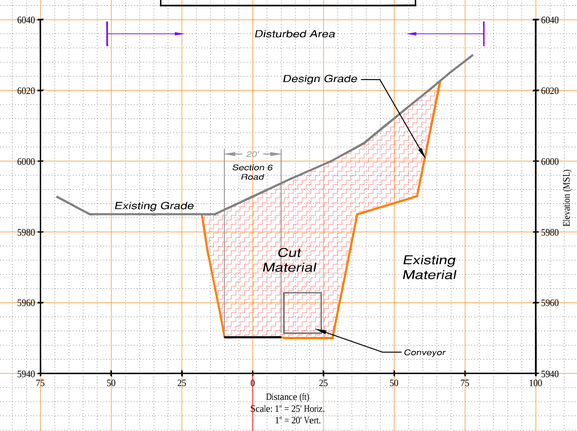
Section 6 Road Cross Section 12+00



Section 6 Road Cross Section 16+00



Section 6 Road Cross Section 19+75



Drawing Revisions

NO.	DATE	BY	DESCRIPTION

NPN ENVIRONMENTAL

Emery 2 Phase I & II Expansion

Roads - Profiles/Cross-Sections

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LOCATION:	EMERY, UTAH	SCALE:	AS SHOWN
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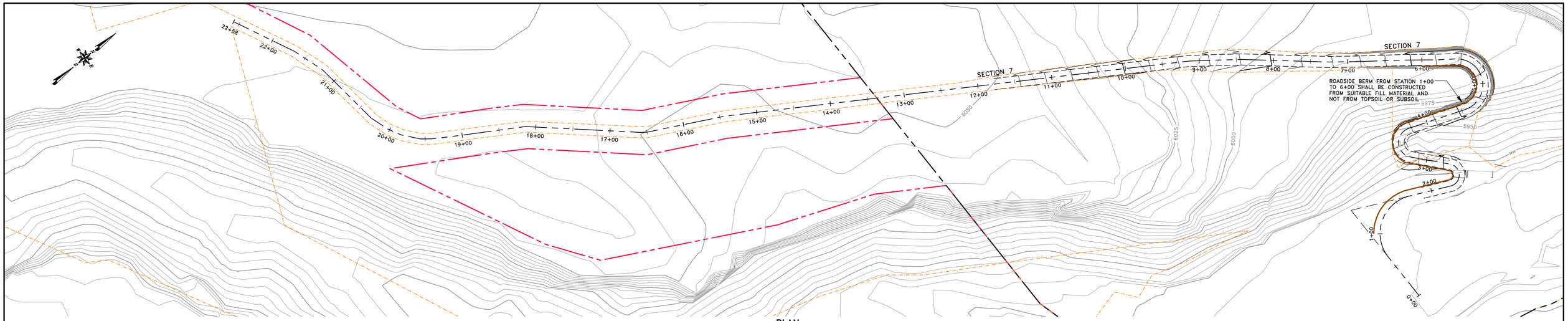
DRAWN BY:	SRR	SHEET	1 OF 1
PLATE NO.	IV-8b		



PLAN

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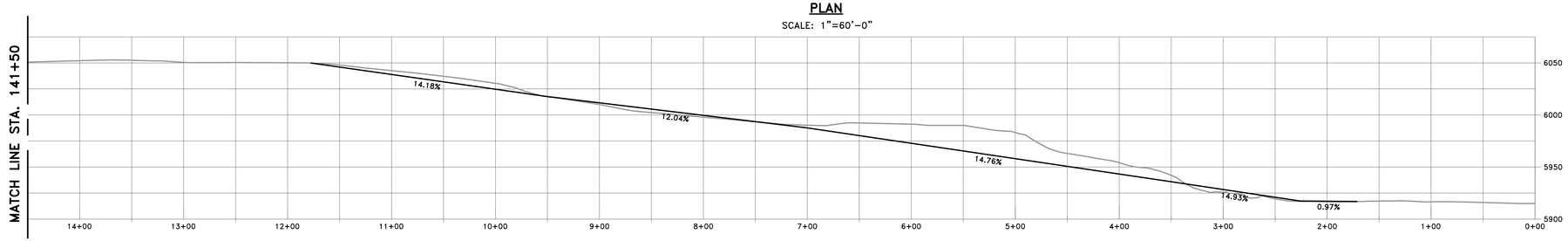

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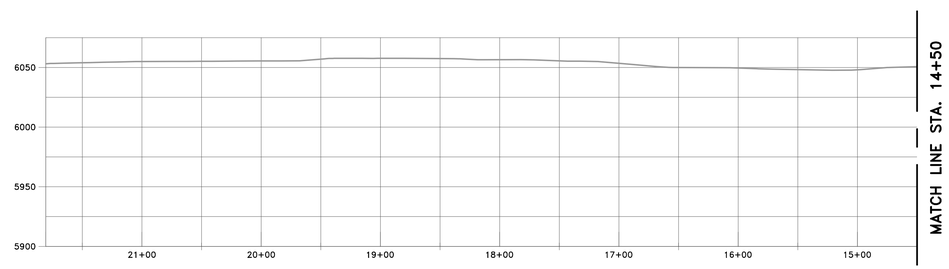
- APPROVED PERMIT AREA BOUNDARY
- PROPOSED E2 PERMIT BOUNDARY
- PROPOSED DISTURBANCE BOUNDARY



PROFILE

SCALE: 1"=60'-0"

Cut/Fill Summary

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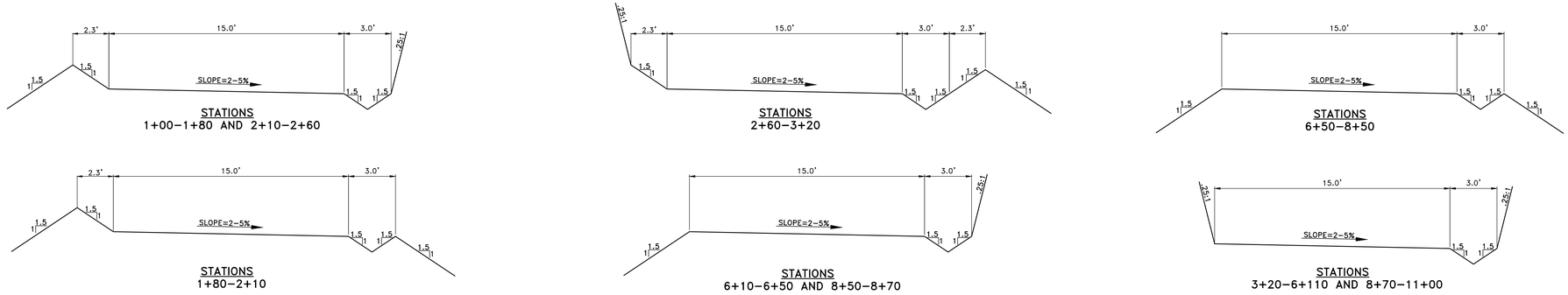

STATIONS
1+00-1+80 AND 2+10-2+60

STATIONS
2+60-3+20

STATIONS
6+50-8+50

STATIONS
1+80-2+10

STATIONS
6+10-6+50 AND 8+50-8+70

STATIONS
3+20-6+110 AND 8+70-11+00

TYPICAL ROAD SECTIONS

SCALE: 1"=4'-0"

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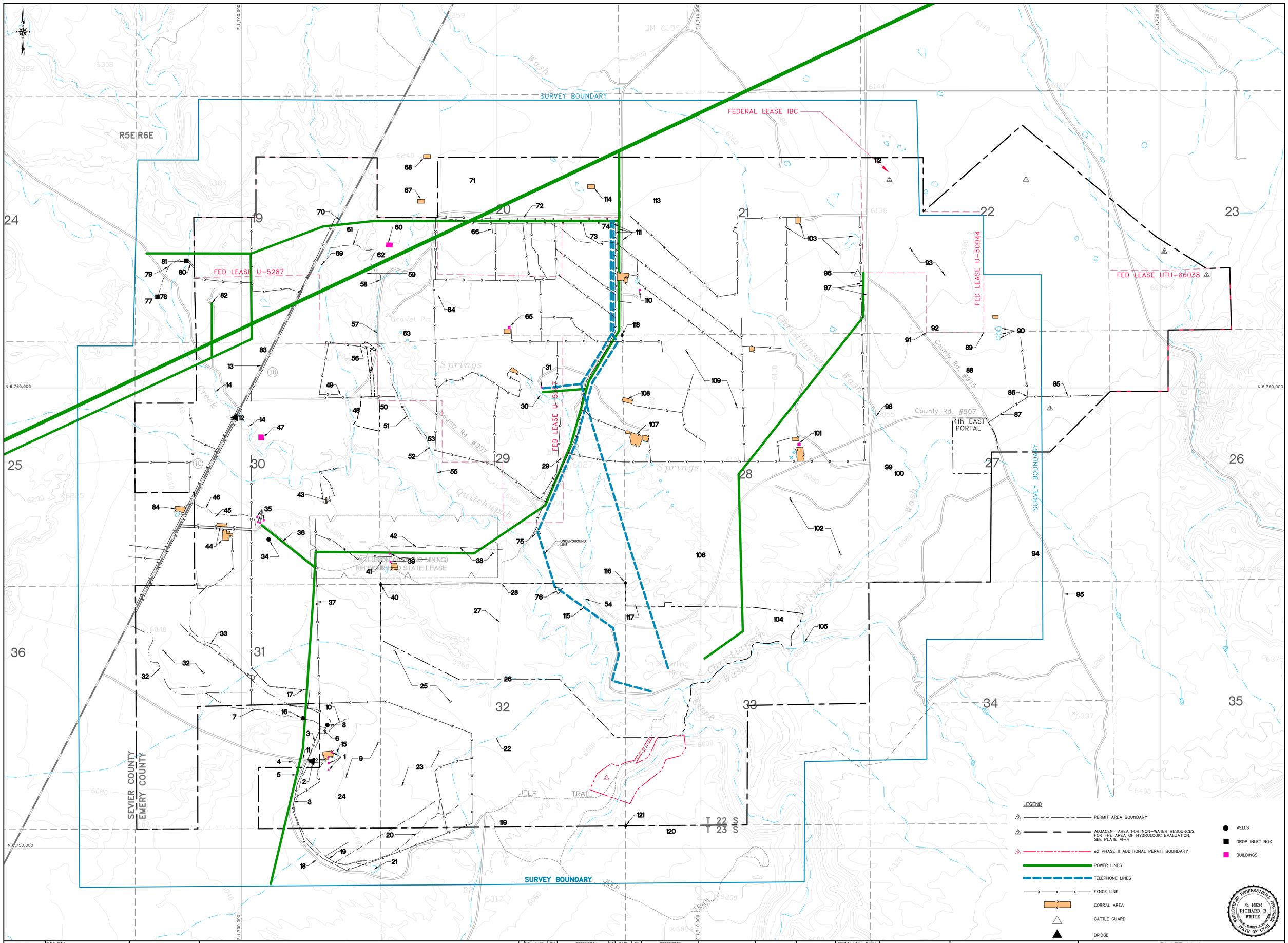
ORIGINAL DATE: 09/16
RE-DRAWN DATE:

EMERY MINE
EMERY COUNTY, UTAH

PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE IV-8c
EMERY 2 EXPANSION
ROADS-PLAN/PROFILE/CROSS SECTIONS
SECTION 7 ROAD



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COORDINATE SYSTEM:
UTM PLANE COORDINATES, ZONE 12 NAD 27, ZONE 4302(Utah Central) US FEET
VERTICAL DATUM - NAVD 88-US FEET

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2	12/12/06	JAG	31 NORTH FED LEASE IBC, 21 NORTH UTU-86038	5	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT
3	05/09	JAG	NOV 2009 ADA VS. PERMIT 22 NORTH, MILLER CANYON				
4	08/09	JAG	FBA UTU-86038				

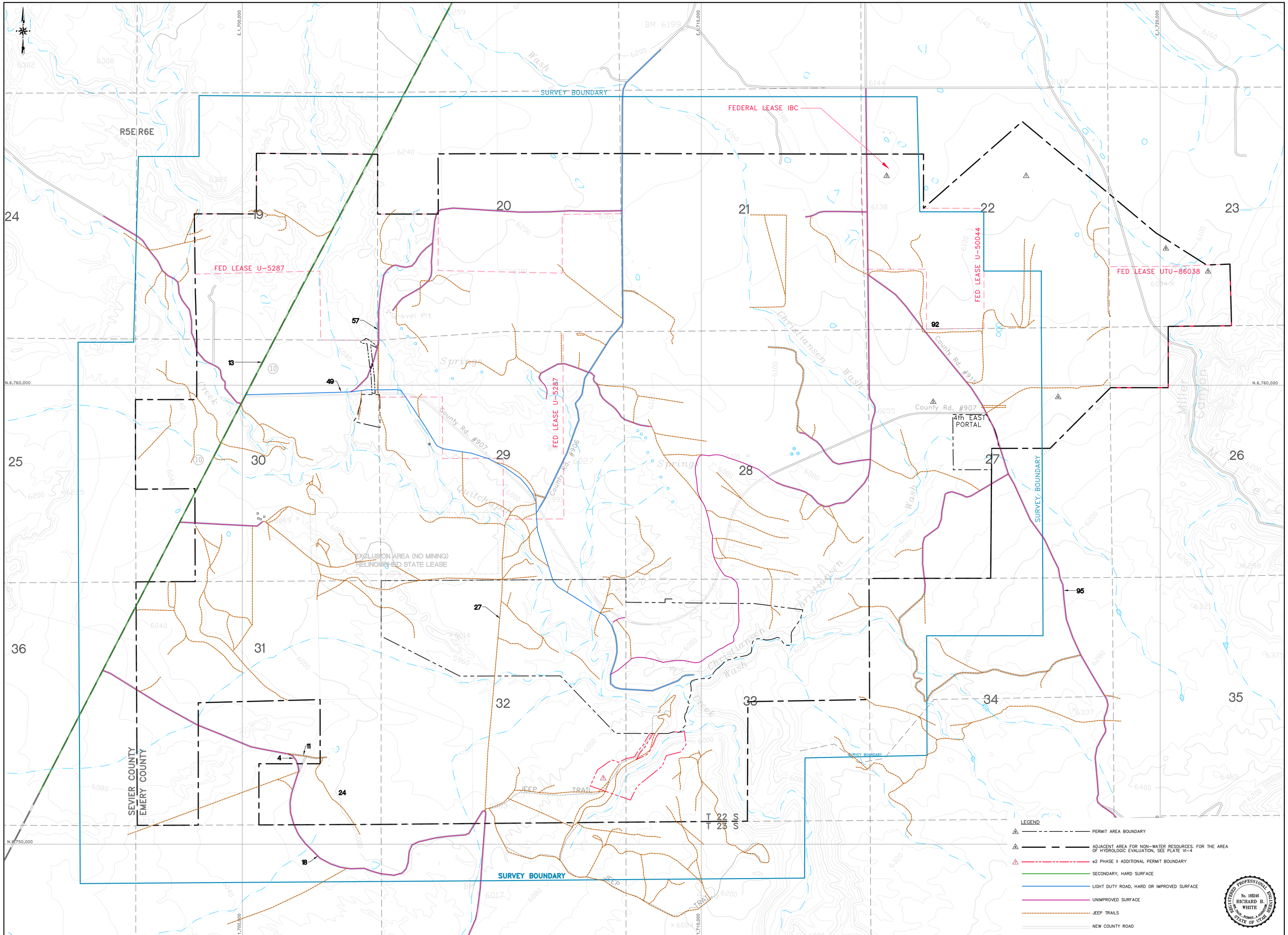
0' 600'
SCALE: 1" = 600'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 10/80 (VALLEY ENGINEERING)
RE-DRAWN DATE: 8/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE V-1
PRESUBSIDENCE SURVEY:
STRUCTURES AND UTILLITIES



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MESA BUTTE 1968, PHOTO REVISED 1978.
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COORDINATE SYSTEM:
UTAH STATE COORDINATES.
LCC, NAD 27
ZONE 4302-UTAH CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

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2	03/06	JAG	ADDED COUNTY ROAD 907	8	04/10	JAG	ZZN WEDGE
3	12/12/08	JAG	B1 NORTH FED LEASE IBC, B1 SOUTHEASTERN	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT	
4	05/09	JAG	A2, NORTH ADJ. VS. PERMIT BOUND.				

0' 600'
SCALE: 1" = 600'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 10/80 (VALLEY ENGINEERING)
RE-DRAWN DATE: 8/05
APPROVED BY: JAG
DWG DATA: G:\1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE V-2
PRESUBSIDENCE SURVEY:
ROADWAYS

NOTE:
"THE PRIMARY POINT OF DIVERSION OF THE IRRIGATION WATER FROM MUDDY CREEK IS APPROX. 20 MILES NORTHWEST OF THE IBC AREA. ADDITIONAL POINTS OF DIVERSION ARE LOCATED ABOUT 6 MILES NORTH OF AND 4 MILES NORTHEAST OF THE IBC. PLEASE REFER TO SECTION VI.A.4 OF THE APPROVED MRP FOR ADDITIONAL INFORMATION CONCERNING WATER RIGHTS."

SURVEY BOUNDARY
FEDERAL LEASE IBC
R5E R6E
FED LEASE U-5287
FED LEASE U-50244
FED LEASE UTU-86038
4th EAST PORTAL
County Rd. #915
County Rd. #907
EXCLUSION AREA (NO MINING)
RELINQUISHED STATE LEASE
SEVIER COUNTY
EMERY COUNTY
T 22 S
T 23 S
JEEP TRAIL
Gravel Pit
Christiansen Wash
Miller Canyon
N.6,760,000
N.6,750,000
E.1,700,000
E.1,710,000
E.1,720,000

LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- NATURAL STREAMS
- DRY WASHES
- IRRIGATION DITCHES

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

EarthFax

BASE MAP:
D.O.G. 7.5-MINUTE QUADRANGLE'S, EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATS 1968, PHOTO REVISED 1978.
COORDINATE SYSTEM:
STATE PLANE COORDINATES.
UTAH CENTRAL ZONE
ZONE 4302-UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88–US FEET

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2	12/12/06	JAG	R1, NORTH FED. LEASE IBC, 4th EAST PORTAL	7	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT
3	05/09	JAG	REV. ADJ. VS. PERMIT				
4	08/09	JAG	1st NORTH, MILLER CANYON (BA UTU-86038)				
5							

0' 600'
SCALE: 1" = 600'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
APPROVED BY: JAG
CHECKED BY: JAG
ORIGINAL DATE: 10/80
VALLEY ENGINEERING
RE-DRAWN DATE: 8/05
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE V-3
PRESUBSIDENCE SURVEY:
HYDROLOGY

SURVEY BOUNDARY

FEDERAL LEASE IBC

R5E R6E

FED LEASE U-5287

FED LEASE U-50044

FED LEASE UTU-86038

SEE IBC CHAPTER XII FOR VEGETATION IN THIS AREA

4th EAST PORTAL

EXCLUSION AREA (NO MINING) RELINQUISHED FED LEASE

SEVIER COUNTY
EMERY COUNTY

T 22 S
T 23 S

HAY
BRUSH
MARSH GRASS
JUNIPER

LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- AGRICULTURAL
- NATIVE

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE STATE OF UTAH

EarthFax

BASE MAP:
CASTLE DALE 7.5 MINUTE QUADRANGLE; EMERY WEST 1968.
CHERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER PLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES
NAD 27
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

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3	05/09	JAG	RE-NORTH ADJ. VS. PERMIT BOUNDARY				
4	08/09	JAG	RE-NORTH MILLER CANYON FED LEASE UTU-86038				

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SCALE: 1" = 600'
CONTOUR INTERVAL = 40'

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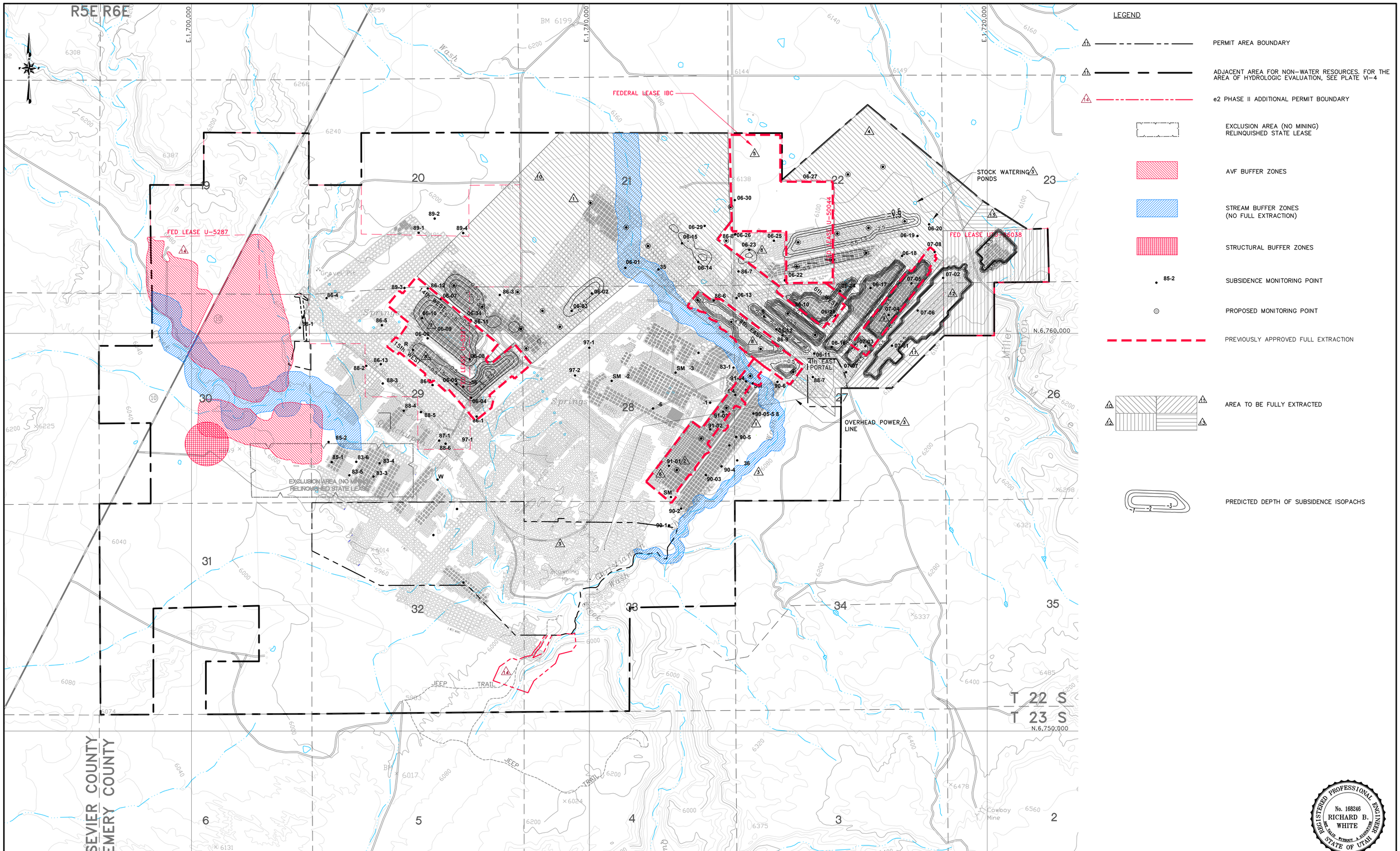
CHECKED BY: JAG
ORIGINAL DATE: 10/80 (VALLEY ENGINEERING)
RE-DRAWN DATE: 8/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE V-4
PRESUBSIDENCE SURVEY:
VEGETATION



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COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
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VERTICAL DATUM - NAVD 88-US FEET

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REVISIONS

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2	07/07	JAG	15th WEST, 6th WEST, AND 4th EAST FULL EXTRACTION	12	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
3	03/08	JAG	ADDITIONAL FULL EXTRACTION ZZ NORTH	13	04/10	JAG	ZZN WEDGE
4	09/08	JAG	LIFE OF MINE FULL EXTRACTION	14	01/17	JAG	e2 PHASE II ADDITIONAL PERMIT

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SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

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CHECKED BY: JAG
ORIGINAL DATE: 1/03
RE-DRAWN DATE: 12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWG

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 1
PRICE, UT 84501

PLATE V-5
SUBSIDENCE MONITORING POINTS AND BUFFER ZONES

CHAPTER VI

HYDROLOGY

~~Consolidation Coal Company~~Bronco Utah Operations, LLC
Emery Mine
Emery, Utah

Utah Permit Number ACT015/015

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CHAPTER VI
HYDROLOGY

VI.1 INTRODUCTION

VI.1.1 General Requirements

This chapter presents a description of:

- Existing hydrologic resources within the permit and adjacent areas;
- Mine operations and the potential impacts of these operations to the hydrologic balance;
- Methods of complying with design criteria;
- Applicable hydrologic performance standards; and
- Hydrologic reclamation plans for the Emery Mine.

VI.1.2 Certification

All maps, plans, and cross sections presented in this chapter have been certified by a qualified, registered professional engineer.

VI.1.3 Inspection

Impoundments associated with the mining and reclamation operations will be inspected as described in Section 5.1.4.3 of this MRP.

VI.2 ENVIRONMENTAL DESCRIPTION

VI.2.1 General Requirements

This section presents a description of hydrologic resources within the permit and adjacent areas that may be affected or impacted by the coal mining and reclamation operations at the Emery Mine.

VI.2.2 Cross Sections and Maps

VI.2.2.1 Location and Extent of Subsurface Water

A generalized hydrostratigraphic cross section of the permit and adjacent areas is presented in Figure VI-1. Thin deposits of Quaternary alluvium overlie some of the areas but are not shown on Figure VI-1 due to the scale. Estimates of recharge and discharge noted on this figure are from Lines and Morrissey (1983) based on data collected and groundwater modeling conducted in the late 1970s and early 1980s. Actual rates are probably different now than when those earlier estimates were developed.

The Ferron Sandstone Member of the Mancos Shale (in which the coal occurs that is extracted from the Emery Mine) is overlain by the Blue Gate and underlain by the Tununk Members of the Mancos Shale. Both the Blue Gate and the Tununk are relatively impermeable shales that bound the more permeable Ferron Sandstone. For the purpose of this MRP, the portion of the Ferron Sandstone including the “I” coal zone and above is called the upper Ferron Sandstone and is designated by the symbol Kmf(u). The portion laying stratigraphically between the base of the “I” zone and the base of the “A” coal zone is referred to herein as the

middle Ferron Sandstone and designated by the symbol Kmf(m). The remaining portion of the Ferron Sandstone lying below the base of the "A" zone is called the lower Ferron Sandstone and designated by the symbol Kmf(l). This partitioning of the Ferron Sandstone is consistent with that of Lines and Morrissey (1983).

The uppermost continuous aquifer beneath the permit and adjacent areas occurs within the Ferron Sandstone. Potentiometric surface maps of this aquifer are presented in Plates VI-1 and VI-2 for the upper and lower Ferron Sandstone, respectively. Plate VI-1 presents data for 1979 while Plate VI-2 portrays conditions in 1985 (the earliest periods of relatively complete data in each zone).

Water rights associated with groundwater within 1 mile of the permit boundary are shown on Plate VI-3. Information concerning these water rights is contained in Appendix VI-4 and summarized in Table VI-1. Seasonal variations in water levels are discussed in Section VI.2.4.1. These fluctuations are not sufficient to result in substantial changes to the potentiometric surface maps (Plates VI-1 and VI-2) or the hydrostratigraphic cross section (Figure VI-1).

VI.2.2.2 Location of Surface Water Bodies

The location of surface water bodies for which water rights have been obtained within the permit and adjacent areas is provided on Plate VI-3. Information concerning these rights is provided in Appendix VI-4 and summarized in Table VI-1. Other water bodies in the area are noted on the base map that comprises Plate VI-3.

VI.2.2.3 Locations of Monitoring Stations

Surface water and groundwater monitoring stations associated with the Emery Mine are shown on Plate VI-4. Approximate surface elevations of the monitoring stations are indicated by the topographic lines on Plate VI-4.

Plate VI-4 contains a line depicting the "approximate area of hydrologic evaluation." This area is approximated by the Joe's Valley-Paradise Fault Zone on the west, Ivie Creek and its adjacent tributaries on the south, Muddy Creek and its adjacent tributaries on the east, and the area of influence associated with the Emery Town wells on the north. The line was drawn to encompass the long-term monitoring points shown on Plate VI-4 as well as most of the temporary monitoring points shown on Figure VI-14, Figure VI-15, and Plate VI-9. The influence of the Joe's Valley-Paradise Fault Zone on groundwater flow in the Ferron Sandstone (as noted on Plates VI-1 and VI-2) was also accounted for when drawing the line. Additional information is found in Section VI.2.8.3 regarding this line and its relationship to the "adjacent area" in the context of the potential impacts of the Emery Mine on the hydrologic balance of the region.

VI.2.2.4 Location and Depth of Water Wells

Water-supply wells and groundwater monitoring wells in the permit and adjacent areas are shown on Plate VI-4. Depths of these wells and other completion details are summarized in Table VI-2.

VI.2.2.5 Surface Topography

Surface topographic features in the permit and adjacent areas are shown on the base maps used for many of the plates in this submittal.

VI.2.3 Sampling and Analysis

All water samples collected under this MRP have been analyzed according to methods in either the "Standard Methods for the Examination of Water and Wastewater" or 40 CFR parts 136 and 434. Where feasible, these same references have been used as the basis for sample collection.

VI.2.4 Baseline Information

Surface and groundwater resource information is presented in this section to assist in understanding hydrologic conditions in the mine area. This information provides a basis for determining if mining operations have had, or can be expected to have, a significant impact on the hydrologic balance of the area. Additional information regarding the hydrology of the Miller Canyon Tract (Zero Zero North mine panel) is provided in Appendix VI-16.

Planned surface disturbances associated with the Emery 2 portal will be located within the currently-approved Mining and Reclamation Plan area for the Emery Mine (i.e., within areas from which baseline hydrologic data have been collected and identified on Plate VI-4 as the "Adjacent Area for Non-Water Resources" and the "Approximate Area of Hydrologic Evaluation"). All underground works currently envisioned to be accessed through the Emery 2 portal are also within those areas of baseline hydrologic data collection identified on Plate VI-4. Thus, the hydrologic baseline information presented below is applicable to the Emery 2 surface facility and its associated underground works. These baseline data are considered adequate to properly revise the Probable Hydrologic Consequences determination and account for construction of the Emery 2 surface facility and its associated underground mining operations.

VI.2.4.1 Groundwater Information

This section presents a discussion of baseline groundwater conditions in the permit and adjacent areas. The locations of wells and springs in the area are presented on Plates VI-3 and VI-4. Lithologic and completion logs for monitoring wells in the permit and adjacent areas are provided in Appendix VI-2.

Geologic conditions in the permit and adjacent areas are described in Volume V of this MRP. Groundwater in the permit and adjacent areas occurs predominantly in the Ferron Sandstone. However, perched aquifers of limited areal extent are present in overlying materials. Hydrogeologic conditions within the permit and adjacent areas are summarized below.

Quaternary Deposits (Qal)

Discontinuous, shallow perched zones are contained within Quaternary alluvial, mud and slope wash, and pediment deposits scattered throughout the Emery area (see Plate VI-5). These Quaternary deposits are generally less than 50 feet thick, with boundaries defined by the contact with the underlying Blue Gate Member of the Mancos Shale.

Recharge to Quaternary *alluvial deposits* in the area occurs primarily by streamflow seepage along adjacent water courses. During the spring and summer months, much of this water consists of irrigation return flow. Groundwater discharges from these Quaternary alluvial deposits primarily via evapotranspiration and horizontal, subsurface outflow to topographically lower areas. Given the relatively impermeable nature of the underlying Blue Gate Member, it is assumed that only minor quantities of alluvial groundwater discharge to the adjacent bedrock.

Most recharge to the Quaternary *mud and slope wash and pediment deposits* occurs via seepage of irrigation water applied to adjacent land. This water, which in the Emery area is diverted predominantly from Muddy Creek, is either evapotranspired or moves horizontally through these deposits and then discharges to the surface at the underlying contact with the relatively impervious Blue Gate Member. Several seepage points representing irrigation return flow from this subsurface mud and slope wash/pediment water are noted on Plate VI-5 (specifically SP-1 through SP-14). Water flowing from some of these seeps becomes trapped in swales which, coupled with the high salinity of the Blue Gate, creates areas of salt accumulation.

Consol Energy (the prior owner of the mine) conducted an inventory of seepage points within one mile of the permit area on October 24, 1979, and again on June 11, 1980. Each point was evaluated in the field for its geologic setting, and field data were collected to define the temperature, pH, specific conductance, dissolved oxygen, and discharge (where possible) of the seepage.

Within the study area, 16 seepage points were identified in 1979-1980. Locations and field measurements for each of the points are exhibited on Plate VI-5 and Table VI-3, respectively. All but two of the seepage points were observed to be issuing from pediment gravels overlying the Bluegate Shale. This seepage originates from infiltrating irrigation water used for farming south of Emery on the weathered pediment gravels. The remaining two springs (SP-15 and SP-16, located east of the permit area) issue from the Ferron Sandstone and are discussed in a subsequent section of this document.

The specific conductance of the seepage water ranged from 658 to 2015 and averaged 1155 umhos/cm at 25°C. The pH ranged from 6.3 to 8.3 with an average of 7.6. Although discharge at most of the seepage sites could not be measured because of the diffuse nature of the discharge and/or vegetative overgrowth, flows were typically less than 10 gpm. The dissolved oxygen of the seepage water is more indicative of a near-surface source and is much higher than would be expected for a natural groundwater source. This observation, coupled with the fact that all seepage appeared to be issuing from the pediment gravels adjacent to irrigated fields, indicates that none of these seepage points would likely exist if not for the adjacent irrigation (i.e., all are considered to have an anthropomorphic source).

Ten monitoring wells were completed in Quaternary deposits in 1982. Wells RDA 1 through 6 were drilled in the Quitchupah Creek drainage and wells SM1-1 through 4 were drilled in the Christiansen Wash drainage. Water-level measurements collected from these wells are summarized in Figure VI-2 and presented in their entirety in Appendix VI-10. No consistent seasonal or long-term variations in water levels are evident in the alluvial monitoring wells. Given the relatively thin nature of the Quaternary deposits in the area, differences in water-level elevations between wells are primarily a function of the ground elevation at the well locations.

A summary of water quality data collected from the Quaternary monitoring wells, together with a limited number of samples from springs, is provided in Table VI-4, with individual sample results presented in Appendix VI-1. The pH of this water tends to be moderately alkaline, averaging 7.3 to 7.7 (field and laboratory measurements, respectively). Total dissolved solids ("TDS") concentrations averaged about 16,600 mg/l and varied by approximately two orders of magnitude (from 940 to nearly 93,000 mg/l) during the period of record (1982 through the present).

TDS concentrations in Quaternary deposits tend to be highest at monitoring wells RDA-5, RDA-6, SM1-1, and SM1-3, being approximately an order of magnitude higher at these wells

than the other “RDA” and “SM1” wells. Figure VI-3 indicates that no consistent trends in TDS concentrations are apparent between these high-TDS wells. These trends can also not be correlated with nearby mining activities. Trends at the “RDA” wells (generally decreasing at RDA-5 and generally increasing at RDA-6) suggest wide variations over relatively short distances, especially considering the lower TDS concentrations in the other nearby “RDA” wells. The cause of these variations is uncertain. Wells SM1-1 and SM1-3 are completed in areas where subsurface irrigation seepage accumulates, concentrating salts from the overlying soil and the underlying Blue Gate Member, suggesting a source for the elevated TDS concentrations relative to the other “SM1” wells. However, it is uncertain why TDS concentrations show no consistent trend between wells SM1-1 and SM1-3.

Groundwater in Quaternary deposits is generally categorized as a sodium sulfate type. This characterization exhibits the influence of the underlying gypsiferous Blue Gate Member of the Mancos Shale. Dissolved iron and manganese concentrations in the Quaternary deposits have averaged approximately 3.6 and 0.9 mg/l, respectively, during the period of record.

Blue Gate Member of the Mancos Shale (Kmb)

In the vicinity of the Emery Mine, the Blue Gate consists of massive gray shales with minor intercalated, fine-grained sandstones and thin carbonaceous layers. Several monitoring wells, installed by Consol and the USGS, are completed totally or partially in this zone.

Water-level data collected from the Blue Gate monitoring wells are provided in Appendix VI-10 and summarized in Figure VI-4. No consistent seasonal variations in water levels occur in this unit. Long-term water-level declines are apparent in the Blue Gate at monitoring wells I, R2, and (to a lesser degree) AA. A comparison of Figure VI-4 with information presented on ~~Plate VI-6~~Plate IV-2 indicates that the timing of water-level declines at these wells is not related to mining in nearby areas. The fact that declines are not consistent over the entire area suggests that they are also not climate related. Thus, water-level declines at wells AA, I, and R2 are presumably the result of local changes in irrigation patterns.

Historically, water-quality data have been collected from only one monitoring well completed in the Blue Gate Member within the permit area (well T1-BG – see Table VI-5 and Appendix VI-1). These data indicate that groundwater in the Blue Gate Member has a near-neutral pH with a high salinity (TDS concentrations in the general range of 15,000 to 24,000 mg/L). Dissolved iron and manganese concentrations in the Blue Gate are typically less than 1 mg/l.

The predominant ions in groundwater within the Blue Gate Member are sodium and sulfate, which is indicative of the gypsiferous nature of the formation. The generally saline nature of the Blue Gate Member is also evident from alkali deposits that occur throughout the Emery area.

Ferron Sandstone Member of the Mancos Shale (Kmf)

Groundwater within the Emery Mine permit and adjacent areas occurs primarily in the Ferron Sandstone Member of the Mancos Shale, the unit that also contains the coal that is extracted from the Emery Mine. The Ferron Sandstone is bounded above by the Blue Gate Member and below by the Tununk Member of the Mancos Shale.

Aquifer Characteristics:

Aquifer pumping tests have been conducted in the Ferron Sandstone in the permit and adjacent areas by the U.S. Geological Survey (see Lines and Morrissey, 1983) and Consol (see Appendix VI-3). The results of these pumping tests are summarized in Table VI-6. As indicated, the average transmissivity of the Ferron Sandstone in the permit and adjacent areas is 230 ft^2/day, varying by more than two orders of magnitude from 5 to 800 ft^2/day. The limited amount of data summarized in Table VI-6 suggests that the transmissivity of the upper Ferron Sandstone is about one-tenth that of the lower Ferron Sandstone (averages of 60 ft^2/day vs. 540 ft^2/day, respectively). However, insufficient data exist to draw definitive conclusions from these numbers.

White et al. (2005) concluded, from calibration of a regional groundwater model, that the permeability of aquifers in the Colorado Plateau of Utah is about four orders of magnitude higher than that of aquicludes in the region. Assuming an approximate thickness of 400 feet for the entire Ferron Sandstone (based on a review of Plate V-20), the average hydraulic conductivity of the Ferron Sandstone as a whole in the Emery area would be approximately 0.5 ft/day (230 ft^2/daty divided by 400 ft). This would suggest that the hydraulic conductivity of the overlying Blue Gate and underlying Tununk Members in the area is about $5x10^{-5}$ ft/day, based on the calibration results of White et al. (2005).

Lines and Morrissey (1983) indicate that the transmissivity of the Ferron Sandstone generally increases to the northwest as the unit thickens. According to Table VI-6, the average storage coefficient of the Ferron Sandstone in the area is $1.3x10^{-3}$, varying by about one order of magnitude across the area.

Groundwater Recharge, Flow, and Fluctuations:

According to Lines and Morrissey (1983), recharge to groundwater in the Ferron Sandstone within the permit and adjacent areas occurs primarily along the Joe's Valley-Paradise fault zone, with this water originating as precipitation at higher-elevations along the Wasatch Plateau to the west. Lines and Morrissey (1983) estimated that recharge to the Ferron Sandstone aquifer is about 2.4 cfs along the Joe's Valley-Paradise fault zone ~~east~~ west of the Emery Mine. Direct recharge from precipitation and from overlying and underlying formations is considered minimal, given the relatively impermeable nature of the Blue Gate and Tununk Members and the limited precipitation that falls on the valley floor (see Figure VI-1).

Potentiometric surface maps of the upper and lower Ferron Sandstone are provided in Plates VI-1 and VI-2 for 1979 and 1985, respectively (the earliest years with relatively complete data sets). A comparison of these maps with data provided by Doelling (2004) indicates that groundwater moves generally updip and in a southeast direction through the permit area. Throughout most of the region, groundwater in the Ferron Sandstone west of the mine has historically been under sufficient artesian pressure to flow at the ground surface.

Plates VI-7 and VI-8 present the potentiometric surface of the upper and lower Ferron Sandstone, respectively, in 2006. With coal being extracted from the upper Ferron Sandstone, Plate VI-7 shows the effects of discharging water that is encountered during mining operations. Mining has not affected the potentiometric surface of the lower Ferron Sandstone to the same degree as the upper Ferron Sandstone.

Figures VI-5 through VI-7 present hydrographs of water-level data collected from the upper, middle, and lower Ferron Sandstone, respectively. As indicated in Figure VI-5, several wells completed in the upper Ferron Sandstone have exhibited substantial water-level declines due to mining activities. For instance, the Bryant and Lewis wells experienced approximately

250 to 300 feet of drawdown beginning in the late 1970s/early 1980s. Water levels have remained relatively constant at these locations since that time. Although these wells are located a mile or more upgradient from areas where mining was occurring at the time, dewatering of the mine is the presumed cause of this drawdown. Consol ~~has~~ furnished and installed pumps and ancillary facilities at these private wells to augment water that formerly flowed at the surface.

Figure VI-5 indicates that groundwater levels in wells AA and Muddy #1 (both completed in the upper Ferron Sandstone) have remained essentially unchanged for several years. Thus, the potentiometric surface data provided on Plate VI-7 are considered representative of current conditions in the vicinity of the proposed Emery 2 portal. These data indicate that the potentiometric surface occurs at an elevation of approximately 5,890 feet at the location of the Emery 2 portal. This is approximately 40 feet below the planned elevation of the mine floor at the portal.

Approximately 300 feet of drawdown occurred at well R2 in the upper Ferron Sandstone through the 1980s, after which the water level at this location has remained relatively constant. Similarly, well TP experienced approximately 300 feet of drawdown in the upper Ferron Sandstone during the 1980s and early 1990s, with relatively constant water levels since that time (see Figure VI-5). These declines all occurred presumably as a result of nearby mining activities. Water levels at well T2 declined by 200 to 300 feet in the upper Ferron Sandstone during the 1980s, with wide fluctuations of 100 to 200 feet (both positive and negative) at this location since 2004. Although additional mining near this location may have caused some of these fluctuations, the relative stability of water levels at the adjacent well TP during this period of time imply that data collection errors may have been the source of some of the recent apparent fluctuations.

According to Figure VI-5, wells AA, Muddy #2, and USGS1-2 in the upper Ferron Sandstone experienced approximately 50 feet of drawdown in the late 1970s and early 1980s, presumably as a result of mining in nearby areas (see well locations on Plate VI-4). Water levels in ~~these~~ well~~s have~~ AA remained relatively constant since then~~,~~. Obstructions in wells ~~even though (in the case of~~ Muddy #2 and USGS1-2~~) additional mining occurred beneath these locations 10 to 20 years later~~ have rendered the data reported from those wells meaningless since about 2006.

Water levels in the upper Ferron Sandstone have remained relatively constant at wells ~~H,~~ I2~~,~~ and Muddy #1 throughout the period of record (see Figure VI-5). These wells are located at similar or closer distances to mined areas than other wells where water-level declines have occurred. The reason for the lack of anticipated water-level response at these locations is unknown.

Water levels in well H completed in the upper Ferron Sandstone remained relatively constant until 2005, when they rose for a short period. Since about the beginning 2006, water levels in this well have decreased nearly 200 feet. The reason for this decrease is not well understood, as indicated in Section VI-2.8.3.

Selected wells completed in the middle Ferron Sandstone have also shown water level declines through the period of record (see Figure VI-6). Wells AA and I experienced about 80 to 100 feet of drawdown in the 1980s. Water levels in the middle Ferron Sandstone have remained relatively unchanged at well AA since that time, but declined an additional 150 feet at well I in the fourth quarter of 2005 after a several-year period of relative stability. Well AA is located near an area where mining occurred in the late 1970s and early 1980s, suggesting that this mining activity resulted in the drawdown noted in this well. Well I is located near an area

where mining occurred in the early to mid 1980s, with additional mining occurring directly beneath this well in 2004 and 2005. The response of water levels in the middle Ferron Sandstone at well I ~~is~~may be indicative of the two phases of mining in the area.

At well R2, the middle Ferron Sandstone experienced a decline of approximately 500 feet in the late 1980s (see Figure VI-6). This decline likely occurred from mining in the immediate area during that time frame (see ~~Plate VI-6~~Plate IV-2). Water levels in this well have been trending upward since about 2003, perhaps due to this well being remote from more recent mining operations.

Water levels in well H monitoring the middle Ferron Sandstone dropped over 300 feet in the late 1980s. The reason for this response is unknown, since similar declines did not occur at well H in the upper Ferron Sandstone (compare Figures VI-5 and VI-6). Underground observations near the area of this well did not indicate any unusual water inflow into the mine nor do discharge records from the mine dewatering system substantiate any sustained increase in water volume entering the mine as would be expected to affect such a sharp decline in water levels. It is possible that the integrity of well H in the middle Ferron Sandstone has been compromised. Field investigations with a water level probe indicate that this well is at least partially blocked above its completion zones. Except at well H, responses of nested wells completed in the upper and middle Ferron Sandstone were essentially similar, suggesting a hydraulic connection between these two intervals.

Water level records of wells AA, I, WW1, and ZZ completed in the lower Ferron Sandstone show no apparent declines during the period of record. Each of these wells is located in the south or east (i.e., downgradient) portion of the permit area. These data suggest hydraulic separation of the upper/middle and lower Ferron Sandstone in the areas of these wells. However, water-level declines have occurred at the Kemmerer well and wells H and R1 completed in the lower Ferron Sandstone (all located in the north or west portion of the permit and adjacent areas). A decline of about 170 feet occurred at well R1 in the late 1980s/early 1990s when mining was active immediately east of that location. Water levels since that time ~~have been~~apparently remained relatively stable at well R1. However, water-level data collected from this well (in the form of pressure measurements) have been improperly reported for several years (see Appendix VI-19). Declines at the Kemmerer well and well H have been more gradual, with a decrease in head of about 40 feet at the Kemmerer well throughout the period of record, and about 70 feet of decline at well H throughout the 1980s and 1990s. These latter two wells are more remote from mining activities than well R1. These data indicate that the potentiometric surface of the lower Ferron Sandstone in upgradient areas is more affected by mining activities than in downgradient areas.

Groundwater Discharge:

The USGS used a three-dimensional finite-difference computer model of the Ferron Sandstone to simulate groundwater flow in the vicinity of the Emery Mine (Lines and Morrissey, 1983). The model was calibrated in a steady-state simulation using water levels and discharges from the aquifer that were measured during 1979. Discharge estimates resulting from that calibration effort are noted on Figure VI-1. The precise recharge and discharge rates noted on Figure VI-1 have probably changed since the work of Lines and Morrissey (1983).

Based on estimates provided in Figure VI-1, the most significant discharges from the Ferron sandstone aquifer in the permit and adjacent areas have historically been leakage to the Blue Gate Member, discharge from the Emery Mine, leakage to streams, and extractions from wells. The largest man-made discharge from the Ferron Sandstone is discharge from the mine.

In a study of the Emery Mine area, Lines (1987) found that "prior to mining, the vertical component of flow was upward from the Ferron into the Blue Gate Member. As mining progressed, ground-water flow was directed toward the mine workings, and much of the aquifer and other rocks above the mined coal bed were dewatered. The steady-state pattern of [predominantly horizontal] flow . . . probably would not develop unless mining ceased and dewatering of the mine continued for several years." These conditions are depicted in Figure VI-8. With this in mind, the declines in water levels in the upper Ferron Sandstone suggest that upward leakage from the Ferron Sandstone to the Blue Gate Member is probably minimal over areas where mining has occurred.

Groundwater from the Ferron Sandstone flows into the mine and ~~is~~were historically discharged via pumps to holding ponds and thence to Quitchupah Creek. The last of these pumps was shut down in January 2016. Pumping from the mine may resume in the future, depending on conditions encountered following opening of the Emery 2 portal. ~~These~~All mine-water discharges are regulated under permits issued by the Utah Division of Water Quality through the Utah Pollutant Elimination Discharge System ("UPDES"). The average discharge from the Emery Mine during the period of 1979 through 20~~0~~15 is shown in Figure VI-9 and Table VI-7. The data contained in Table VI-7 are summarized in ~~three~~four periods: a period of active mining from 1979 through 1990, a period of temporary shutdown from 1991 through 2001, ~~and~~ an additional period of active mining ~~since~~ from 2001 through 2010, and a period of temporary shutdown from 2011 through 2015. As indicated, the average discharge from the mine during the period of 1979 through 1990 was 0.93 cfs. During the temporary shutdown from 1991 through 2001, Consol pumped water from the mine at an average rate of 1.03 cfs to maintain accessible conditions.

Following the restart of mining in 2002, discharge from the mine ~~has~~ averaged 0.63 cfs through 2005 but increased substantially thereafter. ~~Since~~ As part of the 2002 re-start of mine, additional mining equipment ~~has been~~was added to the operation,~~.~~ ~~T~~thus~~, the difference in discharge between the period of temporary shut down and the period since 2002 is likely attributable to~~ increas~~ed~~ing in-mine water usage. The increase in mine-water discharge from 2006 through 2010 was likely due to the effects of subsidence on mine-water inflow as pillars were pulled.

Figure VI-9 shows that the discharge of mine water remained relatively high in 2011 and 2012 as plans were being made to re-enter the mine. As the time frame for re-opening the mine was extended, the decision was made to allow the lower portion of the mine works to flood up to a certain elevation. As a result, the discharge from the mine was reduced in 2013 and was maintained at a lower level until the last pump was shut off in January 2016.

Based on a comparison of the potentiometric surface data presented on Plate VI-7 with bottom-of-coal data presented on Plate V-20, it is anticipated that groundwater will not be encountered in the mine works accessed by the Emery 2 portal until mining has progressed to a point approximately 1,500 feet from the portal entry. Thereafter, groundwater that is encountered underground will initially be used in underground mining operations and not discharged to the surface. An estimate of the timing and quantity of groundwater that will eventually be discharged from the mine to the surface is provided in Section VI.2.8.3 of this chapter.

Discharge to alluvium is presumed to occur naturally from the Ferron Sandstone at various locations within the general mine area. Lines and Morrissey (1983) simulated groundwater discharge to alluvium along Muddy Creek, Ivie Creek, Christiansen Wash, and

Quitchupah Creek within the permit and adjacent areas. They estimated from this simulation that groundwater discharges at a rate of about 0.4 cfs from the Ferron Sandstone to alluvium. As indicated above, discharges from the Emery Mine have averaged 50 to 150% higher than this value, with this water all eventually discharging to Quitchupah Creek. Thus, although discharge in permit-area streams may be locally affected, the net effect of mine-water discharges is an increase in groundwater discharge to local streams above that experienced historically.

Within the general mine area, well discharges from the Ferron sandstone aquifer include the Emery municipal well (approximately 90 gpm) and the Bryant and Lewis wells (approximately 30 gpm each). The Bryant and Lewis wells have been affected by underground mining in that they no longer flow at the land surface. Consol ~~has~~ furnished and installed pumps and surface ancillary facilities in order to replace these water supplies. No further effect to these wells is anticipated from present mining operations, given the relative stability of water levels at these locations noted in Figure VI-5 and the fact that future mining is not currently anticipated in the western portion of the permit area near these wells. Given the distance of the Emery municipal well from the permit area, no impacts are anticipated from mining activities on this well.

Two springs are known to discharge from the Ferron Sandstone within the general mine area (see Plate VI-5). Spring SP-15 appears to discharge from the upper Ferron Sandstone and is appropriated for 0.1 cfs by Consol for stock watering purposes. Spring SP-16 appears to discharge from the lower Ferron sandstone and is unappropriated. The USGS measured the discharge of this spring in 1979 and found it to be issuing at 5 gpm.

Groundwater Quality:

A summary of water-quality analyses for groundwater samples (wells, springs and mine inflow) collected from the Ferron Sandstone in the permit and adjacent areas is presented in Table VI-8. Individual sample results are presented in Appendix VI-1. Groundwater-quality samples have historically been collected in the permit and adjacent areas from four wells completed in the upper Ferron Sandstone (the Bryant well, the Lewis well, and monitoring wells TP and USGS1-2), one spring issuing from the upper Ferron Sandstone (SP-15), two wells completed in the lower Ferron Sandstone (the Kemmerer well and monitoring well ZZ), and one well completed in both the upper and middle Ferron Sandstone (EMRIA2). The locations of these wells are noted on Plate VI-4.

The pH of groundwater in the Ferron Sandstone tends to be moderately alkaline, averaging 7.9 in the upper Ferron and 8.2 in the lower Ferron. Although only two groundwater samples from the Ferron Sandstone have been analyzed for acidity, several have been analyzed for alkalinity. These data indicate that the alkalinity of groundwater in the Ferron Sandstone exceeds the acidity by a factor of more than 5. Coupled with the alkaline pH, these data indicate that no substantial risk exists for acidic groundwater to be discharged from the Emery Mine.

The TDS concentration of water in the upper Ferron Sandstone is substantially lower than that of the overlying Quaternary deposits and Blue Gate Member, averaging approximately 1,600 mg/l in the upper Ferron and 690 mg/l in the lower Ferron. In the upper Ferron Sandstone, TDS concentrations tend to increase in the downgradient direction (from west to east), thus indicating the influence of recharging by fresher water from the Wasatch Plateau and natural leaching of salts as groundwater flows downgradient within the Ferron. Lines and Morrissey (1983) indicate that similar spatial variations in TDS concentrations occur in the lower Ferron Sandstone.

Temporal variations in TDS concentrations in the upper Ferron Sandstone are portrayed in Figure VI-10. The increase in TDS concentration at well USGS1-2 in mid 1989 occurred coincident with nearby mining activities (see ~~Plate VI-6~~Plate IV-2). Mine-related fractures in the overlying rock may have increased the hydraulic connection between the Ferron Sandstone and the more saline Blue Gate Member at this location, thereby locally increasing the TDS concentration of the upper Ferron Sandstone. However, similar changes are not evident at well TP, below which mining occurred in 1986. Hence, the effects of mining on TDS concentrations are likely localized.

Groundwater in the upper Ferron Sandstone tends to be a sodium sulfate type, while that in the lower Ferron is a sodium sulfate/bicarbonate type. The indicated differences in TDS concentrations and general chemistry, coupled with differences in water-level responses to mining (as discussed above), suggest at least some hydraulic separation between the upper and lower Ferron Sandstone.

VI.2.4.2 Surface Water Information

Streamflow

The Emery Mine is situated at the confluence of Quitchupah Creek and its tributary, Christiansen Wash. Quitchupah Creek is tributary to Ivie Creek which in turn is a tributary of Muddy Creek. Muddy Creek empties into the Dirty Devil River which flows into the upper Colorado River. Surface facilities associated with the Emery 2 portal will be constructed in an unnamed ephemeral wash that empties into Quitchupah Creek approximately 900 feet downstream from the confluence with Christiansen Wash and approximately 171 river miles upstream from the Colorado River.

Quitchupah Creek is a perennial stream whose headwaters in the eastern flank of the Wasatch Plateau are primarily sustained by snowmelt. Christiansen Wash, also a perennial stream, originates at lower elevation in the Wasatch Plateau north-northwest of the permit area. Given its lower elevation, Christiansen Wash receives less influence from snowmelt than Quitchupah Creek.

The ephemeral nature of the unnamed wash in which the Emery 2 surface facilities will be constructed was verified in an extensive study of that wash conducted in 2008. A copy of the resulting report describing baseline conditions in the wash is provided in Appendix VI-22. Given its ephemeral nature, this unnamed wash flows only sporadically in response to local, high-intensity precipitation.

Both Quitchupah Creek and Christiansen Wash receive additional flow in the vicinity of the mine from several sources unrelated to the Emery Mine, including:

- Direct irrigation return flow consisting of water whose source is primarily Muddy Creek;
- Irrigation-induced seepage from Quaternary pediment deposits;
- Groundwater discharging from the Ferron Sandstone;
- Water discharged from the Emery Mine; and
- Localized overland flow from storm events.

Quitchupah Creek also receives mine-water discharged from the SUFCO Mine at a point approximately 10 miles ~~northeast~~ northwest (upstream) from the Emery Mine permit area. This discharge represents a substantial quantity of relatively high-quality water.

The assortment of influences affecting both Quitchupah Creek and Christiansen Wash creates considerable fluctuations in both streamflow and water quality. Streamflow data have been collected at least occasionally from the permit and adjacent areas at multiple locations as indicated on Plate VI-9. The U.S. Geological Survey maintained a stream gaging station on Quitchupah Creek, immediately above its confluence with Christiansen Wash (site S-24 on Plate VI-9) from July 1978 through September 1981 (see Appendix VI-11). Average monthly flow at this location during the period of record varied from 2.6 cubic feet per second ("cfs") in August and October to 17 cfs in May. Approximately half of this flow occurred in the months of March through June, presumably as a result of snowmelt runoff. A substantial amount of flow also occurred, on average, in September, probably from thunderstorm activity.

The USGS also maintained a stream gaging station on Christiansen Wash, immediately above its confluence with Quitchupah Creek (site S-14 on Plate VI-9), from August 1978 through September 1984 (see Appendix VI-3). Average monthly flow at this location during the period of record varied from 1.2 cubic feet per second ("cfs") in December to 6.9 cfs in June and July. Most runoff occurred in the period April through September, presumably as a result of snowmelt runoff and thunderstorm activity.

Daily streamflow data collected by the USGS from Quitchupah Creek and Christiansen Wash are presented in Figure VI-11. From these records, it is apparent that both streams experience a wide seasonal variation in flow as well as occasional flood events. Considerable fluctuation in streamflow is evident from day to day during the spring and summer months. This can be explained in the spring by fluctuations in temperature as it affects melting of the mountain snow pack. In the summer and fall, thunderstorms and man-induced irrigation influences are the most likely cause of daily variations in streamflow. In contrast, daily fluctuations are much less substantial during the winter months, when irrigation has stopped and snow is accumulating. Although the period of record on Quitchupah Creek and Christiansen Wash is too short to draw many definitive conclusions, daily variations in streamflow appear to be less extreme than in Christiansen Wash, probably as a result of the discharge of mine water to Quitchupah Creek.

The USGS has also maintained stream gaging stations on Ivie Creek and Muddy Creek for various periods of record at the locations noted on Figure VI-12. A summary of the data collected from these stations is provided in Appendix VI-11. Annual flow data collected by the USGS from these locations, as well as the Quitchupah Creek and Christiansen Wash stations, are summarized in Figure VI-13. As indicated, streamflow varies widely in the region on an annual basis. These annual variations are likely less extreme in Quitchupah Creek than in the surrounding streams, given the consistent discharge of mine water to Quitchupah Creek.

Muddy Creek serves as the main source of irrigation water in the region. This water is diverted primarily from a point approximately 20 miles northwest of the permit area. Additional points of diversion are located about 6 miles north and 4 miles northeast of the permit area. A comparison of flow measurements at up and downstream gaging stations on Muddy Creek indicates that this stream loses approximately 60 percent of its flow between the USGS gaging stations. This dramatic loss in flow is primarily due to the above-noted irrigation diversions.

Between October 1977 and July 1978, Conoco conducted a seasonal streamflow and water quality study along Quitchupah Creek and Christiansen Wash in order to determine seepage and water quality trends within the permit area. Stream gaging data from this investigation are presented in Table VI-9 and gaging sites are indicated on Figure VI-14.

These data indicate that increases in flow generally increased in the downstream direction on both streams. Substantial increases in flow generally occurred between sites "C" and "D" on Christiansen Wash where seepage from irrigation water enters from a tributary. Flow also generally increased between sites "G" and "H" on Quitchupah Creek, where a tributary carrying irrigation return flow and seepage enters. Less consistent fluctuations in flow, including both gains and losses, were measured between the other sites on both streams. These gains and losses may reflect various contributions from groundwater and irrigation return flows, as well as seepage losses to the alluvium. In addition, man-induced and natural streamflow fluctuations during the time period between stream gaging at the various sites may account for some of the apparent gains and losses.

The USGS has also conducted seepage studies along Quitchupah Creek and Christiansen Wash. Available data are given in Table VI-10, with data collected from the locations noted in Figure VI-15. Within the vicinity of the Emery Mine, these data validated the results drawn from the Conoco study, indicating a general downstream increase in flow on both streams.

Due to the complexity of the surface water hydrology of both Christiansen Wash and Quitchupah Creek, it is difficult to determine the individual contributions to streamflow of irrigation return flows and seepage, natural discharge from the Ferron Sandstone, overland flow, and losses to seepage into alluvium. Only the discharges from the mine are practical to measure separately. These data were presented previously in Figure VI-9.

Several small impoundments have been constructed in the permit and adjacent areas to capture water for livestock use. No water rights have been filed on these impoundments. The impoundments capture water from surface runoff local to each pond.

The Emery Mine has eight discharge monitoring points that are regulated under permit number UT0022616 of the Utah Pollutant Discharge Elimination System ("UPDES"). These points are described in Table VI-11 and located as shown on Plate VI-4. Data collected from these points are contained in Appendix VI-12. Consistent discharges have occurred only at UPDES points 001 and 003, where water is discharged from the underground workings. Discharge from UPDES points 001 and 003 has not occurred since August 2011 and October 2015, respectively. Average flow rates associated with these discharge points were presented in Figure VI-9. Eight discharge events, ranging from 100 to 630 gallons per minute, have occurred since 1991 at UPDES point 004. Discharge at this point also represents mine water which is used by a local farmer for irrigation. Discharge has occurred at UPDES point 007 on two occasions since 1994. This pond was constructed in an area initially intended to be the site of a coal preparation plant. The preparation plant was not constructed and no disturbed area drains to the pond, other than that associated with the pond itself. No discharges have occurred from any of the other UPDES points since monitoring began.

Surface Water Quality

Surface water-quality data have been collected from several locations within the permit and adjacent areas, including those locations identified on Plates VI-4 and VI-9. Given the sporadic nature of flow in ephemeral stream channels, water-quality data have not been collected from the unnamed ephemeral wash in which the Emery 2 surface facilities will be constructed. However, sampling equipment will be installed in this wash for the collection of water-quality data up- and downstream from the surface facilities as discussed in Section VI.3.1.2.

The U.S. Geological Survey conducted a water-quality study on Quitchupah Creek from July 1975 through September 1976, collecting samples at site S-18 (See Plate VI-9) where State Highway 10 crosses Quitchupah Creek and at site S-29 on Quitchupah Creek where it joins Ivie Creek. Water-quality analyses for these sites are summarized in Appendix VI-13. Increases in concentration are typical between these two sampling sites, with pH increasing slightly from an average of 8.1 to an average of 8.3; TDS increasing from an average of 939 to an average of 2406 mg/l, and the sodium adsorption ratio ("SAR") increasing from an average of 2.2 to an average of 5.5. The water also changed from a mixed type at S-18 (with Ca, Mg, and Na, being the dominant cations and sulfate and bicarbonate being the dominant anions) to a strongly sodium sulfate type at S-29. At site S-18, the specific conductance of 1346 µmhos/cm at 25°C and SAR of 2.2 classify the water as high salinity, low sodium water which may be used for irrigation of plants with good salt tolerance grown in well drained soils (U.S. Department of Agriculture, 1954). At site S-29, the specific conductance of 3078 µmhos/cm at 25°C and SAR of 5.5 classify the water as very high salinity, medium sodium water which is not suitable for irrigation under ordinary conditions.

Data collected by the USGS on Muddy Creek and its tributaries in the 1970s are also presented in Appendix VI-13. At sample location S-1 located about 6 miles north of the permit are (see Plate VI-9), the quality of water in Muddy Creek was found to be very good, with an average TDS concentration of 212 mg/l. Calcium and magnesium were the dominant cations, while bicarbonate was the dominant anion. The SAR of 0.23 and a mean lab specific conductance of 417 µmhos/cm at 25°C classify this water as medium-salinity, low sodium water suitable for irrigation of plants with moderate salt tolerance. Downstream at site S-5 before its confluence with Ivie Creek, Muddy Creek's water is noticeably more saline, with a mean TDS concentration of 3065 (see Appendix VI-13). Sodium has become the dominant cation and sulfate the dominant anion. The mean lab conductance of 3584 µmhos/cm at 25°C and a SAR of 6.6 classify the water as very high salinity, medium-sodium water which is not suitable for irrigation under ordinary conditions. At site S-6, Ivie Creek dilutes Muddy Creek's waters slightly such that the mean TDS concentration decreases to 2306 mg/l. The water remains a sodium sulfate type, similar to the downstream end of Muddy Creek.

Site S-7 represents water collected from a canal carrying water from Muddy Creek. The quality of this water is very similar to that of Muddy Creek at site S-1. This canal and its associated laterals service the entire Emery area, diverting water from a location near S-1. Thus, the chemical quality of waters sampled at S-1 and S-7 are probably very representative of all irrigation waters in the Emery area.

On three occasions in the late 1970s, Consol conducted water-quality studies on Quitchupah Creek and Christiansen Wash to determine trends along these streams. Grab samples were collected at 19 of the sites indicated on Plate VI-9, with the resulting data contained in Appendix VI-13. These studies indicated that TDS concentrations in Quitchupah Creek increased in the downstream direction, largely as a result of irrigation return flows, seepage from the tributary sampled at site S-20, and mine-water discharges. At this time, the Emery Mine discharged its water into this tributary below site S-20. Notably, Quitchupah Creek after its confluence with Christiansen Wash contained a considerably smaller ionic concentration than that measured in either stream just upstream from the confluence. This decrease in concentrations was probably due to dilution via groundwater inflow from the Ferron Sandstone.

Concentrations of dissolved constituents were also found to increase in the downstream direction in Christiansen Wash above site S-12 as a result of runoff and irrigation return flow south of Emery. Below site S-12, which represents groundwater seepage from the Ferron

Sandstone, water quality in Christiansen Wash improves towards its confluence with Quitchupah Creek due to dilution from the groundwater inflow.

Between October 1977 and July 1978, Conoco collected grab samples in conjunction with a stream gaging program along Christiansen Wash and Quitchupah Creek. These data, which are presented in Appendix VI-13, are consistent with the findings of the previously-cited water-quality studies. These investigations also found that total suspended solids concentrations in both Quitchupah Creek and Christiansen Wash are inversely related to streamflow, being generally less than 200 mg/l except during the spring and early summer months when flows are high.

Routine surface water monitoring in the permit and adjacent areas began at several locations in 1979, with the monitoring network being expanded in later years as needed. Data collected from these stations (Plate VI-4), together with statistical analysis of the data, are provided in Appendix VI-5 and summarized in Table VI-12. These data confirm the conclusions drawn from the previously cited short-term studies on water quality types and trends for both Quitchupah Creek and Christiansen Wash.

Routine monitoring data show that Quitchupah Creek can generally be characterized as a sodium sulfate water, becoming more saline in the downstream direction. At Surface Water Monitoring Site ("SWMS") 1A, the average TDS concentration during the period of record has been 908 mg/l (near the upstream edge of the permit boundary). This concentration increases to an average of 1259 at SWMS-1, an average of 1386 mg/l at SWMS-4, and an average of 1445 at SWMS-3 (near the downstream edge of the permit boundary.

Based on the average flows and average TDS concentrations for these sampling sites (see Appendices VI-12 and VI-5), the salt load of Quitchupah Creek has increased an average of 11.2 tons per day ("TPD") between SWMS-1A and SWMS-1 during the period of record (see Table VI-12). Mine water is discharged to Quitchupah Creek between these sampling sites, with the salt load from this mine-water discharge outfall averaging 4.1 TPD during the period of 2000 through 2006 (see data for UPDES discharge point 003). The remaining increase in salt load in this reach of Quitchupah Creek (averaging 7.1 TPD) is attributed to irrigation return flows and natural leaching of saline bedrock and colluvium, particularly that associated with the Blue Gate Member.

The average salt load of Quitchupah Creek also increases (by 8.1 TPD) between SWMS-1 and SWMS-4. A tributary enters Quitchupah Creek between these sites, carrying irrigation return flows (sampled at SWMS-8, contributing 1.4 TPD) and water discharged from the mine (sampled at SWMS-6 [UPDES outfall 001], contributing 2.0 TPD [see Appendix VI-12]). Again, the remaining increase in salt load (4.9 TPD) is attributed to irrigation return flow and natural leaching of saline deposits. The salt load of Quitchupah Creek increases substantially at SWMS-3, primarily due to inflow from Christiansen Wash (see data at SWMS-2 and SWMS-5), which is not impacted by mine-water discharges. Thus it is evident that, while mine-water discharges increase the salt load of Quitchupah Creek, the majority of the salt-load increase in this stream occurs from irrigation return flows and leaching of naturally-saline deposits.

TDS concentrations are generally highest in local streams during periods of low flow, when dilution is at a minimum. Total suspended solids concentrations, on the other had, tend to be highest in stream during periods of high flow, when streamflow energy is greatest. Mine water concentrations of dissolved and suspended solids show no seasonal variations.

The pH of surface water in the permit and adjacent areas is moderately alkaline. Total iron and manganese concentrations tend to correlate positively with suspended sediment concentrations, as would be expected. All streams included in the routine monitoring network (Quitchupah Creek, Christiansen Wash, and Ivie Creek) can be classified as magnesium-sodium sulfate type at the upstream-most station and strongly sodium sulfate type at downstream stations.

VI.2.4.3 Geologic Information

Geologic information related to the permit and adjacent areas is presented in Chapter V of this MRP. This information is also briefly discussed in this chapter as an aid in understanding hydrologic conditions in the permit and adjacent areas.

VI.2.4.4 Climatological Information

Climatological information is presented in Chapter X, Part B of this MRP.

VI.2.4.5 Supplemental Information

No supplemental information is required at this time.

VI.2.4.6 Survey of Renewable Resource Lands

The existence and recharge of aquifers in the permit and adjacent areas is discussed in Section VI.2.4.1 of this MRP. A description of the probable hydrologic consequences of subsidence on these aquifers and their recharge areas is provided in Section VI.2.8 of this MRP.

VI.2.4.7 Alluvial Valley Floor Requirements

Information regarding the presence or absence of alluvial valley floors in the permit and adjacent areas is presented in Chapter XI of this MRP.

VI.2.5 Baseline Cumulative Impact Area Information

The hydrologic and geologic information required for the Division to develop a Cumulative Hydrologic Impact Assessment is presented in Chapters V and VI of this MRP. Required information not available in these chapters is available from the Utah Division of Water Rights, the Utah Division of Water Resources, the U.S. Geological Survey, and the U.S. Bureau of Land Management.

VI.2.6 Modeling

Numerical and analytical groundwater modeling ~~was~~were conducted to assist in determining the probable hydrologic consequences of mining in the permit area. A discussion of ~~this~~these modeling effort~~s~~ is presented in section VI.2.8 of this MRP.

VI.2.7 Alternative Water Source Information

No surface coal mining has been or will be conducted in the permit and adjacent areas. Therefore, this section does not apply to the Emery Mine.

VI.2.8 Probable Hydrologic Consequences

This section addresses the probable hydrologic consequences of coal mining and reclamation operations in the mine permit and adjacent areas. Mitigating measures are discussed generally in this section and in detail in subsequent sections of this MRP.

VI.2.8.1 Potential Impacts to Surface and Groundwater

The following potential impacts of coal mining on the quality and quantity of surface and groundwater flow within and adjacent to the Emery Mine permit area were evaluated:

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;
- Impacts to groundwater availability;
- Impacts to surface water availability;
- Increased total dissolved solids concentrations in surface and groundwater;
- Flooding or streamflow alteration;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area; and
- Contamination of surface water from coal spillage due to hauling operations.
- Potential alluvial valley floor impacts

These potential impacts are addressed in the following sections of this MRP.

VI.2.8.2 Baseline Hydrologic and Geologic Information

Baseline geologic information is presented in Chapter V of this MRP. Baseline hydrologic information is presented in Sections VI.2.4 of this MRP.

VI.2.8.3 PHC Determination

Potential impacts to the hydrologic balance are addressed below.

Contamination from Acid- or Toxic-Forming Materials. Information concerning acid- and toxic-forming materials in rock at the Emery Mine is presented in Sections V.A.4 through V.A.6 of the MRP. As noted, the pH of roof and floor materials ranges from 5.0 to 9.1, with the acid-base potential indicating a net base potential. The alkaline nature of the system is further indicated by the fact that the pH of groundwater in the area is typically alkaline (see Section VI.2.4.1).

Except near outcrops, the electrical conductivity of the rock is generally low. However, naturally-occurring sodium adsorption ratios and exchangeable sodium percentages of the rock are moderately high. As a result, sodium adsorption ratios calculated from the data presented in Appendix VI-1 suggest that groundwater discharged from the mine may have a low to medium sodium hazard if that water is used for irrigation without further treatment. Analyses of rock samples presented in Section V.A.4 indicate that concentrations of trace elements are generally sufficiently low that the rock can be considered non toxic-forming. Thus, with the exception of moderate sodium concentrations in some samples, analytical data obtained from the local rock and mine-water discharges indicate that no significant potential exists for the contamination of surface and groundwater in the permit and adjacent areas by acid- or toxic-forming materials.

Increased Sediment Yield from Disturbed Areas. Mining and reclamation at the Emery Mine has the potential to increase sediment concentrations in the surface waters downstream from disturbed areas. However, sediment-control measures such as sedimentation ponds, diversions, etc. have been installed to minimize this impact. These facilities have been designed to meet applicable regulatory requirements and are regularly inspected and maintained to ensure that they continue to meet those standards (see Sections VI.3 and VI-4).

No discharges have occurred from the Emery Mine sedimentation ponds during their period of operation, other than two incidences of discharge from pond 5 (UPDES outfall 007). This pond was constructed in an area initially intended to be the site of a coal preparation plant. The preparation plant was not constructed and no disturbed area drains to the pond, other than that associated with the pond itself. Thus, the sediment-control measures at the mine are effective at minimizing sediment yields to adjacent streams.

Impacts to Groundwater Availability. As noted previously in this chapter, coal at the Emery Mine occurs in the Ferron Sandstone Member of the Mancos Shale. In the upper Ferron, sandstones are lenticular, channel-shaped bodies that are generally less than 40 feet thick. These channel sandstones are characterized by unidirectional cross-stratification, fining-upward cycles, and lateral interfingering with mudstones. The middle and lower Ferron consists of thin-bedded sandstone and shale at the base that grade upward to thick, cliff-forming sandstones.

The Ferron Sandstone outcrops in a series of prominent cliffs along the eastern edge of the Emery coal field and dips 2 to 10˚ to the northwest beneath the ground surface. The continuity of the Ferron is broken in the subsurface by the Paradise Valley-Joes Valley fault zone, which exists immediately northwest of the permit area. This fault zone extends for about 60 miles northeast and 20 miles southwest of the mine area (Hintze, 1980). A comparison of Plates VI-1 and VI-7 with Plates V-19 through V-22 indicates that the Emery Mine has historically operated within the saturated zone, except along the outcrop to the east and where water levels have been locally altered due to mining activities.

Morrissey et al. (1980) indicate that recharge to the Ferron Sandstone originates in the Wasatch Plateau west of the Emery Mine and discharges to the southeast along the Paradise Valley-Joes Valley fault zone. Hence, this fault zone effectively acts as a linear source of groundwater recharge to the Ferron Sandstone. Groundwater has the potential to enter the Emery Mine through both the floor and roof from permeable, saturated sandstones. Hydrographs of water-level data collected from monitoring wells at the mine (Figures VI-4 through VI-7) show that water level declines have been experienced in all three sections of the Ferron Sandstone and also in the Blue Gate Member. However, data presented in Plates VI-7 and VI-8 indicate that water levels in the upper Ferron Sandstone have been affected to a greater degree than the lower Ferron Sandstone. Significant upward leakage from the middle and lower Ferron is impeded by shales that constitute the floor of the mine. In-mine observations have verified that most inflow to the mine occurs from the roof rather than the floor.

As water flows into the mine, the flow pattern within the Ferron Sandstone is altered. These conditions in turn induce groundwater level declines in the area. Since the principal avenue of inflow to the mine is through the roof of the workings, the upper portion of the Ferron Sandstone is most subject to water level declines.

Average discharge from the Emery Mine during the period of 1979 through 20~~05~~15 is shown in Figure VI-9 (see also Table VI-7). No data are available for the years prior to 1979. Discharge from the mine continued through a period of temporary shutdown (1991 through 2001) when Consol pumped water to maintain the mine in an accessible condition. Since pillars

were pulled prior to the 1991 temporary shutdown, the mine-water discharge during this period is anticipated to be predictive of full-extraction, post-subsidence conditions.

The long-term effect of mining on groundwater availability in the permit and adjacent areas was determined using a mass balance calculations and groundwater modeling. The mass balance approach relied on the following water balance equation:

Outflow = Inflow + Change in storage

Direct recharge from precipitation to the Ferron Sandstone is limited in the mine area, given the low amount of precipitation (averaging about 8 inches annually) and the presence of the relatively impermeable Blue Gate Member covering the Ferron Sandstone throughout most of the permit area. As a result, subsurface inflow to the permit area occurs predominantly from groundwater that flows from the Paradise Valley-Joes Valley fault zone into the Ferron Sandstone and then toward the mine. Outflow occurs when groundwater is either pumped from the mine or used underground for various purposes (i.e., dust suppression, equipment cooling, etc.) and then removed from the mine as moisture in the coal or in the mine air.

Groundwater inflow to the mine occurs either horizontally (due to the mine being within the flow path) or vertically (due to gravity drainage from the overlying sandstone into the mine void). These conditions are depicted on Figure VI-8 and described in Section VI.2.4.1.

For the mass-balance analysis, it was assumed that the steady state condition identified in Figure VI-8(c) was reached during the several-year shutdown period of 1991 through 2001. Under this condition and assuming no substantial change in underground water storage in the mine during the shutdown, water discharged from the mine during this period would equal the amount of predominantly horizontal inflow to the mine. Data contained in Table VI-7 indicate that discharge from (and therefore horizontal inflow to) the mine during the shutdown period averaged 1.03 cfs. Since groundwater flows horizontally out of the Paradise Valley-Joes Valley fault zone toward the mine, the amount of water flowing into the mine would be a function of the length of mine workings parallel (i.e., exposed) to the fault zone. During the temporary shutdown, this length was 2.17 miles (see ~~Plate VI-6~~Plate IV-2), resulting in a ratio of *horizontal inflow* per unit length of mine exposed to the groundwater flow path of 0.47 cfs/mi. This value was used to predict future quantities of horizontal inflow to the mine as the mine expands.

Following the restart of mining in 2002, some groundwater encountered in the mine was used underground by the mining equipment. The quantity of water used underground was assumed to equal the difference between the mine-water discharge during the period of inactivity (1.03 cfs) and the mine-water discharge following the restart of mining (averaging 0.63 cfs from 2002 through 2005 – see Table VI-7). Since full extraction was not occurring during this period, the difference would be indicative of in-mine usage only (i.e., not influenced by increased inflows due to mine subsidence). Hence, in-mine water usage averaged 0.40 cfs from 2002 through 2005. This value for in-mine water usage compares reasonably with average water usage during a period of full extraction.[1] With an average annual mined area of ~~18.1~~42.5 acres from 2002 to 2005 (see ~~Plate VI-6~~Plate IV-2), *in-mine water usage* is estimated

[1] The average rate of mine-water discharge during 2006 through 2010 (a period of full extraction) was 1.29 cfs. The average rate of mine-water discharge during 2011 and 2012 (temporary shutdown period when Consol was actively controlling water levels in the mine) was 1.75 cfs. The difference between these two rates was 0.46 cfs, representing the approximate quantity of water used by underground operations during a period of full extraction.

to be 0.0~~22~~09 cfs/acre under ~~current~~ operational conditions. This value was used to predict future quantities of in-mine water usage as the mine expands.

Although vertical inflow to the mine is likely limited in areas that were mined prior to 1991 (due to the development of steady-state conditions noted in Figure VI-8(c)), a condition more like Figure VI-8(b) ~~has~~ probably existed in areas mined ~~since~~ during the period of 2002 through 2010 (i.e., components of both vertical and horizontal inflow as the mine expands unto areas where the groundwater has not yet reached static equilibrium). Conditions similar to Figure VI-8(b) are also likely for future operations in the Emery Mine. Under these conditions, it was necessary to estimate the vertical component of inflow to the mine. This was accomplished using two analytical methods, assuming full-extraction conditions, and then comparing the results to pre-1991 conditions to determine the method that most accurately predicts conditions at the mine site.

Each method is limited in its application to simplified flow situations, assuming that the aquifer is of infinite areal extent with uniform thickness. The first method used to estimate vertical mine-water inflow was the tunnel inflow equation presented by Freeze and Cherry (1979). This method assumes that the mine acts as an infinitely long tunnel in a homogeneous, isotropic porous medium. Under this assumption, the rate of ground water inflow Q_o per unit length of mine can be calculated using the following equation:

$$Q_o = \frac{2\pi K H_o}{2.3\log(2H_o / r)}$$

where r is the mine radius, H_o is the depth from the potentiometric surface to the center of the mine, and K is the hydraulic conductivity, with all units being compatible.

The second method used to estimate vertical mine-water inflow was the Hantush equation presented by Singh and Atkins (1985). This equation, which assumes that the aquifer is homogeneous, isotropic, and pumped at a constant rate, is applied to large underground openings as illustrated in Figure VI-16. Inflow to the mine is calculated by:

$$Q = 2\pi TDG(\lambda, r/B)$$

$$\lambda = Tt / r^2 S$$

$$r/B = r(K'/KLL')^{\frac{1}{2}}$$

where B is the leakage factor; D is drawdown to a level H from the original head H_o; G(λ,r/B) is the Hantush well function; K is the aquifer hydraulic conductivity; K' is the aquitard hydraulic conductivity; L is the thickness of the formation being dewatered; L' is the aquitard thickness, Q is the quantity of inflow; r is the radius at which drawdown occurs; and t is elapsed time, with all units being compatible.

Vertical inflow to the mine was estimated using the two methods described above for the period of 1980 through 1990 when Figure VI-8(b) was again assumed to represent mine hydrologic conditions (i.e., prior to attaining steady-state conditions during the temporary shutdown). Assuming no change in water storage in the mine (i.e., discharge is equal to inflow), and accounting for lateral groundwater inflow and in-mine water usage as outlined above, these calculations were then compared with measured discharge rates during the same period. Based on these calculations, the best approach for estimating future conditions was selected.

Preliminary calculations using the two methods indicated that the Hantush equation was a much better predictor of *vertical mine-water inflow* than was the tunnel inflow equation. To more accurately predict inflow, the average post-subsidence hydraulic conductivity of the aquifer was therefore derived by calibration using the Hantush equation, attempting to mimic measured discharge rates as closely as possible. The average hydraulic conductivity of the Ferron Sandstone overlying the coal seam was thereby determined to be 0.20 ft/day. This value compares well with aquifer data presented previously in this chapter and independent data presented by Lines et al. (1983). Assuming an aquifer thickness of 400 feet (based on a review of Plate V-20), the transmissivity data presented in Table VI-6 convert to hydraulic conductivities ranging from 0.01 to 2.0 ft/day and averaging 0.6 ft/day. Laboratory hydraulic conductivity data provided by Lines et al. (1983) ranged from 2.6×10^{-6} to 0.77 ft/day, averaging 0.11 ft/day in the horizontal direction and 0.076 ft/day in the vertical direction. Hydraulic conductivities derived from field tests summarized by Lines et al. (1983) ranged from 0.025 to 2.0 ft/day, averaging 0.55 ft/day (again assuming an aquifer thickness of 400 feet).

Results of the mine-water inflow/discharge calculations for the period of 1980 through 1990, using the Hantush and tunnel inflow equations, are summarized in Table VI-13 and detailed in Appendix VI-14. Each set of calculations accounted for lateral groundwater inflow and in-mine water usage, and assumed that no change in underground water storage occurred during the period of interest (i.e., that discharge was equal to inflow). The equations were able to account for varying inflow as the mine expanded since vertical inflow was assumed to enter the mine only in the area of current mining. As indicated in Table VI-13 and Figure VI-17, the Hantush equation provides a reasonable estimate of mine water discharge. Hence, this equation was used to predict future mine-water discharge rates under the mass-balance approach, again assuming post-subsidence conditions.

Predicted mine-water discharge rates through 2013 (the mine plan period at the time of the calculation) are summarized in Table VI-14, based on the Hantush equation and accounting for mine-water inflow and usage as described above. These calculations again assume that no substantial change in underground water storage will occur during the period of evaluation (i.e., discharge is equal to inflow). Spreadsheets detailing these calculations are provided in Appendix VI-14. Based on these calculations, discharge rates ~~are~~were expected to average 1.50 cfs, ranging from about 1.3 to 2.0 cfs during the calculation period while fully extracting the coal. In fact, during the full-extraction period of 2006 through 2010, mine-water discharge rates averaged 1.29 cfs, ranging from 1.12 to 1.86 cfs. Thus, the calculation approach slightly over-predicts discharge rates. Variations in discharge rates are anticipated depending on the depth of mining below the potentiometric surface and the area over which mining will occur. These estimates ~~are~~were based on the assumed hydraulic conductivity of 0.20 ft/day (i.e., the calibrated value arrived at in the comparison with measured historic discharge rates). Since pillars had been pulled prior to the 1991 temporary shutdown, this hydraulic conductivity is assumed to be indicative of average post-subsidence conditions. Hence, the estimates presented in Table VI-14 are considered adequate predictors of full extraction conditions.

The mine plan currently does not anticipate full extraction of the coal accessed by the Emery 2 portal. It is assumed under this condition that in-mine water usage will continue to amount to 0.009 cfs/acre of mined area (i.e., equivalent to the average unit-area usage in the Emery Mine during the period of 2002 through 2005 prior to pillaring). Until sufficient groundwater is encountered underground, it is currently planned that this operational water will be obtained by leasing waster from a user with an existing right on Quitchupah Creek. This water will be pumped from the creek with temporary equipment. To allow this temporary use of water to occur, an Application for Temporary Change of Water has been filed with the Utah

Division of Water Rights to change the point of diversion and use of water right 94-1178 from irrigation and stockwatering to mining. A copy of this change application is provided in Appendix VI-4. Should currently-unforeseen conditions necessitate a quantity of water beyond that anticipated by the aforementioned Application for Temporary Change of Water, Bronco may choose to obtain additional water from a temporary right to divert water from Quitchupah Creek, by leasing additional water from a user with an existing right on Quitchupah Creek, by purchasing municipal water from the Town of Emery (under the arrangement through which the mine currently purchases water for potable use and fire suppression), or by utilizing water from Emery Mine Borehole #1 (water right number 94-285). If water is obtained from Quitchupah Creek, this water will be pumped from the creek with temporary equipment. If water is obtained from Emery Town or Borehole #1, this water will be trucked to the Emery 2 site for use.

The applicant will use no water associated with the Emery 2 operations unless it has a right to use that water. If water is diverted from Quitchupah Creek, this right would consist of either a temporary right issued by the Utah Division of Water Rights directly to Bronco or a legally-valid lease of all or a portion of an existing water right on Quitchupah Creek for which a temporary change in point of diversion and use has been approved by the Utah Division of Water Rights. If water is obtained from the Town of Emery, this water will be regulated by water rights held by the Town and purchased by Bronco. If water is obtained from Borehole #1, the use of this water will occur under water right number 94-285, which is held by Bronco (see Table VI-1).

Eventually, sufficient water will be encountered underground that in-mine water will be used for this purpose. When the quantity of groundwater encountered exceeds the quantity required for underground operations, excess groundwater will be pumped from the Emery 2 works into the existing works via a horizontal borehole within the underground operations or a vertical borehole in an existing surface disturbed area (i.e., without creating additional surface disturbance). This excess groundwater will then be discharged from the old mine works via existing pumps to Pond 1 or Pond 3 and from thence to Quitchupah Creek in accordance with UPDES permit UT0022616 issued by the Utah Division of Water Quality. Once sufficient water is encountered underground that additional water will not be required from the surface, the use and handling of this water will be regulated by existing rights held by Bronco (water right numbers 94-64 and 94-285).

To estimate the potential inflow of groundwater to mine works accessed by the Emery 2 portal, potentiometric surface data provided on Plate VI-7 were compared with bottom-of-coal elevations presented on Plate V-20. The results of this comparison are presented on Plate VI-6. Although Plate VI-7 is based on data collected in 2006, these data are considered sufficient for this analysis throughout the first 2 years of projected Emery 2 mining since underground operations prior to the December 2010 temporary mine shutdown were conducted in areas that were generally 1 to 2 miles north and east of the future Year 1 and Year 2 mine panels. Water-level data collected from wells Muddy #1 and AA(U) indicate that the elevation of the potentiometric surface was not substantially affected by mine dewatering in the area of the future works after 2006 (see data presented in Figure VI-5). The estimated depth of groundwater shown on Plate VI-6 was adjusted upward in the Year 3 and Year 4 mine panels, based on professional judgment, since data collected from the Pump 3 monitoring well indicates that the cone of depression noted on Plate VI-7 has recovered over 100 feet since pumping ceased.

Estimates of the quantity of groundwater expected to flow into and be discharged from mine areas access by the Emery 2 portal are presented in Appendix VI-14 and summarized in Table VI-22. As indicated, it is predicted that water will be required from surface sources for at

least the first two years of mining in areas access by the Emery 2 portal. Thereafter, as the underground mining operation dips deeper beneath the potentiometric surface and closer to the Joes Valley Fault to the west, it is predicted that sufficient underground water will be encountered to require excess water to be pumped to the surface.

Inflow of water to and discharge of water from the mine will continue to influence the shape of the potentiometric surface in the vicinity of the mine. As a result, it is anticipated that the cone of depression noted on Plate VI-7 will change as mining continues. To predict the impact of mining on groundwater levels in the permit and adjacent areas, Consol modeled groundwater conditions in the permit and adjacent areas using the software package MODFLOW. A description of the groundwater modeling effort is presented in Appendix VI-15.

A main purpose of the modeling effort summarized in Appendix VI-15 was to assess the potential impact of mining operations on groundwater availability in the town of Emery. A comparison of Figure 1 in Appendix VI-15 with the exiting and projected mine works shown on Plate VI-6 indicates that

1. The model assumed more areas of fully-extracted coal on the north side of the mine works than actually occurred and
2. The unmined areas of full extraction assumed by the model area approximately equal to the area to be mine in Years 3 through 5 (i.e., those portions closest to the town of Emery) without full extraction.

Therefore, the MODFLOW results summarized in Appendix VI-15 likely over predict the impacts of anticipated mining on groundwater availability in the vicinity of Emery.

Groundwater in the permit and adjacent areas was modeled using three layers: 1) the Blue Gate Member (where present), 2) the upper Ferron Sandstone, and 3) the “I” coal seam horizon. Geologic structure data were imported into the model to simulate strike, dip, and thickness of the various units. Figure 2 in Appendix VI-15 shows the model in plan view and Figure 3 in Appendix VI-15 shows the model in cross section. Groundwater conditions within the coal seam were simulated using extremely high hydraulic conductivity values for the mine works and low conductivity values for the solid coal surrounding the mine. The initially assumed hydraulic properties of the Blue Gate Member and the Ferron Sandstone were estimated from aquifer tests performed in monitoring wells in the vicinity of Emery Mine. These values were adjusted during calibration to approximate actual mine inflow rates. The initial head values used in the model were based on 2007 groundwater levels in both the Blue Gate Member and the upper Ferron Sandstone. Mine inflow and potentiometric surface changes were predicted from the period of June 2007 through December 2016 (the projected life of mine at the time of modeling).

Three scenarios were run with MODFLOW to approximate a range of future conditions. To simulate worst-case inflow, it was assumed that groundwater levels in the upper Ferron Sandstone do not change in the future (i.e., that the vertical head over the mine remains unchanged beyond 2007). The conservative nature of this set of assumptions is evidenced by the fact that water levels in the upper Ferron Sandstone *have* declined in the vicinity of the mine as mining has progressed, thereby decreasing the head above the mine and the transmissivity of the aquifer.

As a worst case drawdown evaluation, it was assumed that groundwater levels in the upper Ferron Sandstone are allowed to decline as mining progresses. Since water-level

declines will likely continue as mining progresses, this scenario is considered more realistic than the worst case inflow scenario discussed above.

As an independent check to the modeled inflows, a relatively simple calculation of predicted inflow based on unit-area inflows measured in the 1st and 2nd South pillared area was used and applied to the remaining areas to be mined. However, since the 1st and 2nd South areas of the mine are near the outcrop, this unit-area approximation may not be representative of the deeper portions of the mine.

The results of the MODFLOW evaluation are summarized in Table VI-15. Predicted mine-water inflow rates under the worst-case drawdown scenario agree reasonably well with the mass balance estimates presented in Table VI-14. These inflow estimates are also considered most realistic since drawdown is expected to continue to occur in the future, based on past observations.

Figure VI-18 shows the predicted potentiometric surface under the worst-case drawdown scenario for the upper Ferron Sandstone at the end of the year 2016 (when all planned mining ~~has~~ was to have been completed). With all mining upon which this model was based ceasing in the area in December 2010 and with a substantial decrease in mine-water pumping rates in 2013 and shut-down of mine-water pumping operations in January 2916, the model likely over predicted actual groundwater impacts to the region. ~~As indicated, it is anticipated that the trough of depression created by mine dewatering will expand to the northeast as the mine expands in that direction. It is not predicted, however, that the maximum magnitude of drawdown in the area will increase above that currently being experienced, since the elevation of the mine floor will rise as mining proceeds updip.~~

A comparison of Plates VI-1 (1979 data) and VI-7 (2006 data) indicate that the potentiometric surface of the upper Ferron Sandstone has been affected by past mining. As would be expected, declines in this groundwater surface have been most pronounced within the permit area, with decreasing effects away from the mine workings. Whereas Plate VI-1 indicates that groundwater in the upper Ferron Sandstone flowed generally southeastward through the permit area prior to significant mining, the trough of depression caused by mine dewatering causes groundwater to flow toward the center of the permit area under current conditions (see Plate VI-7). This trough of depression ~~currently~~ extend~~s~~ed throughout the permit and much of the adjacent areas in 2006. The groundwater modeling results indicate that the area of impact to groundwater levels will likely continue to extend throughout the permit and immediately adjacent areas into the future as long as mine dewatering continues.

The effect of mining on groundwater levels in the lower Ferron Sandstone is much less pronounced than in the upper Ferron Sandstone. Although groundwater levels at individual wells in the middle and lower Ferron Sandstone have dropped over 100 feet since mining began (see Section VI.2.4.1), a comparison of Plates VI-2 (1985 data) and VI-8 (2006 data) indicates that the general shape and elevations of the potentiometric surface in the lower Ferron Sandstone have remained quite similar between 1985 and 2006. These observations, together with the results of the groundwater modeling effort, suggest that the effects of mining on the potentiometric surfaces within the Ferron Sandstone will decrease in the following order: upper Ferron>middle Ferron>lower Ferron.

Data presented in Appendix VI-15 indicate that the potentiometric surface of the upper Ferron Sandstone will gradually return to pre-mining conditions once pumping ceases. Whereas maximum drawdowns of 350 to 400 feet have occurred in the upper Ferron Sandstone in the center of the permit area during the mining period (compare Plates VI-1 and VI-7), it is

predicted that groundwater levels will recover to within 50 to 60 feet of pre-mining conditions approximately 10 years after cessation of pumping from the mine (compare Plate VI-1 with Figure 5 in Appendix VI-15). It is further predicted that groundwater levels in the upper Ferron Sandstone will recover to within about 30 feet of pre-mining conditions throughout most of the permit area within 20 years following cessation of pumping operations (compare Plate VI-1 with Figure 6 in Appendix VI-15).

Artesian conditions in the western portion of the permit area were such that some wells flowed at the surface prior to mining. It is doubtful that these conditions will return within 20 years after mining. Specifically, the modeling results indicate that the Bryant and Lewis wells will likely not flow at the surface, as they did prior to mining, within 20 years of ceasing pumping operations. Consol ~~has~~ furnished and installed pumps and ancillary facilities at these locations to compensate the well owners for the decline in water levels (see Section VI.2.4.1).

As groundwater levels return to an approximate pre-mining condition, pre-mining groundwater flow directions will also be re-established. This situation is seen in a comparison of Plate VI-1 with Figure 6 of Appendix VI-15, which indicates that groundwater flow directions in the upper Ferron Sandstone will gradually return to approximate pre-mining conditions following the cessation of pumping.

As noted in Table VI-1, the town of Emery has water rights at two wells located adjacent to each other about 14,500 feet north of the mine permit boundary. A review of data on file with the Utah Division of Water Rights indicates that Emery town Well #1 is completed in the lower Ferron Sandstone while Emery town Well #2 (located about 50 feet to the east) is completed in the middle and upper Ferron Sandstone. These wells were constructed to supply water on a backup basis to the town's distribution system. The pump in Well #1 is functional but there is no means to measure water levels in this well. The pump in Well #2 is not functional, but an air line exists by which water levels can be measured. Hence, water quality samples can be collected from Well #1 and water-level measurements can be collected from Well #2.

Several years ago, the town suggested that water levels at the wells had declined significantly since the beginning of operations at the Emery Mine. However, the town indicated in a meeting between Consol and the town in November 1988 that the apparent water-level declines may have been caused by their own pumping operations. As indicated above, Well #2 is completed in the middle and upper Ferron Sandstone (i.e., that section of the formation where water levels are most impacted by dewatering operations at the Emery Mine). ~~The driller's log for Well #2 indicates that the static water level was 91 feet below ground surface in October 1979 when the well was completed. A water-level measurement collected from Well #2 in November 2007 indicated a depth to water of 85 feet. Hence, mining has apparently not impacted water levels at the Emery town wells.~~

To better assess conditions at the Emery wells, the model output was evaluated to determine the potential effects of mining on the potentiometric surface at the location of these wells. As noted in Figure 2 of Appendix VI-15, the northern boundary of the MODFLOW model was approximately 8,800 feet south of the Emery wells. At this northern model boundary, the model results indicate that groundwater levels in the Upper Ferron sandstone will drop 1.6 feet from 2007 to 2016, the period when active mining is planned to cease. From 2016 to 2026, groundwater levels at the northern model boundary are predicted to increase to approximately 5.4 feet above 2007 levels. Twenty years after mining ceases (2036), the model predicts that the head at the northern model boundary will be approximately 12.7 feet above 2007 levels. The predicted heads in 2026 and 2036 are calculated to be higher than 2007 levels primarily

because of the high transmissivity and lateral recharge in the vicinity of the Joe's Valley-Paradise fault zone.

Although the MODFLOW evaluation concentrated on the upper Ferron Sandstone, observations discussed earlier in this section indicate that potentiometric-surface impacts to the middle and lower Ferron Sandstone will be less than those in the upper Ferron Sandstone. Given the distance of the Emery town wells from the modeled area and their completion zones, the effects of mining on water levels at the Emery town wells are predicted to be much less than those predicted to occur in the upper Ferron Sandstone at the model boundary (i.e., these impacts will be minimal at the town wells, if at all).

In 2010, the inoperative pump was pulled from Emery Town Well #2 and the air line used to collect water-level data was found to be faulty. It is not known when the air line became damaged but the 2007 (and perhaps the 1979) data reported for the well may be unreliable. Since the air line was removed, an electronic water-level probe has been used to collect data from this well. Data presented in Figure VI-21 indicate that water levels in Well #2 have remained relatively constant since 2010 when consistent water-level data collection began. A notable exception to this conclusion occurred in March 2013 when a new water-level probe was put into service. However, given the consistency of the water levels in Well #2 during the period of 2011 through 2012 as well as those since the change in probes, together with the information presented above, is it apparent that mining at the Emery Mine has not adversely impacted the available water at the Emery Town Wells.

Water levels in well H(U) monitoring the Upper Ferron sandstone have declined substantially since mid-2005. This well is located in Section 20, T. 22 S., R. 6 E. immediately north of the permit area boundary, as indicated on Plate VI-4. Mining occurred in an area approximately 2,500 feet southwest of this well in 1989 and, over a period of about 15 years, expanded to a location about 6,000 feet southeast of well H(U). As noted in Figure VI-22, water levels remained fairly constant in this well from 1979 until mid-2005, during the period when mining was occurring in the general area of the well. These levels then increased dramatically in the last half of 2005 and have declined since then. Water levels stabilized in 2013 and 2014 and then declined rapidly again in 2015.

As a point of comparison, Figure VI-22 also provides water-level data obtained from monitoring well Muddy #1. This well is also completed in the Upper Ferron sandstone and is located in the southeast portion of the permit area, in Section 33, T. 22 S., R. 6 E. Muddy #1 is located about 500 feet east of an area that was mined beginning in 1945 and adjacent to other areas that were mined from 1990 through 2005. Water levels in this well have remained essentially constant since monitoring began in 1979.

Figure VI-22 also depicts average annual rates at which water has been discharged from the Emery Mine since 1979. During the period of 1979 through 2004, average discharge rates varied between a low of 0.54 cfs (in 2002) and a high of 1.33 cfs (in 1993). Water levels increased in well H(U) approximately 27 feet in mid-2005 during a three-year period when the rate of discharge from the mine was lower than in previous years, perhaps suggesting a response to the lower rate of discharge. However, no influence on water levels is obvious at Muddy #1 during the period of decreased pumping rates. Mine-water discharge rates from 2006 through 2010 were within the range when water levels in H(U) were historically unaffected by changes in discharge even though levels in that well experienced a decline of over 50 feet during that period. Water levels in H(U) then stabilized in spite of a sharp increase in pumping rates in 2011 and then exhibited a dramatic decrease following a period of much lower discharge from 2013 through 2015. Furthermore, water levels in well Muddy #1 remained

largely unaffected by any changes in mine-water discharge rates.

It is not possible to state that water levels at well H(U) have been unaffected by pumping of groundwater encountered in the Emery Mine. However, it is also obvious that mine-water pumping alone cannot account for the decline in water levels observed at that well. The available data do not allow a definitive conclusion to be drawn concerning the reason for the decreased water levels in well H(U).

The Division of Oil, Gas and Mining has also expressed concern about a decline in water levels in monitoring well RDA-4. This well monitors conditions in the alluvium adjacent to Quitchupah Creek in Section 32, T. 22 S., R. 6 E. (see Plate VI-4). Hydrographs of water-level data measured at this well and adjacent wells are provided in Figure VI-23. This figure also provides data for the Palmer Hydrological Drought Index ("PHDI"). The area where these wells are located has not been subjected to underground mining since the early 1980s.

As indicated, water levels in RDA-4 have declined approximately 6 feet since January 2010. Water levels in RDA-2 and RDA-6 declined approximately 3 feet and 10 feet, respectively, during the same period. The PHDI data indicate that this period has been subject to increasing drought severity. Given the lack of mining in the area and the increasing severity of drought conditions, it is concluded that the declines in water levels in this alluvial aquifer were caused by natural climatic conditions.

Two springs have historically issued from the Ferron Sandstone adjacent to the permit area (SP-15 from the upper Ferron Sandstone and SP-16 from the lower Ferron Sandstone). Both of these springs are located near the formation outcrop, making model predictions less precise. However, the model results indicate that the potentiometric surface will decline approximately 24.1 feet at the location of SP-15 from 2007 to 2016 (the modeled period of active mining and dewatering) and subsequently recover to approximately 4.1 feet below 2007 levels by 2036. Data contained in Appendix VI-1 indicate that no flow has occurred at SP-15 since June 2000. The model data imply that this condition will continue for some time in the future.

Quantitative predictions of potentiometric surface impacts at SP-16 are not possible since modeling concentrated on the upper Ferron Sandstone and since SP-16 is located near the formation outcrop just east of the model boundary. This spring is not currently used for beneficial purposes. Given the generally lesser mining-related impacts on the lower as compared to the upper Ferron Sandstone and the fact that this spring is located updip of the upper Ferron Sandstone outcrop, impacts to the potentiometric surface at this location should be less than those predicted for SP-15. Several seepage points representing irrigation return flow are noted on Plate VI-5 (specifically SP-1 through SP-14). Recharge to these seeps is primarily a function of surface irrigation practices. Since this recharge is not connected to the regional groundwater system contained in the Ferron Sandstone, no impacts to these seeps are anticipated as a result of mine-dewatering activities.

The Emery Mine hydrologic monitoring program has been designed to assess the impacts of mining on groundwater resources in the area. Data collected from this program will provide a much more accurate picture of mining impacts than the current model will provide.

Impacts to Surface Water Availability. Water removed from the mine will be discharged to Quitchupah Creek in the future as it has in the past, increasing the flow of this receiving stream. As noted previously, only limited continuous streamflow data are available for Quitchupah Creek, with the U.S. Geological Survey maintaining a gaging station near the mine office from July 1978

through September 1981. The average annual flow of Quitchupah Creek at this location for the three complete water years of record was 8.43 cfs, ranging from 6.73 to 10.8 cfs (see Appendix VI-11). ~~Mine water discharge rates are predicted~~Estimates presented in Table~~s VI-14 and VI-15~~ VI-22 indicate that no discharge will occur to Quitchupah Creek during the first two years of mining from the Emery 2 portal. Thereafter, it is estimated that discharge to Quitchupah Creek will range from ~~1.35~~0.64 cfs to ~~3.20~~1.67 cfs through the end of the current ~~mining~~mine plan. These values represent an ~~16~~ 8 to ~~38~~20% increase in the above-noted average annual flow of Quitchupah Creek.

As noted above, no water has been observed to discharge from the Emery Mine sedimentation ponds. Hence, a small quantity of runoff is precluded from reaching Quitchupah Creek and Christiansen Wash that would discharge to this stream if the mine surface facilities were not present. Given the small amount of precipitation in the area and the relatively small area of the surface facilities, this reduction in the streamflow of Quitchupah Creek and Christiansen Wash is likely minimal. Thus, the net effect of mining on the availability of surface water in the immediate area is an increase in the flow of Quitchupah Creek and downstream waters.

According to Section VI.2.4.2, streamflow in Christiansen Wash and Quitchupah Creek in the permit and adjacent areas is influenced by several factors, including direct irrigation return flow of water that originated in Muddy Creek, groundwater discharge from the Ferron Sandstone, discharge from the Emery Mine, and overland flow from precipitation runoff. Although it is assumed that interception of water in the mine will locally decrease base flow in Christiansen Wash and Quitchupah Creek, the magnitude of this impact cannot be accurately predicted given the multiple factors affecting streamflow in the area.

It should be noted that the discharge of mine water to Quitchupah Creek probably results only in a local increase in flow and not a basin-wide increase. As discussed above, the coal being mined at this location occurs in the Ferron Sandstone Member of the Mancos Shale, which is underlain by the Tununk Shale member of the same formation. The shales of this formation have a low permeability (Waddell et al., 1981), thus forcing groundwater to the surface as streamflow. As a result, although the discharge of water from the mine results in a local loss of groundwater and gain in surface water, this discharge does not disrupt the hydrologic balance of the larger basin.

Given this condition, the only actual loss of groundwater from the hydrologic balance is that water which is contained in the coal and leaves the basin upon mining or is discharged from the mine in the ventilation air. These quantities are estimated in Section II.C, subsection UMC 817.97 of this MRP.

As indicated on Plate V-5, buffer zones have been established to preclude full-extraction mining in the future beneath Christiansen Wash and Quitchupah Creek. Hence, direct impacts to the streambed of these two surface waters are not anticipated. However, subsidence may influence irrigation ditches and stock-watering ponds in areas overlying full-extraction panels. Impacts to irrigation ditches may include the development depressions that cause ponding in areas that would otherwise be free draining. Cracks may also develop in ditch and pond embankments, resulting in seepage outside of the embankments to adjacent ground.

Two conditions make it doubtful that substantial water will be diverted from an irrigation ditch or stock-water pond to the mine as a result of subsidence. First, the Blue Gate member of the Mancos Shale, which exists between the surface and the coal zone throughout the area, contains bentonitic clays (U.S. Geological Survey, 2007). As a result, subsurface cracks will swell and seal when water

enters the crack. Second, irrigation ditches and ponds in the area typically contain water only ephemerally, minimizing the time that surface water may come into contact with a crack. Monitoring and mitigation of subsidence impacts, if they occur, will be in accordance with the plan presented in Section V.B.1 of the approved MRP.

Increased Total Dissolved Solids Concentrations in Surface and Groundwater. Data summarized in Table VI-16 indicate that the average TDS concentration of water entering the mine (as measured in roof samples) is 1025 mg/l. Assuming that the equivalent-weight bicarbonate concentration can be calculated by balancing the anions and cations in that table, the roof inflow is a sodium-bicarbonate water with an average sulfate concentration of 264 mg/l. The average TDS concentration of water discharging from the mine to Quitchupah Creek (as measured at Ponds 1 and 6 [UPDES outfalls 001 and 003, respectively] and reported in Table VI-16) is 3110 mg/l. This is a sodium-sulfate water with an average sulfate concentration of 1510 mg/l. It is anticipated that similar conditions will exist in the future once discharge of water from the mine resumes.

These data indicate that the TDS concentration of water flowing through the mine increases by a factor of approximately 3.0. The sulfate concentration of this water increases by a factor of about 5.7. Furthermore, the ratio of calcium to sodium increases as the water flows through the mine. This increase in calcium concentration suggests that the observed changes in TDS and sulfate concentrations are probably the result of dissolution of gypsum rock dust used in the mine.

~~Consol~~ Bronco operates under a UPDES discharge permit issued by the Utah Division of Water Quality and will control~~s~~ discharges from the mine to be consistent with that permit. As noted in Section VI.2.4.2, although mine-water discharges increase the salt load of Quitchupah Creek, the majority of the salt-load increase in this stream occurs from irrigation return flows and leaching of naturally-saline deposits. Furthermore, except where overlain by a thin veneer of alluvial deposits, surface water in Quitchupah Creek flows across the Tununk Member of the Mancos Shale immediately downstream from the mine permit area. Since this member is a gypsiferous formation, sulfate and TDS concentrations increase naturally in surface water that flows across areas underlain by this unit. Thus, the additional input of these constituents from the mine waters to local streams is considered minor compared with contributions from natural sources and irrigation return flows.

A TMDL study of the Muddy Creek watershed (of which Quitchupah Creek is a tributary) indicated that Muddy Creek and its major tributaries (including Quitchupah Creek) would not support an agricultural beneficial use classification (MFG, 2004). This lack of beneficial-use support occurs at the location where these streams cross State Highway 10 (i.e., upstream from the mine water discharge point). The study concluded that elevated TDS concentrations in areas downstream from Highway 10 are caused predominantly by changes in surficial geology (i.e., outcropping of the saline Mancos Shale) and irrigated agriculture (i.e., return flows), thereby agreeing with the above conclusions.

According to the U.S. Bureau of Reclamation (2003), the salt load from the Muddy Creek watershed averages 86,000 tons/yr. The Emery Mine UPDES permit currently allows a maximum monthly average ~~salt load of 12 tons/day~~TDS concentration of 4,766 mg/L to be discharged from the mine at a maximum monthly average of 1.5 million gallons per day. Assuming that ~~this load~~the maximum allowed concentration is discharged constantly at the maximum allowed rate throughout the year, the annual salt load from the mine to the Muddy Creek watershed would be ~~4380~~ 10, 890 tons/yr (about ~~5~~13% of the basin-wide salt load). ~~The UPDES permit anticipates that the salt-load limit will change in the future to 3839 tons/yr (rather than 12 tons/day) following~~

~~EPA approval of the TMDL loading limit. Once this new limit is adopted, the salt load from the Emery mine will represent about 4.5% of the annual salt load of the Muddy Creek watershed.~~

~~No surface water~~Only stock watering rights exist on Quitchupah Creek downstream from the mine-water discharge point~~, nor do they exist~~ and on Ivie Creek between the confluence of Quitchupah Creek and Muddy Creek. These rights were taken into consideration when the UPDES permit was issued by the Utah Division of Water Quality. Hence, no substantial water-quality impact to downstream water users is anticipated.

In the post-mining situation, there is a potential for water-quality degradation within the upper Ferron Sandstone as groundwater flows through previously mined areas and then into adjacent un-mined rock. However, it is expected that this condition will be tempered by the diluting effect of better-quality recharge water entering the area from the west. As far as the middle and lower Ferron Sandstones are concerned, a fairly uniform shale floor impedes downward seepage of mine water to lower zones. Thus, groundwater quality in these lower sections of the Ferron should not be substantially affected either during or after mining.

Flooding or Streamflow Alteration. Runoff from all disturbed areas flows through sedimentation ponds or other sediment-control devices prior to discharge to adjacent undisturbed drainages. Three factors indicate that these sediment-control devices minimize or preclude flooding impacts to downstream areas as a result of mining operations:

1. The sediment-control facilities have been designed and constructed to be geotechnically stable. Thus, no substantial potential exists for breaches of the sediment-control devices to occur that could cause downstream flooding.
2. These sediment-control devices are sized sufficiently that no discharges have been recorded. This precludes flooding impacts to downstream areas.
3. By retaining sediment on site in the sediment-control devices, the bottom elevations of stream channels downstream from the disturbed areas are not artificially raised. Thus, the hydraulic capacity of the streams channels is not altered and flooding potential is further precluded.

Following reclamation, stream channels will be returned to a stable state. The reclamation channels have been designed in accordance with the requirements of the Division. Thus, flooding in the reclaimed areas will be precluded. Interim sediment-control measures and maintenance of the reclaimed areas during the post-mining period will preclude deposition of significant amounts of sediment in downstream channels following reclamation, thus maintaining the hydraulic capacity of the channels and further precluding adverse flooding impacts.

The mine has been designed to preclude subsidence in areas occupied by perennial streams (see Plate V-5). Thus, no alteration of perennial streamflow is anticipated.

Subsidence will occur in areas occupied by ephemeral stream channels. Although surface cracks that result from subsidence in the permit area are expected to heal with time in areas overlain by unconsolidated deposits and the Bluegate Member of the Mancos Shale, ephemeral stream flows may be partially intercepted prior to completion of the healing process. In addition, the broad depressions created by subsidence may locally retain runoff that would normally discharge from an area. However, the following factors indicate that the impact of subsidence on ephemeral streamflow will be minimal:

1. Ephemeral streamflow in the area is sporadic, allowing significant periods of time for surface cracks to heal between flow events. Ephemeral streamflow typically carries a

high sediment load. This sediment will fill remaining cracks. As the cracks heal, the potential for interception of streamflow is minimized.

2. The depressions created by subsidence are sufficiently broad that changes in slope are not typically of an ample magnitude to cause ponding in anything other than local areas.

Potential Hydrocarbon Contamination. Diesel fuel, oils, greases, and other hydrocarbon products are stored and used at the site for a variety of purposes. Diesel and oil stored in above-ground tanks at the mine surface facilities may spill onto the ground during filling of the storage tank, leakage of the storage tank, or filling of the vehicle tank. Similarly, greases and other oils may be spilled during use in surface and underground operations.

The probable future extent of the contamination caused by diesel and oil spillage is expected to be small for three reasons. First, because the tanks are located above ground, leakage from the tanks can be readily detected and repaired. Second, spillage during filling of the storage or vehicle tanks is minimized to avoid loss of an economically valuable product. Finally, the mine has a Spill Prevention Control and Countermeasure Plan that provides inspection, training, and operation measures to minimize the extent of contamination resulting from the use of hydrocarbons at the site.

Motor oil was introduced into some of the monitoring wells several years ago for reasons that are not clear. An investigation of this issue, conducted in January 2012, concluded that this oil is not causing substantial contamination of the monitored aquifers (see Appendix VI-18).

Coal Spillage During Hauling. Coal is hauled over County roads from the mine to State Highway 10 and ~~future destinations~~other roadways. Past experience has indicated that no substantial quantities of coal have been spilled during transport. If coal is spilled, it may wash into local streams during a runoff event prior to cleanup. Possible impacts to the surface water include increases in total suspended solids and turbidity from the fine coal particulates. The probability of a spill occurring in an area sufficiently close to a stream channel to introduce coal to the stream bed is extremely small.

Potential Alluvial Valley Floor Impacts. Chapter XI of the Emery Mining and Reclamation Plan provides information regarding how mining operations will avoid, during mining and reclamation, interruption, discontinuance, or preclusion of farming on alluvial valley floors. Chapter XI and the information presented in this chapter further indicate how mining and reclamation operations will not materially damage the quantity or quality of water in surface and groundwater systems that supply alluvial valley floors.

A comparison of Plates IV-2 and XI-1 indicates that mining is anticipated in areas beneath potential alluvial valley floors beginning in the second year of mining. As noted in Section XI.B.5.C of the mining and reclamation plan, mining in this area will be conducted without planned subsidence. Furthermore, mine pillars will be sized large enough to provide a factor of safety against failure of at least 1.75. Additional information is provided in Section V.B of the mining and reclamation plan regarding pillar design and other subsidence protection measures that will be implemented in areas underlying potential alluvial valley floors.

Areal Extent of Probable Hydrologic Consequences. The above discussion indicates that the probable hydrologic consequences of mining at the Emery Mine will be limited in areal extent as follows:

- Contamination from acid- and toxic-forming materials – Very limited areal extent of impact, if any.
- Increased sediment yield from disturbed areas – No impacts downstream from disturbed areas.
- Impacts to groundwater availability – Drawdown of the groundwater potentiometric surface due to mine dewatering may extend northward to an area south of the Emery

Town wells, westward to the Joe's Valley-Paradise Fault Zone, eastward to the area of Muddy Creek, and southward to an area north of Ivie Creek.

- Impacts to surface water availability – Increased flow in Quitchupah Creek and immediate downstream portions of Ivie Creek.
- Increased total dissolved solids concentrations in surface and groundwater – Slight increase in TDS concentrations in Quitchupah Creek and immediate downstream portions of Ivie Creek. Temporary increase in TDS concentrations in the upper Ferron Sandstone adjacent to the mine.
- Flooding and streamflow alteration – Very limited areal extent of impact, if any.
- Potential hydrocarbon contamination – Very limited areal extent of impact, if any.
- Coal spillage during hauling – Very limited areal extent of impact, if any.

The above summary indicates that the greatest potential lateral extent of hydrologic impacts due to mining will occur as a result of drawdown of the potentiometric surface. Data presented ~~on page VI-22 of~~previously in this document indicate that drawdown due to mine dewatering ha~~d~~s not occurred at the Emery Town wells~~ as of November 2007~~. The results of groundwater modeling presented in Appendix VI-15 indicate that the potentiometric surface in the Upper Ferron sandstone may drop an additional 1.6 feet at a point 8,800 feet south of the Emery Town wells (the northern extent of the groundwater model) prior to the end of mining (drawdown obtained from model output). Impacts to water levels in the Middle and Lower Ferron Sandstone will be less. Given this minimal predicted drawdown at a point 1-2/3 miles south of the wells, the effects of drawdown are not anticipated to extend as far north as the Emery Town wells.

As indicated in Section VI.2.4.1, recharge to groundwater in the Ferron Sandston occurs primarily along the Joe's Valley-Paradise fault zone. Hence, this fault zone serves essentially as a constant-head boundary, beyond which the drawdown effects of mine dewatering will not extend to the west.

The Ferron Sandstone outcrops west of Muddy Creek (see Plate VI-5). Although the groundwater model predicts that some drawdown will occur in this area, model predictions are of limited accuracy at the outcrops. Furthermore, natural recharge to the Ferron Sandstone due to leakage from Muddy Creek will minimize the magnitude of drawdown beyond this area. As a result, it is not anticipated that drawdown impacts of mine dewatering will extend substantially eastward of Muddy Creek.

A comparison of Plates VI-1 and VI-7 indicates that 486 feet of drawdown occurred at well R2(U) between 1979 and 2006, with 109 feet of drawdown occurring at well AA(U) between 1979 and 2006. These two wells are 8,800 feet apart from each other, indicating that the drawdown gradient between the two is 0.043 ft/ft. At this gradient, the point at which no drawdown has occurred would be 11,300 feet south of well R2(U) (i.e., 2,500 feet south of well AA(U)). This point is approximately 1 mile north of Ivie Creek. In actuality, the gradient associated with a cone of depression in the potentiometric surface is not constant, but rather decreases with distance away from the center. Thus, it is anticipated that the drawdown effects of mine dewatering will extend further to the south toward Ivie Creek than indicated by this simple calculation. However, the distance to Ivie Creek as well as natural recharge to the Ferron Sandstone due to leakage from Ivie Creek will minimize the magnitude of drawdown beyond this stream. As a result, it is not anticipated that drawdown impacts of mine dewatering will extend substantially southward of Ivie Creek.

Plate VI-4 contains a line that represents the "approximate area of hydrologic evaluation." The location of this line was chosen as outlined in Section VI.2.2.3. The above

discussion indicates that his line also delineates the maximum areal extent of the "adjacent area" in the context of the potential impacts of the Emery Mine on the hydrologic balance of the region. In other words, it is not anticipated that adverse impacts to the hydrologic balance will extend beyond this line due to mining at the Emery Mine. Furthermore, from the discussion presented previously in this section, it is anticipated that all hydrologic impacts associated with mining will be temporary. With specific reference to the drawdown effects of mine dewatering, the above discussion ~~on page VI-22~~ indicates that the potentiometric surface of the Ferron Sandstone will gradually return to pre-mining conditions once dewatering activities cease.

Zero Zero North Panel. The probable hydrologic consequences of mining in the Zero Zero North panel were evaluated in an environmental assessment published by the U.S. Bureau of Land Management in 2009[2]. Although no additional mining in that area is currently anticipated, ~~T~~the following is presented in the event that future plans include mining in the Zero Zero North area. This is extracted from Section 4.2.1.1 of ~~that document~~the BLM environmental assessment and describes th~~os~~e probable hydrologic consequences of mining in the Zero Zero North area:

> No surface disturbances (other than indirect subsidence-caused settling) would occur under the proposed action, thus the accelerated runoff and erosion typical of disturbed areas would not occur. However, within the 55 acres of the Tract where full extraction would occur, planned subsidence may locally alter drainage patterns through slight but non-uniform settling and development of tension cracks. This could change infiltration, ponding, erosion/deposition, and runoff characteristics on a very small and local scale but would not be expected to have off-site impacts or otherwise affect either the Miller Canyon or Christiansen Wash streamflow or sediment regimes. Over time, tension cracks would be likely to fill and seal, particularly in the areas where soils have substantial clay components and overly shale parent materials (soil mapping units PCE2 and NME2 - Figure 5 [of the EA]). Similarly, as small depressions collect runoff, conveyed sediments would deposit and over time these depressions would fill, causing local topography to reach pre-subsidence uniformity.
>
> Because the proposed action would simply be an extension of mining, there would be no change to the existing condition regarding other potential surface effects (off of the Tract) such as those related to coal transport, hydrocarbon spillage, surface infrastructure, discharge of intercepted groundwater, etc. Consol would continue to monitor surface and groundwater impacts related to its existing operations to ensure that there are no material damages to the hydrologic balance as per the Emery Mine's already approved MRP.
>
> As mining expands into the Tract, groundwater contained in the Ferron Sandstone would continue to be intercepted. Given the small area (55 acres) of undermining associated with the Tract, as compared to the past, current, and already approved mining, the additional quantity of intercepted groundwater associated with the Emery Mine is not expected to substantially change. Similarly, the discharge of that intercepted groundwater water to Quitchupah Creek would continue, as allowed by the current UPDES Permit, at similar rates and water quality as if the Tract were not mined. In addition, there would be no change in the consumptive use of this groundwater (due to

[2] U.S. Bureau of Land Management. 2009. Environmental Assessment of the Consolidation Coal Company Emery Mine - Miller Canyon Tract Lease UTU-86038, Emery County, Utah. Environmental Assessment UT-070-2008-104. Price, Utah.

entrainment in the coal, dust control in-mine and on the surface, and evaporative losses due to mine ventilation).

Under existing approvals that are irrespective of the proposed action being evaluated here, it has been predicted that Christiansen Spring (also known as SP -15) will be within the cone of depression due to mining and resultant dewatering of the upper Ferron Sandstone aquifer. Groundwater modeling presented in Consol's approved MRP (Consolidation Coal Company 2008) suggests that the potentiometric surface in the vicinity of the spring will temporarily decline about 24 feet; this decline can be expected to affect the discharge of Ferron Sandstone groundwater at Christiansen Spring. As overall premining groundwater levels reestablish after mining is complete, the spring can be expected to again discharge this groundwater. Mining the Tract would not alter either the diminishment or the reestablishment of the spring as it is already expected to occur under the existing mine plan.

Further, this spring is not within the footprint of the area that would be mined or subsided under the proposed action. As such, its physical setting would not be disturbed.

A reach of the Miller Canyon channel would be undermined and subsided as a result of the proposed action. The small earthen dam mentioned in Section 3.1.1 [of the EA] is within this reach, as is the noted zone of piping and interception of stream flows. As was previously discussed, the dominant source for water stored in the dam and conveyed through Miller Canyon is excess irrigation water that is released under the current flood - irrigation system. As this part of the Tract is mined and subsided, ground movements could occur and it would be possible that the already-compromised dam could fail further, perhaps ceasing to have any impoundment capacity, and that the already occurring piping and interception of flows could be exacerbated.

Because the dam is located on ground that Consol owns, they would have several options: (1) reconstruct the dam at that location for the lessee's use, (2) construct another dam further upstream outside of the Tract, (3) enlarge the excavated impoundments located on their property north of the Tract for the lessee's use, or (4) forego the ability to impound water at this location. The fact that the flood irrigation system may soon be converted to a pressurized sprinkler irrigation system and the fact that this structure is not a State Engineer -permitted structure reduce the level of impact associated with the potential loss of the dam's functionality.

The proposed action's potential exacerbation of the piping and interception of flows that are already occurring within this reach of Miller Canyon would represent a greater concern. Once the channel subsides, the intercepted water may not be able to make its way back into the channel as it currently does. In addition to the physical alteration of the existing piping and joint network, the overall lowering of the channel bed through this reach would locally change the channel gradient. These combined effects could result in less water continuing downstream to lower Miller Canyon and Muddy Creek. Because most Miller Canyon discharge is related to irrigation, and comprised of flow that is regulated but not measured, quantification of this potential water loss is not possible. However, as noted, flows may diminish in Miller Canyon in the near future, irrespective of the proposed action, due to the irrigation system conversion. Any loss of water in Miller Canyon due to the proposed action may simply cause this change to occur sooner that it would otherwise occur. Regardless, the BLM's stockwatering right in lower Miller Canyon, which apparently depends in large part upon irrigation releases, may be affected.

The fate of any Miller Canyon flow that may be lost from the surface within the subsided area cannot be predicted with certainty. It may, as it does currently, move laterally down gradient and reappear in the stream channel downstream of the mined area. Alternatively, its movement may have a greater vertical component, and be conveyed into the mine via tension cracks and/or natural joints. If the latter, it would require handling and subsequent discharge to Quitchupah Creek through Consol's UPDES permit.

VI.2.9 Cumulative Hydrologic Impact Assessment (CHIA)

A Cumulative Hydrologic Impact Assessment to include the permit and adjacent areas has been prepared by the Division.

VI.3 OPERATION PLAN

VI.3.1 General Requirements

This permit application includes an operation plan which addresses the following:

- Groundwater and surface water protection and monitoring plans;
- Design criteria and plans;
- Performance standards; and
- A reclamation plan.

VI.3.1.1 Hydrologic-Balance Protection

Groundwater Protection. To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acidic, toxic, or other harmful infiltration to the groundwater system. Additionally, the mine will manage excavations and disturbances to prevent or control discharges of pollutants to the groundwater.

Surface Water Protection. To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acidic or toxic drainage, prevents, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area, and otherwise prevents water pollution. Additionally, ~~Consol~~ Bronco will maintain adequate runoff- and sediment-control facilities to protect local surface waters.

VI.3.1.2 Water Monitoring

Groundwater Monitoring. Groundwater monitoring is conducted in the permit and adjacent areas according to the water monitoring plans presented in Table VI-17. The locations of the monitoring points are presented on Plate VI-4. The monitoring plans were developed based on information presented in the PHC determination, the baseline hydrologic data, the 2011 re-evaluation presented in Appendix VI-17, and the geology chapter of this document.

An extensive evaluation of the integrity of the Emery monitoring wells was undertaken in 2015 and 2016. Some wells had been reportedly “obstructed”, some of the water-level data had been apparently improperly reported, and other data integrity concerns existed. A summary of this evaluation and the steps taken to correct integrity issues is provided in Appendix VI-19. This

information was also considered when developing the groundwater monitoring program presented in Table VI-17 and Plate VI-4.

The monitoring programs provide data that are reviewed and compared to the baseline data. Any significant changes are evaluated to determine their impact on the hydrologic balance. Results of these evaluations are submitted periodically to the Division.

Sampling for the Emery Mine area is accomplished in accordance with the schedule outlined in Table VI-17. Monitoring at locations that are inaccessible during winter months are sampled three times per year. All other sites are monitored quarterly. Groundwater monitoring data are submitted to the Division by the end of the quarter following sampling. Monitoring data are submitted in an annual summary by March 31 of the subsequent year.

Groundwater monitoring will continue through the mining and post-mining periods until bond release. The monitoring requirements, including the analytical parameters and the sampling frequency may be modified in the future in consultation with the Division if the data demonstrate that such a modification is justified.

Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of groundwater in the permit and adjacent areas have been installed, maintained, and operated in accordance with accepted procedures. Where feasible, this equipment will be removed or properly abandoned by ~~Consol~~ Bronco when no longer needed.

Surface Water Monitoring. Surface water monitoring is conducted in the permit and adjacent areas based upon the monitoring plans contained in Table VI-17. Surface water monitoring locations are identified on Plate VI-4. The parameters monitored meet the requirements of R614-301-731.222.1, 40 CFR 122 and 123, R614-301-751, and the applicable UPDES permits.

Two surface-water monitoring stations will be added to the monitoring network to assess impacts associated with the Emery 2 surface facilities. These will be located up- and downstream from the Emery 2 disturbed area as indicated on Plate VI-4. If flow occurs at these locations when sampling personnel are present, samples will be collected directly from the stream flow. As a backup, single-stage samplers will be installed at each location in accordance with the designs outlined by the Subcommittee on Sedimentation (1961). These samplers automatically syphon water into an attached sample bottle when the depth of flow in the channel is sufficient (typically at least 12 inches of flow depth).

Surface water monitoring data are submitted to the Division by the end of the quarter following sampling. Monitoring data are submitted in an annual summary by March 31 of the subsequent year. UPDES reporting requirements will be met for the UPDES discharge sites at the mine.

Surface water monitoring will continue through the mining and post-mining periods until bond release. The monitoring requirements (except those required by UPDES) may be modified in the future in consultation with the Division if the data demonstrate that such a modification is justified.

Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of the surface water in the permit and adjacent areas have been installed, maintained, and operated in accordance with accepted procedures. This equipment will be removed by ~~Consol~~ Bronco when no longer needed.

VI.3.1.3 Acid- and Toxic-Forming Materials

Information presented in Section VI.2.8.3 indicates that acid- and toxic-forming materials are not a significant concern at the Emery Mine. In the event that acid- or toxic-forming materials are identified in the future, they will be disposed of as outlined in Chapter II, Section II.C.

VI.3.1.4 Transfer of Wells

Before final release of bond, exploration or monitoring wells will be sealed in a safe and environmentally sound manner in accordance with R614-301-631, R614-301-738, and R614-301-765. Ownership of wells will be transferred only with prior approval of the Division. The conditions of such a transfer will comply with State and local laws. ~~Consol~~ Bronco will remain responsible for the management of such wells until bond release in accordance with R614-301-529, R614-301-551, R614-301-631, R614-301-738, and R614-301-765.

VI.3.1.5 Discharges

The Emery Mine has ~~eight~~nine discharge monitoring points that are regulated under the Utah Pollutant Discharge Elimination System (permit number UT0022616). These points are described in Table VI-11. One of these points (Outfall Number 008) was never constructed even though it remains permitted.

The primary discharge from the mine consists of water from the underground workings that is diverted into mined-out areas now used as sumps. These sumps are used to settle fines before the water is discharged to the surface. This water is discharged in accordance with the requirements of R614-301-731.100 through R614-301-731.522 and R614-301-731.800.

Water from the underground workings is pumped to the surface and discharged at Pond 1 (UPDES discharge point 001) and Pond 6 (UPDES discharge point 003). Additional settlement of sediment occurs in these ponds before the water is discharged to Quitchupah Creek. Occasionally, water is discharged from the mine to a location known as the “Farmer’s Pond” (UPDES discharge point 004 – see Plate VI-4) where the water is diverted for irrigation use. All discharge water is monitored for compliance with UPDES permit standards.

Water from disturbed surface areas associated with the mine is collected and conveyed to sedimentation ponds. The mine maintains UPDES permits that allow the discharge of this water if it meets appropriate standards. No discharges have occurred from the sedimentation ponds during their period of operation, other than two incidences of discharge from pond 5 (UPDES outfall 007). This pond was constructed in an area initially intended to be the site of a coal preparation plant. The preparation plant was not constructed and no disturbed area drains to the pond, other than that associated with the pond itself. If discharges occur from sedimentation ponds in the future, the discharge water will be monitored for compliance with the UPDES permit standards prior to release from the ponds.

No discharges of surface water are being made to underground mines and none are planned in the future.

VI.3.1.6 Stream Buffer Zones

All perennial and intermittent streams in the mine area are protected by 100-foot stream buffer zones on either side of these streams. Coal mining and reclamation operations will not

cause or contribute to the violation of applicable Utah or federal water standards and will not adversely affect the water quantity and quality or other environmental resources of the stream.

The Emery 2 portal facilities will be constructed in an unnamed ephemeral wash that drains a watershed area of less than 1 square mile. Thus, rule R645-301-731.600 is not applicable to that site. Bronco submitted a Joint Permit Application to the Utah Division of Water Rights and the U.S. Army Corps of Engineers for disturbance of the unnamed ephemeral wash. As stated on the Division of water Rights web site, "the U.S. Army Corps of Engineers issued Programmatic General Permit 10 (PGP-10) which allows an applicant to obtain both state approval and authorization under Section 404 of the Clean Water Act though a single application process." PGP 10 was most recently re-issued to the State of Utah effective February 22, 2016 and remains effective through February 22, 2021. A copy of the current PGP 10 is provided in Appendix VI-20. As stated in that permit, PGP 10 was issued by the U.S. Army Corps of Engineers "for certain activities in waters of the United States (waters) that have been authorized under the State of Utah's Stream Alteration Program. An activity is verified under PGP 10 when the Utah State Engineer issues a Stream Alteration Permit in compliance with state law and the Corps has determined it meets· the terms and conditions of this general permit." In other words, the very issuance of a stream alteration permit by the State is proof that the U.S. Army Corps of Engineers has previously determined that the permit is in compliance with PGP 10. Further proof that the proposed mine expansion qualifies under PGP 10 is provided in the email sent on September 26, 2016 from Mike Pectol of the U.S. Army Corps of Engineers to Daren Rasmussen of the Utah Division of Water Rights. A copy of that email is provided in Appendix VI-20 along with a copy of the stream alteration permit that was issued for the mine expansion work on October 11, 2016 by the Utah Division of Water Rights.

Stream Channel Diversions. Temporary or permanent stream channel diversions comply with R614-301-742.300.

Buffer Zone Designation. Areas surrounding the streams that are not to be disturbed are designated as buffer zones, and ~~Consol has~~have been marked ~~these areas~~ as specified in R614-301-521.260.

VI.3.1.7 Cross Sections and Maps

The locations of surface and groundwater rights for current users of water within the permit and adjacent areas are provided on Plate VI-3. Discharges associated with the permit and adjacent areas occur at locations shown on Plate VI-4.

The location of each water diversion, collection, conveyance, treatment, storage, and discharge facility associated with the Emery Mine is presented on Plate VI-10 and its associated Plates VI-10A through VI-10E. Locations and elevations of each station used for water monitoring during coal mining and reclamation operations are presented on Plate VI-4. Existing plans and profiles for the mine-water discharge and sedimentation ponds are shown on Plates VI-14 through VI-20, VI-15B, VI-20A, and ~~as well as in~~ Appendix VI-7.

Other relevant cross sections or maps required by Division regulations are presented and discussed in other sections of this chapter, in Chapter V, and other chapters of this MRP.

VI.3.1.8 Water Rights and Replacement

This section applies to surface mining only. Therefore, this section does not apply to the Emery Mine where surface mining does not occur.

VI.3.2 Sediment Control Measures

The existing sediment control measures within the permit area have been designed, constructed, and maintained to prevent additional contributions of sediment to streamflow or to runoff outside the permit area. In addition, they have been designed to meet applicable effluent limitations, and minimize erosion to the extent possible.

The structures to be used for the runoff-control plan for the permit area include disturbed and undisturbed area diversion channels and culverts, sedimentation ponds, containment berms, and silt fences.

VI.3.2.1 Siltation Structures

The siltation structures within the permit area consist of the sedimentation ponds described in Section VI.3.2.2. In addition, construction of the Emery 2 surface facilities, as well as construction in other areas that do not drain to an existing siltation structure, will be performed in accordance with the Emery Mine storm water pollution prevention plan. Temporary sediment control measures to be implemented prior to and maintained during construction will include installation of silt fences and/or straw wattles, in accordance with Plate VI-11B, at the downstream boundary between undisturbed areas and those areas affected by the construction activities. Temporary sediment control measures will be installed in all areas that do not report to a sedimentation pond prior to beginning construction of the Emery 2 mine expansion area.

VI.3.2.2 Sedimentation Ponds

Five sedimentation ponds operate at the mine facility, not including the three mine-water discharge ponds. Three of these sedimentation ponds are located in the area of the mine office, where the mine portals formerly existed. Existing sedimentation Pond 3 will provide sediment control in the area disturbed by the Emery 2 portal. The original design of Pond 3 is presented in Appendix VI-7 and Plate VI-15. This pond, which was originally designed for a smaller drainage area, will be modified to control runoff from the Emery 2 surface facilities as indicated in Appendix VI-21 and Plate VI-15B. The information presented in Appendix VI-21 supersedes that presented in Appendix VI-7 with respect to Pond 3 and its associated drainage area. Similarly, Plate VI-15B supersedes Plate VI-15 with respect to Pond 3.

~~Another~~The fourth sedimentation pond associated with the Emery Mine is located at the 4th East portal facility, the former active portal for the mine. The fifth sedimentation pond is located north of the mine office in an area that was formerly under consideration for construction of a preparation plant. The preparation plant was not constructed, and no disturbance exists in this area, outside of that associated with the pond. An additional sedimentation pond (Pond 7) has been designed to provide sediment control in the area of a proposed coarse refuse disposal area (see Plate VI-10B). Neither this refuse disposal area nor the associated pond has been constructed. Yet an additional sedimentation pond (Pond 4) was initially constructed immediately northwest of Pond 5, with Pond 4 designed to serve as an evaporation pond for a planned reverse-osmosis unit. The reverse-osmosis unit was never built, and Pond 4 was subsequently removed from service. Design information concerning this pond is included in Plate VI-16 to serve as background information for future final reclamation of the site where the pond was constructed. Details regarding the design of the mine-water discharge and sedimentation ponds are discussed in Section VI.4.2.2.

Each sedimentation pond was designed to provide treatment or full containment of the total runoff volume from a 10-year, 24-hour precipitation event. Treatment of the design runoff volume is provided by maintaining pool volumes within the pond equal to or greater than the design inflow volume into the pond. The sedimentation ponds were also constructed with a dewatering system consisting of slide gates or valves that remain closed except when dewatering. Dewatering of these ponds will proceed only after a minimum of 24 hours of storm water detention is provided to achieve effluent limitations. These dewatering systems are sufficiently sized to remove the storm water from the ponds once deposition has occurred in a reasonable time, not to exceed 10 days.

The spillways on the sedimentation ponds were designed to safely discharge the peak runoff from a 25-year, ~~24~~6-hour precipitation event. A minimum of 1.0 foot of freeboard is provided above the peak water surface to the crest of the pond embankment. The discharge from the sedimentation ponds will be controlled by riprap or other methods, as necessary, to reduce erosion and minimize disturbance.

The sedimentation pond embankments were designed and constructed to maintain a combined upstream and downstream slope of not less than 1v:5h, with neither slope steeper than 1v:2h. The minimum top width of the embankment was designed to be greater than the quotient of (H+35)/5, where H is the embankment height measured from the upstream toe, in feet. Construction of the pond embankments was performed using prudent engineering practices to ensure a stable structure.

All sedimentation ponds at the Emery Mine were certified after construction by a registered professional engineer with as-built drawings submitted and approved by the Division. All ponds are inspected in accordance with applicable regulations.

Compliance Requirements. All sedimentation ponds will be maintained until removed in accordance with the approved reclamation plan (see Chapter III of this MRP). When a pond is removed, the land will be revegetated in accordance with the reclamation plan defined in Chapter III.

The sedimentation ponds were designed to contain the volume of sediment equal to 5 years of accumulated sediment inflow, based on the Universal Soil Loss Equation. Sediment removal will be conducted once the volume of sediment accumulates to at least 60% and no more than 100% of the total pond volume designated for sediment storage volume. In addition, the sedimentation ponds will fully contain the runoff from the 10-year, 24-hour storm event. The spillways for the sedimentation ponds will adequately pass the peak flow from the 25-year, 6-hour precipitation event.

Additional design standards for all ponds are presented in Section VI.4.2.

MSHA Requirements. MSHA requirements defined in 30 CFR 77.216 are not applicable since the existing sedimentation ponds do not impound water or sediment to an elevation of 20 feet or more above the upstream toe of the structure. The ponds also store a volume less than 20 acre-feet.

VI.3.2.3 Diversions

The objective of the run-off control plan is to isolate, to the extent possible, run-off from disturbed areas from that of undisturbed areas. This is accomplished by:

- Diverting as much upstream run-off around disturbed areas via a network of ditches, culverts, and other diversions.
- Routing of run-off from undisturbed areas which enters the disturbed area into the sediment control system.

The location of each diversion is presented on Plate VI-10 and its associated Plates VI-10A through VI-10E. A brief list of each diversion structure is provided in Table VI-18. Drawings containing plans, profiles, and cross sections of the development waste disposal site diversion, the preparation plant diversion, and the 4th East portal stream diversion are presented in Plates VI-11, VI-13, and VI-21, respectively. Typical cross sections for these and the other diversions, together with additional design information, are found in Appendix VI-6.

Diversion design calculations associated with the Emery 2 surface facility are provided in Appendix VI-21. Diversion structures associated with this facility include ditches that convey runoff within the disturbed area (labeled on Plate VI-10E as "DD-x") to the sedimentation pond, berms that control runoff within the disturbed area ("DB-x"), disturbed area swales ("DS-x"), berms that control runoff from the undisturbed area ("UB-x"), culverts that convey undisturbed area runoff around the disturbed area ("UC-x"), and catch basins ("CB-x"). Details regarding these structures are provided on Plate VI-11B. The dimensions of these diversion structures are summarized in Table VI-18.

Runoff that collects in the bottom of the Emery 2 box cut will either be used underground or pumped to diversion DD-2 which discharges into Pond 3. The design calculations presented in Appendix VI-21 indicate that this ditch and pond are adequately sized to handle this flow.

All diversion ditches are maintained with adequate erosion protection in those sections where flow velocities are great enough that a ditch lining is necessary. Adequate ditch capacities are maintained in all ditch sections. Culvert inlets are kept free of debris. Detailed diversion design information is presented in Section VI.4.2.

VI.3.2.4 Road Drainage

Public roads in the permit and adjacent areas are owned and maintained by Emery County. Drainage associated with these roads is the responsibility of the County. Drainage from all routes within disturbed areas that are the responsibility of ~~Consol~~ Bronco is controlled via sedimentation ponds or alternate sediment-control methods. Drainage associated with these roads is addressed in Appendix IV-7, Appendix VI-21, and associated drawings of this MRP.

VI.3.3 Impoundments

VI.3.3.1 General Plans

Five sedimentation ponds and three mine-water discharge ponds operate at the mine. These ponds are located as shown in Figure VI-20 and Plate VI-10. Design information concerning each of these ponds is provided in Appendix VI-7 and Appendix VI-21.

Certification. All maps and cross sections associated with the sedimentation and mine-water discharge ponds have been prepared by or under the direction of and certified by a qualified, registered, professional engineer.

Maps and Cross Sections. Plans and cross sections associated with the mine-water discharge and sedimentation ponds are provided on Plates VI-14 through VI-20, Plate VI-15B, Plate VI-20A, and Appendi~~x~~ces VI-7 and VI-21 of this MRP.

Narrative. A description of each sedimentation pond is presented in Sections VI.3.1.5, VI.3.2.2, and VI.4.2 of this MRP.

Subsidence Survey Results. No future subsidence is planned beneath the existing mine-water discharge and sedimentation ponds in the permit area.

Hydrologic Impact. The preliminary hydrologic and geologic information required to asses the hydrologic impacts of the impoundments can be found in Section VI.2.4 and Chapter V, respectively.

Design Plans and Construction Schedule. There are no additional structures proposed for the mining operation at this time. Designs of all existing structures have been described within this MRP.

VI.3.3.2 Permanent and Temporary Impoundments

Requirements. All impoundments have been designed and constructed using current, prudent, engineering practices. Specific design criteria for each impoundment are presented in Section VI.4.3. All impoundments will be inspected at least quarterly.

Permanent Impoundments. There are no permanent impoundment structures associated with the mine facilities.

Temporary Impoundments. The Division authorized the construction of the temporary impoundments at the mine as part of coal mining and reclamation operations.

Hazard Notifications. The sedimentation ponds will be examined for structural weakness and erosion at least four times per year. A report of these findings will be submitted to the Division in accordance with permit requirements.

VI.3.4 Discharge Structures

The discharge structures associated the Emery Mine include spillways on the sedimentation ponds and outlets on the mine-water discharge ponds. These discharge structures are defined in Section VI.4.4.

VI.3.5 Disposal of Excess Spoil

There is no excess spoil generated at the mine.

VI.3.6 Coal Mine Waste

Areas designated for the disposal of coal mine waste and coal mine waste structures are constructed and maintained as described in Chapter II of this MRP.

VI.3.7 Noncoal Mine Waste

Noncoal mine waste is stored and disposed of as described in Chapter II.

VI.3.8 Temporary Casing and Sealing of Wells

Each groundwater monitoring well identified on Plate VI-4 will be operated and maintained as described in Section VI.4.8.

VI.4 DESIGN CRITERIA AND PLANS

VI.4.1 General Requirements

This MRP includes site-specific plans that incorporate minimum design criteria for the control of drainage from disturbed and undisturbed areas.

VI.4.2 Sediment Control Measures

VI.4.2.1 General Requirements

Design. Existing sediment control measures have been designed, constructed, and maintained to accomplish the following:

- Prevent additional contributions of sediment to stream flow or to runoff outside the permit area;
- Meet the effluent limitations defined in Section VI.5.1; and
- Minimize erosion to the extent possible.

Measures and Methods. The sediment control measures at the mine include practices carried out within and adjacent to the disturbed area. Sediment control methods include:

- Retention of sediment within the disturbed area;
- Diversion of runoff away from the disturbed area;
- Diversion of runoff using channels or culverts through disturbed areas to prevent additional erosion;
- Provision of riprap, silt fences, site revegetation, ponds and other measures that reduce overland flow velocities, reduce runoff volumes, or trap sediment; and
- Treatment of mine drainage in underground sumps before being discharged to the surface.
- Implementation of a storm water pollution prevention plan in areas subject to new construction.

VI.4.2.2 Siltation Structures

General Requirements. Additional contributions of suspended solids and sediment to stream flow or runoff outside the permit area is being prevented to the extent possible using various siltation structures. These structures were designed and constructed in accordance with applicable State and Federal regulations. Each structure has been certified by a qualified registered professional engineer. All long-term siltation structures which impound water have been designed, constructed and maintained as described in Chapter III and Sections VI.3.3 and VI.4.3. Temporary siltation structures such as silt fences and straw wattles will be installed prior to and maintained during construction activities in areas that do not drain to an existing siltation structure, in accordance with the mine's storm water pollution prevention plan. Temporary

siltation structures will be installed in all areas that do not report to a sedimentation pond prior to beginning construction of the Emery 2 mine expansion area.

Siltation structures are also provided at the mine-water discharges points. Water is presently being discharged from the mine at UPDES discharge points 001 and 003. Water discharges from these outfalls to Quitchupah Creek.

Sedimentation Ponds. There are five sedimentation ponds operating within the permit area. These ponds are located in the areas noted in Figure VI-20, ~~and~~ Plate VI-10, and Plate VI-15B and are described in Table VI-11. An additional sedimentation pond (Pond 7) has been designed to provide sediment control in the area of a proposed coarse refuse disposal area (see Plates VI-10B and VI-19). Neither this refuse disposal area nor the associated pond has been constructed. Furthermore, Pond 4 (Plate VI-16) has been removed from service and partially reclaimed.

Each sedimentation pond is designed to work individually to manage the design sediment volume and safely convey the peak discharge rate from its drainage area. All sedimentation ponds are located as near as possible to the disturbed areas. None of the ponds are located within a perennial stream channel.

Sediment storage and cleanout quantities (volumes and elevations) are presented in Table VI-19 for each of the mine-water discharge and sedimentation ponds. Calculations used to generate these quantities are presented in Appendi~~x~~ces VI-7 and VI-21. Each pond will be cleaned when its actual sediment storage equals at least 60% and no more than 100% of the design volume. A T-post, marked with the elevation of the 60% and 100% accumulation levels, has been installed in each pond to assist in making cleanout decisions.

An adequate detention time will be provided in each pond to allow the effluent to meet UPDES and 40 CFR Part 434 limitations. The decant water will be sampled and discharged from the pond in accordance with the above referenced effluent limitations.

Each mine-water discharge pond and sedimentation pond was designed to fully contain runoff resulting from the 10-year, 24-hour precipitation event. The sedimentation ponds were constructed with slide gates or valves that remain closed except when dewatering. Dewatering of these ponds will proceed only after a minimum of 24 hours of storm water detention is provided to achieve effluent limitations. The ponds have been designed to minimize short circuiting. All mine-water discharge and sedimentation ponds within the permit area have spillway systems that will safely discharge the peak flow resulting from a 25-year, ~~24~~6-hour precipitation event. Information relating to pond storage capacity and spillway hydraulics is presented in Table VI-20.

All of the ponds within the permit area have been operating for a period long enough to ensure that any settlement which may have occurred is now complete. Excessive settlement has not been observed at any of the mine-water discharge or sedimentation ponds.

During construction of the ponds, the embankment materials were free of sod, large roots, frozen soil, and acid- or toxic forming coal-processing waste. The embankments were compacted during placement of the materials.

MSHA Sedimentation Ponds. MSHA requirements defined in 30 CFR 77.216 are not applicable at this mine since the existing mine-water discharge and sedimentation ponds do not

impound water or sediment to an elevation of 20 feet or more above the upstream toe of the structure. The ponds also store a volume less than 20 acre-feet.

Other Treatment Facilities. There are no other water treatment facilities within the mine permit area.

Exemptions. Alternative sediment control methods are provided by the following facilities for surface drainage which does not pass through a sedimentation pond. These alternative treatments provide sufficient sediment control for these areas to meet Division approval, before leaving the permit area. Additional details regarding the following alternative sediment control methods are provided in Appendix VI-8. Locations where alternative sediment control ha~~ve~~s been installed are listed in Table VI-21.

- Mine Office Catch Basin: The catch basin in the mine office area is located in a depression where the drainage berms cannot effectively direct disturbed area runoff from 0.6 acre to Pond No.2. This evaporative catch basin is sufficiently sized to fully contain the expected runoff from a 25-year, 24-hour storm event. The small amount of runoff entering the depression evaporates, effectively providing complete sediment control for these portions of the surface facilities area without discharging from the permit area. This catch basin is a Division approved treatment facility which has functioned effectively for several years.
- Runoff Collection Berms: Runoff collection berms have been constructed along the perimeter of the disturbed area in several locations to provide total containment of runoff.
- Rock Check Dams: A series of rock check dams have been placed in Ditch No. 6 along the downstream toe of the subsoil stockpile at the development waste disposal site. Runoff from the stockpile enters the ditch and flows to the rock check dams where the velocity is reduced, causing sediment deposition to occur. Design details for Ditch No. 6 are provided in Appendix VI-7.
- Silt Fences: Silt fences are used at several areas of minor disturbance for additional sediment control. These silt fences have been installed in general accordance with Figure VI-19.
- Vegetative Cover: Alternative sediment control for several areas of disturbance is provided by vegetative cover. Vegetation on these disturbed sites has proven to be equivalent to or exceed that of the undisturbed ground adjacent to the site. This comparison of disturbed versus undisturbed sites is the result of a vegetation count conducted February 9, 1994 by the Division's reclamation biologist. This vegetation count was conducted upon request by Consolidation Coal Company in order to resolve sediment control concerns for these relatively small, isolated disturbance areas. These primarily inactive sites have been in place a sufficient number of years to re-establish natural vegetative cover. Any further action to control sediment from these small areas would serve only to disturb additional acreages and destroy the vegetation already established. Based on the disturbance areas meeting or exceeding the vegetation provided on the natural, undisturbed adjacent sites, as verified from vegetation count data, no additional sediment control measures are anticipated. The vegetative cover on these existing disturbance sites provides an improved condition, as compared to the surrounding, undisturbed areas.

The current disturbed area associated with the Emery Mine is ~~66.7~~75.2 acres (see Tables III-1 and III-2), to which 10.3 acres will be added with the Emery 2 surface facilities. The total area

for alternate sediment controls is 12.~~47~~96 acres (see Table VI-21). Th~~is~~e total of all alternate sediment control areas represents about 1~~9~~5 percent of the total disturbed area at the mine site.

VI.4.2.3 Diversions

General Requirements. Diversions within the permit area consist of drainage ditches and culverts. All diversions within the permit area have been designed to minimize adverse impacts to the hydrologic balance, to prevent material damage outside the permit area and to assure the safety of the public. All diversions and diversion structures have been designed, located, constructed, maintained and used to:

- Be stable,
- Provide protection against flooding and resultant damage to life and property,
- Prevent, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area, and
- Comply with all applicable local, State, and Federal laws and regulations

All diversions within the permit area are temporary and will be removed when no longer needed. The diversions will be reclaimed in accordance with the plan defined in Chapter III.

Peak discharge rates from the drainages flowing to the diversions were calculated based on design storms varying from the 10-year, 6-hour precipitation event to the 100-year, 24-hour precipitation event, depending on the diversion. Descriptions of the methods used and the resulting calculations required to determine the peak discharge rates are presented in Appendix VI-6 for most of the permit area and in Appendix VI-21 for the disturbed area associated with the Emery 2 portal. The disturbed and undisturbed drainage areas for the facilities area are presented on Plates VI-10 (with its associated Plates VI-10A through VI-10E) and VI-21.

All diversions are located as shown on Plate VI-10 and its associated Plates VI-10A through VI-10E. The capacity and freeboard of each diversion were determined based on the minimum ditch slope, while the maximum velocity and the need for channel armoring were based on the maximum ditch slope. Slopes were measured either in the field or from the design topography. All diversion calculations are presented in Appendix VI-6 and Appendix VI-21.

Diversion of Perennial and Intermittent Streams. Consol constructed a crossing over Quitchupah Creek in the late 1970s using a multi-plate arch on a concrete foundation. This structure was constructed with concrete wingwalls and was equipped with a guardrail. The crossing was installed to allow access to the stockpile area south of Quitchupah Creek. This crossing will also allow access to the Emery 2 portal facilities. ~~It~~The pipe arch replaced two 3-foot-diameter culverts which were determined to be undersized for design flood conditions. Design information concerning this structure is provided in Appendices IV-7 and IV-8.

Diversion of Miscellaneous Flows. Diversion ditches and culverts have been utilized within the permit area to divert miscellaneous flows from ephemeral disturbed- and undisturbed-area drainages. Details regarding these diversions are presented in Appendix VI-6. A summary of these diversions is presented in Table VI-18.

VI.4.2.4 Road Drainage

The access road to the mine is a public road that is owned and maintained by Emery County. Drainage associated with this and other public roads in the permit and adjacent areas is the responsibility of the County. Drainage from all routes within disturbed areas that are the

responsibility of ~~Consol~~ Bronco is controlled via sedimentation ponds or alternate sediment-control methods. Drainage associated with these roads is addressed in Appendix IV-7, Appendix VI-21, and associated drawings of this MRP.

VI.4.3 Impoundments

Eight impoundments have been constructed within the permit area, five of which serve as sedimentation ponds and three of which serve as mine-water discharge ponds. These structures are located as indicated on Figure VI-20 and Plate VI-10 and its associated Plates VI-10A through VI-10E. A ninth pond (Pond 7) has been designed to provide sediment control in the area of a proposed coarse refuse disposal area (see Plate VI-10B). Neither this refuse disposal area nor the associated pond has been constructed. Pertinent information regarding these sedimentation ponds is presented in Sections VI.3.2.2 and VI.4.2.2. An additional impoundment (Pond 4) has been removed from service.

VI.4.4 Discharge Structures

Discharge structures within the permit area consist of spillways on each sedimentation pond and outlets on the mine-water discharge ponds. The spillways on all sedimentation ponds within the permit area will adequately pass the peak discharge from the 25-year, 6-hour precipitation event. Detailed information for each sedimentation pond is presented in Sections VI.3.2.2 and VI.4.2.2. The design calculations for the discharge structures are presented in Appendices~~x~~ VI-7 and VI-21. Detailed drawings of each discharge structure are presented on Plates VI-14 through VI-20.

VI.4.4.1 Erosion Protection

The outlets on each sedimentation pond and mine-water discharge pond associated with the Emery Mine are periodically inspected to assess the need for erosion protection. Conditions are currently adequate to reduce erosion, prevent deepening or enlargement of stream channels, and minimize disturbance of the hydrologic balance at the pond outlets.

VI.4.4.2 Design Standards

All discharge structures within the permit area were designed and constructed according to standard engineering design procedures.

VI.4.5 Disposal of Excess Spoil

There is no excess spoil generated within the permit area.

VI.4.6 Coal Mine Waste

VI.4.6.1 General Requirements

All coal mine waste is currently contained within the development waste disposal area. A coarse refuse disposal area has also been proposed, but not yet constructed. Information regarding these disposal areas is provided in Chapter IV. All coal mine waste will be placed in a controlled manner to minimize adverse effects of leachate and surface water runoff on surface and groundwater quality and quantity.

VI.4.6.2 Refuse Piles

Based on the size, configuration, and open graded structure of the coal-mine waste, no underdrains or rock core chimney drains were required. There are no springs or seeps within the fill areas that require special treatment. All surface precipitation falling on the disposal areas is channeled to sedimentation ponds. All surface drainage from the areas above the sites is diverted around the disposal areas using diversion ditches. No permanent impoundments will exist on the completed refuse piles.

VI.4.6.3 Impounding Structures

There are no impounding structures within the permit area that are constructed of coal mine waste or are used to impound coal mine waste.

VI.4.6.4 Return of Coal Processing Waste to Underground Workings

Coal processing waste is not returned to abandoned underground workings at this mine.

VI.4.7 Disposal of Noncoal Mine Waste

Disposal of noncoal mine waste is discussed in Chapter II.

VI.4.8 Casing and Sealing of Wells

Each monitoring well or other borehole associated with the Emery Mine has been cased, sealed, or otherwise managed, as approved by the Division, to prevent acid or other toxic drainage from entering ground or surface water, to minimize disturbance to the hydrologic balance, and to ensure the safety of people, livestock, fish and wildlife, and machinery in the permit and adjacent area. The drill logs and completion diagrams for the water wells are contained in Appendix VI-2.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division (see Section VI.6.5).

VI.5 PERFORMANCE STANDARDS

All 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 post-mining land uses.

VI.5.1 Water Quality Standards and Effluent Limitations

Discharges of water from disturbed areas will be in compliance with all Utah and Federal water quality laws and regulations and with effluent limitations for coal mining contained in 40 CFR Part 434.

VI.5.2 Sediment Control Measures

All sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections VI.3.2, VI.4.2, and VI.6.

VI.5.2.1 Siltation Structures and Diversions

Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections VI.3.2, VI.4.2, and VI.6.3.

VI.5.2.2 Road Drainage

All roads that are the responsibility of ~~Consol~~ Bronco will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to plans and designs presented in Sections VI.3.2.4, VI.4.2.4, and VI.6.2. Any roads that are the responsibility of ~~Consol~~ Bronco have been constructed to:

- 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;
- Control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area;
- Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under Section VI.5.1.
- Minimize the diminution to or degradation of the quality or quantity of surface- and ground-water systems; and
- Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

VI.5.3 Impoundments and Discharge Structures

Impoundments and discharge structures will be located, maintained, constructed and reclaimed as described in Sections VI.3.3, VI.3.4, VI.4.3, VI.4.5, and VI.6.

VI.5.4 Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste

Disposal areas for coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed as described in Sections VI.3.6, VI.3.7, VI.4.6, VI.4.7, VI.6 and Chapter II.

VI.5.5 Casing and Sealing of Wells

All wells will be managed as described in Sections VI.4.8 and VI.6.5. Water monitoring wells will be managed on a temporary basis as described in Section VI.3.8.

VI.6 RECLAMATION

VI.6.1 General Requirements

A detailed reclamation plan for the mine is presented in Chapter III. In general, ~~Consol~~ Bronco will ensure that all temporary structures are removed and reclaimed. No permanent sedimentation ponds, diversions, impoundments, or treatment facilities are anticipated under the reclamation plan.

VI.6.2 Roads

A road not to be retained for use under an approved post-mining land use will be reclaimed immediately after it is no longer needed for coal mining and reclamation operations.

This will include reclamation of drainage features associated with that road. Additional information regarding reclamation of roads and their associated drainage structures is provided in Chapter III.

VI.6.2.1 Restoring the Natural Drainage Patterns

All natural drainage patterns will be restored during reclamation. This will include establishing drainage channels at their approximate pre-disturbance locations and elevations. Additional information regarding restoration of natural drainage patterns during reclamation is provided in Chapter III and Appendix VI-21.

VI.6.2.2 Reshaping Cut and Fill Slopes

All cut and fill slopes will be reshaped to be compatible with the post-mining land use and to complement the drainage pattern of the surrounding terrain. Additional information regarding reshaping of cut and fill slopes during reclamation is provided in Chapter III.

VI.6.3 Siltation Structures

VI.6.3.1 Maintenance of Siltation Structures

All siltation structures will be maintained until removed in accordance with the approved reclamation plan.

VI.6.3.2 Removal of Siltation Structures

When a siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan presented in Chapter III.

VI.6.4 Structure Removal

A timetable for the removal of each structure is presented in Section III.A.2 of this MRP.

VI.6.5 Permanent Casing and Sealing of Wells

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well, each monitoring well or borehole associated with the Emery Mine will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division and in accordance with the most current regulations concerning well abandonment as promulgated by the Utah Division of Water Rights. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

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TABLE VI-1

Water Rights Near the Emery Mine

Water Right Number[a]	Owner	Source	Quantity	Use[b]	Status
94-2	Muddy Creek Irrigation Company	North Fork of Muddy Creek	51.3 AF	Dom, Irr, Stk	Claimed
94-30	Osburn Bret Carter and J.R. Lawrence	Three unnamed springs	0.45 cfs	Irr	Certificated
94-52	Consolidation Coal Company	Underground water well (Mine supply yard)	2400 AF	Ind, Irr	~~Approved~~Lapsed
94-53	~~Consolidation Coal Company~~Town of Emery	Underground water well (Kemmerer well)	3.0 cfs	Ind	Approved
94-54	~~Consolidation Coal Company~~Town of Emery	Underground mine (Borehole #3) and two proposed wells	5.0 cfs	Ind, Irr, Stk	Approved
94-64	~~Consolidation Coal Company~~Bronco Utah Operations LLC	Underground water well	5.0 cfs	Ind	Approved
94-65	Town of Emery	Underground water well	0.27 cfs	Dom, Mun	Claimed
94-81	Osburn Bret Carter and J.R. Lawrence	Underground water well	0.037 cfs	Irr, Stk	Claimed
94-92	~~Consolidation Coal Company~~Bronco Utah Operations LLC	Christiansen spring	--	Stk	Claimed
94-285	~~Consolidation Coal Company~~Bronco Utah Operations LLC	Underground mine (Borehole #1 and supplemental)	5.0 cfs	Ind, Min, Pwr	Approved
94-303	Town of Emery	Underground water well	0.45 cfs	Dom, Mun	Certificated
94-320	Morgan Robertson	Underground water well (Lewis well)	0.015 cfs	Dom, Irr, Stk	Claimed
94-732	U.S. Bureau of Land Management	Quitchupah Creek	--	Stk	Claimed
94-939	U.S. Bureau of Land Management	Intermittent stream	--	Stk	Claimed
94-1080	U.S. Bureau of Land Management	Intermittent stream	--	Stk	Claimed
94-1180	Morgan Robertson	Quitchupah Creek	--	Stk	Claimed
94-1189	Canyon Fuel Company	Quitchupah Creek	--	Stk	Claimed
94-1191	Osburn Bret Carter and J.R. Lawrence	Quitchupah Creek	5.25 cfs	Irr, Stk	Claimed
94-1193	Osburn Bret Carter and J.R. Lawrence	Unnamed springs	0.011 cfs	Stk	Claimed
94-1215	Castle Valley Ranches	Unnamed springs	0.015 cfs	Stk	Claimed

Water Right Number[a]	Owner	Source	Quantity	Use[b]	Status
94-1216	Castle Valley Ranches	Quitchupah Creek	--	Stk	Claimed
94-1217	Castle Valley Ranches	Quitchupah Creek	--	Stk	Claimed
94-1285	Josiah K. and Etta Marie Eardley	Quitchupah Creek	--	Stk	Claimed
94-1315	Alonzo Olsen	Quitchupah Creek	--	Stk	Claimed
94-1316	George E. Olsen	Quitchupah Creek	--	Stk	Claimed
94-1317	George E. Olsen	Quitchupah Creek	--	Stk	Claimed
94-1318	Josiah K. and Etta Marie Eardley	Quitchupah Creek	--	Stk	Claimed
94-1716	U.S. Bureau of Land Management	Miller Canyon	--	Stk, Wld	Claimed

[a] See Plate VI-3 for locations. See Appendix VI-4 for additional information.
[b] Dom = domestic, Ind = industrial, Irr = irrigation, Min = mining, Mun = municipal, Pwr = power, Stk = stockwatering, Wld = wildlife

TABLE VI-2

Monitoring Well Completion Information

Well Identification	Casing Diameter (in)	Depth Drilled (ft)	Well Depth (ft)	Perforated Interval (ft)
Quaternary Deposits				
RDA1	2	48	48	23-43
RDA2	2	44	44	19-39
RDA3	2	52	52	21-46
RDA4	2	54	54	19-49
RDA5	2	57	57	22-52
RDA6	2	40	40	15-35
SM1-1	2	21	21	14-17
SM1-2	2	14	14	4-9
SM1-3	2	26	24	10-18
SM1-4	2	30	18	8-18
Blue Gate Member				
AA	1	490	79	61-79
H	1	1140	808	755-775
I	1	728	335	60-315
R2	1	825	555	505-525, 545-555
T1	4.5	31	31	5-31
T2	4.5	345	342	31-342
USGS3-1	2	71	71	51-71
USGS4-1	2.5	30	30	10-30
Upper Ferron Sandstone				
AA		490	212	168-188
Bryant	6	466	466	360-466
H	1	1140	869	840-860
I2	1	728	475	440-460
Lewis	4	608	608	590-608
Muddy #1	2.5	162	162	122-162
Muddy #2	2.5	136	136	96-136
R2	1	825	620	600-620
T1	--	Unknown		
T2	2	425	418	338-418
TP	2	419	417	354-417
USGS1-2	2	150	150	Open below 75’
Middle Ferron Sandstone				
AA	1	490	396	336-356
H	1	1140	995	970-990
I	1	728	609	590-610
R2	1	825	820	800-820
Lower Ferron Sandstone				
AA	1	490	460	420-440
H	1	1140	1135	1115-1135
I	1	728	728	700-720
Kemmerer	8 and 12	1551	1543	1368-1543
R1	1	884	880	840-860
WW1	--	Unknown		
ZZ	4	390	390	310-330, 380-390

TABLE VI-3

Field Data from 1979/1980
Irrigation Return Flow Inventory

Location[a]	Date	pH (units)	Temperature (^oC)	Diss. Oxygen (mg/l)	Sp. Cond. (umhos/cm)	Flow (gpm)[b]
SP-1	10/24/79	7.1	13.5	3.0	1196	NM
	06/11/80	7.9	26.4	8.6	1959	NM
SP-2	10/24/79	7.3	13.9	5.0	1613	NM
	06/11/80	7.8	21.1	6.8	1308	NM
SP-3	10/24/79	7.3	12.9	7.6	1307	NM
	06/11/80	7.8	18.3	9.4	1070	NM
SP-4	10/24/79	7.3	14.5	8.1	1295	NM
SP-5	10/24/79	8.1	9.2	10.9	2015	1
SP-6	10/24/79	7.8	15.9	9.2	1086	NM
SP-7	10/24/79	8.2	17.1	11.1	1023	NM
	06/11/80	7.6	18.4	8.4	1012	NM
SP-8	10/24/79	8.3	16.1	9.3	732	NM
	06/11/80	7.8	19.8	8.8	977	NM
SP-9	10/24/79	7.9	13.7	9.3	658	NM
	06/11/80	7.7	16.1	9.6	830	NM
SP-10	10/24/79	7.2	12.9	9.0	1043	NM
	06/11/80	7.5	12.3	9.9	1051	100
SP-11	10/24/79	7.5	13.8	9.2	800	NM
	06/11/80	7.7	14.3	9.2	1272	NM
SP-12	10/24/79	7.9	15.1	8.5	1338	NM
	06/11/80	7.9	22.7	8.1	1040	1
SP-13	10/24/79	7.5	14.3	8.0	1046	NM
	06/11/80	7.3	18.4	10.0	897	NM
SP-14	10/24/79	7.8	13.3	8.3	1022	7
	06/11/80	6.3	14.2	8.4	1280	3

[a] See Plate VI-5
[b] NM = not measured

TABLE VI-4

Groundwater Quality Summary –
Quaternary Deposit Wells

Parameter	Units	Maximum	Minimum	Mean
pH (lab)	units	11.8	6.7	7.7
Specific conductance (lab)	umhos/cm @25°C	51,10054,500	26101020	11,96012,080
Total dissolved solids	mg/l	92,91093,575	940471	16,56017,830
Calcium	mg/l	950	463	37060
Magnesium	mg/l	56,250	30	90060
Potassium	mg/l	780	21	321
Sodium	mg/l	19,30022,900	23127	4,1804,330
Bicarbonate	mg/l	9,629	0	709555
Carbonate	mg/l	301	0	53
Chloride	mg/l	2,998	113	620607
Sulfate	mg/l	94,336	287104	10,67011,260
Iron (dissolved)	mg/l	130469	0	305725.6
Manganese (dissolved)	mg/l	129.6	0	0.921.51
Acidity	mg/l	0	0	0
Total alkalinity	mg/l	7,893	1638	6811

TABLE VI-5

Groundwater Quality Summary –
Blue Gate Member Well

Parameter	Units	Maximum	Minimum	Mean
pH (field)	units	7.37	6.98	7.01
Specific conductance (field)	umhos/cm @25°C	17,92021,400	3,5301,463	8,86015,220
Total dissolved solids	mg/l	24,23273,071	4,531	16,49018,830
Calcium	mg/l	622	193	3918
Magnesium	mg/l	4213520	210	282436
Potassium	mg/l	5290	21	2938
Sodium	mg/l	5,40516,006	268	4,222786
Bicarbonate	mg/l	727	304	465
Carbonate	mg/l	<5	<1	<5
Chloride	mg/l	4501870	29	141421
Sulfate	mg/l	16,00047,790	2,513	10,67011,850
Iron (dissolved)	mg/l	2.2284	0.02	0.6314.6
Manganese (dissolved)	mg/l	1.1311.44	0.20	0.440.90
Acidity	mg/l	--	--	--
Total alkalinity	mg/l	727925	304	443582

TABLE VI-6

Summary of Pumping Tests Conducted
in the Ferron Sandstone

Well Location[a]	Geologic Unit Tested	Type of Test	Transmissivity (ft^2/day)	Storage Coefficient	Testing Entity[b]
Bryant	Kmf(u)	Recovery	200	--	USGS
Emery Town	Kmf(l)	Drawdown	800	--	USGS
		Recovery	600	--	USGS
EMRIA #2	Kmf(u), Kmf(m)	Drawdown	100	$7x10^{-4}$	USGS
EMRIA #3	Kmf(u)	Drawdown	20	$2x10^{-3}$	USGS
		Recovery	10	--	USGS
Kemmerer	Kmf(l)	Drawdown	400	--	USGS
		Recovery	600	--	USGS
Mine Water Well	Kmf(l)	Drawdown	750	--	Consol
Muddy #3	Kmf(u)	Recovery	40	--	USGS
T1 (COW[U50])	Kmf(u)	Drawdown	5	$4x10^{-4}$	Consol
USGS1-1	Kmf(l)	Recovery	100	--	USGS
USGS1-2	Kmf(u)	Drawdown	100	$8x10^{-4}$	USGS
USGS1-4	Kmf(u)	Recovery	30	--	USGS
Walker Flat MW-PW	Kmf(u)	Drawdown	15[c]	--	Consol
Walker Flat MW-20	Kmf(u)	Drawdown	71[c]	$1.7x10^{-3}$	Consol
Walker Flat MW-50	Kmf(u)	Drawdown	110[c]	$2.2x10^{-3}$	Consol
Maximum	--	--	800	$2.2x10^{-3}$	--
Minimum	--	--	5	$4x10^{-4}$	--
Average	--	--	230	$1.3x10^{-3}$	--

[a] See Plate VI-4
[b] USGS data are reported by Lines and Morrissey (1983). Consol data are presented in Appendix VI-3.
[c] Average of test analyses, based on a saturated thickness of 115 feet at the test location.

TABLE VI-7

Emery Mine Average Annual Discharge Data

Year	Discharge (cfs)	Year	Discharge (cfs)	Year	Discharge (cfs)	Year	Discharge (cfs)
Prior to initial temporary shutdown		During initial temporary shutdown		After temporary shutdown		During second temporary shutdown	
1979	0.70	1991	0.97	2002	0.54	2011	2.17
1980	1.11	1992	1.10	2003	0.60	2012	1.32
1981	0.68	1993	1.33	2004	0.77	2013	0.23
1982	1.07	1994	0.88	2005	0.62	2014	0.27
1983	1.20	1995	1.18	2006	1.12	2015	0.24
1984	1.00	1996	0.67	2007	1.51		
1985	0.80	1997	1.14	2008	0.95		
1986	0.60	1998	1.09	2009	1.00		
1987	1.00	1999	1.03	2010	1.86		
1988	1.10	2000	1.03				
1989	0.90	2001	0.90				
1990	0.99						
Average	0.93	Average	1.03	Average	~~0.63~~1.00	Average	0.85

TABLE VI-8

Groundwater Quality Summary –
Ferron Sandstone Wells

Parameter	Units	Maximum	Minimum	Mean
Upper Ferron Sandstone				
pH (lab)	units	9.9	4.0	7.9
Specific conductance (lab)	umhos/cm @25°C	~~6,500~~9,480	8~~80~~71	~~1,810~~2,580
Total dissolved solids	mg/l	8,788	429	1,~~62~~5441
Calcium	mg/l	376	1	~~88~~91
Magnesium	mg/l	474	1	6~~8~~7
Potassium	mg/l	17	1	4
Sodium	mg/l	2,030	~~90~~22.7	4~~27~~11
Bicarbonate	mg/l	627	29	30~~3~~1
Carbonate	mg/l	490	0	138
Chloride	mg/l	209	~~8~~3	4~~5~~4
Sulfate	mg/l	6,884	72	8~~63~~52
Iron (dissolved)	mg/l	24	0.02	1.5~~5~~2
Manganese (dissolved)	mg/l	0.67	0.008	0.2~~2~~0
Acidity	mg/l	0	0	0
Total alkalinity	mg/l	580	88	3~~53~~47
Lower Ferron Sandstone				
pH (lab)	units	10.0	7.3	8.2
Specific conductance (lab)	umhos/cm @25°C	2,200	580	1,~~090~~110
Total dissolved solids	mg/l	1,320	526	6~~85~~59
Calcium	mg/l	~~17~~21.6	1	4.2
Magnesium	mg/l	~~14.4~~18.8	0.9	~~8.0~~10.5
Potassium	mg/l	6	2	3
Sodium	mg/l	348	169	231
Bicarbonate	mg/l	654	80	2~~90~~77
Carbonate	mg/l	424	~~13~~<1	~~131~~95.8
Chloride	mg/l	75	1~~2~~1	1~~9~~8
Sulfate	mg/l	660	1	~~203~~210
Iron (dissolved)	mg/l	19	<0.01	~~2.0~~1.7
Manganese (dissolved)	mg/l	~~0.02~~0.049	0.001	0.0~~08~~10
Acidity	mg/l	--	--	--
Total alkalinity	mg/l	650	150	~~376~~311

TABLE VI-9

Results of 1977-1978 Streamflow Study

Location[a]	Instantaneous Discharge (cfs) by Date			
	25-26 Oct 1977	8-9 Feb 1978	12-13 Apr 1978	26-27 Jul 1978
Christiansen Wash				
A	0.129	0.234	0.523	0.441
B	0.223	0.399	0.559	1.682
C	.0267	0.323	0.597	0.980
D	1.100	0.913	1.267	2.020
E	0.646	1.105	0.891	1.722
F	1.025	0.657	1.365	4.321
Quitchupah Creek				
G	0.000	1.071	3.833	0.000
H	0.501	4.274	17.87	0.800
I	0.898	7.018	22.00	0.650
J	0.690	3.902	13.38	0.699
K	0.951	2.650	15.78	2.140
L	1.123	3.869	14.84	2.450

[a] See Figure VI-14

TABLE VI-10

Results of USGS 1978 Seepage Study

Location[a]	Instantaneous Discharge (cfs) by Date			
	13 Aug 1978	9 Sep 1978	18 Nov 1978	19 Nov 1978
Christiansen Wash				
M	1.72	0.11	--	0.43
N	1.69	0.34	--	1.26
Quitchupah Creek				
O	--	0.67	0.34	--
P	0.91	0.69	0.18	--
Q	0.00	0.02	1.42	--
R	0.00	0.00	--	0.04
S	0.26	1.40	--	0.12
T	1.68	2.09	--	2.39

[a] See Figure VI-15

TABLE VI-11

UPDES Discharge Monitoring Point Descriptions[a]

Outfall Number	MRP Pond Number	Surface Water Monitoring Site	Source Description
Correlated by UPDES Outfall Number			
001	1	6	Underground mine pump No. 1 to surface discharge pond
002	2	7	Sedimentation pond east of mine office
003	6	12	Underground mine pump No. 3 to surface discharge pond
004	Farmer's Pond	13	Underground mine pump No. 3 (alternate discharge location)
005	3	14	Sedimentation pond southeast of mine office
006	8	--	Sedimentation pond south of mine office
007	5	11	Sedimentation pond at location of formerly proposed preparation plant
008	6	12	Slurry emergency discharge (not used since preparation plant not constructed)
009	9	--	Sedimentation pond at 4th East portal facility

Correlated by Pond Number			Correlated by Surface Water Monitoring Site		
MRP Pond Number	Outfall Number	Surf. Water Mon. Site	Surf. Water Mon. Site	MRP Pond Number	Outfall Number
1	001	6	6	1	001
2	002	7	7	2	002
3	005	14	11	5	007
5	007	11	12	6	003
6	003	12	13	Farmer's	004
8	006	--	14	3	005
9	009	--	--	8	006
Farmer's	004	13	--	9	009

[a] All outfall numbers are associated with UPDES permit number UT0022616. Discharge locations are noted on Plate VI-4. Outfall number 008 was intended for a sedimentation pond that was not constructed. MRP pond numbers correspond to information contained in DOGM permit 015/015. Surface water monitoring site numbers correspond to sampling locations noted on Plate VI-4.

TABLE VI-12

Surface Water Quality Summary

Parameter	Average Concentration[a]								
	SWMS-1	SWMS-1A	SWMS-2	SWMS-3	SWMS-4	SWMS-5	SWMS-8	SWMS-9	SWMS-10
pH (field)	7.9	~~8.1~~7.9	7.~~9~~8	~~8.0~~7.9	~~8.0~~7.8	~~8.2~~8.0	8.0	7.~~9~~8	~~8.0~~7.8
Sp. Cond. (field)	~~1570~~1630	~~1220~~1410	~~3240~~3120	~~1610~~1640	~~1620~~1670	~~2270~~1210	5800	~~3180~~3260	~~1940~~1800
Total Diss. Solids	12~~40~~92	~~868~~861	28~~60~~70	~~1400~~1360	1340	~~1900~~1840	10060	~~2390~~2590	~~1970~~1820
Total Salt Load	12.2	23.4	20.5	48.6	31.7	22.0	1.4	--	--
Total Susp. Solids	~~543~~497	~~272~~310	~~789~~759	~~680~~638	~~700~~643	~~567~~617	674	~~508~~487	~~238~~468
Calcium	10~~6~~9	~~89~~91	~~197~~196	105	~~102~~105	~~139~~135	229	~~181~~193	~~180~~174
Magnesium	~~69~~74	~~60~~61	~~176~~171	~~79~~78	~~71~~73	~~120~~113	451	~~190~~208	~~172~~150
Potassium	4.4	4.2	7.1	4.6	4.5	4.5	15	8.4	~~6~~5.2
Sodium	~~192~~204	~~97~~92	457	~~211~~202	~~213~~208	~~247~~236	2880	~~322~~338	~~191~~165
Bicarbonate	333	~~300~~295	~~377~~371	~~326~~322	~~328~~320	~~336~~331	456	~~283~~282	~~283~~278
Carbonate	9	9	15	14	14	15	43	17	17
Chloride	3~~5~~6	~~30~~28	~~5~~149	~~38~~37	~~42~~41	~~35~~32	580	~~123~~134	~~132~~126
Sulfate	~~644~~668	~~390~~375	16~~50~~70	~~735~~705	~~705~~694	~~1020~~978	6550	~~1310~~1430	~~1020~~922
Iron (diss.)	0.3~~3~~0	0.~~2~~26	0.~~5~~4	0.3	0.3	0.~~5~~4	0.04	0.2	0.2
Iron (total)	~~7.1~~6.6	~~4.0~~3.8	~~7.3~~6.8	5.~~2~~1	~~5.2~~4.9	~~4.6~~5.0	8.4	5.~~8~~3	~~1.5~~4.2
Manganese (diss.)	<0.1	0.~~0~~302	0.~~1~~814	0.~~0~~302	0.~~0~~201	0.~~0~~706	<0.05	0.06	0.~~0~~605
Manganese (total)	~~0.18~~0.20	0.09	0.~~3~~734	0.~~19~~18	0.~~18~~16	0.24	0.23	0.~~23~~21	0.~~13~~17
Acidity	~~2.6~~5.8	~~5~~7.6	~~4.4~~7.8	<5	~~<5~~6.0	~~<5~~5.3	<5	~~2~~5.5	~~<5~~8.6
Total Alkalinity	310	~~274~~271	~~364~~347	~~304~~299	~~304~~300	~~310~~306	435	~~263~~269	~~261~~251

[a] All concentrations in mg/l except pH (units), specific conductance (umhos/cm @ 25°C), and total salt load (tons/day). Total salt load was calculated using the average TDS concentration and the average flow rate for the period of record.

TABLE VI-13

Comparison of Mine-Water Discharge Rates
Using Two Analytical Methods
(Mass Balance Approach)

Year	Mine-Water Discharge Rate (cfs)		
	Measured discharge	Hantush inflow equation	Tunnel inflow equation
1980	1.11	1.05	11.38
1981	0.68	0.96	1.38
1982	1.07	1.04	7.42
1983	1.20	1.08	1.98
1984	1.00	0.98	2.13
1985	0.80	0.66	7.60
1986	0.60	0.79	1.67
1987	1.00	1.09	2.95
1988	1.10	1.03	7.13
1989	0.90	0.95	12.10
1990	0.99	1.07	2.47
Average	0.95	0.97	5.29

TABLE VI-14

Predicted Mine-Water Discharge Rates
(Mass Balance Approach - 4th East Portal Works)

Year	Predicted Discharge (cfs)
2006	1.29
2007	1.19
2008	1.33
2009	1.77
2010	1.28
2011	1.52
2012	1.63
2013	1.98
Average	1.50

TABLE VI-15

Predicted Mine-Water Inflow and Discharge Rates
(MODFLOW Approach - 4th East Portal Works)

Year	Predicted Inflow (cfs)		
	Worst-Case Drawdown Scenario	Unit-Area Inflow Estimate	Worst-Case Inflow Scenario
2007	1.37	1.57	1.63
2008	1.46	1.92	2.13
2009	1.51	2.17	2.51
2010	1.56	2.38	2.87
2011	1.69	2.70	3.43
2012	1.72	2.85	3.71
2013	1.99	3.22	4.27
2014	1.96	3.33	4.44
2015	2.14	3.76	5.29
2016	2.12	3.89	5.68
Average Inflow	1.75	2.78	3.60
Average Discharge[a]	1.35	2.38	3.20

[a] Based on in-mine water usage of 0.40 cfs (see discussion in text)

TABLE VI-16

Comparison of Average Water Quality Data Collected
From the Ferron Sandstone and the Emery Mine

Source	TDS (mg/l)	Anions (mg/l)			Cations (mg/l)			
		HCO_3	Cl	SO_4	Ca	K	Na	Mg
Upper Ferron SS[a]	1566	303	45	799	86	36	407	65
Lower Ferron SS[a]	685	290	19	203	4	3	231	8
Mine roof samples[b]	1025	--	31	264	9	--	322	22
Other mine samples[b]	4106	--	241	2298	146	--	680	168
Pond 1 mine water[c]	3812	384	140	1923	169	8	838	152
Pond 6 mine water[c]	2410	324	60	1094	38	4	463	32

[a] See Appendix VI-1
[b] Average of limited Consol sampling
[c] See Appendix VI-12

TABLE VI-17

Emery Mine Hydrologic Monitoring Program

Parameter	Surface Water Monitoring Stations	Sampled Wells	Other Wells	Springs/Seeps	UPDES Outfalls
Monitoring Site Names	SWMS-1A, SWMS-2, SWMS-3, SWMS-4, SWMS-5, SWMS-8, SWMS-9, SWMS-10, SWMS-11, SWMS-12	Emery Town[(a)], Kemmerer, RDA-2, RDA-4, RDA-6, SM1-3, TP-U, USGS4-1	H-U, MUDDY #1, Pump 3 MW, R-1, R-2B, R-2M, AA-B, AA-U. AA-M, AA-L	SP-10, SP-11, SP-13, SP-14, SP-15	001, 002, 003, 004, 005, 006, 007, 009
Monitoring Frequency	Quarterly	Quarterly, except RDA wells (annual)	Quarterly	Quarterly flows. Samples in 2nd and 3rd quarters	Per permit
Field Measurements					
Flow	X			X	X
Water Level		X	X		
pH (field)	X	X		X	X
Sp. Cond. (field)	X	X		X	
Water Temp. (field)	X	X		X	
Laboratory Measurements					
Total Settleable Solids	X				
Total Suspended Solids	X				X
Total Dissolved Solids	X	X		X	X
Total Hardness (as $CaCO_3$)	X	X		X	
Oil and Grease	X				X
Acidity (as $CaCO_3$)	X				
Carbonate	X	X		X	
Bicarbonate	X	X		X	
Alkalinity (as $CaCO_3$)					
Calcium, Total	X				
Calcium, Dissolved	X	X		X	
Chloride	X	X		X	
Iron, Total	X				X
Iron, Dissolved		X		X	
Magnesium, Total	X				
Magnesium, Dissolved		X		X	
Manganese, Total	X				
Manganese, Dissolved		X		X	
Potassium, Total	X				
Potassium, Dissolved		X		X	
Sodium, Total	X				
Sodium, Dissolved		X		X	
Sulfate		X		X	

[(a)] Due to physical limitations in the Emery town wells (see text), water-quality samples will be collected from Well #1 and water-level data will be collected from Well #2. ~~Consol~~ Bronco will evaluate data collected from the Emery town wells, using hydrographs and other appropriate means, and submit a report of findings to DOGM with the annual report.

TABLE VI-18

Summary of Operational Diversion Ditches and Culverts

Structure		Design Event	Ditch Features			Culvert Type
			Bottom Width (ft)	Side Slopes (H:V)	Design Flow Depth (ft)	
Waste Disposal Site Diversion		100-yr, 24-hr	14	3:1	2.1	NA
4th East Portal Stream Diversion		10-yr, 24-hr	6	2:1	1.7	NA
Prep. Plant Ditch and Culvert		10-yr, 24-hr	10	2:1	0.3-0.5	30" CMP
Ditch and Culvert No. 1		10-yr, 6-hr	0	4:1	0.7	18" CMP
Ditch No. 2		10-yr, 6-hr	0-2	2:1	0.3-1.0	NA
Ditch No. 2A		100-yr, 6-hr	0	2:1	1.0	NA
Ditch No. 3		10-yr, 24-hr	2	2:1	1.1	NA
Ditch No. 3A		10-yr, 24-hr	2	2:1	0.4	NA
Ditch No. 4		10-yr, 24-hr	2	2:1	0.4-0.6	18" CMP
Ditch No. 5		10-yr, 24-hr	2	2:1	0.8	NA
Ditch No. 6		10-yr, 24-hr	0	2:1	0.6	NA
Arch Culvert on Quitchupah Creek		25-yr, 24-hr	NA	NA	NA	15'x10' pipe arch
Emery 2 Surface Facility	DB-1	10-yr, 6-hr	0	1.5:1	0.27	NA
	DB-2	10-yr, 6-hr	0	1.5:1	0.15	NA
	DB-3	10-yr, 6-hr	0	1.5:1	0.21	NA
	DC-1	10-yr, 6-hr	NA	NA	0.53	18" CHDPE
	DD-1	10-yr, 6-hr	0	2:1	0.40	NA
	DD-2	10-yr, 6-hr	1	1.5:1	0.55	NA
	DD-3	10-yr, 6-hr	0	1.5:1	0.52	NA
	DD-4	10-yr, 6-hr	0	1.5:1	0.35	NA
	DD-5	10-yr, 6-hr	0	1.5:1	0.34	NA
	DS-1	10-yr, 6-hr	0	1.5:1	0.09	NA
	UB-1	100-yr, 6-hr	0	1.5:1	0.97	NA
	UB-2	100-yr, 6-hr	0	2:1	0.95	NA
	UB-3	100-yr, 6-hr	0	2:1	0.77	NA
	UC-1	100-yr, 6-hr	NA	NA	1.50	30" CHDPE
	UC-2	100-yr, 6-hr	NA	NA	1.89	30" CHDPE

TABLE VI-19

Pond Sediment Storage and Cleanout Quantities

Pond No.	Design Quantities		Cleanout Quantities	
	Volume (AF)	Top Elevation (ft)	Volume (AF)	Cleanout Elevation (ft)
1	10.3	5937.7	6.2	5935.7
2	0.83	5905.3	0.50	5903.0
3	~~1.14~~0.44	590~~6.57~~9.55	~~0.68~~0.26	590~~5.015~~2.15
5	1.13	5944.6	0.68	5943.8
6	7.5	6014.8	4.5	6012.5
8	2.00	5910.0	1.35	5909.0
9	0.32	6052.5	0.18	6051.7

TABLE VI-20

Pond Storage and Spillway Capacity Data

Pond	Runoff Storage Capacity (AF)	Spillway Capacity	
		Design Storm	Peak Outflow (cfs)
1	0.44	25-yr, 24-hr	7.9
2	0.68	25-yr, 24-hr	1.0
3	~~0.37~~1.~~03~~0.26	~~100~~25-yr, 6-hr	~~2.12~~0.52
5	3.70	25-yr, 24-hr	4.0
6	9.18	25-yr, 24-hr	3.6
8	1.07	100-yr, 6-hr	1.8
9	0.22	25-yr, 24-hr	3.9

TABLE VI-21

Alternative Sediment Controls

Site	Area (ac)[a]	Alternative Sediment Control Method				
		Catch Basin	Berms	Rock Check Dams	Silt Fences	Vegetative Cover
Southeast mine office area	0.6	X				
4th East portal topsoil stockpile	1.0		X			X
4th East portal excavation stockpile	4.0		X			
4th East portal perimeter	0.4				X	
Topsoil stockpile T-3	1.38		X			X
Pond No. 6 topsoil and subsoil stockpiles	0.85		X			X
Waste disposal site – Ditch No. 6 and Subsoil stockpile S-2	1.88			X	X	X
Borehole pump No. 1	0.17					X
Borehole pump No. 2	0.92					X
Borehole pump No. 3	0.86		X		X	X
Revegetation test plot	0.34					X
Fire control area	0.07					X
Emery 2 pad outslope adjacent to Quitchupah Creek	0.49				X	X

[a] Total area included in alternative sediment controls = 12.~~47~~96 ac

TABLE VI-22

Predicted Mine-Water Discharge Rates
(Mass Balance Approach - Emery 2 Portal Works)

Year	Predicted Inflow (cfs)	Predicted Usage (cfs)	Predicted Discharge (cfs)
1	0.70	1.18	-0.48
2	1.26	1.32	-0.05
3	2.15	0.92	1.24
4	2.09	1.45	0.64
5	3.14	1.47	1.67
Average	1.87	1.27	0.60

Note: Negative discharge represents a net underground requirement to be satisfied by surface sources.

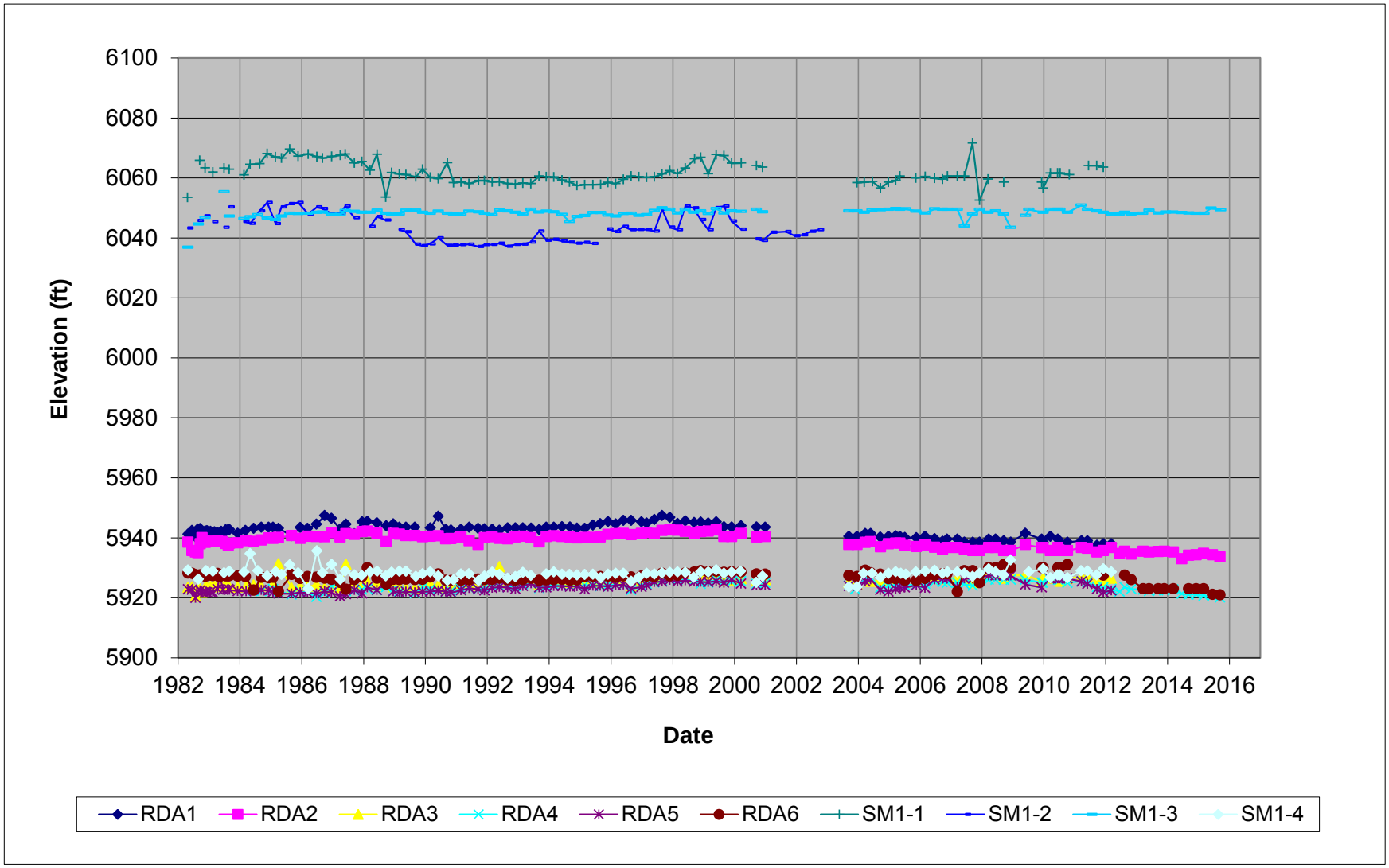

FIGURE VI-2. HYDROGRAPHS OF WELLS COMPLETED IN QUATERNARY DEPOSITS.

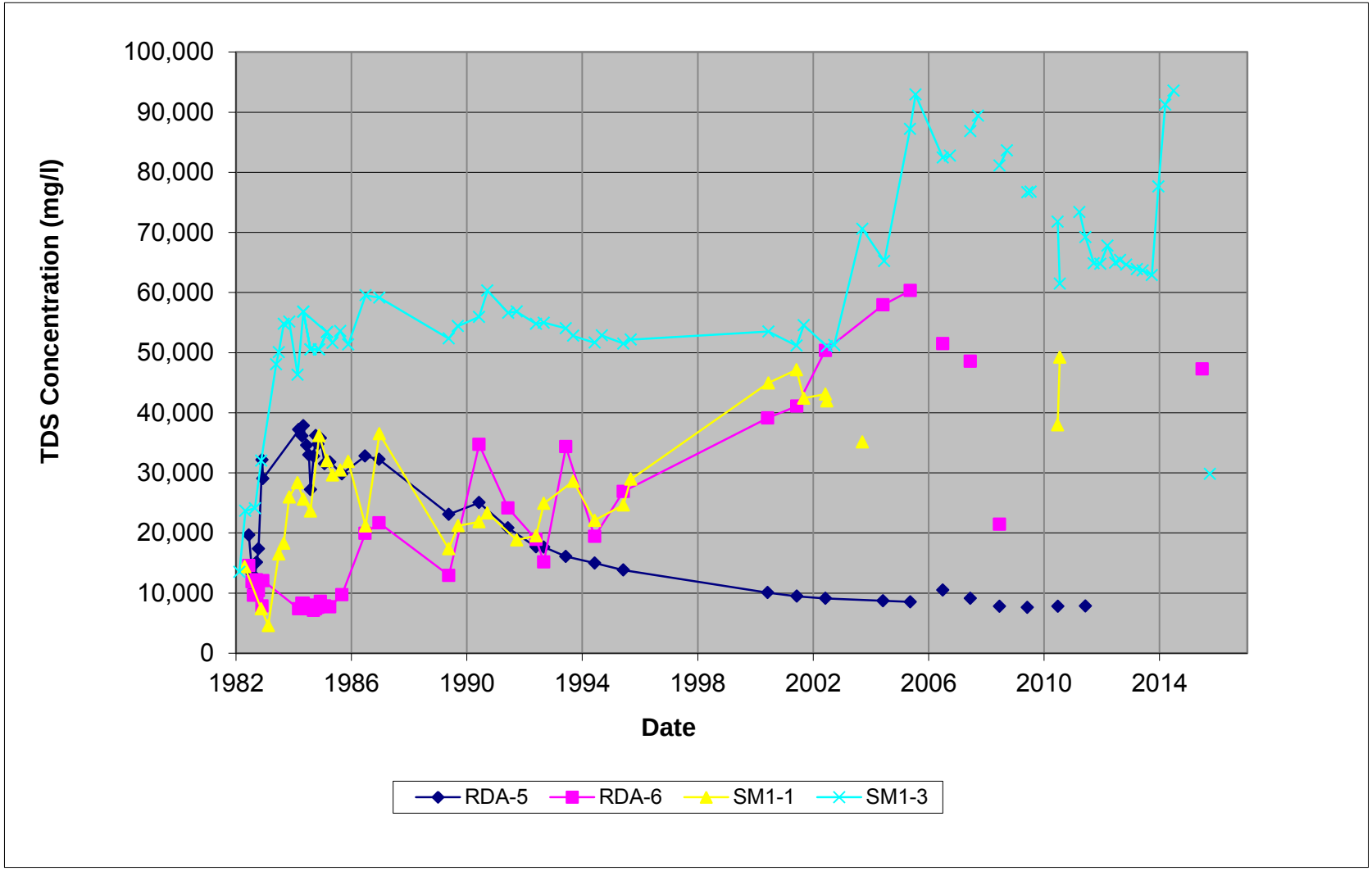

FIGURE VI-3. TDS CONCENTRATIONS OF SELECTED WELLS COMPLETED IN QUATERNARY DEPOSITS.

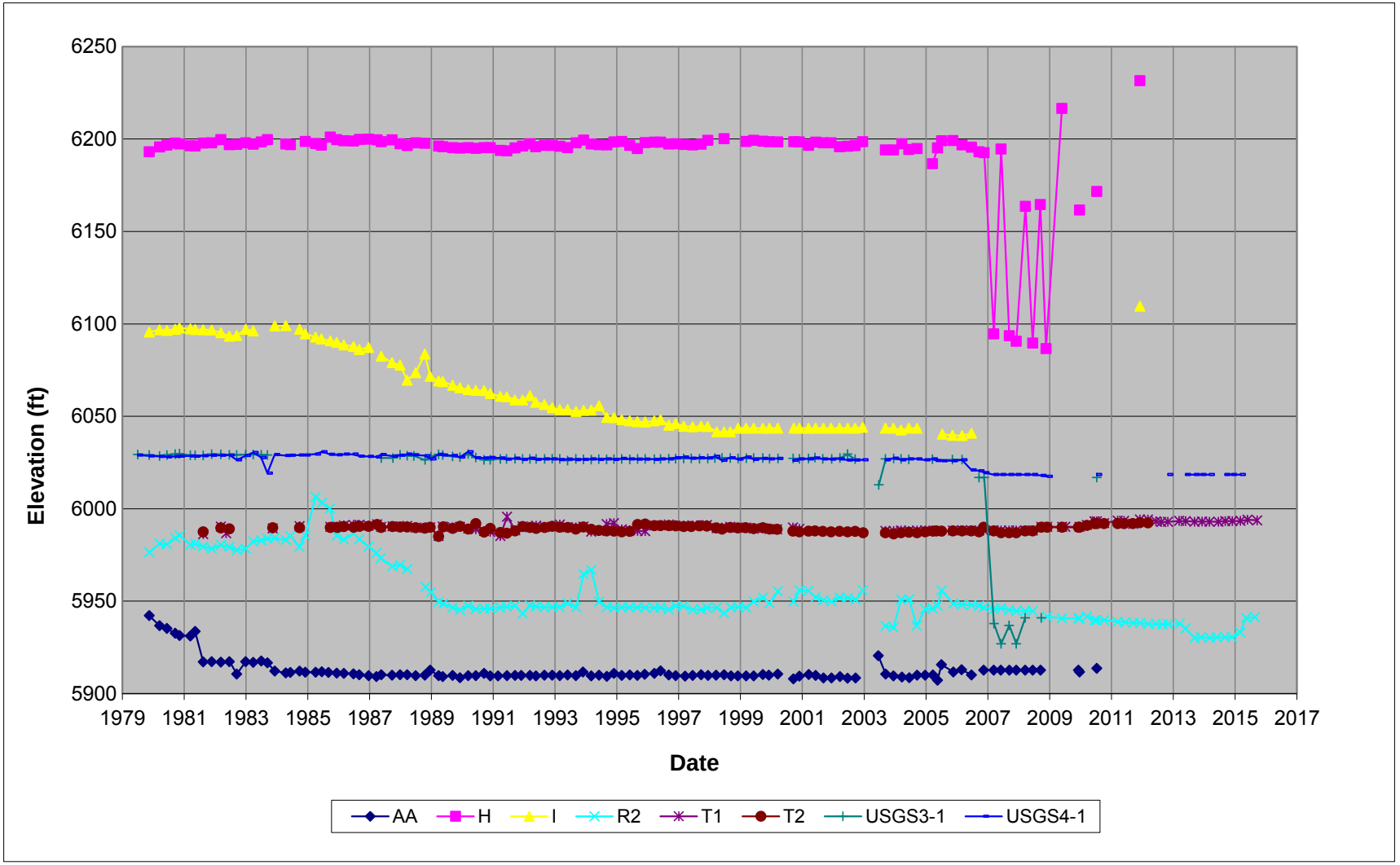

FIGURE VI-4. HYDROGRAPHS OF WELLS COMPLETED IN THE BLUE GATE MEMBER

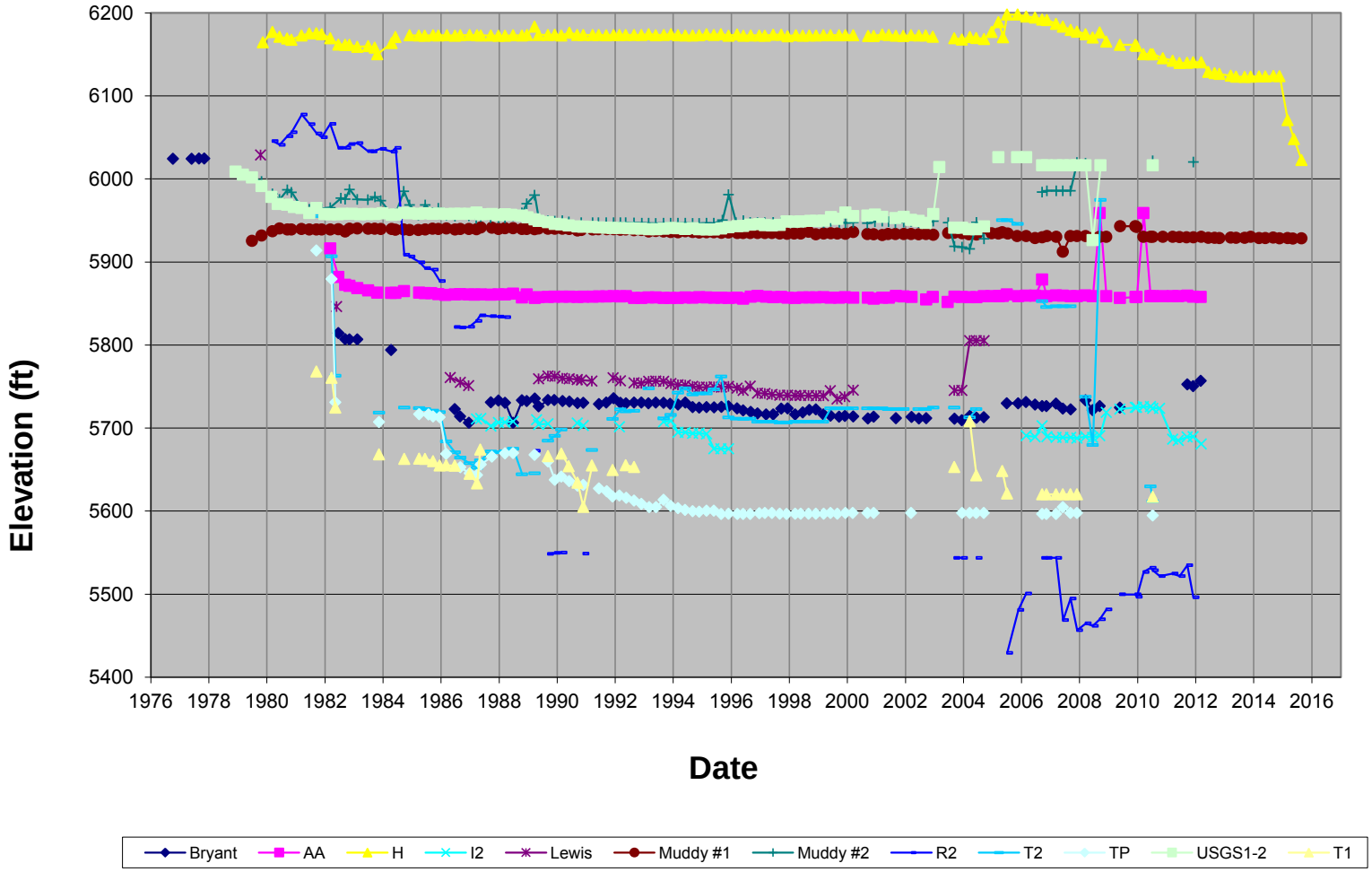

FIGURE VI-5. HYDROGRAPHS OF WELLS COMPLETED IN THE UPPER FERRON SANDSTONE.

FIGURE VI-6. HYDROGRAPHS OF WELLS COMPLETED IN THE MIDDLE FERRON SANDSTONE.

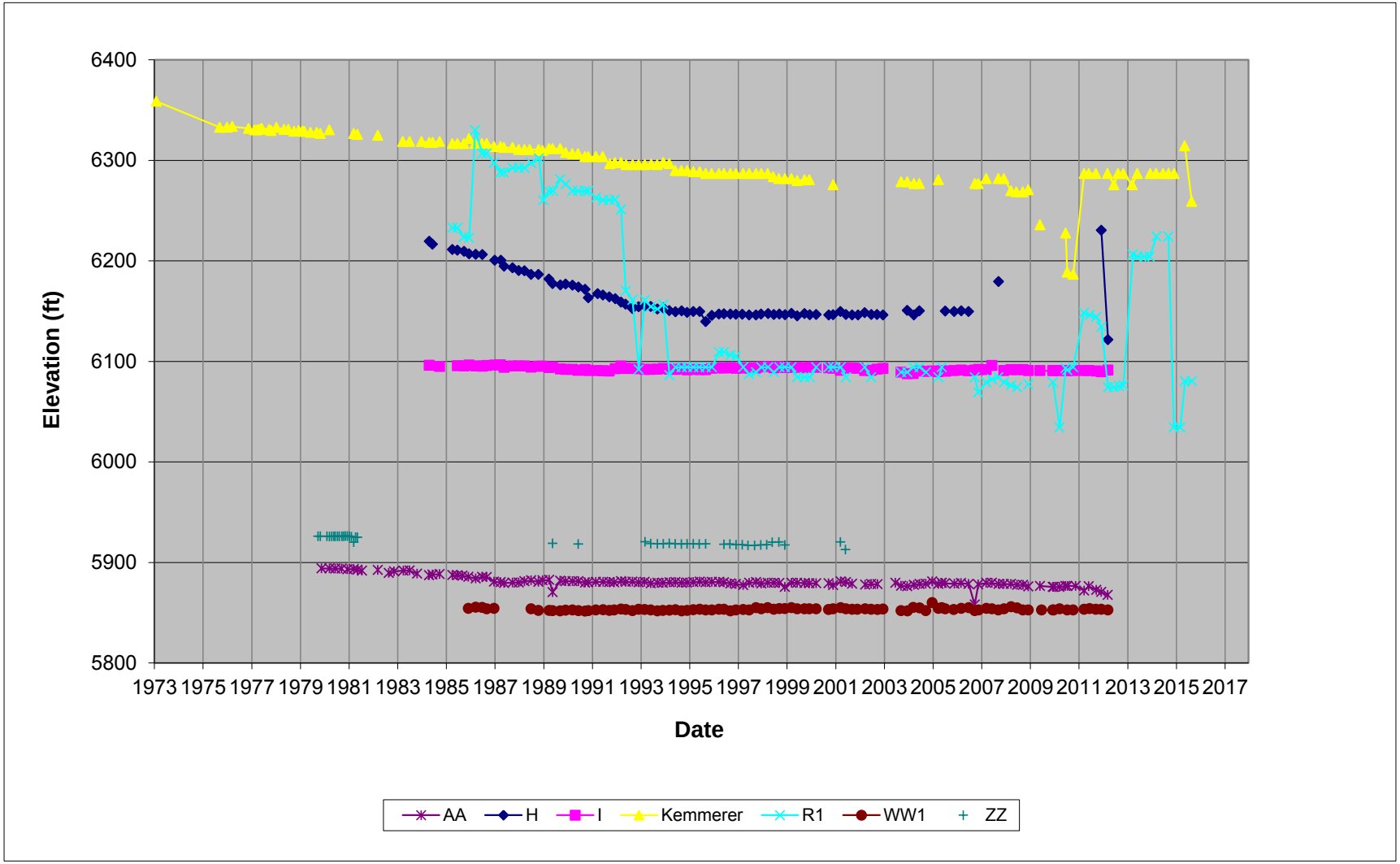

FIGURE VI-7. HYDROGRAPHS OF WELLS COMPLETED IN THE LOWER FERRON SANDSTONE.

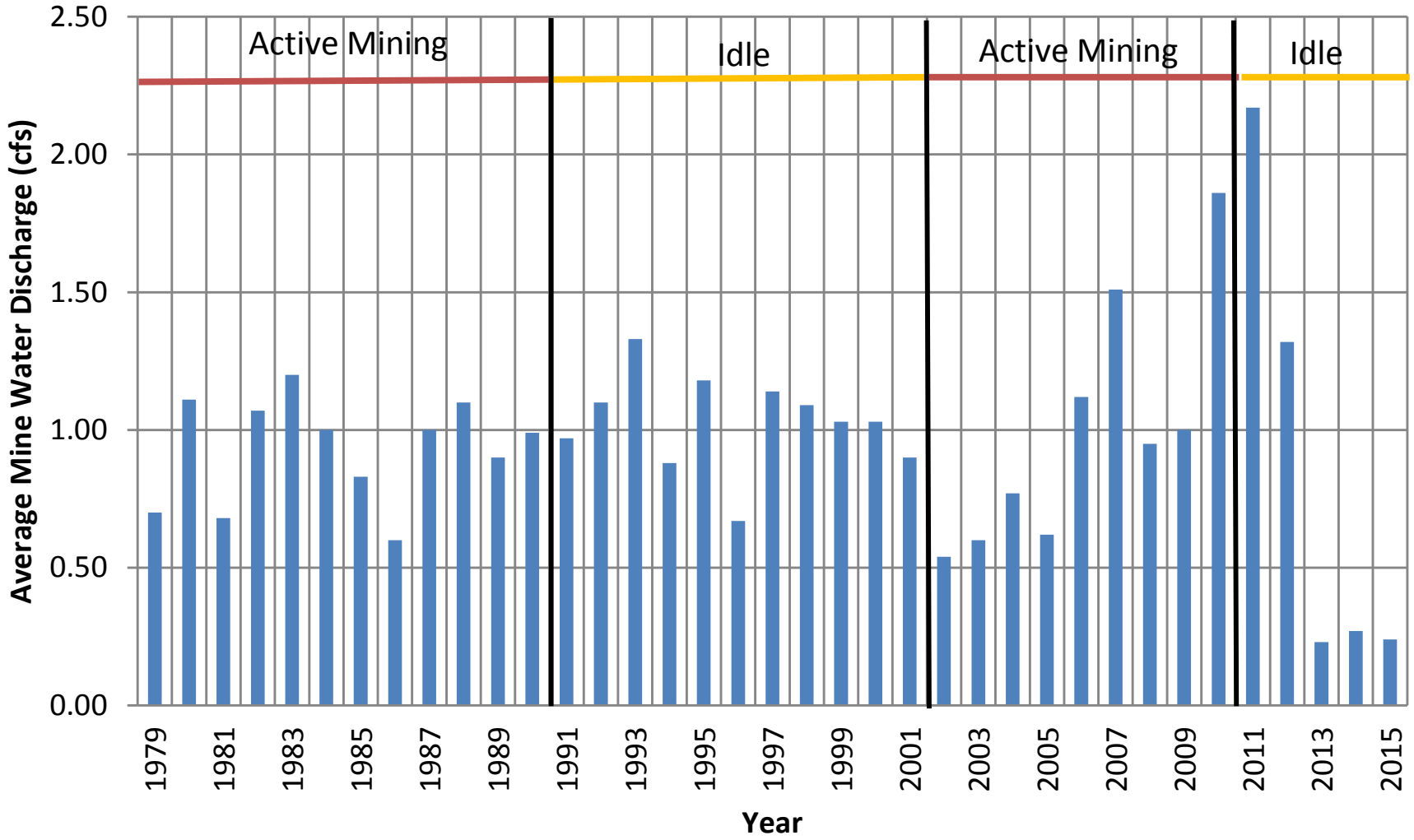

FIGURE V1-9. AVERAGE MINE WATER DISCHARGE BY YEAR.

APPENDIX VI-1

Groundwater Monitoring –
Water Quality Data

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Spring	SP-10	12/18/1995				0																					
Spring	SP-10	3/5/1997				0																					
Spring	SP-10	6/24/1997				30																					
Spring	SP-10	9/30/1997				44																					
Spring	SP-10	12/12/1997				0																					
Spring	SP-10	3/9/1998				0																					
Spring	SP-10	6/26/1998				30																					
Spring	SP-10	9/29/1998				65																					
Spring	SP-10	12/7/1998				0																					
Spring	SP-10	3/15/1999				0																					
Spring	SP-10	12/4/2000				0																					
Spring	SP-10	3/21/2001				0																					
Spring	SP-10	6/15/2001				7																					
Spring	SP-10	9/11/2001				3																					
Spring	SP-10	12/11/2001				0																					
Spring	SP-10	1/1/2002				0																					
Spring	SP-10	3/1/2002				0																					
Spring	SP-10	6/19/2002				0																					
Spring	SP-10	9/24/2002		7.5	1810																						
Spring	SP-10	6/30/2003				0																					
Spring	SP-10	9/18/2003				18																					
Spring	SP-10	12/26/2003				0																					
Spring	SP-10	3/29/2004				0																					
Spring	SP-10	6/22/2004				305																					
Spring	SP-10	9/25/2004				157																					
Spring	SP-10	12/28/2004				0																					
Spring	SP-10	3/31/2005				0																					
Spring	SP-10	5/23/2005				0																					
Spring	SP-10	7/19/2005				0																					
Spring	SP-10	11/22/2005				0																					
Spring	SP-10	3/9/2006				0																					
Spring	SP-10	6/27/2006				0																					
Spring	SP-10	9/29/2006				0																					
Spring	SP-10	11/28/2006				0																					
Spring	SP-10	3/26/2007				0																					
Spring	SP-10	6/18/2007				83.9																					
Spring	SP-10	9/26/2007				20.2																					
Spring	SP-10	12/11/2007				0																					
Spring	SP-10	3/24/2008				180																					
Spring	SP-10	6/26/2008				274																					
Spring	SP-10	9/30/2008				45.7																					
Spring	SP-10	12/11/2008				39.7																					
Spring	SP-10	2/26/2009				0																					
Spring	SP-10	7/15/2009				8.5																					
Spring	SP-10	12/15/2009				5.8																					
Spring	SP-10	12/30/2009																									
Spring	SP-10	3/25/2010				0																					
Spring	SP-10	6/28/2010	16.8	7.2	1020	37.8	7.2						74.94		< .03		42.48	0.003	1.62		26.5		295	0	> 5.	4	
Spring	SP-10	7/21/2010	13.1	7.8	1250	9							84.97		< .03		49.35	< .002	1.34		34.57		0	0	0	5	
Spring	SP-10	11/24/2010				1696																					
Spring	SP-10	3/25/2011	6.9	7.8	1246	3.8							102.67		< .03		66.43	0.031	2.84		63.49		0	0	0	8	
Spring	SP-10	6/24/2011	11.3	8.1	1388	23							88.79		< .03		51.81	0.004	1.24		33.37		0	0	0	5	
Spring	SP-10	9/27/2011	15.5	9.3	1080	68.1							81.12		< .03		47.98	< .002	1.85		30.51		0	0	0	7	
Spring	SP-10	12/9/2011				0																					
Spring	SP-10	3/22/2012				5.1																					
Spring	SP-10	6/25/2012				0																					
Spring	SP-10	8/20/2012				0																					
Spring	SP-10	11/7/2012				0																					
Spring	SP-10	3/27/2013				0																					
Spring	SP-10	6/4/2013	19.6	7.2	1265	1.3							103.47		< .03		58.74	0.038	2.79		52.3		355	0	< 5.	3	
Spring	SP-10	9/16/2013	17.4	7.1	1400	44.9							124.49		< .03		66.63	0.07	4.28		75.73					11	
Spring	SP-10	12/17/2013	1.1	7.1	1860	9.0							152.42		< .03		88.99	0.077	5.2		138.89		0	0	0	18	
Spring	SP-10	3/14/2014	0.4	7	1890	9.0							140.27		< .03		85.48	0.042	3.39		100.92		0	0	0	16	
Spring	SP-10	6/23/2014	19.7	7.2	823	736							67.98		< .03		39.77	< .002	1.69		30.28		0	0	0	9	
Spring	SP-10	9/16/2014	11.6	7	1012	180							76.74		0.1		50.09	0.006	1.46		43.29		349	0	< 5.	7	
Spring	SP-10	12/1/2014	6.2	7	1040	184.01							80.44		< .03		48.12	0.022	2.53		50.52		337	0	< 5.	7	
Spring	SP-10	3/9/2015	4.5	7	1260	125.66							84.69		< .03		56.31	0.004	2.61		76.37		335		< 5.	9	

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Spring	SP-10	5/18/2015	10.5	7.1	785	80.784							57.92		< .03		34.39	0.005	2.42		29.45		265	0	< 5.	3	
Spring	SP-10	9/1/2015	12.6	7	992	166.06							77.54		< .03		52.93	< .002	1.95		39.44		348	0	< 5.	5	
Spring	SP-10	12/1/2015	1.9	6.8	1006	143.62							85.13		0.06		53.73	< .002	2.05		37.43		343	0	< 5.	5	
Spring	SP-11	12/18/1995				0																					
Spring	SP-11	3/5/1997				0																					
Spring	SP-11	6/24/1997				34																					
Spring	SP-11	9/30/1997				34																					
Spring	SP-11	12/12/1997				0																					
Spring	SP-11	3/9/1998				0																					
Spring	SP-11	6/26/1998				39																					
Spring	SP-11	9/29/1998				55																					
Spring	SP-11	12/7/1998				0																					
Spring	SP-11	3/21/2001				0.01																					
Spring	SP-11	6/15/2001				3.0																					
Spring	SP-11	9/11/2001				1.3																					
Spring	SP-11	12/11/2001				0																					
Spring	SP-11	1/1/2002				0																					
Spring	SP-11	3/1/2002				0																					
Spring	SP-11	6/19/2002				0																					
Spring	SP-11	6/30/2003				0																					
Spring	SP-11	9/18/2003				0																					
Spring	SP-11	12/26/2003				0																					
Spring	SP-11	3/29/2004				1.9																					
Spring	SP-11	6/22/2004				126																					
Spring	SP-11	9/25/2004				0																					
Spring	SP-11	12/28/2004				0																					
Spring	SP-11	3/31/2005				0																					
Spring	SP-11	5/23/2005				0																					
Spring	SP-11	7/19/2005				0																					
Spring	SP-11	11/22/2005				0																					
Spring	SP-11	3/9/2006				0																					
Spring	SP-11	6/27/2006				0																					
Spring	SP-11	9/29/2006				0																					
Spring	SP-11	11/28/2006				0																					
Spring	SP-11	3/26/2007				0																					
Spring	SP-11	6/18/2007				20.2																					
Spring	SP-11	9/26/2007				0																					
Spring	SP-11	12/11/2007				0																					
Spring	SP-11	3/24/2008				0																					
Spring	SP-11	6/26/2008				162																					
Spring	SP-11	9/30/2008				9																					
Spring	SP-11	12/11/2008				3.8																					
Spring	SP-11	2/26/2009				0																					
Spring	SP-11	7/15/2009				47.5																					
Spring	SP-11	12/15/2009				39.7																					
Spring	SP-11	12/30/2009																									
Spring	SP-11	3/25/2010				0																					
Spring	SP-11	6/28/2010	14.8	7.3	1220	14.1	7.3						92.41		< .03		79.36	0.003	2.26		90.34		376	0	> 5.	9	
Spring	SP-11	7/21/2010	12.5	7.5	1229	2.3							88.52		< .03		74.91	0.009	2.28		88.04		0	0	0	10	
Spring	SP-11	11/24/2010				49.4																					
Spring	SP-11	3/25/2011				0																					
Spring	SP-11	6/24/2011	11.5	8.4	873	92.2							95.17		< .03		80.6	0.014	2.4		112.76		0	0	0	12	
Spring	SP-11	9/27/2011				0																					
Spring	SP-11	12/9/2011				0																					
Spring	SP-11	3/22/2012				27.6																					
Spring	SP-11	6/25/2012	19.1	7.2	9580	10.9							78.72		< .03		54.43	0.003	0.88		38.61		0	0	0	3	
Spring	SP-11	8/20/2012	20.3	7	995	18.0							97.18		< .03		65.45	0.004	2.46		48.6		0	0	0	5	
Spring	SP-11	11/7/2012	10.3	7	1360	18.0							99.9		< .03		58.59	0.02	3.41		57.27		366	0	5	7	
Spring	SP-11	3/27/2013				898																					
Spring	SP-11	6/4/2013				0																					
Spring	SP-11	9/16/2013				0																					
Spring	SP-11	12/5/2013				0																					
Spring	SP-11	3/7/2014				0																					
Spring	SP-11	6/6/2014				0																					
Spring	SP-11	9/15/2014				0																					
Spring	SP-11	12/1/2014				0																					

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Spring	SP-11	3/9/2015				0																					
Spring	SP-11	5/18/2015				0																					
Spring	SP-11	9/1/2015																									
Spring	SP-11	12/1/2015																									
Spring	SP-13	12/12/1997				0																					
Spring	SP-13	3/9/1998				0																					
Spring	SP-13	6/26/1998				14																					
Spring	SP-13	9/29/1998				0.5																					
Spring	SP-13	12/7/1998				0																					
Spring	SP-13	3/21/2001				0																					
Spring	SP-13	6/15/2001				0.5																					
Spring	SP-13	9/11/2001				0																					
Spring	SP-13	12/11/2001				0																					
Spring	SP-13	1/1/2002				0																					
Spring	SP-13	3/1/2002				0																					
Spring	SP-13	6/19/2002				0																					
Spring	SP-13	6/30/2003				0																					
Spring	SP-13	9/18/2003				0																					
Spring	SP-13	12/26/2003				0																					
Spring	SP-13	3/29/2004				0																					
Spring	SP-13	6/22/2004				9																					
Spring	SP-13	9/20/2004				0																					
Spring	SP-13	12/28/2004				0																					
Spring	SP-13	3/31/2005				0																					
Spring	SP-13	5/23/2005				0																					
Spring	SP-13	7/19/2005				0																					
Spring	SP-13	11/22/2005				0																					
Spring	SP-13	3/9/2006				0																					
Spring	SP-13	6/27/2006				0																					
Spring	SP-13	9/29/2006				0																					
Spring	SP-13	11/28/2006				0																					
Spring	SP-13	3/26/2007																									
Spring	SP-13	6/18/2007																									
Spring	SP-13	9/26/2007																									
Spring	SP-13	12/11/2007																									
Spring	SP-13	3/24/2008																									
Spring	SP-13	6/26/2008																									
Spring	SP-13	9/30/2008																									
Spring	SP-13	12/11/2008																									
Spring	SP-13	2/26/2009																									
Spring	SP-13	7/15/2009																									
Spring	SP-13	12/17/2009																									
Spring	SP-13	12/30/2009																									
Spring	SP-13	3/25/2010																									
Spring	SP-13	6/28/2010																									
Spring	SP-13	7/20/2010																									
Spring	SP-13	11/24/2010																									
Spring	SP-13	3/25/2011				0.9																					
Spring	SP-13	6/24/2011				0																					
Spring	SP-13	9/27/2011				0																					
Spring	SP-13	12/9/2011				0																					
Spring	SP-13	3/22/2012				0																					
Spring	SP-13	6/25/2012				0																					
Spring	SP-13	8/20/2012				0																					
Spring	SP-13	11/7/2012				0																					
Spring	SP-13	3/27/2013				0																					
Spring	SP-13	6/4/2013				0																					
Spring	SP-13	9/16/2013				0																					
Spring	SP-13	12/5/2013				0																					
Spring	SP-13	3/7/2014				0																					
Spring	SP-13	6/6/2014				0																					
Spring	SP-13	9/15/2014				0																					
Spring	SP-13	12/1/2014				0																					
Spring	SP-13	3/11/2015				0																					
Spring	SP-13	5/18/2015				0																					
Spring	SP-13	9/1/2015																									

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Spring	SP-13	12/1/2015																									
Spring	SP-14	9/30/1997				8.0																					
Spring	SP-14	12/12/1997				0																					
Spring	SP-14	3/9/1998				0																					
Spring	SP-14	6/26/1998				1.9																					
Spring	SP-14	9/29/1998				1.1																					
Spring	SP-14	12/7/1998				0																					
Spring	SP-14	3/21/2001				0																					
Spring	SP-14	6/15/2001				0.5																					
Spring	SP-14	9/11/2001				0																					
Spring	SP-14	12/11/2001				0																					
Spring	SP-14	1/1/2002				0																					
Spring	SP-14	3/1/2002				0																					
Spring	SP-14	6/19/2002				0																					
Spring	SP-14	6/30/2003				0																					
Spring	SP-14	9/18/2003				0																					
Spring	SP-14	12/26/2003				0																					
Spring	SP-14	3/29/2004				0																					
Spring	SP-14	6/22/2004				54																					
Spring	SP-14	9/20/2004				0																					
Spring	SP-14	12/28/2004				0																					
Spring	SP-14	3/31/2005				0																					
Spring	SP-14	5/23/2005				0																					
Spring	SP-14	7/19/2005				0																					
Spring	SP-14	11/22/2005				0																					
Spring	SP-14	3/9/2006				0																					
Spring	SP-14	6/27/2006				0																					
Spring	SP-14	9/29/2006				0																					
Spring	SP-14	11/28/2006				0																					
Spring	SP-14	3/26/2007				0																					
Spring	SP-14	6/18/2007				0																					
Spring	SP-14	9/26/2007				0																					
Spring	SP-14	12/11/2007				0																					
Spring	SP-14	3/24/2008				0																					
Spring	SP-14	6/26/2008				0																					
Spring	SP-14	9/30/2008				2.3																					
Spring	SP-14	12/11/2008				0																					
Spring	SP-14	2/26/2009				0																					
Spring	SP-14	7/15/2009				1.3																					
Spring	SP-14	12/17/2009																									
Spring	SP-14	12/30/2009																									
Spring	SP-14	3/25/2010				0																					
Spring	SP-14	6/28/2010				0																					
Spring	SP-14	7/20/2010	12.3	7.4	1620								160.04		< .03		130.18	< .002	3.59		78.6					14	
Spring	SP-14	11/24/2010				0																					
Spring	SP-14	3/25/2011				0.4																					
Spring	SP-14	6/24/2011				0																					
Spring	SP-14	9/27/2011				0																					
Spring	SP-14	12/9/2011				153																					
Spring	SP-14	3/22/2012				0																					
Spring	SP-14	6/25/2012				0																					
Spring	SP-14	8/20/2012				0																					
Spring	SP-14	11/7/2012				0																					
Spring	SP-14	3/27/2013				0																					
Spring	SP-14	6/4/2013				0																					
Spring	SP-14	9/16/2013				0																					
Spring	SP-14	12/5/2013				0																					
Spring	SP-14	3/7/2014				0																					
Spring	SP-14	6/6/2014				0																					
Spring	SP-14	9/15/2014				0																					
Spring	SP-14	12/1/2014				0																					
Spring	SP-14	3/11/2015				0																					
Spring	SP-14	5/18/2015				0																					
Spring	SP-14	9/1/2015																									
Spring	SP-14	12/1/2015																									
Well	RDA1	6/16/1982					7								0.5			0.57									

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA1	7/26/1982					7.2								0.46			0.53									
Well	RDA1	8/24/1982					7								0.5			0.6									
Well	RDA1	9/21/1982					7.1								0.63			0.57									
Well	RDA1	10/13/1982					7								0.6			0.53									
Well	RDA1	11/29/1982					7.1								0.57			0.49									
Well	RDA1	3/7/1984					7.2								<0.05			0.26									
Well	RDA1	4/18/1984					7.1								0.07			0.35									
Well	RDA1	5/3/1984					7.2		<0.05						<0.05			0.2					581		<1.	139	0.09
Well	RDA1	6/12/1984					7.85										<50.	0.31									
Well	RDA1	7/12/1984					7.4								<0.05			0.15									
Well	RDA1	8/2/1984					7								<0.05			0.21									
Well	RDA1	9/11/1984					7								<0.05			0.14									
Well	RDA1	10/9/1984					7.8								<0.05			0.29									
Well	RDA1	11/5/1984					7.3								<0.05			<0.01									
Well	RDA1	12/6/1984					7.2								<0.05			0.58									
Well	RDA1	1/29/1985					7.5								<0.05			0.4									
Well	RDA1	4/3/1985					7.15								<0.05			0.23									
Well	RDA1	9/3/1985					7.1								<0.05			0.3									
Well	RDA1	12/16/1985					6.7								0.26			0.56									
Well	RDA1	6/25/1986					7.4		<0.05						<0.05			0.21					478		<1.	131	0.02
Well	RDA1	12/18/1986					7.27								<0.05			0.6									
Well	RDA1	5/19/1989											404		<0.02		228	0.39	12		754		522		0	198	
Well	RDA1	6/4/1990							0.15	0.008	0.53	<0.01	411	<0.01	0.03	0.03	168	0.34	10	<0.001	468	0.13	544		0	110	0.61
Well	RDA1	6/6/1991											378		0.44		164	3.04	9		443		526		0	106	
Well	RDA1	5/26/1992											337		<0.02		135	0.23	11		424		538		0	100	
Well	RDA1	9/2/1992											320		<0.02		137	0.13	10		409		562		0	109	
Well	RDA1	6/7/1993											434		0.52		168	1.86	14		517		470		0	103	
Well	RDA1	6/6/1994											405		0.24		160	0.62	13		481		566		0	118	
Well	RDA1	6/6/1995	12.9	7.9	3340								360		<0.1		140	0.4	11		410		710		<5.	96	
Well	RDA1	6/5/2000	13	7.2	3750								368		<0.1		143	0.3	10		364		668		<5.	80	
Well	RDA1	6/8/2001	12.2	7	3640								344		<0.1		132	0.2	10		354		641		<5.	78	
Well	RDA1	6/5/2002	12.4	7.2	4160								348		<0.1		149	0.22	10		422		645		<5.	81	
Well	RDA1	6/2/2004	11.4	7.3	3910								394		< .03		140	0.048	10.4		382		542		< 5.	86	
Well	RDA1	5/12/2005	12.6	7.4	3970								380		< .03		148	0.105	11.2		403					80	
Well	RDA1	7/9/2005																									
Well	RDA1	11/22/2005																									
Well	RDA1	3/6/2006																									
Well	RDA1	6/28/2006	12.9	6.9	3780	0							370		< .03		145	0.561	9.77		346		493		< 5.	76	
Well	RDA1	9/28/2006																									
Well	RDA1	11/20/2006																									
Well	RDA1	3/22/2007																									
Well	RDA1	6/14/2007	12.3	8	3680	0							345		< .03		141	0.024	14.8		390		0		0	67	
Well	RDA1	9/20/2007																									
Well	RDA1	12/10/2007																									
Well	RDA1	3/28/2008																									
Well	RDA1	6/16/2008	14.5	7.1	3260	0							353.69		< .03		138.7	0.366	10.11		333.8		0		0	62	
Well	RDA1	9/20/2008																									
Well	RDA1	12/13/2008																									
Well	RDA1	6/4/2009	14.2	8	3.43	0							366.65		< .03		145	0.431	10.79		342.86		524		> 5.	65	
Well	RDA1	12/14/2009																									
Well	RDA1	12/29/2009																									
Well	RDA1	3/26/2010																									
Well	RDA1	6/24/2010	16.8	6.6	3210	0							365.24		< .03		149.09	0.16	10.64		358.31		548		> 5.	63	
Well	RDA1	7/19/2010																									
Well	RDA1	10/15/2010																									
Well	RDA1	3/29/2011																									
Well	RDA1	6/8/2011	13.4	7	3480	0							366.16		< .03		145.87	0.165	10.36		328.52		0		0	57	
Well	RDA1	9/28/2011																									
Well	RDA1	12/12/2011																									
Well	RDA1	3/16/2012																									
Well	RDA2	6/16/1982					11.8								0.46												
Well	RDA2	7/28/1982					11.5								0.53			0.09									
Well	RDA2	8/24/1982					11.6								0.51			0.1									
Well	RDA2	9/21/1982					11								0.57			0.09									
Well	RDA2	10/13/1982					11.3								0.49			0.1									
Well	RDA2	11/29/1982													0.5			0.12									

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA2	12/9/1982					9.8								0.53			0.1									
Well	RDA2	3/7/1984					7.5								<0.05			0.08									
Well	RDA2	4/18/1984					7.4								0.06			0.02									
Well	RDA2	5/3/1984					7.3		<0.05						<0.05			<0.01					406		<1.	136	0.24
Well	RDA2	6/12/1984					8.1								<0.05			0.02									
Well	RDA2	7/12/1984					7.7								<0.05			0.03									
Well	RDA2	8/2/1984					7.5								<0.05			0.08									
Well	RDA2	9/11/1984					7.4								<0.05			0.05									
Well	RDA2	10/9/1984					7.75								<0.05			0.2									
Well	RDA2	11/5/1984					7.55								<0.05			0.04									
Well	RDA2	12/6/1984					7.45								<0.05			0.31									
Well	RDA2	1/29/1985					7.65								<0.05			0.06									
Well	RDA2	4/3/1985					7.5								<0.05			0.04									
Well	RDA2	9/3/1985					7.3								<0.05			0.17									
Well	RDA2	6/25/1986					7.4		<0.05						<0.05			0.02					412		<1.	152	0.03
Well	RDA2	12/18/1986					7.49								0.05			0.22									
Well	RDA2	5/19/1989											430		<0.02		175	<0.01	12		588		506		0	165	
Well	RDA2	6/4/1990							0.33	0.005	0.57	<0.01	454	<0.01	0.03	<0.02	179	<0.01	9	<0.001	576	<0.01	500		0	142	0.36
Well	RDA2	6/6/1991											498		10.2		193	2.03	10		554		516		0	140	
Well	RDA2	5/26/1992											383		<0.02		150	<0.01	10		700		522		0	118	
Well	RDA2	9/2/1992											384		<0.02		150	0.41	10		519		828		0	144	
Well	RDA2	6/7/1993											450		0.35		170	0.69	12		618		462		0	150	
Well	RDA2	6/6/1994											412		0.08		159	0.07	11		591		540		0	132	
Well	RDA2	6/6/1995	12.2	7.3	2820								340		<0.1		150	<0.1	9		530		770		<5.	128	
Well	RDA2	6/5/2000	13.4	7.4	5400								439		<0.1		180	<0.1	10		631		712		<5.	138	
Well	RDA2	6/8/2001	12.6	7.2	5600								421		<0.1		170	<0.1	10		649		691		<5.	147	
Well	RDA2	6/5/2002	11.8	6.9	4690								403		<0.1		166	<0.05	11		559		691		<5.	125	
Well	RDA2	6/2/2004	12.4	7.3	4820								445		< .03		166	0.011	11.4		570		554		< 5.	122	
Well	RDA2	5/13/2005	11.6	7.6	4850								446		< .03		176	0.017	11.4		622		556		< 5.	103	
Well	RDA2	7/9/2005																									
Well	RDA2	11/22/2005																									
Well	RDA2	3/6/2006																									
Well	RDA2	6/28/2006	12.3	7.2	4610	0							428		< .03		170	0.042	10.8		517		542		< 5.	122	
Well	RDA2	9/28/2006																									
Well	RDA2	11/20/2006																									
Well	RDA2	3/22/2007																									
Well	RDA2	6/14/2007	11	7.8	4540	0							393		< .03		160	0.003	15.7		564		0		0	104	
Well	RDA2	9/20/2007																									
Well	RDA2	12/10/2007																									
Well	RDA2	3/28/2008																									
Well	RDA2	6/16/2008	12.2	7	4130	0							400.15		< .03		158.63	< .002	11.09		510.95		0		0	105	
Well	RDA2	9/20/2008																									
Well	RDA2	12/13/2008																									
Well	RDA2	6/4/2009	14.3		3.89								397.01		< .03		158.23	0.015	11.34		512.09					102	
Well	RDA2	12/14/2009																									
Well	RDA2	12/29/2009																									
Well	RDA2	3/26/2010																									
Well	RDA2	6/24/2010	16.4	6.5	3920	0							388.12		< .03		157.09	0.015	11.67		544.59		541		> 5.	93	
Well	RDA2	7/19/2010																									
Well	RDA2	10/15/2010																									
Well	RDA2	3/29/2011																									
Well	RDA2	6/8/2011	14.2	7.1	4200	0							368.97		< .03		146.67	0.012	11.11		482.16		0		0	90	
Well	RDA2	9/28/2011																									
Well	RDA2	12/12/2011																									
Well	RDA2	3/16/2012																									
Well	RDA2	6/20/2012	13.4	7.2	4370	0							382.96		< .03		157.06	0.027	10.62		513.16		0		0	81	
Well	RDA2	8/20/2012																									
Well	RDA2	11/6/2012																									
Well	RDA2	3/28/2013																									
Well	RDA2	6/4/2013	15.4	7.1	4080	0							374.48		< .03		140.55	0.006	10.83		494.65		525		< 5.	91	
Well	RDA2	9/19/2013																									
Well	RDA2	12/1/2013																									
Well	RDA2	3/19/2014																									
Well	RDA2	6/26/2014	14.2	7	3990	0							320.33		< .03		131.58	0.035	9.18		463.87		0		0	82	
Well	RDA2	9/16/2014																									
Well	RDA2	12/12/2014																									

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA2	3/12/2015																									
Well	RDA2	6/26/2015	11.9	6.9	3930	0							326.6		0.21		138.9	0.251	11.27		437.82		519		< 5.	76	
Well	RDA2	9/22/2015																									
Well	RDA2	12/2/2015																									
Well	RDA3	6/15/1982					7.1								1.14			0.18									
Well	RDA3	7/26/1982					7.3								1.06			0.16									
Well	RDA3	8/13/1982					6.9								1.1			0.19									
Well	RDA3	9/21/1982					7.6								1			0.2									
Well	RDA3	10/13/1982					7.1								1.96			0.17									
Well	RDA3	11/29/1982					7.6								1.62			0.15									
Well	RDA3	12/9/1982					7.9								1.6			0.17									
Well	RDA3	3/7/1984					7.3								<0.05			0.46									
Well	RDA3	4/18/1984					7.1								0.06			0.42									
Well	RDA3	5/3/1984					7		0.14						<0.05			0.45					585		<1.	94	0.03
Well	RDA3	6/12/1984					8								<0.05			0.28									
Well	RDA3	7/12/1984					7.5								<0.05			0.11									
Well	RDA3	8/2/1984					7.2								<0.05			0.34									
Well	RDA3	9/11/1984					7.5								<0.05			0.13									
Well	RDA3	10/9/1984					7.4								<0.05			0.32									
Well	RDA3	11/5/1984					7.5								0.07			0.03									
Well	RDA3	12/6/1984					7.4								0.06			0.48									
Well	RDA3	1/29/1985					7.65								<0.05			0.4									
Well	RDA3	4/3/1985					7.4								<0.05			0.25									
Well	RDA3	9/3/1985					7.2								<0.05			0.14									
Well	RDA3	6/25/1986					7.5		<0.05						<0.05								462		<1.	103	0.02
Well	RDA3	12/18/1986					7.32								<0.05			0.17									
Well	RDA3	5/19/1989											398		<0.02		1300	0.56	16		4474		980		0	1400	
Well	RDA3	6/4/1990							0.49	0.002	1.7	<0.01	493	<0.01	0.31	<0.02	554	0.51	7	<0.001	1410	<0.01	686		0	96	
Well	RDA3	6/5/1991											536		17.3		390	1.18	7		823		584		0	330	
Well	RDA3	5/26/1992											295		<0.02		211	0.41	6		620		518		0	77	
Well	RDA3	9/2/1992											362		0.16		260	0.35	6		438		644		0	93	
Well	RDA3	6/7/1993											515		16.6		276	1.03	6		376		866		0	88	
Well	RDA3	6/6/1994											295		0.49		254	0.2	6		486		615		0	707	
Well	RDA3	6/6/1995	13.1	7.1	7110								229		<0.1		1100	0.3	9		3800		1310		<5.	960	
Well	RDA3	6/5/2000	16	7.1	22700								376		<0.1		1588	0.2	11		5215		1567		<5.	1130	
Well	RDA3	6/8/2001	13.1	7.5	25200								374		<0.1		1605	0.3	10		5475		1481		<5.	1437	
Well	RDA3	6/5/2002	15.8	7	24200								350		<0.1		1539	0.56	10		5115		1637		<5.	1897	
Well	RDA3	6/2/2004	11.6	7.4	5620								359		0.08		352	0.251	5.42		683		620		< 5.	296	
Well	RDA3	5/13/2005	13.1	7.6	14250								398		< .03		694	0.892	9.29		1970					444	
Well	RDA3	7/9/2005																									
Well	RDA3	11/22/2005																									
Well	RDA3	3/6/2006																									
Well	RDA3	6/28/2006	13.1	7.5	5250	0							387		< .03		336	0.665	7.25		532		710		< 5.	238	
Well	RDA3	9/28/2006																									
Well	RDA3	11/20/2006																									
Well	RDA3	3/22/2007																									
Well	RDA3	6/14/2007	12.4	7.8	5220	0							384		0.04		363	0.659	14.31		705		0		0	184	
Well	RDA3	9/20/2007																									
Well	RDA3	12/10/2007																									
Well	RDA3	3/28/2008																									
Well	RDA3	6/16/2008	13.8	7.1	4710	0							389.3		< .03		319.73	0.614	6.45		512.38		0		0	149	
Well	RDA3	9/20/2008																									
Well	RDA3	12/13/2008																									
Well	RDA3	6/4/2009	14.2		4.18								370.66		< .03		307.03	0.521	7.31		505.12					148	
Well	RDA3	12/14/2009																									
Well	RDA3	12/29/2009																									
Well	RDA3	3/26/2010																									
Well	RDA3	6/24/2010	15.2	6.3	4470	0							375.19		< .03		304.52	0.739	6.51		540.64		627		> 5.	138	
Well	RDA3	7/19/2010																									
Well	RDA3	10/15/2010																									
Well	RDA3	3/29/2011																									
Well	RDA3	6/8/2011	13.1	7.2	4950	0							379.61		< .03		338.04	0.325	7.28		665.9		0		0	191	
Well	RDA3	9/28/2011																									
Well	RDA3	12/12/2011																									
Well	RDA3	3/16/2012																									

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA4	6/15/1982					7.3								0.73			0.19									
Well	RDA4	7/26/1982					7.3								0.81			0.18									
Well	RDA4	8/13/1982					7.2								0.8			0.2									
Well	RDA4	9/21/1982					7.2								0.8			0.19									
Well	RDA4	10/13/1982					7.2								0.85			0.15									
Well	RDA4	11/29/1982					7.4								0.87			0.15									
Well	RDA4	12/9/1982					7.4								0.8			0.16									
Well	RDA4	3/7/1984					7.4								<0.05			0.31									
Well	RDA4	4/18/1984					7.2								0.07			0.24									
Well	RDA4	5/3/1984					7.3		0.11						0.05			0.26					695		<1.	295	5.42
Well	RDA4	6/12/1984					8.15								<0.05			0.23									
Well	RDA4	7/12/1984					7.6								0.05			0.06									
Well	RDA4	8/2/1984					7.4								<0.05			0.22									
Well	RDA4	9/11/1984					7.35								<0.05			0.06									
Well	RDA4	10/9/1984					7.45								0.05			0.32									
Well	RDA4	11/5/1984					7.7								<0.05			<0.01									
Well	RDA4	12/6/1984					7.6								0.09			0.24									
Well	RDA4	1/29/1985					7.85								0.07			0.39									
Well	RDA4	4/3/1985					7.6								0.07			0.4									
Well	RDA4	9/3/1985					7.3								0.05			0.06									
Well	RDA4	6/25/1986					7.7		0.1						<0.05			0.02					533		<1.	224	0.44
Well	RDA4	12/18/1986					7.33								0.05			0.15									
Well	RDA4	5/19/1989											436		<0.02		497	0.17	7		1420		560		0	300	
Well	RDA4	6/4/1990							0.29	0.006	1.4	<0.01	503	<0.01	0.09	<0.02	438	0.1	4	<0.001	1090	<0.01	562		0	270	
Well	RDA4	6/5/1991											470		56		356	1.02	6		813		558		0	290	
Well	RDA4	5/26/1992											304		<0.02		321	0.3	5		774		536		0	240	
Well	RDA4	9/2/1992											360		0.17		376	0.3	5		856		642		0	222	
Well	RDA4	6/7/1993											825		14.7		404	1.97	5		730		1220		0	192	
Well	RDA4	6/6/1994											354		0.78		383	0.26	7		946		634		12	238	
Well	RDA4	6/6/1995	14.5	7.5	5060								252		<0.1		310	0.2	5		690		800		<5.	130	
Well	RDA4	6/5/2000	14.3	7.3	4920								314		<0.1		277	0.1	5		573		1109		<5.	125	
Well	RDA4	6/8/2001	12.8	7.2	4780								319		<0.1		261	0.1	5		535		912		<5.	127	
Well	RDA4	6/5/2002	13.4	13.4	5520								320		<0.1		305	0.25	5		671		902		<5.	171	
Well	RDA4	6/2/2004	11.6	7.3	4780								379		0.04		268	0.353	5.45		483		657		< 5.	130	
Well	RDA4	5/13/2005	11.9	7.4	5500								427		< .03		326	0.269	6.18		648					161	
Well	RDA4	7/9/2005																									
Well	RDA4	11/22/2005																									
Well	RDA4	3/6/2006																									
Well	RDA4	6/28/2006	12.4	7.5	4790	0							401		0.07		296	0.366	5.99		487		704		< 5.	143	
Well	RDA4	9/28/2006																									
Well	RDA4	11/20/2006																									
Well	RDA4	3/22/2007																									
Well	RDA4	6/14/2007	11.8	7.8	4870	0							370		0.19		290	0.427	9.94		542		0		0	145	
Well	RDA4	9/20/2007																									
Well	RDA4	12/10/2007																									
Well	RDA4	3/28/2008																									
Well	RDA4	6/16/2008	13.9	7.1	4700	0							400.05		< .03		296.28	0.339	5.9		509.42		0		0	149	
Well	RDA4	9/20/2008																									
Well	RDA4	12/13/2008																									
Well	RDA4	6/4/2009	14.3	8.4	4.88	0							413.98		0.05		326.26	0.383	7.02		568.53		548		> 5.	176	
Well	RDA4	12/14/2009																									
Well	RDA4	12/29/2009																									
Well	RDA4	3/26/2010																									
Well	RDA4	6/24/2010	14.4	6.3	4590	0							407.75		< .03		313.59	0.376	6.85		588.55		569		> 5.	162	
Well	RDA4	7/19/2010																									
Well	RDA4	10/15/2010																									
Well	RDA4	3/29/2011																									
Well	RDA4	6/8/2011	12.5	7	5340	0							393.58		< .03		322.21	0.347	6.9		580.53		0		0	186	
Well	RDA4	9/28/2011																									
Well	RDA4	12/12/2011																									
Well	RDA4	3/16/2012																									
Well	RDA4	6/20/2012	13.5	7.2	6500	0							403.5		0.12		381.79	0.405	6.49		777.78		0		0	228	
Well	RDA4	8/20/2012																									
Well	RDA4	11/6/2012																									
Well	RDA4	3/28/2013																									
Well	RDA4	6/4/2013	15.3	7	5250	0							337.52		0.21		306.94	0.378	7.03		655.61		599		< 5.	186	

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA4	9/19/2013																									
Well	RDA4	12/1/2013																									
Well	RDA4	3/19/2014																									
Well	RDA4	6/26/2014	14.8	7.1	5740	0							322.71		< .03		325.29	0.422	7.13		719.81		0		0	191	
Well	RDA4	9/16/2014																									
Well	RDA4	12/12/2014																									
Well	RDA4	3/12/2015																									
Well	RDA4	6/26/2015	12.2	6.9	5820	0							280.74		< .03		351.47	0.493	8.42		746.71		611		< 5.	203	
Well	RDA4	9/22/2015																									
Well	RDA4	12/2/2015																									
Well	RDA5	6/15/1982					7.6								0.81												
Well	RDA5	7/26/1982					7.6								0.91			0.66									
Well	RDA5	8/13/1982					7.6								0.91			0.6									
Well	RDA5	9/21/1982					7.6								1			0.73									
Well	RDA5	10/13/1982					7.5								1.03			0.74									
Well	RDA5	11/29/1982					7.4								1.1			0.8									
Well	RDA5	12/9/1982					7.5								1.13			0.86									
Well	RDA5	3/7/1984					7.7								0.12			0.5									
Well	RDA5	4/18/1984					7.5								0.19			0.51									
Well	RDA5	5/3/1984					7.5		0.16						0.19			0.59					770		<1.	2910	0.07
Well	RDA5	6/13/1984					8.3								0.09			0.7									
Well	RDA5	7/12/1984					7.8								0.15			0.8									
Well	RDA5	8/2/1984					7.7								0.14			0.59									
Well	RDA5	9/11/1984					7.55								0.12			0.77									
Well	RDA5	10/9/1984					7.7								0.19			0.75									
Well	RDA5	11/5/1984					7.9								0.11			0.29									
Well	RDA5	12/6/1984					7.85								0.21			0.53									
Well	RDA5	1/28/1985					8.1								0.18			0.87									
Well	RDA5	4/3/1985					7.8								0.18			0.6									
Well	RDA5	9/3/1985					7.55								0.18			0.26									
Well	RDA5	6/25/1986					7.85		0.23						0.14			0.33					582		<1.	2160	0.22
Well	RDA5	12/18/1986					7.61	20800							0.17			0.46									
Well	RDA5	5/19/1989											361		<0.02		1100	0.17	7		6275		498		0	1150	
Well	RDA5	6/4/1990							0.36	<0.005	3.2	<0.1	663	<0.1	<0.2	<0.02	1280	0.35	<10.	<0.001	4845	<0.1	499		0	1060	
Well	RDA5	6/5/1991											450		18.9		1000	2.5	<5.		4290		460		0	880	
Well	RDA5	5/26/1992											371		<0.2		766	<0.1	<10.		3490		458		0	850	
Well	RDA5	9/2/1992											403		0.2		861	0.44	<10		4140		588		0	708	
Well	RDA5	6/7/1993											392		4.94		695	2.6	4		3215		0		88	633	
Well	RDA5	6/6/1994											355		0.5		625	0.08	<1		2941		456		20	478	
Well	RDA5	6/6/1995	13.8	7.1	20200								236		<0.1		570	<0.1	3		2900		570		<5.	350	
Well	RDA5	6/5/2000	13.6	7	10760								363		<0.1		438	<0.1	3		2202		518		<5.	186	
Well	RDA5	6/8/2001	12.6	7.1	10320								364		<0.1		408	<0.1	2		1928		514		<5.	213	
Well	RDA5	6/5/2002	12.8	7.1	10020								349		<0.1		397	<0.05	3		1788		519		<5.	181	
Well	RDA5	6/2/2004	11.7	7.6	9130								397		< .03		377	0.011	3.16		1700		425		< 5.	161	
Well	RDA5	5/13/2005	11.9	7.8	10140								415		< .03		391	< .002	2.56		1720					203	
Well	RDA5	7/9/2005																									
Well	RDA5	11/22/2005																									
Well	RDA5	3/6/2006																									
Well	RDA5	6/28/2006	12.7	7.8	10880	0							406		< .03		470	0.033	3.38		1910		416		< 5.	285	
Well	RDA5	9/28/2006																									
Well	RDA5	11/20/2006																									
Well	RDA5	3/22/2007																									
Well	RDA5	6/14/2007	11.8	8	9570	0							387		0.24		396	0.021	9.61		1840		0		0	177	
Well	RDA5	9/20/2007																									
Well	RDA5	12/10/2007																									
Well	RDA5	3/28/2008																									
Well	RDA5	6/16/2008	14.1	7.3	8180	0							423.04		< .03		373.09	0.019	3.54		1305.2		0		0	166	
Well	RDA5	9/20/2008																									
Well	RDA5	12/13/2008																									
Well	RDA5	6/4/2009	14.4	7.4	7.49	0							433.22		< .03		356.71	0.129	5.39		1457		555		> 5.	233	
Well	RDA5	12/14/2009																									
Well	RDA5	3/26/2010																									
Well	RDA5	6/24/2010	15	6.1	7530	0							426.59		< .03		355.52	0.005	3.5		1580		572		> 5.	245	
Well	RDA5	7/19/2010																									
Well	RDA5	10/15/2010																									

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA5	3/29/2011																									
Well	RDA5	6/8/2011	12.2	7.5	8660	0							438.04		< .03		357.4	0.006	3.73		1486		0		0	244	
Well	RDA5	9/28/2011																									
Well	RDA5	12/12/2011																									
Well	RDA5	3/16/2012																									
Well	RDA6	6/15/1982					8.3								0.46			0.12									
Well	RDA6	7/26/1982					8.2								0.44			0.11									
Well	RDA6	8/13/1982					8.2								0.41			0.09									
Well	RDA6	9/21/1982					7.9								0.5			0.07									
Well	RDA6	10/13/1982					7.8								0.53			0.09									
Well	RDA6	11/29/1982					7.6								0.66			0.1									
Well	RDA6	12/9/1982					7.6								0.6			0.1									
Well	RDA6	3/7/1984					8								<0.05			0.05									
Well	RDA6	4/18/1984					7.6								<0.05			0.11									
Well	RDA6	5/3/1984					7.6		0.12						<0.05			0.14					231		<1.	310	5.43
Well	RDA6	6/12/1984					8.3								<0.05			0.04									
Well	RDA6	7/12/1984					7.8								0.06			0.17									
Well	RDA6	8/2/1984					7.8								<0.05			0.15									
Well	RDA6	9/11/1984					7.7								0.05			0.15									
Well	RDA6	10/9/1984					7.8								<0.05			0.19									
Well	RDA6	11/5/1984					7.95								0.07			<0.01									
Well	RDA6	12/6/1984					7.8								0.08			0.18									
Well	RDA6	1/29/1985					8.1								<0.05			0.06									
Well	RDA6	4/3/1985					7.95								<0.05			0.04									
Well	RDA6	9/3/1985					7.7								0.05			0.04									
Well	RDA6	6/25/1986					7.8		0.06						0.08			0.04					495		<1.	1124	4.25
Well	RDA6	12/18/1986					7.62	14000							0.11			0.09									
Well	RDA6	5/19/1989											445		<0.02		690	<0.01	13		2940		400		0	550	
Well	RDA6	6/4/1990							0.45	0.016	1.7	<0.1	435	<0.1	1.6	0.04	1260	<0.1	20	0.3	5951	<0.1	728		0	1100	
Well	RDA6	6/5/1991											440		6		960	0.49	15		4303		588		0	920	
Well	RDA6	5/26/1992											393		<0.2		843	0.17	13		3620		518		24	900	
Well	RDA6	9/2/1992											419		<0.2		738	<0.1	11		3290		503		0	750	
Well	RDA6	6/7/1993											515		4.5		1520	0.7	20		7550		830		0	1280	
Well	RDA6	6/6/1994											342		0.2		795	<0.01	10		3595		762		0	1010	
Well	RDA6	6/6/1995	13.3	7	9790								221		<0.1		1100	<0.1	13		5400		900		10	830	
Well	RDA6	6/5/2000	13.3	7	33400								349		<0.1		1593	0.1	19		9110		1289		<5	1217	
Well	RDA6	6/8/2001	14.1	7.2	35200								352		<0.1		1690	<0.1	18		9780		1317		<5	1545	
Well	RDA6	6/5/2002	13.1	6.9	42800								353		<0.1		2169	0.14	20		11840		1462		<5	1894	
Well	RDA6	6/2/2004	12.3	7.5	4560								446		< .03		2290	0.308	18.1		13100		1179		< 5	1943	
Well	RDA6	5/13/2005	12.2	7.7	48300								444		< .03		2650	0.387	22.3		15100					1719	
Well	RDA6	7/9/2005																									
Well	RDA6	11/22/2005																									
Well	RDA6	3/6/2006																									
Well	RDA6	6/28/2006	12.7	7.7	36900	0							428		2.38		2090	0.36	35.4		12100		1062		< 5.	1728	
Well	RDA6	9/28/2006																									
Well	RDA6	11/20/2006																									
Well	RDA6	3/22/2007																									
Well	RDA6	6/14/2007	11.4	7.8	4130	0							417		0.11		1920	0.283	33.4		12100		0		0	1493	
Well	RDA6	9/20/2007																									
Well	RDA6	12/10/2007																									
Well	RDA6	3/28/2008																									
Well	RDA6	6/16/2008	15	7.2	20000	0							397.4		< .03		799.13	0.161	11.15		5009.9		0		0	576	
Well	RDA6	9/20/2008																									
Well	RDA6	12/13/2008																									
Well	RDA6	12/14/2009																									
Well	RDA6	12/29/2009																									
Well	RDA6	3/24/2010																									
Well	RDA6	6/24/2010																									
Well	RDA6	7/19/2010																									
Well	RDA6	10/15/2010																									
Well	RDA6	3/29/2011																									
Well	RDA6	6/8/2011																									
Well	RDA6	9/28/2011																									
Well	RDA6	12/12/2011																									
Well	RDA6	3/16/2012																									
Well	RDA6	6/20/2012																									

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	RDA6	8/20/2012																									
Well	RDA6	11/6/2012																									
Well	RDA6	3/28/2013																									
Well	RDA6	6/4/2013																									
Well	RDA6	9/19/2013																									
Well	RDA6	12/1/2013																									
Well	RDA6	3/19/2014																									
Well	RDA6	6/26/2014																									
Well	RDA6	9/16/2014																									
Well	RDA6	12/12/2014																									
Well	RDA6	3/12/2015																									
Well	RDA6	6/26/2015	12.4	6.8	3650	0							278.24		0.15		1079.6	0.464	22.82		10585		995		< 5.	1368	
Well	RDA6	9/22/2015																									
Well	RDA6	12/2/2015																									
Well	SM1-1	4/23/1982					8.4		1		0.3		46		0		95		45		2013	0.03	683	0	0	281	5.3
Well	SM1-1	11/17/1982					7.5				0.1		950		0.29		30		25		899	0.027	472	0	0	475	0.09
Well	SM1-1	2/15/1983					7.3		0.39		0.1		500		0.03		218		30		350	0.04	320	0	0	63	0.07
Well	SM1-1	6/28/1983					7.6		0.3		1.8	0.13	416	0.08	0.14		815	0.4	400		3350	0.16	559	0	0	540	59.3
Well	SM1-1	8/29/1983									0.78	0.08	396	0.03	0.07		452	0.05	31	0.02	4985	0.04	168	0	0	738	20.1
Well	SM1-1	11/7/1983									0.72	0.07	448	0.05	0.32		841		38	0.007	5655	0.18	508	0	0	775	23
Well	SM1-1	2/21/1984					7.9			0.002	0.97	0.16	396	0.05	0.17	0.84	1568	0.36	34	0.04	5700	0.16	676	0	0	950	0.25
Well	SM1-1	5/3/1984							0.17														1307		<1.	960	1.5
Well	SM1-1	8/2/1984							0.51														1129		<1.	1060	1.25
Well	SM1-1	11/19/1984							<0.05														1098		<1.	2600	0.15
Well	SM1-1	2/26/1985							0.11														1154		<1.	1220	0.14
Well	SM1-1	5/8/1985							<0.05														1174		<1.	1990	0.1
Well	SM1-1	8/14/1985							0.6														1311		<1.	1080	0.22
Well	SM1-1	11/21/1985							<0.05														1240		<1.	1800	1.01
Well	SM1-1	6/30/1986							0.17														895		<1.	760	4.07
Well	SM1-1	12/23/1986							<0.5														1354			1140	33.8
Well	SM1-1	5/18/1989											360		<0.02		652	0.27	48		3773		308		0	700	
Well	SM1-1	9/12/1989											449		0.02		1100	1.33	54		4900		800		0	650	
Well	SM1-1	6/4/1990							1.31	0.007	0.8	<0.1	685	<0.1	1.8	<0.02	1060	0.48		0.12	4550	0.01	687		0	1200	53.8
Well	SM1-1	9/19/1990											457		0.73		773	0.91	37		4670		936		0	750	
Well	SM1-1	9/24/1991											377		<0.4		685	0.03	35		4283		488		0	589	
Well	SM1-1	5/26/1992											400		130		408	12.6	6		4680		528		0	1000	
Well	SM1-1	9/2/1992											430		<0.2		752	<0.1	40		6600		2280		0	850	
Well	SM1-1	9/8/1993											460		2.9		1780	0.4	26		5870		1000		0	680	
Well	SM1-1	6/6/1994											260		0.5		1200	0.05	24		4280		840		0	505	
Well	SM1-1	6/6/1995	9	7.2	9090								241		<0.1		890	<0.1	33		5900		1100		10	720	
Well	SM1-1	9/6/1995	17	6.7	2410								398		<0.1		1086	<0.1	41		7200		975		<5.	632	
Well	SM1-1	6/13/2000	14.3	6.7	38600								332		<0.1		2695	<0.1	29		8520		1684		<5.	901	
Well	SM1-1	6/5/2001	11.2	6.7	38900								383		<0.1		3106	<0.1	34		8800		1751		<5.	1306	
Well	SM1-1	9/5/2001	16.6	7.1	33100								336		<0.1		2502	0.07	30		7750		1601		<5.	1052.7	
Well	SM1-1	6/5/2002	10.6	6.7	3690								236		<0.1		185	<0.05	5		400		519		<5.	58	
Well	SM1-1	6/24/2002	15.4	6.5	32900								410		<0.1		2510	0.28	34		7790		267		<5.	1122	
Well	SM1-1	9/24/2002																									
Well	SM1-1	12/26/2002																									
Well	SM1-1	3/13/2003																									
Well	SM1-1	9/17/2003	15.7	7.5	29.9								439		5.5		2310	2.46	46.3		7510		9629		< 5.	979	
Well	SM1-1	12/22/2003																									
Well	SM1-1	3/18/2004																									
Well	SM1-1	6/23/2004																									
Well	SM1-1	9/25/2004																									
Well	SM1-1	12/27/2004																									
Well	SM1-1	3/25/2005																									
Well	SM1-1	5/12/2005																									
Well	SM1-1	7/20/2005																									
Well	SM1-1	11/17/2005																									
Well	SM1-1	3/7/2006																									
Well	SM1-1	6/28/2006																									
Well	SM1-1	9/28/2006																									
Well	SM1-1	11/27/2006																									
Well	SM1-1	3/22/2007																									
Well	SM1-1	6/14/2007																									

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	SM1-1	9/18/2007																									
Well	SM1-1	12/10/2007																									
Well	SM1-1	3/20/2008																									
Well	SM1-1	6/24/2008																									
Well	SM1-1	9/20/2008																									
Well	SM1-1	12/13/2008																									
Well	SM1-1	2/20/2009																									
Well	SM1-1	12/14/2009																									
Well	SM1-1	12/29/2009																									
Well	SM1-1	3/26/2010																									
Well	SM1-1	6/21/2010	13.7	6.5	34000	0							345.12		1.82		2575.6	0.308	37.47		7359.6		1244		> 5.	1307	
Well	SM1-1	7/20/2010	18.3	6.7	34300	0							424.14		0.38		3448.4	0.237	55.03		10052		0		0	1603	
Well	SM1-1	11/5/2010																									
Well	SM1-1	3/29/2011																									
Well	SM1-1	6/21/2011																									
Well	SM1-1	9/27/2011																									
Well	SM1-1	12/13/2011																									
Well	SM1-1	3/15/2012																									
Well	SM1-2	4/28/1982					10.5		0.5		0.1		53				149		27		1033	0.01	408	0		210	3.3
Well	SM1-2	8/30/1982					7.1		2.1		0.3		210				137		15		233	0.04	550	0		56	0.7
Well	SM1-2	11/17/1982					7.1		2.0		0.32		450		0.6		130		17		400	0.04	547	0		76	0.7
Well	SM1-2	2/15/1983					7.3		1.95		0.21		220		0.6		140		14		250	0.04	500	0		57	0.7
Well	SM1-3	5/26/1983					7.2		0.11		0.29		180		5.9		207	1.4	13.3		470	0.03		0	0	86	0.36
Well	SM1-3	6/28/1983					7.6				1.6	0.01	196		0.8		197		110	0.004	520	0.05	640	0	0	79	1.7
Well	SM1-2	8/29/1983									0.9	0.01	130	0.05	0.2		125	0.8	9	0.05	346	0.016	593	0		44	1.9
Well	SM1-2	11/7/1983									0.46	0.008	236		0.33		326	1.7	13	0.004	440	0.04	612	0		60	0.29
Well	SM1-2	2/21/1984					7.2		0.23		0.73	0.05	416	0.03	0.5	0.36	890	2.3	15	0.02	872	0.097	671	0		163	0.25
Well	SM1-2	5/3/1984							0.17														782		<1.	154	0.19
Well	SM1-2	8/2/1984							0.23														359		<1.	51	0.08
Well	SM1-2	11/19/1984							<0.05														587		<1.	150	0.05
Well	SM1-2	2/26/1985							<0.05														643		<1.	160	0.04
Well	SM1-2	5/8/1985							<0.05														514		<1.	93	0.02
Well	SM1-2	8/14/1985							<0.05														611		<1.	120	0.02
Well	SM1-2	11/21/1985							<0.05														559		<1.	194	<0.01
Well	SM1-2	6/30/1986							0.09														538		<1.	72	0.15
Well	SM1-2	12/23/1986							<0.5														695		0	143	1.35
Well	SM1-2	4/2/1987							0.52	0.001	0.36	0.005	411	0.01	0.07	0.02	720	1.8	13	0.002	921	0.16	553	0		168	0.69
Well	SM1-2	6/1/1987							0.37	0.002	0.31	0.005	267	0.01		0.02	321	1.34	12	0.001	1042	0.02	524	0		170	1.01
Well	SM1-2	9/17/1987							0.4	0.001	0.58	0.005	498	0.01		0.02	890	5.4	21	0.002	977	0.05	704	0		159	1.07
Well	SM1-2	12/15/1987							0.06	0.001	0.19	0.005	143	0.01		0.02	182	2.24	10	0.002	580	0.14	350	0		74	0.94
Well	SM1-2	3/21/1988							1.96	0.001	0.57	0.005	505	0.01		0.02	1060	4.85	27	0.01	2470	0.05	719	0		297	21.94
Well	SM1-2	6/10/1988					7.8				0.39		113				182	1.35	13		802		443	0		68	3.88
Well	SM1-2	9/22/1988					7.4		3.81	0.004	0.61	0.005	460	0.01		0.02	920	3.16	18	0.001	984	0.05	718	0		138	6.37
Well	SM1-2	9/8/1993											105		0.04		94	0.03	11		319		370		0	46	
Well	SM1-2	6/6/1994											90		0.1		144	0.1	95		410		2640		0	240	
Well	SM1-2	9/6/1995	21.1	7.8	1590								105		1.2		83	0.1	8		342		480		25	21	
Well	SM1-2	6/13/2000	18	6.9	2420								100		0.6		120	0.3	10		266		510		<5.	22	
Well	SM1-2	6/5/2001	17.3	7.1	2030								78		<0.1		95	<0.1	12		231		551		<5.	25	
Well	SM1-2	6/30/2003																									
Well	SM1-2	6/23/2004																									
Well	SM1-2	5/11/2005																									
Well	SM1-2	7/20/2005																									
Well	SM1-2	11/22/2005																									
Well	SM1-2	3/9/2006																									
Well	SM1-2	6/28/2006																									
Well	SM1-2	9/28/2006																									
Well	SM1-2	11/27/2006																									
Well	SM1-2	3/22/2007																									
Well	SM1-2	6/15/2007																									
Well	SM1-2	9/18/2007																									
Well	SM1-2	12/10/2007																									
Well	SM1-2	3/20/2008																									
Well	SM1-2	6/24/2008																									
Well	SM1-2	9/20/2008																									
Well	SM1-2	12/13/2008																									

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	SM1-2	2/20/2009																									
Well	SM1-2	6/4/2009																									
Well	SM1-2	12/14/2009																									
Well	SM1-2	12/29/2009																									
Well	SM1-2	3/24/2010																									
Well	SM1-2	6/22/2010																									
Well	SM1-2	7/20/2010																									
Well	SM1-2	11/24/2010																									
Well	SM1-2	3/25/2011																									
Well	SM1-2	6/8/2011																									
Well	SM1-2	9/22/2011																									
Well	SM1-2	12/12/2011																									
Well	SM1-2	3/15/2012																									
Well	SM1-3	2/15/1982					8.3		7.2		0.3		570		3.1		200		59		3100	0.04	240	0	0	11	4.1
Well	SM1-3	4/30/1982					9.2		1.6		0.3		43				95	0.29	58		2139	0.02	840	0	301	840	2.2
Well	SM1-3	8/30/1982					8.3		9.9		0.3		562				233		60		3580	0.03	240	0	0	13	5.4
Well	SM1-3	11/17/1982					7.8		8.7		0.3		600		3		240		69		3650	0.03	402	0	0	1370	4.7
Well	SM1-2	5/26/1983					8.0		3.6		0.3	0.04	400		6.2		1702	0.59	59	0.01	12000	0.063		0		1137	32.6
Well	SM1-2	6/28/1983					8.0				0.95	0.29	436	0.14	0.27		1868		780		8650	0.17	605	0		1196	97
Well	SM1-3	8/29/1983									0.62	0.21	456	0.14	0.2		2142		47	0.013	7750	0.1	544	0	0	1480	39
Well	SM1-3	11/7/1983									0.38	0.14	492	0.14	0.3		907	0.69	63	0.006	11000	0.32	616	0	0	1300	11
Well	SM1-3	2/21/1984					8.0		0.4		0.5	0.3	440	0.1	0.32	1.4	1739		55	0.04	12000	0.32	596	0	0	1520	9.8
Well	SM1-3	5/3/1984							0.16	0.004	0.18	0.21	432	0.14	0.19	1.9	2290	0.36	106		13000	0.25	560	0	0	1610	27.5
Well	SM1-3	8/2/1984							0.19		0.56	0.07	452	0.08	0.08	0.6	2381	0.43	47	0.04	12000	0.126	620	0	0	1900	9.8
Well	SM1-3	11/19/1984									0.63	0.066	220		0.2	0.43	2440	0.74	45		13000	0.113	635	0	0	1550	11
Well	SM1-3	2/26/1985							0.13		0.52	0.13	440		0.21	0.55	2446	0.78	75		13000	0.086	617	0	0	1870	10.3
Well	SM1-3	5/3/1984							0.16														683		<1.	1610	27.5
Well	SM1-3	8/2/1984							0.19														620		<1.	1900	9.8
Well	SM1-3	11/19/1984							<0.05														635		<1.	1550	11
Well	SM1-3	2/26/1985							0.13														617		<1.	1870	10.3
Well	SM1-3	5/8/1985							<0.05														596		<1.	1836	10
Well	SM1-3	8/14/1985							0.13														667		<1.	1500	6.5
Well	SM1-3	11/21/1985							0.1														675		<1.	2870	3.25
Well	SM1-3	6/30/1986							0.23														679		<1.	1220	7.23
Well	SM1-3	12/23/1986							<0.5														720			1376	36.82
Well	SM1-3	5/18/1989											414		<0.02		2110	2.75	69		11650		690		0	1200	
Well	SM1-3	9/11/1989											505		0.02		2250	3.41	100		14200		680		0	980	
Well	SM1-3	6/4/1990							0.78	0.032	<2.	<1.	479	<1.	<2.	<0.02	2222	5	95	0.12	12380	<1.	712		0	168	133.99
Well	SM1-3	9/19/1990											863		<0.02		2130	4.03	74		13500		676		0	1200	
Well	SM1-3	6/10/1991											440		70		2370	4.7	90		13800		652		0	1200	
Well	SM1-3	9/24/1991											<1.		<0.4		2238	6.48	73		12918		634		0	1189	
Well	SM1-3	5/26/1992											442		<0.2		2140	5.51	61		14400		636		0	1160	
Well	SM1-3	9/2/1992											524		6.72		2240	6.64	77		12400		580		0	1368	
Well	SM1-3	6/7/1993											490		25.4		2350	6	70		13200		604		0	1400	
Well	SM1-3	9/8/1993											430		3.2		2130	6.3	72		12000		588		0	1366	
Well	SM1-3	6/6/1994											430		7.9		2100	5.14	60		12000		918		0	1200	
Well	SM1-3	9/7/1994	14.6	6.8	84500								460		0.86		2180	5.06	86		12300		560		0	1260	
Well	SM1-3	6/6/1995	9.3	7	52500								237		2.2		2000	1.8	61		12000		730		<5.	1120	
Well	SM1-3	9/6/1995	15.2	6.6	90200								412		22.5		2060	3.7	77		13500		675		<5.	1193	
Well	SM1-3	6/13/2000	14.2	6.7	44200								342		0.5		2077	0.8	59		11920		931		<5.	1260	
Well	SM1-3	6/5/2001	12.7	6.9	43300								413		22.2		1938	2.6	59		12100		824		<5.	1290	
Well	SM1-3	9/5/2001	17.5	7.2	43910								385		30.2		2021	3.1	62		12600		699		<5.	1292.3	
Well	SM1-3	6/24/2002	16.1	6.8	42400								406		10.4		2080	2.74	63		12100		1021		<5.	1266	
Well	SM1-3	9/24/2002	16.4	6.7	43100								402		11.6		2000	3.93	68		12020		780		<5.	1045	
Well	SM1-3	9/16/2003	18.4	6.7	55400								458		35.8		3500	10.2	92.2		16600		723		< 5.	1852	
Well	SM1-3	6/18/2004	12.5	6.7	52300								454		0.65		3040	0.088	68		14600		574		< 5.	1370	
Well	SM1-3	5/11/2005	9.9	7.1	61500								491		< .03		5250	8.6	87.5		19300					2998	
Well	SM1-3	7/20/2005	17.2	7	61500								505		2.51		4980	6.5	115		17600					2723	
Well	SM1-3	6/28/2006	16	7.1	58100								493		12.8		4620	7.94	96.7		16100		670		< 5.	2200	
Well	SM1-3	9/28/2006	21.1	8	57800	0							475.12		< .03		4313.8	8.209	72.56		17002		758		< 5.	1412	
Well	SM1-3	11/27/2006																									
Well	SM1-3	3/22/2007																									
Well	SM1-3	6/13/2007	14	7.4	5940	0							480		8.7		4670	11.9	91.7		18700		0		0	2300	
Well	SM1-3	9/18/2007	8.5	7.3	5950	0							630		113		6250	19.6	292		22900		0		0	2440	
Well	SM1-3	12/10/2007																									
Well	SM1-3	3/20/2008																									

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	SM1-3	6/16/2008	12.3	6.8	5340	0							486.16		72.79		4241.7	13.479	84.01		15908		0		0	2149	
Well	SM1-3	9/18/2008	20.9	8	5140	0							464.93		170.66		4231.2	12.915	93.36		16138		374		< 5.	2026	
Well	SM1-3	12/13/2008																									
Well	SM1-3	2/19/2009																									
Well	SM1-3	6/5/2009	14.4	7.1	7.49	0							473.38		225.22		4168.7	10.287	111.64		15936		0		> 5.	1992	
Well	SM1-3	7/14/2009	15.3	7.4	4810	0							470.55		159.76		3950.2	10.859	76.25		16896		0		0	1584	
Well	SM1-3	12/29/2009																									
Well	SM1-3	3/26/2010																									
Well	SM1-3	6/21/2010	18	6	47200	0							471.44		243.86		3743.1	11.892	87.29		17016		276		> 5.	1745	
Well	SM1-3	7/19/2010	20	6.1	47000	0							396.86		< .03		334.34	0.804	41.89		4356.3		0		0	820	
Well	SM1-3	10/14/2010																									
Well	SM1-3	3/25/2011	9	6.6	52300	0							469.36		258.23		3440.6	11.441	74.05		16171		0		0	1784	
Well	SM1-3	6/8/2011	17.2	6.2	52100	0							483		298.26		3396.3	11.883	80.05		15720		0		0	1717	
Well	SM1-3	9/22/2011	19.2	6.2	44600	0							431.29		286.75		2944.2	11.774	78.44		14847		0		0	1742	
Well	SM1-3	12/13/2011	8.6	7.1	46700	0							448.76		332.51		2993.3	12.409	87.46		15473		0		0	1589	
Well	SM1-3	3/15/2012	8.4	7.2	49400	0							465.04		400.34		2992.3	13.43	70.43		15110		0		0	1621	
Well	SM1-3	6/20/2012	15.8	7.2	47800	0							475.13		172.88		3107.1	10.155	68.79		14768		0		0	1609	
Well	SM1-3	8/20/2012	21	7.1	49400	0							494.69		144.35		3189.9	10.356	74.4		15290		0		0	1613	
Well	SM1-3	11/7/2012	11	6.9	46400	8.5							489.83		369.28		2862.7	13.716	128.66		15801		165		5	1692	
Well	SM1-3	3/21/2013	9.6	7.1	47800	0							471.94		469.37		2829.3	13.831	77.18		14305		138		5	1642	
Well	SM1-3	6/4/2013	18.6	7	47300	0							470.74		348.3		2775.5	11.785	96.67		15070		262		< 5.	1516	
Well	SM1-3	9/24/2013	12.6	7	5080								429.74		271.34		2415.5	10.896	70.13		13507					1483	
Well	SM1-3	12/17/2013	9.5	7.1	57100	0							413.55		245.95		3308.3	11.755	75.75		16137		0		0	2221	
Well	SM1-3	3/14/2014	9.5	7.1	61100	0							474.99		122.94		4711.8	15.649	84.09		19242		0		0	2512	
Well	SM1-3	6/26/2014	16.2	6.9	61100	0							467.5		148.36		4482.5	17.24	70.96		19791		0		0	2527	
Well	SM1-3	9/19/2014																									
Well	SM1-3	12/11/2014																									
Well	SM1-3	3/16/2015																									
Well	SM1-3	6/8/2015	13.2	7.2	14210	0							90.53		4.5		268.34	1.275	18.73		1027.1		302		< 5.	154	
Well	SM1-3	9/29/2015	16	7.1	31400	0							316.07		0.06		1307.7	5.87	46.67		6448.4		465		< 5.	841	
Well	SM1-3	12/29/2015	7.9	7	37600	0							397.31		75.31		2009.6	11.671	52.18		9221.9		90		< 5.	1177	
Well	SM1-4	4/28/1982					8.5		4.3		0.2		58				84		17		847	0.02	1680	0	0	91	4.9
Well	SM1-4	8/30/1982					7.3		3.9		0.2		383				174		15		348	0.03	437	0	0	68	3.0
Well	SM1-4	11/29/1982					7.3		3.8		0.19		300		0.6		166		14		250	0.036	510	0	0	52.5	1.99
Well	SM1-4	2/15/1983					7.6		3.0		0.21		390		0.7		220		13		310	0.04	420	0	0	61	1.7
Well	SM1-4	6/28/1983					8.0				1.8	0.01	238		0.12		182		7		346	0.1	435	0	0	61	0.8
Well	SM1-4	8/29/1983									0.6	0.022	304	0.02	0.06		228		9	0.013	568	0.009	383	0	0	52	0.8
Well	SM1-4	11/7/1983									0.8	0.008	304		0.19		226	0.1	10	0.007	388	0.032	374	0	0	40	0.42
Well	SM1-4	2/21/1984					7.4		0.12		0.5	0.025	280		0.19	0.2	236		6	0.01	371	0.04	331	0	0	54	2.0
Well	SM1-4	8/2/1984							0.62														362		<1.	47	0.04
Well	SM1-4	11/19/1984							<0.05														332		<1.	42	0.04
Well	SM1-4	2/26/1985							<0.05														299		<1.	36	0.04
Well	SM1-4	5/8/1985							<0.05														310		<1.	43	0.02
Well	SM1-4	8/14/1985							<0.05														349		<1.	40	0.05
Well	SM1-4	11/21/1985							<0.05														329		<1.	77	0.98
Well	SM1-4	6/30/1986							0.1														349		<1.	50	0.06
Well	SM1-4	12/23/1986							<0.5														326			36.5	0.16
Well	SM1-4	5/26/1989											247		0.02		203	0.04	13		748		284		0	63	
Well	SM1-4	9/11/1989											270		0.02		229	0.03	10		408		338		0	60	
Well	SM1-4	6/8/1990							0.16	0.005	0.28	<0.01	314	<0.01	0.18	<0.02	225	<0.01	5	0.028	466	<0.01	355		0	65	8.01
Well	SM1-4	6/10/1991											363		<0.02		214	0.37	5		433		344		0	60	
Well	SM1-4	5/26/1992											212		<0.02		173	<0.01	6		455		366		0	51	
Well	SM1-4	9/2/1992											296		<0.02		218	<0.01	6		483		758		0	54	
Well	SM1-4	6/7/1993											294		5.59		196	1.05	6		443		372		0	48	
Well	SM1-4	6/6/1994											259		0.2		219	<0.01	6		427		450		24	63	
Well	SM1-4	9/7/1994	18.2	7.4	4160								284		0.1		228	<0.01	7		562		412		0	69	
Well	SM1-4	6/6/1995	15.8	7.3	2820								178		<0.1		160	<0.1	5		380		510		20	60	
Well	SM1-4	9/6/1995	17.1	7.5	2690								149		0.7		168	0.2	7		814		455		<5.	30	
Well	SM1-4	6/5/2000	10.6	7.4	3100								207		<0.1		156	<0.1	5		328		568		<5.	30	
Well	SM1-4	6/4/2001	9.9	6.8	3620								234		<0.1		173	<0.1	5		388		495		<5.	50	
Well	SM1-4	9/23/2002	15.4	6.4	3600								206		<0.1		174	0.29	7		425		627		<5.	37	
Well	SM1-4	9/18/2003																									
Well	SM1-4	6/18/2004	11.7	7.7	4760								320		< .03		226	0.002	6.28		530		493		< 5.	55	
Well	SM1-4	9/25/2004																									
Well	SM1-4	5/23/2005	10.8	7.6	4680								324		< .03		244	0.035	5.29		472					59	

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l
Well	SM1-4	7/20/2005	16.9	7.5	4340								272		< .03		208	< .002	6.36		447					57	
Well	SM1-4	6/28/2006	11.1	7.8	4200								311		0.05		247	0.031	5.6		441		563		< 5.	71	
Well	SM1-4	9/28/2006	19.4	7.9	3880	0							292.73		< .03		213.68	0.038	7.23		402.29		440		< 5.	81	
Well	SM1-4	11/27/2006																									
Well	SM1-4	3/22/2007																									
Well	SM1-4	6/14/2007	8.5	8.4	3400	0							255		0.04		184	0.023	7.2		353		0		0	34	
Well	SM1-4	9/18/2007	12.6	7.8	3680	0							302		< .03		201	0.015	6.62		360		0		0	44	
Well	SM1-4	12/11/2007																									
Well	SM1-4	3/28/2008																									
Well	SM1-4	6/16/2008	10.4	7.1	4260	0							383.5		0.18		269.74	0.035	6.26		475.34		0		0	69	
Well	SM1-4	9/18/2008	20.7	7.8	3330	0							283.28		< .03		183.38	0.022	7.1		404.71		439		< 5.	41	
Well	SM1-4	12/11/2008																									
Well	SM1-4	2/19/2009																									
Well	SM1-4	6/3/2009																									
Well	SM1-4	7/15/2009	15.3	7.4	2780	0							230.04		0.03		151.05	0.008	5.59		369.47		0		0	30	
Well	SM1-4	12/29/2009																									
Well	SM1-4	3/26/2010																									
Well	SM1-4	6/21/2010	10.3	7	3210	0							278.53		< .03		182.65	0.002	5.22		373.88		409		> 5.	43	
Well	SM1-4	7/19/2010	14.3	7.8	2960	0							232.29		< .03		153.47	0.009	5.57		360.95		0		0	39	
Well	SM1-4	10/14/2010																									
Well	SM1-4	3/25/2011	9.5	7.7	4650	0							315.49		0.07		222.66	0.344	5.98		472.97		0		0	55	
Well	SM1-4	6/8/2011	12.7	7.4	4720	0							307.09		< .03		207.57	0.003	6.15		445.05		0		0	48	
Well	SM1-4	9/27/2011	11.9	6.5	3820	0							233.84		< .03		165.66	0.471	8.11		424.49		0		0	47	
Well	SM1-4	12/13/2011	10.8	7.1	4750	0							228.46		0.04		168.85	0.326	6.1		423.32		0		0	41	
Well	SM1-4	3/15/2012	7.8	7.2	4440	0							277.33		0.05		192.93	0.013	5.13		372.37		0		0	39	
	Number of Observations:		176	175	177	316	160	2	61	16	52	27	291	19	221	16	292	353	286	25	292	45	323	64	168	339	95
	Maximum:		21.1	13.4	90200	1696	11.8	20800	9.9	0.032	3.20	0.300	950	0.14	469.37	1.90	6250	19.60	780.0	0.30	22900	0.3	9629	0.0	301	2998	134.0
	Minimum:		0.4	6.0	3	0.0	6.7	14000	0.1	0.001	0.10	0.005	43	0.01	0.00	0.02	30	0.00	0.9	0.00	27	0.0	0	0.0	0.0	3	0.02
	Mean:		13.4	7.2	15167	21.5	7.7	17400	1.2	0.006	0.64	0.077	353.6	0.06	25.26	0.40	950.0	1.53	30.6	0.03	4285	0.1	552.2	0.0	3.3	601	8.58
	Standard Deviation:		3.4	0.7	19810	120.3	0.8	4808	2.0	0.008	0.58	0.090	137.4	0.05	76.49	0.56	1197.5	3.33	59.6	0.06	5602	0.1	638.9	0.0	24.4	705	19.64
	Equivalent weights of means:												17.6				78.2		0.8		186.4		9.1			16.9	

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Spring	SP-10	12/18/1995																
Spring	SP-10	3/5/1997																
Spring	SP-10	6/24/1997																
Spring	SP-10	9/30/1997																
Spring	SP-10	12/12/1997																
Spring	SP-10	3/9/1998																
Spring	SP-10	6/26/1998																
Spring	SP-10	9/29/1998																
Spring	SP-10	12/7/1998																
Spring	SP-10	3/15/1999																
Spring	SP-10	12/4/2000																
Spring	SP-10	3/21/2001																
Spring	SP-10	6/15/2001																
Spring	SP-10	9/11/2001																
Spring	SP-10	12/11/2001																
Spring	SP-10	1/1/2002																
Spring	SP-10	3/1/2002																
Spring	SP-10	6/19/2002																
Spring	SP-10	9/24/2002																
Spring	SP-10	6/30/2003																
Spring	SP-10	9/18/2003																
Spring	SP-10	12/26/2003																frozen
Spring	SP-10	3/29/2004																
Spring	SP-10	6/22/2004																some irrigation water
Spring	SP-10	9/25/2004																
Spring	SP-10	12/28/2004																Site was dry
Spring	SP-10	3/31/2005																
Spring	SP-10	5/23/2005																Irrigation water flowing from above springs
Spring	SP-10	7/19/2005																Irrigation water only
Spring	SP-10	11/22/2005																
Spring	SP-10	3/9/2006																No Flow in 1st. Quarter.
Spring	SP-10	6/27/2006																
Spring	SP-10	9/29/2006																
Spring	SP-10	11/28/2006																
Spring	SP-10	3/26/2007																
Spring	SP-10	6/18/2007																with irrigation water coming in
Spring	SP-10	9/26/2007																
Spring	SP-10	12/11/2007																
Spring	SP-10	3/24/2008																
Spring	SP-10	6/26/2008																Irrigation water is running
Spring	SP-10	9/30/2008																
Spring	SP-10	12/11/2008																
Spring	SP-10	2/26/2009																Frozen No flow
Spring	SP-10	7/15/2009																
Spring	SP-10	12/15/2009																
Spring	SP-10	12/30/2009																Frozen No flow
Spring	SP-10	3/25/2010																
Spring	SP-10	6/28/2010			115		295	362	1020	495			0	0	> .03	42.48		
Spring	SP-10	7/21/2010			147		332	415		537			0	0	0	0		
Spring	SP-10	11/24/2010																
Spring	SP-10	3/25/2011			297		339	530		800			0	0	0	0		
Spring	SP-10	6/24/2011			143		332	435		553			0	0	0	0		
Spring	SP-10	9/27/2011			104		339	400		471			0	0	0	0		
Spring	SP-10	12/9/2011																
Spring	SP-10	3/22/2012																
Spring	SP-10	6/25/2012																
Spring	SP-10	8/20/2012																
Spring	SP-10	11/7/2012																
Spring	SP-10	3/27/2013																
Spring	SP-10	6/4/2013			241		335	500		671			0	0	0	0		
Spring	SP-10	9/16/2013			376		359	585		967								
Spring	SP-10	12/17/2013			582		423	747		1289			0	0	0	0		
Spring	SP-10	3/14/2014			551		320	702		1181			0	0	0.03	0.042		
Spring	SP-10	6/23/2014			128		280	334		485			0	0	0	0		
Spring	SP-10	9/16/2014			134		349	398		621			0	0	0.1	0.006		
Spring	SP-10	12/1/2014			189		337	399	0	625			0	0	0	0		
Spring	SP-10	3/9/2015			306		335	443		781								

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Spring	SP-10	5/18/2015			75		265	286	0	387			0	0	0	0		
Spring	SP-10	9/1/2015			131		348	412	0	577			0	0	< .03	< .002		
Spring	SP-10	12/1/2015			147		343	434	0	605			0	0	0	0		
Spring	SP-11	12/18/1995																
Spring	SP-11	3/5/1997																
Spring	SP-11	6/24/1997																
Spring	SP-11	9/30/1997																
Spring	SP-11	12/12/1997																
Spring	SP-11	3/9/1998																
Spring	SP-11	6/26/1998																
Spring	SP-11	9/29/1998																
Spring	SP-11	12/7/1998																
Spring	SP-11	3/21/2001																
Spring	SP-11	6/15/2001																
Spring	SP-11	9/11/2001																
Spring	SP-11	12/11/2001																
Spring	SP-11	1/1/2002																
Spring	SP-11	3/1/2002																
Spring	SP-11	6/19/2002																
Spring	SP-11	6/30/2003																
Spring	SP-11	9/18/2003																dry
Spring	SP-11	12/26/2003																frozen
Spring	SP-11	3/29/2004																
Spring	SP-11	6/22/2004																
Spring	SP-11	9/25/2004																Site was dry
Spring	SP-11	12/28/2004																Site was dry
Spring	SP-11	3/31/2005																
Spring	SP-11	5/23/2005																Irrigation water flowing from above springs
Spring	SP-11	7/19/2005																Irrigation water only
Spring	SP-11	11/22/2005																
Spring	SP-11	3/9/2006																No Flow in 1st. Quarter.
Spring	SP-11	6/27/2006																
Spring	SP-11	9/29/2006																
Spring	SP-11	11/28/2006																
Spring	SP-11	3/26/2007																
Spring	SP-11	6/18/2007																
Spring	SP-11	9/26/2007																Dry
Spring	SP-11	12/11/2007																
Spring	SP-11	3/24/2008																Dry
Spring	SP-11	6/26/2008																
Spring	SP-11	9/30/2008																
Spring	SP-11	12/11/2008																
Spring	SP-11	2/26/2009																Frozen
Spring	SP-11	7/15/2009																
Spring	SP-11	12/15/2009																
Spring	SP-11	12/30/2009																Frozen No flow
Spring	SP-11	3/25/2010																
Spring	SP-11	6/28/2010			340		376	558	1220	904			0	0	> .03	0.003		
Spring	SP-11	7/21/2010			324		372	529		835			0	0	0	0		
Spring	SP-11	11/24/2010																
Spring	SP-11	3/25/2011																
Spring	SP-11	6/24/2011			391		359	570		932			0	0	0	0		
Spring	SP-11	9/27/2011																
Spring	SP-11	12/9/2011																
Spring	SP-11	3/22/2012																
Spring	SP-11	6/25/2012			146		374	421		584			0	0	0	0		
Spring	SP-11	8/20/2012			146		406	512		625			0	0	0	0		
Spring	SP-11	11/7/2012			226		366	491		699			0	0	0.03	0		
Spring	SP-11	3/27/2013																
Spring	SP-11	6/4/2013																
Spring	SP-11	9/16/2013																
Spring	SP-11	12/5/2013																
Spring	SP-11	3/7/2014																
Spring	SP-11	6/6/2014																
Spring	SP-11	9/15/2014																
Spring	SP-11	12/1/2014																

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Spring	SP-11	3/9/2015																
Spring	SP-11	5/18/2015																
Spring	SP-11	9/1/2015																
Spring	SP-11	12/1/2015																
Spring	SP-13	12/12/1997																
Spring	SP-13	3/9/1998																
Spring	SP-13	6/26/1998																
Spring	SP-13	9/29/1998																
Spring	SP-13	12/7/1998																
Spring	SP-13	3/21/2001																
Spring	SP-13	6/15/2001																
Spring	SP-13	9/11/2001																
Spring	SP-13	12/11/2001																
Spring	SP-13	1/1/2002																
Spring	SP-13	3/1/2002																
Spring	SP-13	6/19/2002																
Spring	SP-13	6/30/2003																
Spring	SP-13	9/18/2003																dry
Spring	SP-13	12/26/2003																frozen
Spring	SP-13	3/29/2004																damp
Spring	SP-13	6/22/2004																
Spring	SP-13	9/20/2004																Site was dry
Spring	SP-13	12/28/2004																Site was dry
Spring	SP-13	3/31/2005																
Spring	SP-13	5/23/2005																Irrigation water flowing from above springs
Spring	SP-13	7/19/2005																Irrigation water only
Spring	SP-13	11/22/2005																
Spring	SP-13	3/9/2006																No Flow in 1st. Quarter.
Spring	SP-13	6/27/2006																
Spring	SP-13	9/29/2006																
Spring	SP-13	11/28/2006																
Spring	SP-13	3/26/2007																
Spring	SP-13	6/18/2007																Just damp
Spring	SP-13	9/26/2007																Damp
Spring	SP-13	12/11/2007																
Spring	SP-13	3/24/2008																Dry
Spring	SP-13	6/26/2008																Was damp no flow
Spring	SP-13	9/30/2008																
Spring	SP-13	12/11/2008																
Spring	SP-13	2/26/2009																Frozen No flow
Spring	SP-13	7/15/2009																
Spring	SP-13	12/17/2009																
Spring	SP-13	12/30/2009																
Spring	SP-13	3/25/2010																
Spring	SP-13	6/28/2010																Dry NO FLOW
Spring	SP-13	7/20/2010																
Spring	SP-13	11/24/2010																FROZEN
Spring	SP-13	3/25/2011																
Spring	SP-13	6/24/2011																Damp not enough to sample
Spring	SP-13	9/27/2011																
Spring	SP-13	12/9/2011																
Spring	SP-13	3/22/2012																
Spring	SP-13	6/25/2012																
Spring	SP-13	8/20/2012																
Spring	SP-13	11/7/2012																
Spring	SP-13	3/27/2013																
Spring	SP-13	6/4/2013																
Spring	SP-13	9/16/2013																
Spring	SP-13	12/5/2013																
Spring	SP-13	3/7/2014																
Spring	SP-13	6/6/2014																
Spring	SP-13	9/15/2014																
Spring	SP-13	12/1/2014																
Spring	SP-13	3/11/2015																
Spring	SP-13	5/18/2015																
Spring	SP-13	9/1/2015																

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Spring	SP-13	12/1/2015																
Spring	SP-14	9/30/1997																
Spring	SP-14	12/12/1997																
Spring	SP-14	3/9/1998																
Spring	SP-14	6/26/1998																
Spring	SP-14	9/29/1998																
Spring	SP-14	12/7/1998																
Spring	SP-14	3/21/2001																
Spring	SP-14	6/15/2001																
Spring	SP-14	9/11/2001																
Spring	SP-14	12/11/2001																
Spring	SP-14	1/1/2002																
Spring	SP-14	3/1/2002																
Spring	SP-14	6/19/2002																
Spring	SP-14	6/30/2003																
Spring	SP-14	9/18/2003																dry
Spring	SP-14	12/26/2003																frozen
Spring	SP-14	3/29/2004																damp
Spring	SP-14	6/22/2004																
Spring	SP-14	9/20/2004																Site was dry
Spring	SP-14	12/28/2004																Site was dry
Spring	SP-14	3/31/2005																
Spring	SP-14	5/23/2005																Irrigation water flowing from above springs
Spring	SP-14	7/19/2005																Irrigation water only
Spring	SP-14	11/22/2005																
Spring	SP-14	3/9/2006																No Flow in 1st. Quarter.
Spring	SP-14	6/27/2006																
Spring	SP-14	9/29/2006																
Spring	SP-14	11/28/2006																
Spring	SP-14	3/26/2007																
Spring	SP-14	6/18/2007																Just damp
Spring	SP-14	9/26/2007																Damp
Spring	SP-14	12/11/2007																
Spring	SP-14	3/24/2008																Dry
Spring	SP-14	6/26/2008																Was damp no flow
Spring	SP-14	9/30/2008																
Spring	SP-14	12/11/2008																
Spring	SP-14	2/26/2009																Dry
Spring	SP-14	7/15/2009																
Spring	SP-14	12/17/2009																could not get a reading
Spring	SP-14	12/30/2009																Frozen No flow
Spring	SP-14	3/25/2010																
Spring	SP-14	6/28/2010																Dry NO FLOW
Spring	SP-14	7/20/2010			707		320	936		1400								
Spring	SP-14	11/24/2010																FROZEN
Spring	SP-14	3/25/2011																
Spring	SP-14	6/24/2011																Damp not enough to sample
Spring	SP-14	9/27/2011																
Spring	SP-14	12/9/2011																
Spring	SP-14	3/22/2012																Was damp
Spring	SP-14	6/25/2012																
Spring	SP-14	8/20/2012																
Spring	SP-14	11/7/2012																
Spring	SP-14	3/27/2013																
Spring	SP-14	6/4/2013																
Spring	SP-14	9/16/2013																
Spring	SP-14	12/5/2013																
Spring	SP-14	3/7/2014																
Spring	SP-14	6/6/2014																
Spring	SP-14	9/15/2014																
Spring	SP-14	12/1/2014																
Spring	SP-14	3/11/2015																
Spring	SP-14	5/18/2015																
Spring	SP-14	9/1/2015																
Spring	SP-14	12/1/2015																
Well	RDA1	6/16/1982			2753				5200	4101								

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA1	7/26/1982			2893				5800	4665								
Well	RDA1	8/24/1982			860				2700	1590								
Well	RDA1	9/21/1982			2100				5800	3450								
Well	RDA1	10/13/1982			2000				5100	3488								
Well	RDA1	11/29/1982			2100				5900	4392								
Well	RDA1	3/7/1984			2250				4800	4318								
Well	RDA1	4/18/1984			2400				4900	4300								
Well	RDA1	5/3/1984			2400			1980	4800	4312			64.18	63.43			190	
Well	RDA1	6/12/1984			2500				4650	4250								
Well	RDA1	7/12/1984			2500				4950	3860								
Well	RDA1	8/2/1984			2450				4700	4262								
Well	RDA1	9/11/1984			2250				4500	4024								
Well	RDA1	10/9/1984			2250				4500	4104								
Well	RDA1	11/5/1984			2350				4300	3972								
Well	RDA1	12/6/1984			2150				4300	4040								
Well	RDA1	1/29/1985			2250				4425	3896								
Well	RDA1	4/3/1985			2200				4500	3533								
Well	RDA1	9/3/1985			2600				4500	3736								
Well	RDA1	12/16/1985			2500				4525	4000								
Well	RDA1	6/25/1986			2200			1702	4550	3788			59.66	59.06			163	
Well	RDA1	12/18/1986			2160				4600	3900								
Well	RDA1	5/19/1989			2996		522	1945		5052			72.38	78.9			228	
Well	RDA1	6/4/1990	<0.01	<0.005	2083		544	1716		3668	<0.05	<0.05	55.18	57.7				
Well	RDA1	6/6/1991			1900		526	1617		3554			52.07	53.39				
Well	RDA1	5/26/1992			1836		538			3282			46.86	52.12				
Well	RDA1	9/2/1992			1704		562	1362		3400			45.49	50.08				
Well	RDA1	6/7/1993			1935		470	1774		3516			58.59	52.92				
Well	RDA1	6/6/1994			2058		566	1669		3425			54.87	57.84				
Well	RDA1	6/6/1995			2000		590	1480		3370			47.3	56				
Well	RDA1	6/5/2000			1809		547	1508		3237								
Well	RDA1	6/8/2001			1761		525	1403		3028								
Well	RDA1	6/5/2002			1814		529	1483		3245								
Well	RDA1	6/2/2004			1886		542	1560		3282								
Well	RDA1	5/12/2005			2007		521	1558		3213								
Well	RDA1	7/9/2005																
Well	RDA1	11/22/2005																
Well	RDA1	3/6/2006																
Well	RDA1	6/28/2006			1682		493	1521		3139								
Well	RDA1	9/28/2006																
Well	RDA1	11/20/2006																
Well	RDA1	3/22/2007																
Well	RDA1	6/14/2007			1566		512	1442		3118								
Well	RDA1	9/20/2007																
Well	RDA1	12/10/2007																
Well	RDA1	3/28/2008																
Well	RDA1	6/16/2008			1542		523	1457		2916								
Well	RDA1	9/20/2008																
Well	RDA1	12/13/2008																
Well	RDA1	6/4/2009			279		524	1513		2964								
Well	RDA1	12/14/2009																
Well	RDA1	12/29/2009																
Well	RDA1	3/26/2010																
Well	RDA1	6/24/2010			1594		548	1526		3013								
Well	RDA1	7/19/2010																
Well	RDA1	10/15/2010																
Well	RDA1	3/29/2011																
Well	RDA1	6/8/2011			1519		538	1515		2886								
Well	RDA1	9/28/2011																
Well	RDA1	12/12/2011																
Well	RDA1	3/16/2012																
Well	RDA2	6/16/1982			1605				4900	3901						0.09		
Well	RDA2	7/28/1982			1610				4800	3821								
Well	RDA2	8/24/1982			1900				4400	2520								
Well	RDA2	9/21/1982			2900				7000	4800								
Well	RDA2	10/13/1982			2200				5000	2790								
Well	RDA2	11/29/1982		10.3	2400				6300	3658								

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA2	12/9/1982			2000				6100	3728								
Well	RDA2	3/7/1984			2250				4650	4170								
Well	RDA2	4/18/1984			2475				4900	4564								
Well	RDA2	5/3/1984			2500			1930	4800	4168			62.93	62.55			185	
Well	RDA2	6/12/1984			2480				4400	4002								
Well	RDA2	7/12/1984			2450				4700	3660								
Well	RDA2	8/2/1984			2450				4425	4162								
Well	RDA2	9/11/1984			2550				4500	4026								
Well	RDA2	10/9/1984			2230				4450	4164								
Well	RDA2	11/5/1984			2500				4450	4198								
Well	RDA2	12/6/1984			2500				4500	4326								
Well	RDA2	1/29/1985			2250				4500	4178								
Well	RDA2	4/3/1985			2250				4800	3843								
Well	RDA2	9/3/1985			3000				4990	4294								
Well	RDA2	6/25/1986			2600			1910	5020	4293			66.27	66.67			187	
Well	RDA2	12/18/1986			2800				5100	4636								
Well	RDA2	5/19/1989			2535		506	1793		4424			62.03	67.98			183	
Well	RDA2	6/4/1990	<0.01	0.066	2440		500	1869		4172	<0.05	<0.05	62.96	65.22				
Well	RDA2	6/6/1991			2486		516	2036		4154			65.36	66.45				
Well	RDA2	5/26/1992			2354		522			4028			62.51	63.18				
Well	RDA2	9/2/1992			1688		828	1575		3960			54.6	56.04				
Well	RDA2	6/7/1993			2511		462	1822		4072			63.94	66.17				
Well	RDA2	6/6/1994			2264		540	1682		3960			59.93	62.04				
Well	RDA2	6/6/1995			2300		630	1470		3810			52.4	64				
Well	RDA2	6/5/2000			2493		584	1837		4327								
Well	RDA2	6/8/2001			2690		567	1751		4352								
Well	RDA2	6/5/2002			2206		567	1690		4071								
Well	RDA2	6/2/2004			2520		554	1795		4074								
Well	RDA2	5/13/2005			2339		556	1838		4126								
Well	RDA2	7/9/2005																
Well	RDA2	11/22/2005																
Well	RDA2	3/6/2006																
Well	RDA2	6/28/2006			2205		542	1769		3973								
Well	RDA2	9/28/2006																
Well	RDA2	11/20/2006																
Well	RDA2	3/22/2007																
Well	RDA2	6/14/2007			2040		517	1640		3900								
Well	RDA2	9/20/2007																
Well	RDA2	12/10/2007																
Well	RDA2	3/28/2008																
Well	RDA2	6/16/2008			2092		520	1652		3818								
Well	RDA2	9/20/2008																
Well	RDA2	12/13/2008																
Well	RDA2	6/4/2009			2053		512	1643		3732								
Well	RDA2	12/14/2009																
Well	RDA2	12/29/2009																
Well	RDA2	3/26/2010																
Well	RDA2	6/24/2010			1985		541	1616		3663								
Well	RDA2	7/19/2010																
Well	RDA2	10/15/2010																
Well	RDA2	3/29/2011																
Well	RDA2	6/8/2011			1933		527	1525		3384								
Well	RDA2	9/28/2011																
Well	RDA2	12/12/2011																
Well	RDA2	3/16/2012																
Well	RDA2	6/20/2012			1875		524	1603		3606								
Well	RDA2	8/20/2012																
Well	RDA2	11/6/2012																
Well	RDA2	3/28/2013																well only sampled annually
Well	RDA2	6/4/2013			1894		525	1514		3422								
Well	RDA2	9/19/2013																
Well	RDA2	12/1/2013																
Well	RDA2	3/19/2014																
Well	RDA2	6/26/2014			1925		521	1342		3504								
Well	RDA2	9/16/2014																
Well	RDA2	12/12/2014																

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA2	3/12/2015																
Well	RDA2	6/26/2015			1651		519	1388		3577								
Well	RDA2	9/22/2015																
Well	RDA2	12/2/2015																
Well	RDA3	6/15/1982			1988				5000	3841								
Well	RDA3	7/26/1982			2498				5500	3861								
Well	RDA3	8/13/1982			2520				4390	3000								
Well	RDA3	9/21/1982			2400				4800	3230								
Well	RDA3	10/13/1982			1900				4040	3226								
Well	RDA3	11/29/1982			1900				4310	3385								
Well	RDA3	12/9/1982			1720				4230	2632								
Well	RDA3	3/7/1984			2050				4300	3800								
Well	RDA3	4/18/1984			2150				4400	3948								
Well	RDA3	5/3/1984			2250			2110	4300	3884			60.01	59.11			289	
Well	RDA3	6/12/1984			2480				4200	3886								
Well	RDA3	7/12/1984			2400				4500	3555								
Well	RDA3	8/2/1984			2200				4275	4088								
Well	RDA3	9/11/1984			2100				4200	3542								
Well	RDA3	10/9/1984			2100				4200	3856								
Well	RDA3	11/5/1984			2480				4150	3888								
Well	RDA3	12/6/1984			2100				4050	3848								
Well	RDA3	1/29/1985			2150				4150	3848								
Well	RDA3	4/3/1985			2000				4300	3531								
Well	RDA3	9/3/1985			2650				4300	3780								
Well	RDA3	6/25/1986			2250			1870	4300	3665			58.82	58.99		0.03	250	
Well	RDA3	12/18/1986			2400				4500	3900								
Well	RDA3	5/19/1989			14118		980	6325		22488			323.77	355.28			1644	
Well	RDA3	6/4/1990			5808		686	3504		9250	0.58	<0.05	132.3	138.38				
Well	RDA3	6/5/1991			3560		584	2939		7454			95.17	95.68				
Well	RDA3	5/26/1992			2231		518			3514			59.49	59.37				
Well	RDA3	9/2/1992			2132		644	1971		3822			58.85	60.26				
Well	RDA3	6/7/1993			2066		866	2419		3634								
Well	RDA3	6/6/1994			7985		615	1779		12900			57.12	199.78				
Well	RDA3	6/6/1995			13000		1080	5100		21210			267.2	319.2				
Well	RDA3	6/5/2000			94336		1284	7478		25818								
Well	RDA3	6/8/2001			18981		1214	7543		27058								
Well	RDA3	6/5/2002			14975		1342	7212		5899								
Well	RDA3	6/2/2004			2996		620	2346		5141								
Well	RDA3	5/13/2005			6423		929	3852		11023								
Well	RDA3	7/9/2005																
Well	RDA3	11/22/2005																
Well	RDA3	3/6/2006																
Well	RDA3	6/28/2006			2609		710	2350		4929								
Well	RDA3	9/28/2006																
Well	RDA3	11/20/2006																
Well	RDA3	3/22/2007																
Well	RDA3	6/14/2007			2785		579	2454		5327								
Well	RDA3	9/20/2007																
Well	RDA3	12/10/2007																
Well	RDA3	3/28/2008																
Well	RDA3	6/16/2008			2512		601	2289		4796								
Well	RDA3	9/20/2008																
Well	RDA3	12/13/2008																
Well	RDA3	6/4/2009			2419		561	2190		4534								
Well	RDA3	12/14/2009																
Well	RDA3	12/29/2009																
Well	RDA3	3/26/2010																
Well	RDA3	6/24/2010			2359		627	2191		4530								
Well	RDA3	7/19/2010																
Well	RDA3	10/15/2010																
Well	RDA3	3/29/2011																
Well	RDA3	6/8/2011			2700		582	2340		4852								
Well	RDA3	9/28/2011																
Well	RDA3	12/12/2011																
Well	RDA3	3/16/2012																

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA4	6/15/1982			4761				9810	7641								
Well	RDA4	7/26/1982			4893				8900	6486								
Well	RDA4	8/13/1982			4800				8100	4790								
Well	RDA4	9/21/1982			3900				7800	5730								
Well	RDA4	10/13/1982			3800				7900	6144								
Well	RDA4	11/29/1982			3950				9000	6925								
Well	RDA4	12/9/1982			3200				8900	7066								
Well	RDA4	3/7/1984			5000				8750	7496								
Well	RDA4	4/18/1984			5000				8000	7800								
Well	RDA4	5/3/1984			5250			3000	8500	7812			109.55	129.04			481	
Well	RDA4	6/12/1984			5000				8000	7892								
Well	RDA4	7/12/1984			5000				8800	7216								
Well	RDA4	8/2/1984			5000				8000	7940								
Well	RDA4	9/11/1984			5000				8000	6580								
Well	RDA4	10/9/1984			4500				7500	6624								
Well	RDA4	11/5/1984			5500				8000	7732								
Well	RDA4	12/6/1984			5000				7950	7564								
Well	RDA4	1/29/1985			5500				9000	7984								
Well	RDA4	4/3/1985			5250				8750	6782								
Well	RDA4	9/3/1985			6000				8100	6528								
Well	RDA4	6/25/1986			4100			2712	8000	6594			103.33	102.34			411	
Well	RDA4	12/18/1986			6000				8900	7752								
Well	RDA4	5/19/1989			5186		560	3128		8186			125.22	128.51			497	
Well	RDA4	6/4/1990			4565		562	3053		6960	0.11	<0.05	109.13	114.66				
Well	RDA4	6/5/1991			3322		558	2635		7314			88.62	89.04				
Well	RDA4	5/26/1992			3161		536			6020			75.71	83.82				
Well	RDA4	9/2/1992			3272		642	2442		5866			86.63	87.77				
Well	RDA4	6/7/1993			3374		1220	3719		5420								
Well	RDA4	6/6/1994			4322		646	2455		6854			90.91	110.35				
Well	RDA4	6/6/1995			2400		660	1910		4930			68.1	66.7				
Well	RDA4	6/5/2000			2608		909	1925		4447								
Well	RDA4	6/8/2001			2693		748	1871		4238								
Well	RDA4	6/5/2002			2884		740	2055		5055								
Well	RDA4	6/2/2004			2600		657	2050		4220								
Well	RDA4	5/13/2005			2875		713	2409		5026								
Well	RDA4	7/9/2005																
Well	RDA4	11/22/2005																
Well	RDA4	3/6/2006																
Well	RDA4	6/28/2006			2395		704	2220		4483								
Well	RDA4	9/28/2006																
Well	RDA4	11/20/2006																
Well	RDA4	3/22/2007																
Well	RDA4	6/14/2007			2368		551	2118		4610								
Well	RDA4	9/20/2007																
Well	RDA4	12/10/2007																
Well	RDA4	3/28/2008																
Well	RDA4	6/16/2008			2466		544	2219		4558								
Well	RDA4	9/20/2008																
Well	RDA4	12/13/2008																
Well	RDA4	6/4/2009			2718		548	2377		4892								
Well	RDA4	12/14/2009																
Well	RDA4	12/29/2009																
Well	RDA4	3/26/2010																
Well	RDA4	6/24/2010			2605		569	2310		4842								
Well	RDA4	7/19/2010																
Well	RDA4	10/15/2010																
Well	RDA4	3/29/2011																
Well	RDA4	6/8/2011			2651		590	2310		4949								
Well	RDA4	9/28/2011																
Well	RDA4	12/12/2011																
Well	RDA4	3/16/2012																
Well	RDA4	6/20/2012			2999		608	2580		5873								
Well	RDA4	8/20/2012																
Well	RDA4	11/6/2012																
Well	RDA4	3/28/2013																Well only sampled annually
Well	RDA4	6/4/2013			2629		599	2107		5008								

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA4	9/19/2013																
Well	RDA4	12/1/2013																
Well	RDA4	3/19/2014																
Well	RDA4	6/26/2014			2613		604	2145		5342								
Well	RDA4	9/16/2014																
Well	RDA4	12/12/2014																
Well	RDA4	3/12/2015																
Well	RDA4	6/26/2015			2685		611	2148		5423								
Well	RDA4	9/22/2015																
Well	RDA4	12/2/2015																
Well	RDA5	6/15/1982			11983				25500	19634						0.65		
Well	RDA5	7/26/1982			11485				23900	13157								
Well	RDA5	8/13/1982			9490				14200	11010								
Well	RDA5	9/21/1982			8000				19000	15120								
Well	RDA5	10/13/1982			8900				27500	17360								
Well	RDA5	11/29/1982			4700				40900	32175								
Well	RDA5	12/9/1982			4000				37000	29040								
Well	RDA5	3/7/1984			21250				35000	37176								
Well	RDA5	4/18/1984			24000				35000	36158								
Well	RDA5	5/3/1984			21500			10380	33500	37812			534.08	542.34			2276	
Well	RDA5	6/13/1984			22500				29000	34576								
Well	RDA5	7/12/1984			23000				33100	33000								
Well	RDA5	8/2/1984			19500				29000	27200								
Well	RDA5	9/11/1984			20500				29000	32728								
Well	RDA5	10/9/1984			20000				30000	36192								
Well	RDA5	11/5/1984			24500				26500	34768								
Well	RDA5	12/6/1984			22000				23750	35752								
Well	RDA5	1/28/1985			20000				32000	31528								
Well	RDA5	4/3/1985			19000				32500	31780								
Well	RDA5	9/3/1985			24500				31500	29820								
Well	RDA5	6/25/1986			20500			9010	51100	32792			502.62	499.39			1923	
Well	RDA5	12/18/1986							36500	32240								
Well	RDA5	5/19/1989			15270		498	5413		23108			384.53	362.83			1277	
Well	RDA5	6/4/1990			15624		499	6906		25040	<0.5	<0.5	351.03	367.76				
Well	RDA5	6/5/1991			11895		460	5225		20838			293.13	283.64				
Well	RDA5	5/26/1992			10553		458			17664			234.66	254.57				
Well	RDA5	9/2/1992			10743		588	4538		17648			272.65	257.19				
Well	RDA5	6/7/1993			10866		416	3830		16092								
Well	RDA5	6/6/1994			10084		476	3450		14992			198.38	234.67				
Well	RDA5	6/6/1995			8700		470	2940		13820			184.8	200.3				
Well	RDA5	6/5/2000			5641		425	2710		10059								
Well	RDA5	6/8/2001			7026		422	2589		9471								
Well	RDA5	6/5/2002			6126		426	2506		9122								
Well	RDA5	6/2/2004			6239		425	2544		8725								
Well	RDA5	5/13/2005			5430		453	2646		8528								
Well	RDA5	7/9/2005																
Well	RDA5	11/22/2005																
Well	RDA5	3/6/2006																
Well	RDA5	6/28/2006			6444		416	2949		10476								
Well	RDA5	9/28/2006																
Well	RDA5	11/20/2006																
Well	RDA5	3/22/2007																
Well	RDA5	6/14/2007			5526		394	2597		9104								
Well	RDA5	9/20/2007																
Well	RDA5	12/10/2007																
Well	RDA5	3/28/2008																
Well	RDA5	6/16/2008			4960		440	2603		7780								
Well	RDA5	9/20/2008																
Well	RDA5	12/13/2008																
Well	RDA5	6/4/2009			4624		555	2551		7599								
Well	RDA5	12/14/2009																
Well	RDA5	3/26/2010																
Well	RDA5	6/24/2010			4597		572	2529		7798								
Well	RDA5	7/19/2010																
Well	RDA5	10/15/2010																

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA5	3/29/2011																
Well	RDA5	6/8/2011			4542		592	2566		7816								
Well	RDA5	9/28/2011																
Well	RDA5	12/12/2011																
Well	RDA5	3/16/2012																
Well	RDA6	6/15/1982			9230				18300	14570								
Well	RDA6	7/26/1982			8436				15000	11843								
Well	RDA6	8/13/1982			9330				17100	9610								
Well	RDA6	9/21/1982			9000				15800	12200								
Well	RDA6	10/13/1982			8000				14100	10380								
Well	RDA6	11/29/1982			6900				10000	7828								
Well	RDA6	12/9/1982			5200				15100	12064								
Well	RDA6	3/7/1984			4750				8400	7372								
Well	RDA6	4/18/1984			5500				8750	8272								
Well	RDA6	5/3/1984			5500			2400	9000	8280			110.5	127.04			335	
Well	RDA6	6/12/1984			5000				8000	7432								
Well	RDA6	7/12/1984			5000				9000	7380								
Well	RDA6	8/2/1984			5250				8250	7984								
Well	RDA6	9/11/1984			5250				8000	7108								
Well	RDA6	10/9/1984			5000				8300	7388								
Well	RDA6	11/5/1984			5500				8000	7620								
Well	RDA6	12/6/1984			6250				8950	8604								
Well	RDA6	1/29/1985			5250				8790	7812								
Well	RDA6	4/3/1985			5500				10000	7700								
Well	RDA6	9/3/1985			8250				11900	9732								
Well	RDA6	6/25/1986			12500			4950	30100	19920			299.2	301.86			924	
Well	RDA6	12/18/1986							21850	21676								
Well	RDA6	5/19/1989			8067		400	3942		12936			208.53	192.81			690	
Well	RDA6	6/4/1990			17009		728	6254		34732	0.3	<0.5	387.43	402.55				
Well	RDA6	6/5/1991			11689		588	5036		24152			290.44	282.99				
Well	RDA6	5/26/1992			11319		542			18924			248.39	273.74				
Well	RDA6	9/2/1992			9940		503	4073		15184			226.51	239.8				
Well	RDA6	6/7/1993			22350		830	7520		34330			483.11	521.79				
Well	RDA6	6/6/1994			12471		782	4115		19424			240.73	305.81				
Well	RDA6	6/6/1995			16000		760	5080		26890			336.4	371.6				
Well	RDA6	6/5/2000			26271		1056	7431		39107								
Well	RDA6	6/8/2001			30577		1079	7838		41100								
Well	RDA6	6/5/2002			33030		1198	9813		50358								
Well	RDA6	6/2/2004			39550		1179	10544		57940								
Well	RDA6	5/13/2005			37550		1354	12021		60314								
Well	RDA6	7/9/2005																
Well	RDA6	11/22/2005																
Well	RDA6	3/6/2006																
Well	RDA6	6/28/2006			32646		1062	9675		51489								
Well	RDA6	9/28/2006																
Well	RDA6	11/20/2006																
Well	RDA6	3/22/2007																
Well	RDA6	6/14/2007			29727		1097	8948		48553								
Well	RDA6	9/20/2007																
Well	RDA6	12/10/2007																
Well	RDA6	3/28/2008																
Well	RDA6	6/16/2008			12609		703	4283		21446								
Well	RDA6	9/20/2008																
Well	RDA6	12/13/2008																
Well	RDA6	12/14/2009																
Well	RDA6	12/29/2009																
Well	RDA6	3/24/2010																Obstruction in well - Stops at 12 feet
Well	RDA6	6/24/2010																too shallow to sample
Well	RDA6	7/19/2010																
Well	RDA6	10/15/2010																
Well	RDA6	3/29/2011																Dry Wells
Well	RDA6	6/8/2011																Dry Wells
Well	RDA6	9/28/2011																Dry Wells
Well	RDA6	12/12/2011																Hit something at this level
Well	RDA6	3/16/2012																Dry Wells
Well	RDA6	6/20/2012																Dry Wells

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	RDA6	8/20/2012																HIT SOMETHING AT 14.5 FT
Well	RDA6	11/6/2012																
Well	RDA6	3/28/2013																
Well	RDA6	6/4/2013																
Well	RDA6	9/19/2013																
Well	RDA6	12/1/2013																
Well	RDA6	3/19/2014																
Well	RDA6	6/26/2014																Dry Wells
Well	RDA6	9/16/2014																
Well	RDA6	12/12/2014																
Well	RDA6	3/12/2015																
Well	RDA6	6/26/2015			21556		995	5141		47280								
Well	RDA6	9/22/2015																
Well	RDA6	12/2/2015																
Well	SM1-1	4/23/1982	0	0	9604	0.08	683	508	18100	14400	0.2							
Well	SM1-1	11/17/1982	0	0	4000	0	472	3607	13200	7394	0.05							
Well	SM1-1	2/15/1983	0	0	2610	0	320	2146		4600								
Well	SM1-1	6/28/1983	0.7	0	12200	0.12	559	4390	18000	16492	1.35							
Well	SM1-1	8/29/1983	0.4	0	11500	0.25	168	2850	22000	18280	0.12	0.6						
Well	SM1-1	11/7/1983	17	0	16000	0.07	508	4580		25988		0.26						
Well	SM1-1	2/21/1984	5	0	17000	0.19	676	7440	27000	28344		0.2						
Well	SM1-1	5/3/1984	0.18		16600			8310		25600			394.4	394.16	0.17	0.78	1785	
Well	SM1-1	8/2/1984	0.5		17000			8140		23628			372.05	406.46	0.06	0.55	1756	
Well	SM1-1	11/19/1984	0.6		20000			9692		36192			510.51	511.73	0.19	1.12	2233	
Well	SM1-1	2/26/1985	0.54		21000			9800		32000			498.02	494.77	0.19	1.26	2145	
Well	SM1-1	5/8/1985	0.5		20000			9634		29616			496.6	496.05	0.07	1.11	2100	
Well	SM1-1	8/14/1985	0.28		20000			9440		30471			457.11	471.72	0.24	1.2	2038	
Well	SM1-1	11/21/1985	0.11		19500			9450		31860			481.31	481.61	0.27	0.9	2043	
Well	SM1-1	6/30/1986	0.93		15000			7620		21143			362.45	351.64	0.16	1	1573	
Well	SM1-1	12/23/1986	0.2		24000			11170		36488			551.64	558.98	0.45	1.12	2444	
Well	SM1-1	5/18/1989			10660		308	3573		17358			238.72	249.62			683	
Well	SM1-1	9/12/1989			13007		800	5633		21194			329.65	307.35			1650	
Well	SM1-1	6/4/1990	2.2	0.097	13500		687	6059		21840	5.4	0.11	322.15	330.84				
Well	SM1-1	9/19/1990			13525		936	4312		23336			292.68	323.74				
Well	SM1-1	9/24/1991			11887		488	3751		18844			264.38	275.88				
Well	SM1-1	5/26/1992			10413		528			19524			259.53	257.23				
Well	SM1-1	9/2/1992			15312		2280	4158		24922			374.6	390.95				
Well	SM1-1	9/8/1993			19880		1000	8448		28600			427.92	456.52				
Well	SM1-1	6/6/1994			15312		840	5570		22098			300.34	352.49				
Well	SM1-1	6/6/1995			14000		920	4270		24640			341.9	330.2				
Well	SM1-1	9/6/1995			18626		800	5466		28930			422.4	421.6				
Well	SM1-1	6/13/2000			29193		1381	11927		44950			609.6	660.8				
Well	SM1-1	6/5/2001			33535		1435	13747		47137								
Well	SM1-1	9/5/2001			27056		1312	11142		42414								
Well	SM1-1	6/5/2002			1646		425	1351		43081								
Well	SM1-1	6/24/2002			25414		219	11360		41938			566.7	565.2				
Well	SM1-1	9/24/2002																Not enough water to take sample
Well	SM1-1	12/26/2002																
Well	SM1-1	3/13/2003																
Well	SM1-1	9/17/2003			24338		7893	10609		35122			539.8	692.1				
Well	SM1-1	12/22/2003																
Well	SM1-1	3/18/2004																
Well	SM1-1	6/23/2004																
Well	SM1-1	9/25/2004																Dry
Well	SM1-1	12/27/2004																
Well	SM1-1	3/25/2005																
Well	SM1-1	5/12/2005																Not enough water to sample
Well	SM1-1	7/20/2005																Stops at 11.3 ft. No Water
Well	SM1-1	11/17/2005																
Well	SM1-1	3/7/2006																
Well	SM1-1	6/28/2006																Not enough water to sample.
Well	SM1-1	9/28/2006																
Well	SM1-1	11/27/2006																
Well	SM1-1	3/22/2007																
Well	SM1-1	6/14/2007																

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	SM1-1	9/18/2007																
Well	SM1-1	12/10/2007																
Well	SM1-1	3/20/2008																
Well	SM1-1	6/24/2008																Dry Wells
Well	SM1-1	9/20/2008																
Well	SM1-1	12/13/2008																Dry Wells
Well	SM1-1	2/20/2009																Dry Wells
Well	SM1-1	12/14/2009																
Well	SM1-1	12/29/2009																
Well	SM1-1	3/26/2010																
Well	SM1-1	6/21/2010			23574		1244	11468		37955								
Well	SM1-1	7/20/2010			31020		1644	15260		49254								
Well	SM1-1	11/5/2010																
Well	SM1-1	3/29/2011																Dry Wells
Well	SM1-1	6/21/2011																
Well	SM1-1	9/27/2011																
Well	SM1-1	12/13/2011																
Well	SM1-1	3/15/2012																Dry Wells
Well	SM1-2	4/28/1982	0		5934		559	746	10000	8746	0.1							
Well	SM1-2	8/30/1982	0		940	0.08	549	1088	2610	1928								
Well	SM1-2	11/17/1982	0		1900		547	1659	5800	3688								
Well	SM1-2	2/15/1983	0		900		500	1126		1820								
Well	SM1-3	5/26/1983	0.52		1810	0.25	406		4500	3384	0.53							
Well	SM1-3	6/28/1983	0.8		1800	0.15	640	1300	3600	2896	0.9							
Well	SM1-2	8/29/1983	0.01		900	0.18	593	840	2900	1850	0.39							
Well	SM1-2	11/7/1983	0.56		2100	0.23	612	1930		3452								
Well	SM1-2	2/21/1984	0.1		5500		671	4700	9000	7302	0.1							
Well	SM1-2	5/3/1984	0.13		5250			4210		7612			117.43	126.49	0.05	2.26	805	
Well	SM1-2	8/2/1984	<0.01		800			730		1530			25.18	25.28	<0.05	<0.01	122	
Well	SM1-2	11/19/1984	<0.01		1650			1692		3276			48.77	50.34	0.15	1.19	351	
Well	SM1-2	2/26/1985	0.03		8800			3750		14000			196.2	200.62	0.1	3.02	692	
Well	SM1-2	5/8/1985	<0.01		9000			3654		11848			190.83	200.31	<0.05	1.5	670	
Well	SM1-2	8/14/1985	<0.01		3250			3050		5242			83.29	88.38	0.1	1	545	
Well	SM1-2	11/21/1985	0.08		3200			2810		5442			84.6	83.29	0.07	2.16	496	
Well	SM1-2	6/30/1986	0.14		1600			1108		2863			45.49	46.1	0.25	0.34	179	
Well	SM1-2	12/23/1986	0.85		4200			3595		6926					46.9	2.85	667.6	
Well	SM1-2	4/2/1987	0.03	0.02	5227		553	3980		8328	0.23							
Well	SM1-2	6/1/1987	0.03	0.01	3128		524	1984		6190	0.05	0.05						
Well	SM1-2	9/17/1987	0.2	0.1	5640		704	4894		8910	0.05	0.05						
Well	SM1-2	12/15/1987	0.01	0.04	1714		350	1104		2792	0.05	0.05						
Well	SM1-2	3/21/1988	0.06	0.14	9384		719	5609		14582	0.05	0.05						
Well	SM1-2	6/10/1988	0.05	0.03	2188		443	1029	4090	2240								
Well	SM1-2	9/22/1988	0.83	0.45	5756		718	4922	7450	9374	0.05	0.05						
Well	SM1-2	9/8/1993			1005		370	648		1822			27.28	29.79				
Well	SM1-2	6/6/1994			287		2640	815		3006			36.82	65.55				
Well	SM1-2	9/6/1995			378		435	604		940			26.9	17.2				
Well	SM1-2	6/13/2000			607		418	744		1751								
Well	SM1-2	6/5/2001			737		452	586		1420								
Well	SM1-2	6/30/2003																No Access. Well buried by County road
Well	SM1-2	6/23/2004																No Access
Well	SM1-2	5/11/2005																
Well	SM1-2	7/20/2005																Buried by County Road
Well	SM1-2	11/22/2005																Buried by county road
Well	SM1-2	3/9/2006																Buried by county road.
Well	SM1-2	6/28/2006																
Well	SM1-2	9/28/2006																
Well	SM1-2	11/27/2006																
Well	SM1-2	3/22/2007																
Well	SM1-2	6/15/2007																Buried by county road
Well	SM1-2	9/18/2007																
Well	SM1-2	12/10/2007																Buried by county road
Well	SM1-2	3/20/2008																Buried by county road
Well	SM1-2	6/24/2008																
Well	SM1-2	9/20/2008																
Well	SM1-2	12/13/2008																Buried by the county road

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	SM1-2	2/20/2009																Buried by the county road
Well	SM1-2	6/4/2009																Buried by the county road
Well	SM1-2	12/14/2009																Buried by the county road
Well	SM1-2	12/29/2009																Buried by the county road
Well	SM1-2	3/24/2010																Buried by the county road
Well	SM1-2	6/22/2010																Buried by the county road
Well	SM1-2	7/20/2010																
Well	SM1-2	11/24/2010																
Well	SM1-2	3/25/2011																BURIED BY COUNTY ROAD
Well	SM1-2	6/8/2011																No Access
Well	SM1-2	9/22/2011																No Access
Well	SM1-2	12/12/2011																No Access
Well	SM1-2	3/15/2012																No Access
Well	SM1-3	2/15/1982			8830		240	2252		13500	0.06							
Well	SM1-3	4/30/1982			17579		1290	499	30500	23695	0.2							
Well	SM1-3	8/30/1982			19340		240	2368	31500	24099	0.1							
Well	SM1-3	11/17/1982			18000		402	2491	41000	32030	0.07							
Well	SM1-2	5/26/1983	7.4		29000		489		41500	48024	0.48							
Well	SM1-2	6/28/1983	7.2		25000	0.3	605	8770	45000	50050	0.3							
Well	SM1-3	8/29/1983	0.45		23000	0.14	544	9950	50000	54784	0.2	0.28						
Well	SM1-3	11/7/1983	8		33500	0.09	616	4960		55128		0.15						
Well	SM1-3	2/21/1984	7.8		32000	0.12	596	8250	46000	46308	0.4	0.17						
Well	SM1-3	5/3/1984	7.5		32000	0.1	560	10000		56772		0.33						
Well	SM1-3	8/2/1984	7		33000	0.08	620	10000		50500								
Well	SM1-3	11/19/1984	6		34500	0.05	635	11000		50528								
Well	SM1-3	2/26/1985	5.4		35500		617	11000		53400								
Well	SM1-3	5/3/1984	7.5		32000			10500		56772			761.84	722.87	0.19	0.36	2290	
Well	SM1-3	8/2/1984	7		33000			10460		50500			746.92	753.07	0.08	0.43	2381	
Well	SM1-3	11/19/1984	6		34500			10584		50528			771.52	774.74	0.2	0.74	2440	
Well	SM1-3	2/26/1985	5.4		35500			11160		53400			801.3	804.22	0.21	0.78	2446	
Well	SM1-3	5/8/1985	4		36000			11404		51600			817.08	813.25	0.08	0.43	2500	
Well	SM1-3	8/14/1985	3.5		35000			11160		53604			821.27	784.38	0.39	0.56	2434	
Well	SM1-3	11/21/1985	3.75		35500			10950		51344			846.08	833.58	0.41	0.48	2383	
Well	SM1-3	6/30/1986	1.27		40000			11230		59522			873.8	880.8	0.18	0.57	2439	
Well	SM1-3	12/23/1986	3.18		41000			11140		59130			894.83	906.88	3.61	1.33	2437	
Well	SM1-3	5/18/1989			35274		690	9686		52334			708.11	788.15			2360	
Well	SM1-3	9/11/1989			39020		680	10488		54396			837.15	860.46			4850	
Well	SM1-3	6/4/1990	0.01		36953		712	10308		55942	<5.	<5.	753.34	794.96				
Well	SM1-3	9/19/1990			39357		676	10891		60330			813.73	873.62				
Well	SM1-3	6/10/1991			37332		652	10817		56630			825.88	830.61				
Well	SM1-3	9/24/1991			33834		634	9173		56844			753.76	756.49				
Well	SM1-3	5/26/1992			38979		636			54788			832.77	863.76				
Well	SM1-3	9/2/1992			32352		580	10494		54980			757.48	729.3				
Well	SM1-3	6/7/1993			36550		604	10860		54050			799.82	818.83				
Well	SM1-3	9/8/1993			38485		588	9808		52794			726.03	858.19				
Well	SM1-3	6/6/1994			35809		918	9685		51654			723.26	803.95				
Well	SM1-3	9/7/1994			36632		560	10088		52878			745.2	815.75				
Well	SM1-3	6/6/1995			34000		600	8830		51490			698.4	751.4				
Well	SM1-3	9/6/1995			36469		555	9512		52154			771.3	804				
Well	SM1-3	6/13/2000			33328		763	9407		53499								
Well	SM1-3	6/5/2001			35205		676	9012		51156								
Well	SM1-3	9/5/2001			35812		573	9284		54564								
Well	SM1-3	6/24/2002			35992		837	9579		51047								
Well	SM1-3	9/24/2002			34004			9240		51269								
Well	SM1-3	9/16/2003			48641		593	15557		70600								
Well	SM1-3	6/18/2004			44750		574	13652		65224								
Well	SM1-3	5/11/2005			50360		618	19348		87210								Verified by Lab Report
Well	SM1-3	7/20/2005			52390		792	21769		92910								Referenced lab notes
Well	SM1-3	6/28/2006			52552		670	20256		82434								
Well	SM1-3	9/28/2006			33556		758	18951		82780								
Well	SM1-3	11/27/2006																
Well	SM1-3	3/22/2007																
Well	SM1-3	6/13/2007			74810		612	20430		86854								
Well	SM1-3	9/18/2007			58405		465	27311		89426								
Well	SM1-3	12/10/2007																
Well	SM1-3	3/20/2008																

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	SM1-3	6/16/2008			55025		364	18681		81122								
Well	SM1-3	9/18/2008			52537		374	18585		83656								
Well	SM1-3	12/13/2008																
Well	SM1-3	2/19/2009																Dry Wells
Well	SM1-3	6/5/2009			> 10000.		343	18349		76674								
Well	SM1-3	7/14/2009			47225		403	17441	54500	76783								
Well	SM1-3	12/29/2009																
Well	SM1-3	3/26/2010																
Well	SM1-3	6/21/2010			47277		276	16591		71779								
Well	SM1-3	7/19/2010			9982		713	2368		61455								
Well	SM1-3	10/14/2010																
Well	SM1-3	3/25/2011			47134		203	15340		73389								
Well	SM1-3	6/8/2011			43822		323	15192		69201								
Well	SM1-3	9/22/2011			43419		258	13201		64861								
Well	SM1-3	12/13/2011			40483		212	13447		64768								
Well	SM1-3	3/15/2012			43917		151	13484		67773								
Well	SM1-3	6/20/2012			44696		223	13981		64924								
Well	SM1-3	8/20/2012			42441		257	14371		65382								
Well	SM1-3	11/7/2012			40093		165	13012		64611								
Well	SM1-3	3/21/2013			40628		138	12830		63886								
Well	SM1-3	6/4/2013			41455		262	12605		63676								
Well	SM1-3	9/24/2013			40360		205	11020		62879								
Well	SM1-3	12/17/2013			51155		211	14656		77619								
Well	SM1-3	3/14/2014			59519		407	20589		91242								
Well	SM1-3	6/26/2014			61656		267	19626		93575								
Well	SM1-3	9/19/2014																
Well	SM1-3	12/11/2014																
Well	SM1-3	3/16/2015																
Well	SM1-3	6/8/2015			3235		302	1331		5704								
Well	SM1-3	9/29/2015			19620		465	6670		29833								
Well	SM1-3	12/29/2015			28489		90	9268		43118								
Well	SM1-4	4/28/1982			3103	0.05	1680	492	6000	4232								
Well	SM1-4	8/30/1982			1700	0.07	437	1673	4100	3195								
Well	SM1-4	11/29/1982			1600		510	1432	3600	2580								
Well	SM1-4	2/15/1983			1970		420	1879		3210								
Well	SM1-4	6/28/1983	0.18		1500		435	1345	3500	3033								
Well	SM1-4	8/29/1983	0.01		1900	0.09	383	1700	4300	3468								
Well	SM1-4	11/7/1983	0.08		1750	0.21	374	1690		3052								
Well	SM1-4	2/21/1984	0.04		1900		331	1670	3750	3100								
Well	SM1-4	8/2/1984	<0.01		1700			1450		2740			43.13	43.97	<0.05	0.02	190	
Well	SM1-4	11/19/1984	0.02		1600			1336		2614			40.98	41.15	0.09	<0.01	251	
Well	SM1-4	2/26/1985	0.02		1250			1070		1996			31.89	33.03	0.07	0.03	154	
Well	SM1-4	5/8/1985	<0.01		1250			1041		2010			32.88	33.45	<0.05	<0.01	150	
Well	SM1-4	8/14/1985	<0.01		1440			1360		2481			40.31	38.1	<0.05	0.02	88	
Well	SM1-4	11/21/1985	0.08		1700			1400		2708			43.38	44.16	0.1	0.04	177	
Well	SM1-4	6/30/1986	0.01		1400			1138		2372			37.93	37.54	<0.05	0.01	145	
Well	SM1-4	12/23/1986	0.14		1200			1045		2031			33.12	32.54	8.77	0.44	132.5	
Well	SM1-4	5/26/1989			2638		284	1450		4276			62.25	62.84			203	
Well	SM1-4	9/11/1989			2058		338	1614		3386			50.49	51.66			275	
Well	SM1-4	6/8/1990	<0.01	0.095	2293		355	1708		3824	0.44	<0.05	54.78	57.07				
Well	SM1-4	6/10/1991			2251		344	1785		3690			54.88	55.83				
Well	SM1-4	5/26/1992			1753		366			3148			44.96	45.56				
Well	SM1-4	9/2/1992			1844		758	1634		3162			54.08	55.4				
Well	SM1-4	6/7/1993			1764		372	1539		2836			50.42	45.83				
Well	SM1-4	6/6/1994			2140		450	1545		3532			49.85	55.7				
Well	SM1-4	9/7/1994			2346		412	1645		3726			57.81	59.44				
Well	SM1-4	6/6/1995			1900		460	1100		3030			38.6	50.3				
Well	SM1-4	9/6/1995			854		375	1064		2230			56.7	26.1				
Well	SM1-4	6/5/2000			1506		465	1159		2601								
Well	SM1-4	6/4/2001			1858		405	1297		3041								
Well	SM1-4	9/23/2002			1635			1231		2906								
Well	SM1-4	9/18/2003																Dry
Well	SM1-4	6/18/2004			2371		493	1730		3920					32.7	0.63		
Well	SM1-4	9/25/2004																probe stops at 66'
Well	SM1-4	5/23/2005			2502		499	1813		4223								

Emery Water Quality Data - Qal

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	SM1-4	7/20/2005			1977		667	1536		3700								
Well	SM1-4	6/28/2006			2173		563	1794		3761								
Well	SM1-4	9/28/2006			1830		440	1611		3440								
Well	SM1-4	11/27/2006																
Well	SM1-4	3/22/2007																
Well	SM1-4	6/14/2007			1551		423	1394		2922								
Well	SM1-4	9/18/2007			1793		490	1581		3174								
Well	SM1-4	12/11/2007																
Well	SM1-4	3/28/2008																
Well	SM1-4	6/16/2008			2443		422	2068		4277								
Well	SM1-4	9/18/2008			1776		439	1463		3166								
Well	SM1-4	12/11/2008																
Well	SM1-4	2/19/2009																Dry Wells
Well	SM1-4	6/3/2009																Dry Wells
Well	SM1-4	7/15/2009			1373		410	1196		2536								
Well	SM1-4	12/29/2009																
Well	SM1-4	3/26/2010																
Well	SM1-4	6/21/2010			1650		409	1448		2889								
Well	SM1-4	7/19/2010			1479		422	1212		2658								
Well	SM1-4	10/14/2010																
Well	SM1-4	3/25/2011			2192		428	1705		3704								
Well	SM1-4	6/8/2011			1927		399	1622		3414								
Well	SM1-4	9/27/2011			1628		465	1266		2991								
Well	SM1-4	12/13/2011			1647		417	1266		2954								
Well	SM1-4	3/15/2012			1746		423	1487		3280								
	Number of Observations:		66	18	456	23	290	328	166	459	28	13	153	153	47	55	59	
	Maximum:		17.0	10.3	94336	0.30	7893	27311	54500	93575	5.40	0.60	894.8	906.9	46.9	42.48	4850	
	Minimum:		0.00	0.0	75	0.00	90	286	0	387	0.05	0.05	0.0	0.0	0.00	0.00	88	
	Mean:		2.01	0.63	11180	0.13	604.6	4930.5	11793	17707	0.46	0.18	249.6	259.5	2.06	1.34	1150	
	Standard Deviation:		3.25	2.42	14597	0.08	520.7	4972.3	11901	21813	1.01	0.16	273.6	282.1	8.29	5.70	1039	
	Equivalent weights of means:				232.8													

Emery Water Quality Data - Kmb

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	T1-B	6/30/1986					7.6	4							0.12								447		<1.	228
Well	T1-B	5/26/1989											347		<0.02		280	0.36	52		4710		304			140
Well	T1-B	9/11/1989											399		0.02		391	0.26	50		5405		424			190
Well	T1-B	6/8/1990							0.23	<0.001	0.5	<0.1	612	<0.1	<0.2	<0.02	406	0.2	26	0.001	4390	<0.1	405			29
Well	T1-B	9/17/1990											622		<0.02		421	0.61	26		4290		402			160
Well	T1-B	6/17/1991											315		<0.1		303	0.41	27		5105		428			190
Well	T1-B	9/23/1991											267		<0.4		285	0.48	35		4820		410			66
Well	T1-B	5/26/1992											345		<0.2		242	<0.1	23		4510		390			56
Well	T1-B	9/2/1992											391		<0.2		276	0.63	27		4800		727			115
Well	T1-B	6/7/1993											390		1.62		258	0.87	27		4410		394			111
Well	T1-B	9/8/1993											355		<0.1		240	0.3	25		4135		416			114
Well	T1-B	6/6/1994											355		0.2		239	0.2	24		4000		440			118
Well	T1-B	9/7/1994	16.5	7.3	4980								375		0.07		245	0.22	27		4100		406			105
Well	T1-B	6/6/1995	12.3	7.0	3530								193		<0.1		210	0.2	21		4000		530		<5.	117
Well	T1-B	9/6/1995	16.0	6.9	5170								358		0.2		231	0.3	21		4510		510		<5.	124
Well	T1-B	6/5/2000	14.2	6.9	17920								484		<0.1		264	<0.1	24		4485		636		<5.	167
Well	T1-B	6/4/2001	12.7	6.9	16740								420		<0.1		225	<0.1	24		3830		571		<5.	450
Well	T1-B	6/18/2004																								
Well	T1-B	9/25/2004																								
Well	T1-B	5/11/2005																								
Well	T1-B	7/11/2005																								
Well	T1-B	9/28/2006																								
Well	T1-B	11/20/2006																								
Well	T1-B	3/20/2007																								
Well	T1-B	6/14/2007																								
Well	T1-B	9/18/2007																								
Well	T1-B	12/10/2007																								
Well	T1-B	3/26/2008																								
Well	T1-B	6/24/2008																								
Well	T1-B	9/30/2008																								
Well	T1-B	12/11/2008																								
Well	T1-B	6/4/2009	14.5	7.6	1463								422.32		0.43		314.37	1.059	35.09		3985.6		925		< 5.	915
Well	T1-B	7/14/2009	14.7	7	1640								412.88		0.91		324.58	1.103	37.05		4328.9					959
Well	T1-B	12/29/2009																								
Well	T1-B	3/26/2010																								
Well	T1-B	6/24/2010	15.2	6.8	16220								396.87		< .03		337.04	0.768	37.79		4358.7		726		< 5.	866
Well	T1-B	7/19/2010	19.4	6.9	16550								450.98		284.32		3520.5	11.441	90.32		16006					1870
Well	T1-B	10/15/2010																								
Well	T1-B	3/25/2011	11	7.7	17090								420.32		< .03		387.86	0.636	37.28		4581					711
Well	T1-B	6/8/2011	13.6	7.6	18840								426.11		< .03		407.47	0.616	47.35		4694.7					680
Well	T1-B	9/22/2011	15.3	7.6	21400								425.11		0.13		458.48	0.768	41.16		5334.1					760
Well	T1-B	12/13/2011	10.9	7.1	18700								399.18		0.06		423.68	0.627	43.11		5126.2					620
Well	T1-B	3/15/2012	9.6	7.2	18470								397.06		< .03		403.34	0.223	37.36		4721.7					570
Well	T1-B	6/20/2012	15	7.2	18490								404.23		< .03		426.81	0.607	35.1		4444.3					524
Well	T1-B	8/20/2012	18.2	7.1	18240								410.79		< .03		435.49	0.752	41.92		4775.8		675		5	522
Well	T1-B	11/7/2012	9.5	7	18310								407.86		0.04		408.11	0.82	60.75		4776.6		712		5	538
Well	T1-B	3/21/2013	9.8	7.1	19500								401.65		0.11		445.27	0.632	50.64		4785.5		619		5	557
Well	T1-B	6/4/2013	15.3	7.1	18840								393.37		< .03		425.11	0.616	44.34		4694.5		654		< 5.	525
Well	T1-B	9/17/2013	15.2	7.1	18500								390.41		0.14		420.83	0.767	41.63		4604					474
Well	T1-B	12/17/2013	11.8	7.1	18800								383.75		0.3		410.32	0.706	38.9		4733.9					501
Well	T1-B	3/14/2014	12.2	7.1	19800								375.99		0.15		434.95	0.684	36.63		4400.1					453
Well	T1-B	6/26/2014	16.3	7.1	20200								398.77		0.05		451.53	0.677	39.12		5147.6		685		5	471
Well	T1-B	9/16/2014	15.4	7	21200								396.61		0.2		494.13	0.824	57.06		5172		738		< 5.	490
Well	T1-B	12/9/2014	9.8	7.1	20400								362.66		0.33		407.99	0.8	63.09		4662.6		736		< 5.	450
Well	T1-B	3/16/2015	10.7	7.1									334.46		0.23		421.92	0.685	32.83		4322.8		669		< 5.	429
Well	T1-B	6/8/2015	13.2	7.1	19340								327.52		0.24		414.36	0.648	42.49		4149.5		675		< 5.	419
Well	T1-B	9/29/2015	16.1	6.9	19900								338.8		70.31		468.6	6.128	46.85		5260.8		722		< 5.	393
Well	T1-B	12/29/2015	7.8	7	19100								377.92		0.45		451.3	0.696	44.14		5262.8		686		< 5.	369

Emery Water Quality Data - Kmb

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	USGS 3-1	9/27/2004	11.3	7.2	4850								424		2.2		273	1.13	31.9		268		532		< 5.	53
Well	USGS 3-1	12/28/2004																								
Well	USGS 3-1	3/25/2005																								
Well	USGS 3-1	5/11/2005																								
Well	USGS 3-1	7/19/2005																								
Well	USGS 3-1	11/17/2005																								
Well	USGS 3-1	3/9/2006																								
Well	USGS 3-1	6/28/2006																								
Well	USGS 3-1	9/28/2006																								
Well	USGS 3-1	11/27/2006																								
Well	USGS 3-1	3/22/2007																								
Well	USGS 3-1	6/15/2007																								
Well	USGS 3-1	9/18/2007																								
Well	USGS 3-1	12/11/2007																								
Well	USGS 3-1	3/26/2008																								
Well	USGS 3-1	6/24/2008																								
Well	USGS 3-1	9/30/2008																								
Well	USGS 3-1	12/13/2008																								
Well	USGS 3-1	2/25/2009																								
Well	USGS 3-1	6/4/2009																								
Well	USGS 3-1	12/14/2009																								
Well	USGS 3-1	12/29/2009																								
Well	USGS 3-1	3/24/2010																								
Well	USGS 3-1	6/21/2010																								
Well	USGS 3-1	7/19/2010																								
Well	USGS 3-1	11/5/2010																								
Well	USGS 3-1	3/28/2011																								
Well	USGS 3-1	6/8/2011																								
Well	USGS 3-1	9/20/2011																								
Well	USGS 3-1	12/13/2011																								
Well	USGS 3-1	3/16/2012																								
Well	USGS 4-1	12/2/2014																								
Well	USGS 4-1	3/16/2015																								
Well	USGS 4-1	6/8/2015																								
Well	USGS 4-1	9/4/2015																								
Well	USGS 4-1	12/2/2015																								

Note: Remaining wells dry or have access issues (blockages, oil, etc.).

Number of Observations:	30	30	29	0	1	1	1	0	1	0	41	0	24	0	41	38	41	1	41	0	31	0	4	42
Maximum:	19.4	7.7	21400	0	7.6	4	0.23	0	0.5	0	622	0	284.32	0	3520.5	11.441	90.32	0.001	16006	0	925	0	5	1870
Minimum:	7.8	6.8	1463	0	7.6	4	0.23	0	0.5	0	193	0	0.02	0	210	0.2	21	0.001	268	0	304	0	5	29
Mean:	13.5	7.1	15661.5	0.0	7.6	4.0	0.2	--	0.5	--	392.9	--	15.1	--	436.2	1.0	38.4	0.0	4782.9	--	567.5	--	5.0	419.0
Standard Deviation:	2.8	0.2	6421.4	--	--	--	--	--	--	--	71.0	--	59.1	--	500.9	2.0	13.7	--	1960.9	--	151.9	--	0.0	342.4
Equivalent weights of means:											19.6				35.9		1.0		208.1		9.3			11.8

Emery Water Quality Data - Kmb

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	T-Al mg/l	T-As mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	T1-B	6/30/1986	0.08	<0.01	0.05	16000			2960	25500	24232			348.8	348.5	0.24	0.36	472	
Well	T1-B	5/26/1989				10533		304	2016		17062			248.9	231.2			305	
Well	T1-B	9/11/1989				13118		424	2601		19806			291.1	289.3			450	
Well	T1-B	6/8/1990				12200		405	3195		17998	<0.1	<0.5	257.7	265.1				
Well	T1-B	9/17/1990				12159		402	3281		18176			255.1	267.9				
Well	T1-B	6/17/1991				11648		428	2030		20164			265.9	258.5				
Well	T1-B	9/23/1991				11484		410	1836		17770			249.7	251.2				
Well	T1-B	5/26/1992				10825		402			16506			236.1	236.9				
Well	T1-B	9/2/1992				11978		727	2109		16548			254.1	269.3				
Well	T1-B	6/7/1993				10949		394	2033		15910			235.4	240.9				
Well	T1-B	9/8/1993				11936		416	1872		15360			220.0	262.2				
Well	T1-B	6/6/1994				11442		440	1867		15656			214.0	252.4				
Well	T1-B	9/7/1994				9660		406	1942		15544			219.9	213.9				
Well	T1-B	6/6/1995				11000		430	1350		15500			200.9	241.0				
Well	T1-B	9/6/1995				9531		415	1845		14630			233.1	210.3				
Well	T1-B	6/5/2000				5542		521	2296		16673								
Well	T1-B	6/4/2001				9471		468	1975		14757								
Well	T1-B	6/18/2004																	Not enough water to sample
Well	T1-B	9/25/2004																	Not enough water to sample
Well	T1-B	5/11/2005																	Not enough water to sample
Well	T1-B	7/11/2005																	Not enough water to sample
Well	T1-B	9/28/2006																	Not enough water to sample
Well	T1-B	11/20/2006																	
Well	T1-B	3/20/2007																	
Well	T1-B	6/14/2007																	Not enough water to sample
Well	T1-B	9/18/2007																	Not enough water to sample
Well	T1-B	12/10/2007																	
Well	T1-B	3/26/2008																	
Well	T1-B	6/24/2008																	Not enough to sample
Well	T1-B	9/30/2008																	
Well	T1-B	12/11/2008																	
Well	T1-B	6/4/2009				9456		925	2349		15541								
Well	T1-B	7/14/2009				9091		882	2368	17500	16137								
Well	T1-B	12/29/2009																	
Well	T1-B	3/26/2010																	
Well	T1-B	6/24/2010				10225		726	2379		16376								
Well	T1-B	7/19/2010				47790		326	15624		73071								
Well	T1-B	10/15/2010																	
Well	T1-B	3/25/2011				10687		714	2647		16880								
Well	T1-B	6/8/2011				10689		688	2742		17588								
Well	T1-B	9/22/2011				13648		859	2950		20891								
Well	T1-B	12/13/2011				11219		763	2741		18508								
Well	T1-B	3/15/2012				10809		695	2652		17415								
Well	T1-B	6/20/2012				10206		650	2767		17644								
Well	T1-B	8/20/2012				10834		675	2819		17450								
Well	T1-B	11/7/2012				10995		712	2699		18329								
Well	T1-B	3/21/2013				11147		619	2837		18451								
Well	T1-B	6/4/2013				11704		654	2733		18709								
Well	T1-B	9/17/2013				10992		657	2708		17972								
Well	T1-B	12/17/2013				12280		682	2648		18816								
Well	T1-B	3/14/2014				12375		620	2730		18498								
Well	T1-B	6/26/2014				12111		685	2855		19991								
Well	T1-B	9/16/2014				11099		738	3025		20699								
Well	T1-B	12/9/2014				11136		736	2586		19755								
Well	T1-B	3/16/2015				11977		669	2573		18793								
Well	T1-B	6/8/2015				11933		675	2524		16656								
Well	T1-B	9/29/2015				12540		722	2776		19809								
Well	T1-B	12/29/2015				12315		686	2802		18901								

Emery Water Quality Data - Kmb

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	T-Al mg/l	T-As mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	USGS 3-1	9/27/2004				2513		532	2183		4531								Dissolved metals filtered at lab
Well	USGS 3-1	12/28/2004																	
Well	USGS 3-1	3/25/2005																	
Well	USGS 3-1	5/11/2005																	
Well	USGS 3-1	7/19/2005																	
Well	USGS 3-1	11/17/2005																	
Well	USGS 3-1	3/9/2006																	
Well	USGS 3-1	6/28/2006																	
Well	USGS 3-1	9/28/2006																	
Well	USGS 3-1	11/27/2006																	
Well	USGS 3-1	3/22/2007																	
Well	USGS 3-1	6/15/2007																	
Well	USGS 3-1	9/18/2007																	
Well	USGS 3-1	12/11/2007																	
Well	USGS 3-1	3/26/2008																	
Well	USGS 3-1	6/24/2008																	Dry Wells
Well	USGS 3-1	9/30/2008																	
Well	USGS 3-1	12/13/2008																	Dry Wells
Well	USGS 3-1	2/25/2009																	Dry Wells
Well	USGS 3-1	6/4/2009																	Dry Wells
Well	USGS 3-1	12/14/2009																	Dry Wells
Well	USGS 3-1	12/29/2009																	Dry Wells
Well	USGS 3-1	3/24/2010																	Dry Wells
Well	USGS 3-1	6/21/2010																	Dry Wells
Well	USGS 3-1	7/19/2010																	
Well	USGS 3-1	11/5/2010																	Dry Wells
Well	USGS 3-1	3/28/2011																	Dry Wells
Well	USGS 3-1	6/8/2011																	Dry Wells
Well	USGS 3-1	9/20/2011																	Dry Wells
Well	USGS 3-1	12/13/2011																	Dry Wells
Well	USGS 3-1	3/16/2012																	Dry Wells
Well	USGS 4-1	12/2/2014																	Dry Wells
Well	USGS 4-1	3/16/2015																	Dry Wells
Well	USGS 4-1	6/8/2015																	Dry Wells
Well	USGS 4-1	9/4/2015																	Dry Wells
Well	USGS 4-1	12/2/2015																	Dry Wells

Note: Remaining wells dry or have access issues (blockages, oil, etc.).

Number of Observations:	1	0	1	42	0	41	41	2	42	0	0	15	15	1	1	3
Maximum:	0.08	0	0.05	47790	0	925	15624	25500	73071	0	0	348.79	348.5	0.24	0.36	472
Minimum:	0.08	0	0.05	2513	0	304	1350	17500	4531	0	0	200.9	210.3	0.24	0.36	305
Mean:	0.1	--	0.1	11886.8	--	592.2	2803.0	21500.0	18802.5	--	--	248.7	255.9	0.2	0.4	409.0
Standard Deviation:	--	--	--	6027.6	--	162.5	2096.6	5656.9	9022.4	--	--	35.8	33.2	--	--	90.7
Equivalent weights of means:				247.5												

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	AA-U	5/23/2005																								
Well	AA-U	7/8/2005																								
Well	AA-U	11/28/2005																								
Well	AA-U	3/6/2006																								
Well	AA-U	6/29/2006																								
Well	AA-U	9/27/2006																								
Well	AA-U	11/20/2006																								
Well	AA-U	3/20/2007																								
Well	AA-U	6/13/2007																								
Well	AA-U	9/20/2007																								
Well	AA-U	12/10/2007																								
Well	AA-U	3/26/2008																								
Well	AA-U	6/24/2008																								
Well	AA-U	9/22/2008																								
Well	AA-U	12/12/2008																								
Well	AA-U	6/3/2009																								
Well	AA-U	12/15/2009																								
Well	AA-U	12/29/2009																								
Well	AA-U	3/25/2010																								
Well	AA-U	6/22/2010																								
Well	AA-U	7/20/2010																								
Well	AA-U	11/24/2010																								
Well	AA-U	3/28/2011																								
Well	AA-U	6/8/2011																								
Well	AA-U	9/28/2011																								
Well	AA-U	12/12/2011																								
Well	AA-U	3/16/2012																								
Well	BRYANT-U	6/24/1981					7.9	<2.							1								162.8		<1.	54.7
Well	BRYANT-U	3/12/1984					8.6	16							2.64								193		46	102
Well	BRYANT-U	6/13/1984					8.5																171		24	120
Well	BRYANT-U	9/24/1984					9.8																47		108	77
Well	BRYANT-U	3/25/1985					7.4																214		<1.	65
Well	BRYANT-U	6/20/1985					9.2	6							<0.05								100		86	77
Well	BRYANT-U	5/19/1989											3		<0.02		3	<0.01	4		451				136	89
Well	BRYANT-U	9/11/1989											1		0.18		1	0.01	5		410				127	85
Well	BRYANT-U	6/8/1990							0.74	<0.001	0.25	<0.01	21	<0.01	<0.02	<0.02	15	<0.01	3	<0.001	350	<0.01	72		138	70
Well	BRYANT-U	9/17/1990											2		0.03		9	0.01	3		412		92		123	77
Well	BRYANT-U	6/17/1991											2		1.58		1	0.01	3		340				172	59
Well	BRYANT-U	9/30/1991											35		0.06		19	0.02	3		351		238		16	43
Well	BRYANT-U	6/15/1992											2		0.07		1	<0.01	3		327				88	84
Well	BRYANT-U	9/2/1992											29		0.1		19	0.02	3		356		243			49
Well	BRYANT-U	6/7/1993											2		1.12		3	0.01	5		374		74		332	50
Well	BRYANT-U	9/8/1993											2		0.02		4	<0.01	4		349		100		128	49
Well	BRYANT-U	6/20/1994	14.9	9.3	1480								2		0.14		2	<0.01	5		359		86		204	54
Well	BRYANT-U	9/7/1994	15.3	8.5	1470								1		<0.02		1	<0.01	3		393		58		136	63
Well	BRYANT-U	6/6/1995	12.9	9.1	1840								2		<0.1		3	<0.1	3		340		<5.		300	72
Well	BRYANT-U	9/5/1995	17.3	7.9	1700								6		<0.1		9	<0.1	4		396		55		155	80
Well	BRYANT-U	6/13/2000	13.6	8.5	1940								2		<0.1		<1.	<0.1	3		367		<5.		247	44
Well	BRYANT-U	6/5/2001	13.4	8.5	1850								2		<0.1		1	<0.1	3		355		<5.		160	52
Well	BRYANT-U	9/5/2001	15.1	9.1	2060								2		<0.1		1	<0.05	4		365		<5.		88	53.1
Well	BRYANT-U	6/24/2002	14.7	8.7	1840								2		<0.1		<1.	<0.05	3		363		<5.		130	45
Well	BRYANT-U	9/24/2002	14.1	7.5	1810								4		<0.1		9	<0.05	3		363		99.75		51	47
Well	BRYANT-U	9/18/2003																								
Well	BRYANT-U	9/25/2004																								
Well	BRYANT-U	12/27/2004																								
Well	BRYANT-U	5/26/2005	13.5	8.5	9480								318		< .03		209	0.491	11.9		1970					83
Well	BRYANT-U	7/22/2005	13.8	8.4	1920			58					14.9		< .03		15.7	0.008	3.01		327					42
Well	BRYANT-U	6/30/2006																								
Well	BRYANT-U	9/27/2006																								
Well	BRYANT-U	11/20/2006																								
Well	BRYANT-U	3/20/2007																								
Well	BRYANT-U	9/20/2007																								
Well	BRYANT-U	12/10/2007																								
Well	BRYANT-U	3/26/2008																								
Well	BRYANT-U	6/24/2008																								

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	BRYANT-U	9/22/2008																								
Well	BRYANT-U	12/12/2008																								
Well	BRYANT-U	6/3/2009																								
Well	BRYANT-U	12/14/2009																								
Well	BRYANT-U	12/29/2009																								
Well	BRYANT-U	3/24/2010																								
Well	BRYANT-U	6/24/2010																								
Well	BRYANT-U	7/20/2010																								
Well	BRYANT-U	11/24/2010																								
Well	BRYANT-U	3/28/2011																								
Well	BRYANT-U	6/8/2011																								
Well	BRYANT-U	9/28/2011																								
Well	BRYANT-U	12/12/2011																								
Well	BRYANT-U	3/15/2012																								
Well	H-U	9/17/2003																								
Well	H-U	12/19/2003																								
Well	H-U	3/30/2004																								
Well	H-U	6/18/2004																								
Well	H-U	9/25/2004																								
Well	H-U	12/28/2004																								
Well	H-U	3/25/2005																								
Well	H-U	5/23/2005																								
Well	H-U	7/11/2005																								
Well	H-U	11/22/2005																								
Well	H-U	3/9/2006																								
Well	H-U	6/29/2006																								
Well	H-U	9/27/2006																								
Well	H-U	11/27/2006																								
Well	H-U	3/20/2007																								
Well	H-U	6/14/2007																								
Well	H-U	9/20/2007																								
Well	H-U	12/10/2007																								
Well	H-U	3/28/2008																								
Well	H-U	6/24/2008																								
Well	H-U	9/20/2008																								
Well	H-U	12/12/2008																								
Well	H-U	6/3/2009																								
Well	H-U	12/14/2009																								
Well	H-U	12/29/2009																								
Well	H-U	3/25/2010																								
Well	H-U	6/23/2010																								
Well	H-U	7/21/2010																								
Well	H-U	11/24/2010																								
Well	LEWIS-U	6/20/1985					8.3	1							<0.05								285		<1.	41
Well	LEWIS-U	9/19/1985					8.3	<0.5							<0.05								288		<1.	38
Well	LEWIS-U	6/24/1986					8.5	<0.5							<0.05								268		30	31
Well	LEWIS-U	6/30/1989											1		0.03		1	<0.01	1		370		286		20	29
Well	LEWIS-U	9/11/1989											1		0.02		1	0.01	2		330		276		32	26
Well	LEWIS-U	6/8/1990							0.5	0.002	0.29	<0.01	17	<0.01	0.09	<0.02	11	<0.01	1	<0.001	300	0.03	275		40	44
Well	LEWIS-U	9/17/1990											<1.		<0.02		2	<0.01	1		340		280		32	30
Well	LEWIS-U	6/5/1991											27		0.25		16	<0.01	1		270		264		36	31
Well	LEWIS-U	9/23/1991											5		<0.04		2	0.02	1		365		274		28	28
Well	LEWIS-U	5/26/1992											2		<0.02		1	<0.01	1		316		274		32	30
Well	LEWIS-U	9/2/1992											2		0.07		1	<0.01	1		281		290		28	30
Well	LEWIS-U	6/7/1993											2		<0.02		2	<0.01	1		335		266		32	29
Well	LEWIS-U	9/7/1993											2		<0.02		1	<0.01	1		302		290		32	29
Well	LEWIS-U	6/6/1994											3		<0.02		2	<0.01	1		328		294		68	32
Well	LEWIS-U	9/7/1994	15.9	7.6	1250								2		<0.02		2	<0.01	1		338		286		28	33
Well	LEWIS-U	6/6/1995	12.5	7.7	1110								7		<0.1		19	<0.1	1		330		300		40	30
Well	LEWIS-U	9/5/1995	16	7.5	1250								4		<0.1		7	<0.1	1		346		295		40	29
Well	LEWIS-U	6/13/2000	14.2	7.7	1560								2		<0.1		2	<0.1	<1.		325		336		17	26
Well	LEWIS-U	6/5/2001	13.4	7.8	1550								3		<0.1		2	<0.1	1		319		330		17	32
Well	LEWIS-U	9/5/2001	13.9	7.9	1550								2		<0.1		2	<0.05	1		331		306		21	33.1
Well	LEWIS-U	6/24/2002	15.8	7.9	1590								3		<0.1		2	<0.05	1		324		326		17	26
Well	LEWIS-U	9/24/2002	13.1	7.9	1540								3		<0.1		1.5	<0.05	<1.		330		326		16	25

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	LEWIS-U	9/17/2003																								
Well	LEWIS-U	3/29/2004																								
Well	LEWIS-U	6/18/2004																								
Well	LEWIS-U	9/25/2004																								
Well	LEWIS-U	9/27/2006																								
Well	LEWIS-U	11/20/2006																								
Well	LEWIS-U	3/22/2007																								
Well	LEWIS-U	6/13/2007																								
Well	LEWIS-U	9/20/2007																								
Well	LEWIS-U	12/10/2007																								
Well	LEWIS-U	3/26/2008																								
Well	LEWIS-U	6/24/2008																								
Well	LEWIS-U	9/22/2008																								
Well	LEWIS-U	12/12/2008																								
Well	LEWIS-U	2/25/2009																								
Well	LEWIS-U	6/3/2009																								
Well	LEWIS-U	12/14/2009																								
Well	LEWIS-U	3/25/2010																								
Well	LEWIS-U	6/22/2010																								
Well	LEWIS-U	7/20/2010																								
Well	LEWIS-U	11/24/2010																								
Well	LEWIS-U	3/28/2011																								
Well	LEWIS-U	6/8/2011																								
Well	LEWIS-U	9/22/2011																								
Well	LEWIS-U	12/12/2011																								
Well	LEWIS-U	3/15/2012																								
Well	MUDDY2	12/28/2004																								
Well	MUDDY2	3/25/2005																								
Well	MUDDY2	5/12/2005																								
Well	MUDDY2	7/20/2005																								
Well	MUDDY2	11/17/2005																								
Well	MUDDY2	3/9/2006																								
Well	MUDDY2	6/28/2006																								
Well	MUDDY2	9/28/2006																								
Well	MUDDY2	11/27/2006																								
Well	MUDDY2	3/22/2007																								
Well	MUDDY2	6/15/2007																								
Well	MUDDY2	9/18/2007																								
Well	MUDDY2	12/10/2007																								
Well	MUDDY2	3/26/2008																								
Well	MUDDY2	6/24/2008																								
Well	MUDDY2	9/22/2008																								
Well	MUDDY2	12/13/2008																								
Well	MUDDY2	6/4/2009																								
Well	MUDDY2	12/14/2009																								
Well	MUDDY2	12/29/2009																								
Well	MUDDY2	3/24/2010																								
Well	MUDDY2	6/21/2010																								
Well	MUDDY2	7/19/2010																								
Well	MUDDY2	11/24/2010																								
Well	MUDDY2	3/28/2011																								
Well	MUDDY2	6/21/2011																								
Well	MUDDY2	9/20/2011																								
Well	MUDDY2	12/13/2011																								
Well	MUDDY2	3/16/2012																								
Well	R2-U	9/17/2003																								
Well	R2-U	3/18/2004																								
Well	R2-U	9/20/2004																								
Well	R2-U	12/28/2004																								
Well	R2-U	3/24/2005																								
Well	R2-U	5/23/2005																								
Well	R2-U	7/11/2005																								
Well	R2-U	11/28/2005																								
Well	R2-U	3/7/2006																								
Well	R2-U	6/29/2006																								

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	R2-U	9/28/2006																								
Well	R2-U	11/20/2006																								
Well	R2-U	3/20/2007																								
Well	R2-U	6/14/2007																								
Well	R2-U	9/18/2007																								
Well	R2-U	12/10/2007																								
Well	R2-U	3/26/2008																								
Well	R2-U	6/24/2008																								
Well	R2-U	9/20/2008																								
Well	R2-U	12/12/2008																								
Well	R2-U	6/3/2009																								
Well	R2-U	12/14/2009																								
Well	R2-U	12/29/2009																								
Well	R2-U	3/25/2010																								
Well	R2-U	6/23/2010																								
Well	R2-U	7/19/2010																								
Well	R2-U	10/15/2010																								
Well	R2-U	3/25/2011																								
Well	R2-U	6/21/2011																								
Well	R2-U	9/27/2011																								
Well	R2-U	12/13/2011																								
Well	R2-U	3/21/2012																								
Spring	SP-15	8/30/1982					6.8		1.99														281		<1.	16.3
Spring	SP-15	2/15/1983							2														260		<1.	17
Spring	SP-15	6/26/1984					7.2																240		<1.	14
Spring	SP-15	5/21/1985							<0.05														233		<1.	26
Spring	SP-15	8/14/1985							<0.05														256		<1.	19
Spring	SP-15	3/31/1986					4	828							0.33								<1.		<1.	69
Spring	SP-15	6/30/1986					7.65	25							<0.05								256		<1.	8
Spring	SP-15	12/23/1986							<0.5														35		0	24.7
Spring	SP-15	12/4/1995				0																				
Spring	SP-15	3/4/1997				0																				
Spring	SP-15	6/2/1997				0																				
Spring	SP-15	9/10/1997				0																				
Spring	SP-15	12/3/1997				0																				
Spring	SP-15	3/2/1998				0																				
Spring	SP-15	6/1/1998				0																				
Spring	SP-15	9/1/1998				0																				
Spring	SP-15	6/13/2000	13.9	7.6	1790								328		<0.1		102	0.2	3		90		175		<5.	12
Spring	SP-15	3/21/2001				0																				
Spring	SP-15	6/5/2001				0																				
Spring	SP-15	9/4/2001				0																				
Spring	SP-15	12/10/2001				0																				
Spring	SP-15	1/1/2002				0																				
Spring	SP-15	3/6/2002				0																				
Spring	SP-15	6/8/2002				0																				
Spring	SP-15	6/30/2003				0																				
Spring	SP-15	9/18/2003				0																				
Spring	SP-15	12/26/2003				0																				
Spring	SP-15	3/10/2004				0																				
Spring	SP-15	6/23/2004				0																				
Spring	SP-15	9/25/2004				0																				
Spring	SP-15	12/28/2004				0																				
Spring	SP-15	3/31/2005				0																				
Spring	SP-15	5/23/2005				0																				
Spring	SP-15	7/19/2005				0																				
Spring	SP-15	11/22/2005				0																				
Spring	SP-15	3/9/2006				0																				
Spring	SP-15	6/27/2006				0																				
Spring	SP-15	9/29/2006				0																				
Spring	SP-15	11/28/2006				0																				
Spring	SP-15	3/26/2007				0																				
Spring	SP-15	6/18/2007				29.2																				
Spring	SP-15	9/26/2007				1.3																				
Spring	SP-15	12/11/2007				0																				

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Spring	SP-15	3/24/2008				18.0																				
Spring	SP-15	6/26/2008				175																				
Spring	SP-15	9/30/2008				2.3																				
Spring	SP-15	12/11/2008				9.9																				
Spring	SP-15	7/15/2009				2.3																				
Spring	SP-15	12/15/2009				2.3																				
Spring	SP-15	12/30/2009																								
Spring	SP-15	3/24/2010				0																				
Spring	SP-15	6/28/2010	17.7	7.4	1247	5.1							192.5		< .03		57.13	0.089	5.03		34.74		148		> 5.	4
Spring	SP-15	7/20/2010	15.4	7	1280	1010							203.53		< .03		55.04	0.066	3.79		35.37				0	3
Spring	SP-15	11/5/2010				0																				
Spring	SP-15	3/25/2011				0																				
Spring	SP-15	6/24/2011	16.2	8	871	193							86.87		0.16		37.82	0.013	4.95		22.69				0	3
Spring	SP-15	9/27/2011				0																				
Spring	SP-15	12/9/2011				0																				
Spring	SP-15	3/22/2012				0																				
Spring	SP-15	6/25/2012				0																				
Spring	SP-15	8/20/2012				0																				
Spring	SP-15	11/7/2012				0																				
Spring	SP-15	3/27/2013				0																				
Spring	SP-15	6/4/2013				0																				
Spring	SP-15	9/16/2013				0																				
Spring	SP-15	12/5/2013				0																				
Spring	SP-15	3/7/2014				0																				
Spring	SP-15	6/6/2014				0																				
Spring	SP-15	9/15/2014				0																				
Spring	SP-15	12/1/2014				0																				
Spring	SP-15	3/11/2015				0																				
Spring	SP-15	5/21/2015				0																				
Spring	SP-15	9/1/2015																								
Spring	SP-15	12/1/2015																								
Well	T1-U	3/29/2004																								
Well	T1-U	12/28/2004																								
Well	T1-U	3/31/2005																								
Well	T1-U	5/11/2005																								
Well	T1-U	7/11/2005																								
Well	T1-U	11/22/2005																								
Well	T1-U	9/28/2006																								
Well	T1-U	11/20/2006																								
Well	T1-U	3/20/2007																								
Well	T1-U	6/14/2007																								
Well	T1-U	9/18/2007																								
Well	T1-U	12/10/2007																								
Well	T1-U	3/26/2008																								
Well	T1-U	6/24/2008																								
Well	T1-U	9/30/2008																								
Well	T1-U	12/12/2008																								
Well	T1-U	2/20/2009																								
Well	T1-U	6/4/2009																								
Well	T1-U	12/14/2009																								
Well	T1-U	12/29/2009																								
Well	T1-U	3/24/2010																								
Well	T1-U	6/23/2010																								
Well	T1-U	7/19/2010																								
Well	T1-U	10/15/2010																								
Well	T1-U	3/25/2011																								
Well	T1-U	6/8/2011																								
Well	T1-U	9/20/2011																								
Well	T1-U	12/13/2011																								
Well	T1-U	3/21/2012																								
Well	T1-U	6/20/2012																								
Well	T1-U	8/20/2012																								
Well	T1-U	11/1/2012																								
Well	T1-U	3/21/2013																								
Well	T1-U	6/4/2013																								

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	T1-U	9/17/2013																								
Well	T1-U	12/5/2013																								
Well	T1-U	3/14/2014																								
Well	T1-U	6/26/2014																								
Well	T1-U	9/16/2014																								
Well	T1-U	12/9/2014																								
Well	T2-U	9/17/2003																								
Well	T2-U	3/29/2004																								
Well	T2-U	6/18/2004																								
Well	T2-U	12/28/2004																								
Well	T2-U	5/11/2005																								
Well	T2-U	7/11/2005																								
Well	T2-U	11/22/2005																								
Well	T2-U	9/28/2006																								
Well	T2-U	11/20/2006																								
Well	T2-U	3/20/2007																								
Well	T2-U	6/14/2007																								
Well	T2-U	9/18/2007																								
Well	T2-U	12/10/2007																								
Well	T2-U	3/26/2008																								
Well	T2-U	6/24/2008																								
Well	T2-U	9/30/2008																								
Well	T2-U	12/12/2008																								
Well	T2-U	2/20/2009																								
Well	T2-U	6/4/2009																								
Well	T2-U	12/14/2009																								
Well	T2-U	12/29/2009																								
Well	T2-U	3/24/2010																								
Well	T2-U	6/23/2010																								
Well	T2-U	7/19/2010																								
Well	T2-U	10/15/2010																								
Well	T2-U	12/13/2011																								
Well	T2-U	3/15/2012																								
Well	TP-U	7/31/1985					9.9	85							<0.05								158		370	53
Well	TP-U	9/26/1985					9.5	78							1.6								254		218	52
Well	TP-U	6/30/1986					9.5	165							0.11								138		312	46
Well	TP-U	5/26/1989											<1.		0.35		<1.	<0.01	3		402		32		336	49
Well	TP-U	9/11/1989											1		0.07		1	0.01	2		369		140		440	45
Well	TP-U	6/8/1990							0.46	<0.001	0.3	<0.01	2	<0.01	<0.02	<0.02	<1.	<0.01	1	<0.001	348	0.04	29		490	48
Well	TP-U	9/18/1990											<1.		0.07		<1.	<0.01	1		386		302		204	55
Well	TP-U	6/17/1991											2		21		<1.	0.09	1		339		310		218	55
Well	TP-U	9/23/1991											2		0.06		<1.	<0.01	1		437		284		246	48
Well	TP-U	5/26/1992											1		<0.02		<1.	<0.01	1		341		106		384	45
Well	TP-U	9/2/1992											1		<0.02		<1.	<0.01	1		348				80	48
Well	TP-U	6/7/1993											<1.		0.3		<1.	<0.01	1		349				56	46
Well	TP-U	9/8/1993											<1.		<0.02		<1.	<0.01	1		379		82		472	45
Well	TP-U	6/6/1994											<1.		<0.02		1	<0.01	1		389					46
Well	TP-U	9/7/1994	17.2	8.8	2980								<1.		<0.02		<1.	<0.01	1		417		82		464	55
Well	TP-U	9/17/2003																								
Well	TP-U	9/23/2004																								
Well	TP-U	12/28/2004																								
Well	TP-U	3/31/2005																								
Well	TP-U	5/11/2005																								
Well	TP-U	7/11/2005																								
Well	TP-U	11/22/2005																								
Well	TP-U	3/9/2006																								
Well	TP-U	6/28/2006																								
Well	TP-U	9/28/2006																								
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Well	TP-U	3/20/2007																								
Well	TP-U	6/14/2007																								
Well	TP-U	9/18/2007																								
Well	TP-U	12/10/2007																								
Well	TP-U	3/26/2008																								
Well	TP-U	6/24/2008																								

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	TP-U	9/30/2008																								
Well	TP-U	12/12/2008																								
Well	TP-U	6/4/2009																								
Well	TP-U	12/14/2009																								
Well	TP-U	12/29/2009																								
Well	TP-U	3/24/2010																								
Well	TP-U	6/23/2010																								
Well	TP-U	7/19/2010																								
Well	TP-U	10/15/2010																								
Well	TP-U	3/25/2011																								
Well	TP-U	6/8/2011																								
Well	TP-U	9/20/2011																								
Well	TP-U	12/13/2011																								
Well	TP-U	3/15/2012																								
Well	USGS 1-2	6/24/1981					7.6	355.5							24								410.6		<1.	25.7
Well	USGS 1-2	12/30/1981					8.3																561		<1.	51.1
Well	USGS 1-2	3/16/1982					7.5																484		<1.	34.1
Well	USGS 1-2	6/15/1982					8.1																458		<1.	33.5
Well	USGS 1-2	9/20/1982					7.7																418		<1.	33
Well	USGS 1-2	12/10/1982					7.6																386		<1.	30.6
Well	USGS 1-2	3/22/1983					7.3																412		<1.	25
Well	USGS 1-2	6/30/1983					7.65																451		<1.	27
Well	USGS 1-2	9/26/1983					7.55																436		<1.	21
Well	USGS 1-2	12/29/1983					7.3																472		<1.	18
Well	USGS 1-2	3/8/1984					7.6	253							0.22								447		<1.	26
Well	USGS 1-2	6/13/1984					7.5																380		<1.	21
Well	USGS 1-2	9/24/1984					7.4																376		<1.	17
Well	USGS 1-2	3/27/1985					7.45																354		<1.	21
Well	USGS 1-2	6/20/1985					7.35	5							<0.05								330		<1.	18
Well	USGS 1-2	9/19/1985					7.45	58							<0.05								324		<1.	18
Well	USGS 1-2	6/24/1986					7.1	20							<0.05								336		<1.	17
Well	USGS 1-2	5/19/1989											241		<0.02		474	0.13	17		2030		456			209
Well	USGS 1-2	9/11/1989											307		0.02		290	0.21	12		521		458			68
Well	USGS 1-2	6/4/1990							1.07	0.004	0.37	<0.01	175	<0.01	0.03	<0.02	146	0.06	6	<0.001	418	0.01	450			45
Well	USGS 1-2	9/18/1990											68		<0.02		58	0.06	5		298		366			<1.
Well	USGS 1-2	6/17/1991											312		0.97		162	0.52	7		369		378			46
Well	USGS 1-2	9/24/1991											376		<0.02		170	0.67	8		410		374			50
Well	USGS 1-2	6/24/1992											281		0.53		155	0.37	7		462		462			40
Well	USGS 1-2	9/2/1992											249		0.24		102	0.32	6		372		428			37
Well	USGS 1-2	6/7/1993											242		0.83		150	0.32	7		471		450			44
Well	USGS 1-2	9/8/1993											179		0.04		129	0.21	7		446		494			45
Well	USGS 1-2	6/6/1994											268		0.12		110	0.51	6		397		450			39
Well	USGS 1-2	9/7/1994	12.5	8.4									288		<0.02		103	0.52	6		393		440			26
Well	USGS 1-2	6/6/1995	9.7	8.2									154		<0.1		95	0.3	5		450		580		<5.	31
Well	USGS 1-2	9/6/1995	18.5	7.5	3250								230		0.4		85	0.3	6		446		605		<5.	35
Well	USGS 1-2	6/5/2001	12.5	7.5	4320								223		0.2		204	0.1	9		518		582		<5.	65
Well	USGS 1-2	9/5/2001	14.6	7.5	5450								254		<0.1		230	0.11	9		592		627		<5.	64.3
Well	USGS 1-2	6/24/2002	15.5	7.5	3710								185		<0.1		148	0.27	7		456		493		<5.	41
Well	USGS 1-2	9/23/2002	12.3	6.4	3910								215		<0.1		174	0.28	7		491		501		<5.	41
Well	USGS 1-2	9/17/2003	13.3	7.1	5870								331		< .005		311	0.486	13.4		743		626		< 5.	78
Well	USGS 1-2	6/18/2004	14.5	7.1	6530								369		0.04		346	0.511	14.2		797		469		< 5.	71
Well	USGS 1-2	12/28/2004																								
Well	USGS 1-2	3/25/2005																								
Well	USGS 1-2	5/11/2005																								
Well	USGS 1-2	7/19/2005																								
Well	USGS 1-2	11/17/2005																								
Well	USGS 1-2	3/9/2006																								
Well	USGS 1-2	6/28/2006																								
Well	USGS 1-2	9/28/2006																								
Well	USGS 1-2	11/27/2006																								
Well	USGS 1-2	3/22/2007																								
Well	USGS 1-2	6/15/2007																								
Well	USGS 1-2	9/18/2007																								
Well	USGS 1-2	12/10/2007																								
Well	USGS 1-2	3/26/2008																								

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l
Well	USGS 1-2	6/24/2008																								
Well	USGS 1-2	9/30/2008																								
Well	USGS 1-2	12/13/2008																								
Well	USGS 1-2	2/25/2009																								
Well	USGS 1-2	6/4/2009																								
Well	USGS 1-2	12/14/2009																								
Well	USGS 1-2	3/24/2010																								
Well	USGS 1-2	6/21/2010																								
Well	USGS 1-2	7/19/2010																								
Well	USGS 1-2	11/5/2010																								
Well	USGS 1-2	3/28/2011																								
Well	USGS 1-2	6/8/2011																								
Well	USGS 1-2	9/20/2011																								
Well	USGS 1-2	12/13/2011																								
Well	USGS 1-2	3/16/2012																								

Note: Remaining wells dry or have access issues (blockages, etc.).

Number of Observations:	33	33	31	62	33	14	6	2	4	4	69	4	39	0	64	36	74	4	76	3	96	0	59	112
Maximum:	18.5	9.3	9480		9.9	828	2	0.004	0.37	<0.01	376	<0.01	24	0	474	0.67	17	<0.001	2030	0.04	627	0	490	209
Minimum:	9.7	6.4	871		4	1	0.46	0.002	0.25	<0.01	1	<0.01	0.02	0	1	0.008	1	<0.001	22.69	0.01	29	0	0	3
Mean:	14.5	7.9	2581		7.9	139.5	1.13	0.003	0.3	<0.01	91.446	<0.01	1.52	--	67.2	0.20	4.0	<0.001	411.4	0.03	301.5	--	133.7	44.0
Standard Deviation:	1.8	0.7	1945	--	1.1	223.9	0.71	0.001	0.0	--	124	--	4.99	--	100.8	0.20	3.5	--	286.9	0.02	149.7	--	136.6	26.5
Equivalent weights of means:											4.6				5.5		0.1		17.9		4.9			1.2

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	AA-U	5/23/2005																Oil in Well
Well	AA-U	7/8/2005																
Well	AA-U	11/28/2005																
Well	AA-U	3/6/2006																
Well	AA-U	6/29/2006																
Well	AA-U	9/27/2006																
Well	AA-U	11/20/2006																
Well	AA-U	3/20/2007																
Well	AA-U	6/13/2007																
Well	AA-U	9/20/2007																
Well	AA-U	12/10/2007																
Well	AA-U	3/26/2008																
Well	AA-U	6/24/2008																
Well	AA-U	9/22/2008																
Well	AA-U	12/12/2008																
Well	AA-U	6/3/2009																
Well	AA-U	12/15/2009																
Well	AA-U	12/29/2009																
Well	AA-U	3/25/2010																
Well	AA-U	6/22/2010																
Well	AA-U	7/20/2010																
Well	AA-U	11/24/2010																
Well	AA-U	3/28/2011																
Well	AA-U	6/8/2011																
Well	AA-U	9/28/2011																
Well	AA-U	12/12/2011																
Well	AA-U	3/16/2012																
Well	BRYANT-U	6/24/1981	<0.01	<0.01		768.5	162.8	559.3	1720	1256			21.4	20.5	6	6	19	
Well	BRYANT-U	3/12/1984	0.05	<0.01	0.02	1000		225	2600	1770			25.75	26.88	5.44	0.06	30	
Well	BRYANT-U	6/13/1984	<0.01	<0.01	0.04	1050		191	2720	1813			25.47	28.67	1.5	0.01	32	
Well	BRYANT-U	9/24/1984	<0.01	<0.01	<0.01	900		130	2350	1475			21.59	21.85	0.91	<0.01	23	
Well	BRYANT-U	3/25/1985	<0.01	<0.01	0.07	795		203	2400	1519			23.1	22.67	8.55	0.09	25	
Well	BRYANT-U	6/20/1985	0.04	<0.01	0.05	755		118	2310	1602			21.83	21.62	3.08	0.03	21	
Well	BRYANT-U	5/19/1989				617	160	20		1232			20.34	18.65			10	
Well	BRYANT-U	9/11/1989				677	167	2		1238			18.2	19.94			2	
Well	BRYANT-U	6/8/1990				593	210	114		1152	<0.05	<0.05	17.76	18.61				
Well	BRYANT-U	9/17/1990				562	215	42		1148			19.04	18.26				
Well	BRYANT-U	6/17/1991				506	172	9		1130			15.22	15.72				
Well	BRYANT-U	9/30/1991				652	254	165		1224			18.83	19.98				
Well	BRYANT-U	6/15/1992				529	88			998			14.65	15.22				
Well	BRYANT-U	9/2/1992				681	243	150		1250			18.75	20.53				
Well	BRYANT-U	6/7/1993				348	406	17		954			16.93	16.83				
Well	BRYANT-U	9/8/1993				531	228	21		1000			15.89	17.08				
Well	BRYANT-U	6/20/1994				500	290	13		1026			16.19	17.81				
Well	BRYANT-U	9/7/1994				593	194	7		1042			17.5	18.1				
Well	BRYANT-U	6/6/1995				230	430	20		1070			15.1	16.8				
Well	BRYANT-U	9/5/1995				607	305	52		1040			18.3	21				
Well	BRYANT-U	6/13/2000				465	214	5		1073								
Well	BRYANT-U	6/5/2001				553	170	9		1048								
Well	BRYANT-U	9/5/2001				536	179	9		1058								
Well	BRYANT-U	6/24/2002				529	217	5		1036			16	16.6				
Well	BRYANT-U	9/24/2002				589		47		1067								
Well	BRYANT-U	9/18/2003																Power off. Could not sample.
Well	BRYANT-U	9/25/2004																Fuse blown. No power to pump.
Well	BRYANT-U	12/27/2004																Fuse blown to pump
Well	BRYANT-U	5/26/2005				6884		378										Suspect data. Reported TDS=7963
Well	BRYANT-U	7/22/2005				699		148		1172								
Well	BRYANT-U	6/30/2006																No access to sample
Well	BRYANT-U	9/27/2006																No power to sample
Well	BRYANT-U	11/20/2006																
Well	BRYANT-U	3/20/2007																
Well	BRYANT-U	9/20/2007																
Well	BRYANT-U	12/10/2007																
Well	BRYANT-U	3/26/2008																
Well	BRYANT-U	6/24/2008																No Acess to sample

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	BRYANT-U	9/22/2008																
Well	BRYANT-U	12/12/2008																Units Measured in PSI
Well	BRYANT-U	6/3/2009																unabe to obtain a sample
Well	BRYANT-U	12/14/2009																
Well	BRYANT-U	12/29/2009																
Well	BRYANT-U	3/24/2010																
Well	BRYANT-U	6/24/2010																
Well	BRYANT-U	7/20/2010																measured in PSI and was broken
Well	BRYANT-U	11/24/2010																
Well	BRYANT-U	3/28/2011																PUMP BURNED UP? DEPTH WAS 272.7'
Well	BRYANT-U	6/8/2011																Pump doesn't work
Well	BRYANT-U	9/28/2011																
Well	BRYANT-U	12/12/2011																
Well	BRYANT-U	3/15/2012																Pump was burned up
Well	H-U	9/17/2003																Oily
Well	H-U	12/19/2003																
Well	H-U	3/30/2004																
Well	H-U	6/18/2004																
Well	H-U	9/25/2004																
Well	H-U	12/28/2004																
Well	H-U	3/25/2005																
Well	H-U	5/23/2005																
Well	H-U	7/11/2005																
Well	H-U	11/22/2005																
Well	H-U	3/9/2006																
Well	H-U	6/29/2006																
Well	H-U	9/27/2006																
Well	H-U	11/27/2006																
Well	H-U	3/20/2007																
Well	H-U	6/14/2007																
Well	H-U	9/20/2007																
Well	H-U	12/10/2007																
Well	H-U	3/28/2008																
Well	H-U	6/24/2008																hit oil
Well	H-U	9/20/2008																
Well	H-U	12/12/2008																
Well	H-U	6/3/2009																
Well	H-U	12/14/2009																
Well	H-U	12/29/2009																
Well	H-U	3/25/2010																
Well	H-U	6/23/2010																
Well	H-U	7/21/2010																
Well	H-U	11/24/2010																
Well	LEWIS-U	6/20/1985	0.02	<0.01	0.1	380		18	1600	895			14.03	14.07	0.12	<0.01	4	
Well	LEWIS-U	9/19/1985	<0.01	<0.01	0.04	456		25	1405	912			15.81	16.33	0.13	0.01	2	
Well	LEWIS-U	6/24/1986	0.03	<0.01	0.05	370		13	1510	887			15.15	14.94	<0.05	<0.01	1	
Well	LEWIS-U	6/30/1989				358	306	7		876			16.44	14.45			2	
Well	LEWIS-U	9/11/1989				370	308	2		882			14.6	14.66			1	
Well	LEWIS-U	6/8/1990				362	315	88		916	0.05	<0.05	14.98	15.13				
Well	LEWIS-U	9/17/1990				360	312	6		910			15.1	14.64				
Well	LEWIS-U	6/5/1991				370	300	133		886			14.57	14.64				
Well	LEWIS-U	9/23/1991				445	302	21		1060			16.5	16.17				
Well	LEWIS-U	5/26/1992				348	306			876			14.11	14.27				
Well	LEWIS-U	9/2/1992				270	318	9		898			12.57	12.87				
Well	LEWIS-U	6/7/1993				381	298	13		902			15.03	14.77				
Well	LEWIS-U	9/7/1993				329	322	9		830			13.5	14.16				
Well	LEWIS-U	6/6/1994				403	318	16		924			14.77	15.72				
Well	LEWIS-U	9/7/1994				387	314	13		888			15.16	15.33				
Well	LEWIS-U	6/6/1995				370	310	100		960			16.3	14.8				
Well	LEWIS-U	9/5/1995				389	310	39		890			15.8	15.1				
Well	LEWIS-U	6/13/2000				353	304	13		906								
Well	LEWIS-U	6/5/2001				429	298	16		911								
Well	LEWIS-U	9/5/2001				400	286	13		938								
Well	LEWIS-U	6/24/2002				387	296	16		921			14.4	14.7				
Well	LEWIS-U	9/24/2002				387		12		1015								

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	LEWIS-U	9/17/2003																Dry
Well	LEWIS-U	3/29/2004																probe stops at 215 feet
Well	LEWIS-U	6/18/2004																probe hangs up no water to sample
Well	LEWIS-U	9/25/2004																Not enough water to sample
Well	LEWIS-U	9/27/2006																No access to sample or probe for depth
Well	LEWIS-U	11/20/2006																
Well	LEWIS-U	3/22/2007																No Access
Well	LEWIS-U	6/13/2007																No Access
Well	LEWIS-U	9/20/2007																
Well	LEWIS-U	12/10/2007																No Access
Well	LEWIS-U	3/26/2008																No Access
Well	LEWIS-U	6/24/2008																No Access
Well	LEWIS-U	9/22/2008																No Access
Well	LEWIS-U	12/12/2008																No Access
Well	LEWIS-U	2/25/2009																No Access
Well	LEWIS-U	6/3/2009																No Access
Well	LEWIS-U	12/14/2009																No Access
Well	LEWIS-U	3/25/2010																No Access
Well	LEWIS-U	6/22/2010																Oil in well
Well	LEWIS-U	7/20/2010																No Access
Well	LEWIS-U	11/24/2010																No Access
Well	LEWIS-U	3/28/2011																No Access
Well	LEWIS-U	6/8/2011																No Access
Well	LEWIS-U	9/22/2011																No Access
Well	LEWIS-U	12/12/2011																No Access
Well	LEWIS-U	3/15/2012																No Access
Well	MUDDY2	12/28/2004																Broken Pipe
Well	MUDDY2	3/25/2005																665+ Dry
Well	MUDDY2	5/12/2005																655+ Dry
Well	MUDDY2	7/20/2005																Well is dry
Well	MUDDY2	11/17/2005																Well is broken at 510 ft.
Well	MUDDY2	3/9/2006																Broken down in well.
Well	MUDDY2	6/28/2006																Buried by county road
Well	MUDDY2	9/28/2006																
Well	MUDDY2	11/27/2006																
Well	MUDDY2	3/22/2007																
Well	MUDDY2	6/15/2007																
Well	MUDDY2	9/18/2007																
Well	MUDDY2	12/10/2007																
Well	MUDDY2	3/26/2008																
Well	MUDDY2	6/24/2008																Dry Wells
Well	MUDDY2	9/22/2008																
Well	MUDDY2	12/13/2008																Well was Dry
Well	MUDDY2	6/4/2009																Dry AT 57 feet
Well	MUDDY2	12/14/2009																Dry at 57 feet
Well	MUDDY2	12/29/2009																57 feet then stops dry
Well	MUDDY2	3/24/2010																Dry at 27 feet
Well	MUDDY2	6/21/2010																Dry at 28 feet
Well	MUDDY2	7/19/2010																
Well	MUDDY2	11/24/2010																Dry Wells
Well	MUDDY2	3/28/2011																Dry Wells
Well	MUDDY2	6/21/2011																Dry Wells
Well	MUDDY2	9/20/2011																Dry Wells
Well	MUDDY2	12/13/2011																
Well	MUDDY2	3/16/2012																Dry Wells
Well	R2-U	9/17/2003																Dry
Well	R2-U	3/18/2004																dry
Well	R2-U	9/20/2004																Site was dry
Well	R2-U	12/28/2004																Dry
Well	R2-U	3/24/2005																Dry
Well	R2-U	5/23/2005																Dry
Well	R2-U	7/11/2005																
Well	R2-U	11/28/2005																
Well	R2-U	3/7/2006																
Well	R2-U	6/29/2006																

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	R2-U	9/28/2006																
Well	R2-U	11/20/2006																
Well	R2-U	3/20/2007																
Well	R2-U	6/14/2007																
Well	R2-U	9/18/2007																
Well	R2-U	12/10/2007																
Well	R2-U	3/26/2008																
Well	R2-U	6/24/2008																
Well	R2-U	9/20/2008																
Well	R2-U	12/12/2008																
Well	R2-U	6/3/2009																
Well	R2-U	12/14/2009																
Well	R2-U	12/29/2009																
Well	R2-U	3/25/2010																
Well	R2-U	6/23/2010																
Well	R2-U	7/19/2010																
Well	R2-U	10/15/2010																
Well	R2-U	3/25/2011																
Well	R2-U	6/21/2011																
Well	R2-U	9/27/2011																
Well	R2-U	12/13/2011																
Well	R2-U	3/21/2012																Dry Wells
Spring	SP-15	8/30/1982	0.37	<0.01		1400		1813	3500	2313					0.24	0.09	91	
Spring	SP-15	2/15/1983	0.39	<0.01		1680		1744		2580					0.39	0.1	90	
Spring	SP-15	6/26/1984	0.11			840			1900	1549			24.13	22.69			81	
Spring	SP-15	5/21/1985	0.14	<0.01		1040		1190		1720			28.04	27.05	0.21	0.06	95	
Spring	SP-15	8/14/1985	0.1	<0.01		1400		1550		2198			35.11	34.81	<0.05	0.02	142	
Spring	SP-15	3/31/1986	6.22	0.18	0.08	4000		2580	6500	5392					0.33	4.54	331	
Spring	SP-15	6/30/1986	0.02	<0.01	0.06	180		366	880	523			9.29	9.09	0.23	<0.01	42	
Spring	SP-15	12/23/1986	2.74	0.06		2000		1925		3142			44.36	43.04	4.51	1.42	180	
Spring	SP-15	12/4/1995																
Spring	SP-15	3/4/1997																
Spring	SP-15	6/2/1997																
Spring	SP-15	9/10/1997																
Spring	SP-15	12/3/1997																
Spring	SP-15	3/2/1998																
Spring	SP-15	6/1/1998																
Spring	SP-15	9/1/1998																
Spring	SP-15	6/13/2000				1113	143	1239		2269								
Spring	SP-15	3/21/2001																
Spring	SP-15	6/5/2001																
Spring	SP-15	9/4/2001																
Spring	SP-15	12/10/2001																
Spring	SP-15	1/1/2002																
Spring	SP-15	3/6/2002																
Spring	SP-15	6/8/2002																
Spring	SP-15	6/30/2003																
Spring	SP-15	9/18/2003																dry
Spring	SP-15	12/26/2003																frozen
Spring	SP-15	3/10/2004																damp
Spring	SP-15	6/23/2004																dry
Spring	SP-15	9/25/2004																Site was dry
Spring	SP-15	12/28/2004																Site was dry
Spring	SP-15	3/31/2005																
Spring	SP-15	5/23/2005																Irrigation water flowing from above springs
Spring	SP-15	7/19/2005																Irrigation water only
Spring	SP-15	11/22/2005																
Spring	SP-15	3/9/2006																No Flow in 1st. Quarter.
Spring	SP-15	6/27/2006																
Spring	SP-15	9/29/2006																
Spring	SP-15	11/28/2006																
Spring	SP-15	3/26/2007																
Spring	SP-15	6/18/2007																With irrigation water coming in
Spring	SP-15	9/26/2007																
Spring	SP-15	12/11/2007																

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Spring	SP-15	3/24/2008																
Spring	SP-15	6/26/2008																Irrigation water is running
Spring	SP-15	9/30/2008																
Spring	SP-15	12/11/2008																
Spring	SP-15	7/15/2009																
Spring	SP-15	12/15/2009																
Spring	SP-15	12/30/2009																Frozen No flow
Spring	SP-15	3/24/2010																
Spring	SP-15	6/28/2010				626	148	716		1103								
Spring	SP-15	7/20/2010				591	184	735		1090								
Spring	SP-15	11/5/2010																
Spring	SP-15	3/25/2011																
Spring	SP-15	6/24/2011				102	287	373		475								
Spring	SP-15	9/27/2011																
Spring	SP-15	12/9/2011																
Spring	SP-15	3/22/2012																
Spring	SP-15	6/25/2012																
Spring	SP-15	8/20/2012																
Spring	SP-15	11/7/2012																
Spring	SP-15	3/27/2013																
Spring	SP-15	6/4/2013																
Spring	SP-15	9/16/2013																
Spring	SP-15	12/5/2013																
Spring	SP-15	3/7/2014																
Spring	SP-15	6/6/2014																
Spring	SP-15	9/15/2014																
Spring	SP-15	12/1/2014																
Spring	SP-15	3/11/2015																
Spring	SP-15	5/21/2015																
Spring	SP-15	9/1/2015																
Spring	SP-15	12/1/2015																
Well	T1-U	3/29/2004																Just moist
Well	T1-U	12/28/2004																Well is Dry
Well	T1-U	3/31/2005																Well is Dry
Well	T1-U	5/11/2005																Well is Dry
Well	T1-U	7/11/2005																Well is Dry
Well	T1-U	11/22/2005																Well is Dry
Well	T1-U	9/28/2006																Well is Dry
Well	T1-U	11/20/2006																
Well	T1-U	3/20/2007																
Well	T1-U	6/14/2007																
Well	T1-U	9/18/2007																
Well	T1-U	12/10/2007																
Well	T1-U	3/26/2008																
Well	T1-U	6/24/2008																
Well	T1-U	9/30/2008																
Well	T1-U	12/12/2008																Dry Wells
Well	T1-U	2/20/2009																Dry Wells
Well	T1-U	6/4/2009																Dry Wells
Well	T1-U	12/14/2009																Dry Wells
Well	T1-U	12/29/2009																Dry Wells
Well	T1-U	3/24/2010																Dry Wells
Well	T1-U	6/23/2010																Dry Wells
Well	T1-U	7/19/2010																
Well	T1-U	10/15/2010																Dry Wells
Well	T1-U	3/25/2011																Dry Wells
Well	T1-U	6/8/2011																Dry Wells
Well	T1-U	9/20/2011																Dry Wells
Well	T1-U	12/13/2011																Dry Wells
Well	T1-U	3/21/2012																Dry Wells
Well	T1-U	6/20/2012																Dry Wells
Well	T1-U	8/20/2012																Dry Wells
Well	T1-U	11/1/2012																
Well	T1-U	3/21/2013																Dry Wells
Well	T1-U	6/4/2013																

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	T1-U	9/17/2013																
Well	T1-U	12/5/2013																
Well	T1-U	3/14/2014																
Well	T1-U	6/26/2014																Dry Wells
Well	T1-U	9/16/2014																
Well	T1-U	12/9/2014																
Well	T2-U	9/17/2003																Probe Stops in Mud
Well	T2-U	3/29/2004																muddy
Well	T2-U	6/18/2004																hits mud
Well	T2-U	12/28/2004																Dry Wells
Well	T2-U	5/11/2005																
Well	T2-U	7/11/2005																
Well	T2-U	11/22/2005																
Well	T2-U	9/28/2006																
Well	T2-U	11/20/2006																
Well	T2-U	3/20/2007																
Well	T2-U	6/14/2007																
Well	T2-U	9/18/2007																
Well	T2-U	12/10/2007																Black Sludge
Well	T2-U	3/26/2008																
Well	T2-U	6/24/2008																
Well	T2-U	9/30/2008																
Well	T2-U	12/12/2008																Obstruction in well - Stops at 20 feet
Well	T2-U	2/20/2009																Obstruction in well - Stops at 20 feet
Well	T2-U	6/4/2009																Dry at 125 feet
Well	T2-U	12/14/2009																Dry at 125 feet
Well	T2-U	12/29/2009																125 feet dry
Well	T2-U	3/24/2010																Dry at 368 feet
Well	T2-U	6/23/2010																
Well	T2-U	7/19/2010																
Well	T2-U	10/15/2010																Dry Wells
Well	T2-U	12/13/2011																Dry Wells
Well	T2-U	3/15/2012																Dry Wells
Well	TP-U	7/31/1985	<0.01	<0.01	0.04	125		15	1400	429			14.82	14.68	22.6	0.25	2	
Well	TP-U	9/26/1985	0.04	<0.01	0.05	280		20	1648	942			16.56	16.75	19.6	0.24	2	
Well	TP-U	6/30/1986	0.02	<0.01	0.06	150		13	1780	948			17.53	17.58	0.12	0.04	1	
Well	TP-U	5/26/1989				327	368	<7.		1048			17.63	15.6			<1.	
Well	TP-U	9/11/1989				163	580	7		994			16.42	16.28			1	
Well	TP-U	6/8/1990				245	519	1		978	<0.05	<0.05	15.36	16.87				
Well	TP-U	9/18/1990				243	506	<7.		998			16.88	16.76				
Well	TP-U	6/17/1991				72	528	1		990			14.96	13.61				
Well	TP-U	9/23/1991				286	530	1		986			19.27	17.95				
Well	TP-U	5/26/1992				255	490			918			15	16.42				
Well	TP-U	9/2/1992				364	308	<2.		992			15.31	15.15				
Well	TP-U	6/7/1993				233	416	<7.		720								
Well	TP-U	9/8/1993				241	554	<7.		1160			16.57	17.4				
Well	TP-U	6/6/1994				288	542	2		990			17.17	18.18				
Well	TP-U	9/7/1994				288	546	<7.		1322			18.24	18.51				
Well	TP-U	9/17/2003																Dry
Well	TP-U	9/23/2004																Site was dry
Well	TP-U	12/28/2004																Dry
Well	TP-U	3/31/2005																Dry
Well	TP-U	5/11/2005																Dry
Well	TP-U	7/11/2005																Dry
Well	TP-U	11/22/2005																Dry
Well	TP-U	3/9/2006																Dry
Well	TP-U	6/28/2006																Dry Wells
Well	TP-U	9/28/2006																
Well	TP-U	11/20/2006																
Well	TP-U	3/20/2007																
Well	TP-U	6/14/2007																
Well	TP-U	9/18/2007																
Well	TP-U	12/10/2007																
Well	TP-U	3/26/2008																
Well	TP-U	6/24/2008																

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	TP-U	9/30/2008																
Well	TP-U	12/12/2008																
Well	TP-U	6/4/2009																Dry at 405 feet
Well	TP-U	12/14/2009																goes in about 150' then stops
Well	TP-U	12/29/2009																Obstruction in well - Stops at 150 feet
Well	TP-U	3/24/2010																Dry at 403 feet
Well	TP-U	6/23/2010																Dry at 403 feet
Well	TP-U	7/19/2010																
Well	TP-U	10/15/2010																Dry Wells
Well	TP-U	3/25/2011																Dry Wells
Well	TP-U	6/8/2011																Dry Wells
Well	TP-U	9/20/2011																Dry Wells
Well	TP-U	12/13/2011																Dry Wells
Well	TP-U	3/15/2012																Dry Wells
Well	USGS 1-2	6/24/1981	<0.01	<0.01		616.5	410.6	740.2	1460	1043			22.5	21.5	39	7	36	
Well	USGS 1-2	12/30/1981	0.016	<0.002	0.068	169		428	1150	638			15.9	15.9	1.43	0.17	27	
Well	USGS 1-2	3/16/1982	0.03	<0.002	0.3	365		458	1380	837			16.6	18	1.31	0.19	18	
Well	USGS 1-2	6/15/1982	0.04	<0.002	0.296	436		526	1450	910			19.2	19.2	1.1	0.14	18	
Well	USGS 1-2	9/20/1982	0.03	<0.01	0.3	510		564	1600	1020					0.97	0.1	20	
Well	USGS 1-2	12/10/1982	0.026	<0.01	0.287	500		544	1380	988			19.8	19	0.93	0.08	23	
Well	USGS 1-2	3/22/1983	<0.01	<0.01		240		181	1150	871			13.5	14	0.89	0.16	21	
Well	USGS 1-2	6/30/1983	0.18	0.62	0.2	240		210	1500	942			13.43	13.16	3.3	0.14	28	
Well	USGS 1-2	9/26/1983	0.19	0.02	0.31	250		134	1400	746			8.85	13	1.16	0.06	12	
Well	USGS 1-2	12/29/1983	0.07	<0.01	<0.01	240		124	1300	764			11.9	13.24	0.2	0.04	12	
Well	USGS 1-2	3/8/1984	0.08	<0.01	0.06	240		140	1150	781			12.35	13.07	0.63	0.06	17	
Well	USGS 1-2	6/13/1984	<0.01	<0.01	0.07	230		137	1300	804			11.55	12.99	0.96	0.05	15	
Well	USGS 1-2	9/24/1984	<0.01	<0.01	<0.01	280		150	1300	800			12.55	13.84	1.35	0.07	12	
Well	USGS 1-2	3/27/1985	<0.01	<0.01	0.05	180		122	1200	670			11.27	11.43	0.4	0.08	11	
Well	USGS 1-2	6/20/1985	0.06	0.02	0.02	240		102	1250	684			12.09	12.11	0.2	0.03	10	
Well	USGS 1-2	9/19/1985	0.01	<0.01	0.07	280		110	1100	709			12.01	12.83	0.85	0.06	12	
Well	USGS 1-2	6/24/1986	0.04	0.04	0.07	260		109	1250	736			12.69	12.61	0.36	0.06	11	
Well	USGS 1-2	5/19/1989				5886	456	2546		8788			140.68	138.58			474	
Well	USGS 1-2	9/11/1989				2696	458	1957		4274			62.37	67.68			295	
Well	USGS 1-2	6/4/1990				1455	450	1036		2414	<0.05	<0.05	39.27	40.82				
Well	USGS 1-2	9/18/1990				584	366	408		1248			21.4	19.56				
Well	USGS 1-2	6/17/1991				1819	378	1444		3262			45.3	47.05				
Well	USGS 1-2	9/24/1991				1976	374	1637		3112			50.99	50.38				
Well	USGS 1-2	6/24/1992				1893	462	1338		3246								
Well	USGS 1-2	9/2/1992				1482	428	1041		2682			37.34	40.72				
Well	USGS 1-2	6/7/1993				1646	450	1220		2758			45.31	44.8				
Well	USGS 1-2	9/8/1993				1461	494	976		2508			39.33	41.82				
Well	USGS 1-2	6/6/1994				1531	450	1121		2682			40.04	42.24				
Well	USGS 1-2	9/7/1994				1389	440	1142	2890	2842			40.29	38.7				
Well	USGS 1-2	6/6/1995				1000	470	780	2050	2080			35.1	31.2				
Well	USGS 1-2	9/6/1995				1257	495	924		2470			37.9	37.1				
Well	USGS 1-2	6/5/2001				2210	477	1397		3502								
Well	USGS 1-2	9/5/2001				2495	514	1581		4254								
Well	USGS 1-2	6/24/2002				1683	405	1071		2961			41.4	44.3				
Well	USGS 1-2	9/23/2002				1789		1253		3187								
Well	USGS 1-2	9/17/2003				3203	513	2107		5103			74.8	79.1				
Well	USGS 1-2	6/18/2004				3545		2346		5406								
Well	USGS 1-2	12/28/2004																Dry
Well	USGS 1-2	3/25/2005																Dead Mouse in Bottom
Well	USGS 1-2	5/11/2005																Dry
Well	USGS 1-2	7/19/2005																Dry
Well	USGS 1-2	11/17/2005																
Well	USGS 1-2	3/9/2006																
Well	USGS 1-2	6/28/2006																29.5' deep and dry
Well	USGS 1-2	9/28/2006																
Well	USGS 1-2	11/27/2006																
Well	USGS 1-2	3/22/2007																
Well	USGS 1-2	6/15/2007																
Well	USGS 1-2	9/18/2007																
Well	USGS 1-2	12/10/2007																
Well	USGS 1-2	3/26/2008																

Emery Water Quality Data - Kmf(u)

SITE TYPE	SITE NAME	DATE	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	USGS 1-2	6/24/2008																
Well	USGS 1-2	9/30/2008																
Well	USGS 1-2	12/13/2008																Dry at 30 feet
Well	USGS 1-2	2/25/2009																Dry at 29 feet
Well	USGS 1-2	6/4/2009																Dry at 30 feet
Well	USGS 1-2	12/14/2009																Dry at 30 feet
Well	USGS 1-2	3/24/2010																Dry at 29 feet
Well	USGS 1-2	6/21/2010																Dry at 29 feet
Well	USGS 1-2	7/19/2010																
Well	USGS 1-2	11/5/2010																Dry
Well	USGS 1-2	3/28/2011																Dry Wells
Well	USGS 1-2	6/8/2011																Dry Wells
Well	USGS 1-2	9/20/2011																Dry Wells
Well	USGS 1-2	12/13/2011																Dry Wells
Well	USGS 1-2	3/16/2012																Dry Wells

Note: Remaining wells dry or have access issues (blockages, etc.).

Number of Observations:	26	6	25	113	72	103	35	112	4	4	89	89	34	32	44
Maximum:	6.22	0.62	0.31	6884	580	2580	6500	8788	0.05	<0.05	140.7	138.6	39	7	474
Minimum:	0.01	0.02	0.02	72	88	1	880	429	<0.05	<0.05	8.9	9.1	0.12	0.01	1
Mean:	0.43	0.1567	0.11	851.9	346.8	481.9	1813.8	1544.3	<0.05	<0.05	22.7	23.0	3.79	0.67	52.3
Standard Deviation:	1.29	0.2347	0.10	1043.5	124.0	664.3	1004.6	1240.8	--	--	17.4	17.5	8.02	1.74	96.1

Equivalent weights of means: 17.7

Emery Water Quality Data:
Multizone (Kmf[u] and Kmf[m])

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	NO3 mg/l	NO2 mg/l
Well	EMRIA2	6/24/1981					6.3	7.5							41								265.7		<1.	55.4	<0.01	<0.01
Well	EMRIA2	12/3/1981					6.5																526		<1.	58.8	<0.002	<0.002
Well	EMRIA2	3/16/1982					6.6																449		<1.	56.8	<0.002	<0.002
Well	EMRIA2	6/15/1982					6.5																427		<1.		<0.002	<0.002
Well	EMRIA2	9/17/1982					7																447		<1.	36	4	<0.01
Well	EMRIA2	12/10/1982					7.4																417		<1.	32	3.7	<0.01
Well	EMRIA2	3/22/1983					6.9																437		<1.	60	0.033	0.025
Well	EMRIA2	6/30/1983					6.9																503		<1.	83	9.56	0.041
Well	EMRIA2	9/26/1983					7.15																464		<1.	59	4.98	0.02
Well	EMRIA2	12/29/1983					7.5																495		<1.	48	0.9	<0.01
Well	EMRIA2	3/8/1984					7.2	51							<0.05								475		<1.	57	3.58	0.02
Well	EMRIA2	6/13/1984					7.1																412		<1.	53	0.8	<0.01
Well	EMRIA2	9/24/1984					7.3																409		<1.	39	1.4	<0.01
Well	EMRIA2	3/27/1985					7																371		<1.	44	0.11	<0.01
Well	EMRIA2	7/31/1985					6.6	25							<0.05								414		<1.	45	1.3	<0.01
Well	EMRIA2	9/19/1985					6.7	16							<0.05								416		<1.	45	0.23	<0.01
Well	EMRIA2	6/24/1986					7	22							<0.05								413		<1.	50	0.83	0.01
Well	EMRIA2	5/19/1989											455		<0.02		999	3.46	44		307		434			59		
Well	EMRIA2	9/12/1989											462		0.02		1350	5.3	20		290		406			65		
Well	EMRIA2	6/8/1990							0.57	0.005	0.28	<0.01	662	<0.01	0.34	<0.02	1675	5.4	12	0.008	630	0.14	371			600		
Well	EMRIA2	9/19/1990											483		2.13		2100	7.54	11		381		257			79		
Well	EMRIA2	6/10/1991											636		337		893	19.4	5		829					65		
Well	EMRIA2	9/24/1991											709		71.4		687	13.9	6		801					45		
Well	EMRIA2	5/26/1992											356		119		391	11.2	6		1410					42		
Well	EMRIA2	9/2/1992											622		50.6		521	10.5	6		681					59		
Well	EMRIA2	6/7/1993					3.8						402		118		391	11	7		423					53		
Well	EMRIA2	9/8/1993											388		68.6		352	8.48	7		436					47		
Well	EMRIA2	6/6/1994											371		19.3		367	12	7		419					49		
Well	EMRIA2	9/7/1994	12.9	5.6									405		111		350	12	8		450					47		
Well	EMRIA2	6/6/1995											215		39		300	13	6		390		<5.		<5.	240		
Well	EMRIA2	9/6/1995	14	6.4	5270		3.24						330		20		346	11.7	7		458		<5.		<5.	6		
Well	EMRIA2	6/5/2001	12.9	6.5	6810								456		18		755	1.2	20		414		698		<5.	50		
Well	EMRIA2	9/5/2001	14.7	7.4	7260								454		7.8		789	1.39	20		444		580		<5.	33.7		
Well	EMRIA2	6/24/2002	14.3	6.6	7490								435		50.2		931	4.34	16		432		395		<5.	55		
Well	EMRIA2	9/24/2002	13.1	6.6	7700								413		2		880	2.82	17		464		504		<5.	60		
Well	EMRIA2	9/24/2002	13.1	6.6	7700																							
Well	EMRIA2	9/16/2003	17.3	5.2	5000								444		53.4		1480	7.78	13.4		451		23		< 5.	86		
Well	EMRIA2	6/18/2004	12.7	5	9650								438		4.79		1430	0.829	10.7		429		< 5.		< 5.	73		
Well	EMRIA2	9/25/2004	13.8	4.8	7650								438		29.9		682	11.3	11.5		567		< 5.		< 5.	62		
Well	EMRIA2	5/11/2005	12.4	4.7	8160								438		< .03		654	9.69	13.2		716					70		
Well	EMRIA2	7/22/2005	14	5.1	7200								393		14.6		568	10.3	12.4		550					78		
Well	EMRIA2	6/28/2006	14.3	4.3	12490								449		81.8		1350	18.5	21.9		882		< 5.		< 5.	159		
Well	EMRIA2	9/27/2006	15.7	7.4	12230	0							407.55		76.56		1240.5	18.591	3.62		824.92		< 5.		< 5.	106		
Well	EMRIA2	11/27/2006																										
Well	EMRIA2	3/22/2007																										
Well	EMRIA2	6/15/2007	12.6	4.1	11930	0							413		63.5		1320	18.1	6.16		889		0		0	162		
Well	EMRIA2	9/18/2007	11.1	4.9	12410	0							426		91.3		1330	16.7	3.55		797		0		0	115		
Well	EMRIA2	12/10/2007																										
Well	EMRIA2	3/28/2008																										
Well	EMRIA2	6/16/2008	17.4	3.4	11710	0							417.62		93.67		1361.5	19.324	2.87		748.32		0		0	128		
Well	EMRIA2	9/22/2008																										
Well	EMRIA2	12/13/2008																										
Well	EMRIA2	6/5/2009																										
Well	EMRIA2	12/14/2009																										
Well	EMRIA2	12/29/2009																										
Well	EMRIA2	3/25/2010	Dry Wells	Dry at 101 feet																								
Well	EMRIA2	6/22/2010	Dry Wells	Dry at 98 feet																								
Well	EMRIA2	7/20/2010																										
Well	EMRIA2	11/5/2010																										
Well	EMRIA2	3/29/2011																										
Well	EMRIA2	6/21/2011																										
Well	EMRIA2	9/28/2011																										
Well	EMRIA2	12/12/2011																										
Well	EMRIA2	3/15/2012																										
Well	EMRIA2	3/21/2013																										
Well	EMRIA2	6/4/2013																										
Number of Observations:			17	17	16	4	19	5	1	1	1	1	28	1	30	1	28	28	28	1	28	1	29	0	28	44	17	17
Maximum:			17.4	7.4	12490	--	7.5	51	0.57	0.005	0.28	<0.01	709	<0.01	337	<0.02	2100	19.4	44	0.008	1410	0.14	698	--	<5.	600	9.56	0.041
Minimum:			11.1	3.4	5000	--	3.24	7.5	0.57	0.005	0.28	<0.01	215	<0.01	<0.02	<0.02	300	0.829	2.87	0.008	290	0.14	0	--	<1.	6	<0.002	<0.002
Mean:			13.9	5.6	8791.3	--	6.6	24.3	0.57	0.005	0.28	<0.01	447.1	<0.01	58.7	<0.02	910.5	10.2	11.6	0.008	589.8	0.14	379.6	--	--	79.9	2.4	0.02
Standard Deviation:			1.7	1.2	2569.8	--	1.1	16.4	--	--	--	--	101.9	--	67.3	--	482.0	5.7	8.4	--	244.2	--	172.8	--	--	89.8	2.7	0.01
Equivalent weights of means:													22.3				74.9		0.3		25.7		6.2			2.3		

Emery Water Quality Data:
Multizone (Kmf[u] and Kmf[m])

SITE TYPE	SITE NAME	DATE	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	T-Al mg/l	T-As mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	EMRIA2	6/24/1981		3374.3	265.7	1366.8	6000	4790			75.4	76.9	47	9	300	
Well	EMRIA2	12/3/1981	0.019	1729		2025	4620	2760			47.7	47.9	0.74	5.62	172	
Well	EMRIA2	3/16/1982	0.003	2017		2356	5800	3324			53.2	52.3	0.46	5.02	238	
Well	EMRIA2	6/15/1982		4082		3661	8000	6012			84.9	92.3	4.9	3.95	299	
Well	EMRIA2	9/17/1982	<0.01	3900		3723	8400	5865					5	3.07	300	
Well	EMRIA2	12/10/1982	<0.01	1800		2002	4500	2790			47	46.8	3.3	1.92	120	
Well	EMRIA2	3/22/1983	<0.01	12000		836	4600	5323					0.27	0.36	97	
Well	EMRIA2	6/30/1983	0.29	3000		3380	5500	510.5			77.01	73.05	0.19	1.89	535	
Well	EMRIA2	9/26/1983	0.31	3200		3240	6000	4897			76	75.89	0.38	0.09	494	
Well	EMRIA2	12/29/1983	<0.01	3060		3230	5100	4577			75.11	74.97	0.18	0.07	489	
Well	EMRIA2	3/8/1984	0.04	3000		3300	5000	4542			77.1	72	0.25	0.11	513	
Well	EMRIA2	6/13/1984	0.07	2900		3350	5000	4461			78.06	70.13	0.16	0.06	528	
Well	EMRIA2	9/24/1984	<0.01	3000		3100	4700	4400			72.25	71.76	0.11	0.02	607	
Well	EMRIA2	3/27/1985	0.05	3250		3144	6200	4596			73.48	76.34	0.2	0.08	461	
Well	EMRIA2	7/31/1985	0.08	3000		3070	5800	4455			70.95	72.02	0.49	0.16	452	
Well	EMRIA2	9/19/1985	0.07	2900		3050	4350	4335			70.11	69.98	0.16	0.44	456	
Well	EMRIA2	6/24/1986	0.08	3100		3138	5000	4786			74.02	74.21	<50.	0.3	466	
Well	EMRIA2	5/19/1989		5639	434	5233		8016			119.32	128.75			1000	
Well	EMRIA2	9/12/1989		7285	406	6690		9960			147.08	162.92			4795	
Well	EMRIA2	6/8/1990		8965	371	8523		13204	0.18	<0.05	198.48	212.48				
Well	EMRIA2	9/19/1990		9936	257	9818		14722			213.4	216.01				
Well	EMRIA2	6/10/1991		7454		5251		13994			141.63	158.35				
Well	EMRIA2	9/24/1991		6244		4589		9966			127.18	132.38				
Well	EMRIA2	5/26/1992		5268				7456			112.06	111.8				
Well	EMRIA2	9/2/1992		5063		3691		7314			103.94	107.98				
Well	EMRIA2	6/7/1993		4766		2608		6670								
Well	EMRIA2	9/8/1993		4281		2413		5436			71.8	91.22				
Well	EMRIA2	6/6/1994		5268		2432		7900			69.02	112				
Well	EMRIA2	9/7/1994		5804		2448	6480	7490			114.8	123.2				
Well	EMRIA2	6/6/1995		6000		1770		9240			52.4	131.7				
Well	EMRIA2	9/6/1995		5005		2249		7280			64.9	104.4				
Well	EMRIA2	6/5/2001		5090	572	4248		7289								
Well	EMRIA2	9/5/2001		3143	475	4383		7861								
Well	EMRIA2	6/24/2002		5771	324	4920		8253			117.5	128.2				
Well	EMRIA2	9/24/2002		5229		4655		7980								
Well	EMRIA2	9/24/2002														
Well	EMRIA2	9/16/2003		8157			7203		11163							
Well	EMRIA2	6/18/2004		8739			6982		2181							
Well	EMRIA2	9/25/2004		6602			3902		8843							Diss. metals filtered in lab
Well	EMRIA2	5/11/2005		5770			3787		8474							
Well	EMRIA2	7/22/2005		5207			3320		8473							
Well	EMRIA2	6/28/2006		13327			6680		18568							
Well	EMRIA2	9/27/2006		12866	< 5.	6126		8175								
Well	EMRIA2	11/27/2006														
Well	EMRIA2	3/22/2007														
Well	EMRIA2	6/15/2007		11976	< 5.	6467		18054								
Well	EMRIA2	9/18/2007		12431	< 5.	6541		17742								
Well	EMRIA2	12/10/2007														
Well	EMRIA2	3/28/2008														
Well	EMRIA2	6/16/2008		13856	< 5.	6649		20309								
Well	EMRIA2	9/22/2008														
Well	EMRIA2	12/13/2008														
Well	EMRIA2	6/5/2009														unabe to obtain a sample
Well	EMRIA2	12/14/2009														
Well	EMRIA2	12/29/2009														
Well	EMRIA2	3/25/2010														
Well	EMRIA2	6/22/2010														
Well	EMRIA2	7/20/2010														
Well	EMRIA2	11/5/2010														
Well	EMRIA2	3/29/2011														Dry Wells
Well	EMRIA2	6/21/2011														
Well	EMRIA2	9/28/2011														
Well	EMRIA2	12/12/2011														
Well	EMRIA2	3/15/2012														
Well	EMRIA2	3/21/2013														
Well	EMRIA2	6/4/2013														Dry Wells

Number of Observations:	15	45	8	38	24	39	7	1	29	29	17	17	19
Maximum:	0.31	13856	572	9818	8400	20309	18568	<0.05	213.4	216.01	47	9	4795
Minimum:	<0.001	1729	257	836	3320	510.5	0.18	<0.05	47	46.8	0.11	0.02	97
Mean:	0.1	5876.8	388.1	3938.8	5538.5	7608.6	8243.2	<0.05	93.3	102.3	4.0	1.9	648.5
Standard Deviation:	0.1	3329.8	107.2	1959.8	1301.2	4397.2	6059.3	--	41.2	43.8	11.6	2.6	1024.7
Equivalent weights of means		122.4											

Emery Water Quality Data - Kmf(l)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l
Well	KEMMERER-L	6/24/1981					8.3	19							9								173.3		<1.
Well	KEMMERER-L	3/16/1982					8.8																183		56.7
Well	KEMMERER-L	6/15/1982					8.7																242		35.8
Well	KEMMERER-L	9/17/1982					8.5																227		30.8
Well	KEMMERER-L	3/22/1983					9.1																178		76
Well	KEMMERER-L	6/30/1983					8.15																403		<1.
Well	KEMMERER-L	12/29/1983					8.2																302		<1.
Well	KEMMERER-L	6/13/1984					8.5																226		16
Well	KEMMERER-L	9/24/1984					8.3																230		<1.
Well	KEMMERER-L	3/25/1985					8.6																200		42
Well	KEMMERER-L	6/24/1985					8.9	24							<0.05								206		40
Well	KEMMERER-L	9/19/1985					8.5	34							<0.05								205		40
Well	KEMMERER-L	6/24/1986					8.5	31							0.06								185		58
Well	KEMMERER-L	5/18/1989											6		0.22		9	<0.01	4		285		214		32
Well	KEMMERER-L	9/11/1989											4		0.43		8	0.01	6		215		140		120
Well	KEMMERER-L	6/4/1990							0.45	<0.001	0.17	<0.01	13	<0.01	<0.02	<0.02	13	0.02	3	<0.001	176	<0.01	137		13
Well	KEMMERER-L	9/17/1990											5		0.03		14	<0.01	4		218		192		44
Well	KEMMERER-L	6/10/1991											17		0.03		14	<0.01	3		175		160		64
Well	KEMMERER-L	9/24/1991											3		<0.02		5	<0.01	4		225		166		72
Well	KEMMERER-L	5/26/1992											2		<0.02		5	<0.01	3		191		158		88
Well	KEMMERER-L	9/2/1992											2		0.02		5	<0.01	3		199		126		88
Well	KEMMERER-L	6/7/1993											3		0.58		8	<0.01	4		217		162		88
Well	KEMMERER-L	9/7/1993											2		<0.02		6	<0.01	3		201		180		72
Well	KEMMERER-L	6/6/1994											2		<0.02		8	<0.01	3		205		200		
Well	KEMMERER-L	9/7/1994	18	7	1350								2		<0.02		7	<0.01	3		216		180		76
Well	KEMMERER-L	6/6/1995	13.4	7.4	910								4		<0.1		11	<0.1	3		210		100		110
Well	KEMMERER-L	9/5/1995	21.6	8.2	960								4		<0.1		12	<0.1	3		220		170		70
Well	KEMMERER-L	6/13/2000	19.5	7.6	1030								4		<0.1		13	<0.1	3		192		265		<5.
Well	KEMMERER-L	3/23/2001				11																			
Well	KEMMERER-L	6/5/2001	16.2	7.6	1150								5		<0.1		14	<0.1	3		186		166		49
Well	KEMMERER-L	9/5/2001	21.5	8	1020								4		<0.1		13	<0.05	4		192		186		34
Well	KEMMERER-L	6/24/2002	22.6	7.8	1020								4		<0.1		12	<0.05	3		181		199		30
Well	KEMMERER-L	9/24/2002	15.8	7.3	1200								4		<0.1		13	<0.05	3		185		194		36
Well	KEMMERER-L	9/18/2003	15.9	9.4	1.14	8							3.45		< .01		13.6	<.01	3.45		181		206		35
Well	KEMMERER-L	6/18/2004	19.1	9.3	1130								4.06		< .03		13.3	0.006	3.57		188		157		62
Well	KEMMERER-L	9/25/2004	14.9	9.8	1.26								1.34		< .03		0.91	0.001	2.58		240		260		274
Well	KEMMERER-L	5/24/2005	18.4	9.5	1204								4.22		< .03		13.8	0.006	3.44		176				
Well	KEMMERER-L	7/22/2005	25.3	9.1	1004	4		< 5.					3.63		< .03		11.9	0.005	3.3		169				
Well	KEMMERER-L	6/29/2006	21.8	9.2	1006	10							4.15		< .03		14.4	0.006	3.64		186		147		67
Well	KEMMERER-L	9/27/2006	13.6	9.5	999	10							3.5		< .03		12.53	0.005	3.46		180.82		364		70
Well	KEMMERER-L	11/20/2006																							
Well	KEMMERER-L	3/20/2007																							
Well	KEMMERER-L	6/13/2007	19.2	9.4	1044	5							3.76		0.09		14.7	0.007	4.31		195				0
Well	KEMMERER-L	9/18/2007	16.8	7.9	1001	5							3.37		< .03		13.6	0.008	4.75		185				0
Well	KEMMERER-L	12/10/2007																							
Well	KEMMERER-L	3/26/2008																							
Well	KEMMERER-L	6/16/2008	19.7	9.1	920	18							3.68		< .03		14.88	0.003	3.6		172.4				0
Well	KEMMERER-L	9/18/2008																							
Well	KEMMERER-L	12/12/2008																							
Well	KEMMERER-L	6/4/2009	14.2	8	1.03	0							7.31		< .03		18.83	0.012	3.95		189.42		153		59
Well	KEMMERER-L	7/14/2009	22.8	7.4	1120	0							5.36		< .03		16.84	0.009	3.65		178.51				0
Well	KEMMERER-L	12/29/2009				52																			
Well	KEMMERER-L	3/25/2010				75																			
Well	KEMMERER-L	6/23/2010	17.4	8.2	1123	0							3.5		< .03		13.67	0.007	3.67		186.35		137		71
Well	KEMMERER-L	7/19/2010	27.4	8	913	0							3.2		< .03		13.28	0.006	3.76		180.51				0
Well	KEMMERER-L	10/15/2010																							
Well	KEMMERER-L	3/28/2011	8.5	10	1000	0							3.46		0.04		15.94	0.009	3.65		175.81				0
Well	KEMMERER-L	6/8/2011	16.8	9.8	1068	5							3.4		< .03		15.4	0.007	3.7		177.99				0
Well	KEMMERER-L	9/22/2011	16.5	9.7	1570	5							3.25		0.3		16.5	0.019	3.72		189.55				0
Well	KEMMERER-L	12/12/2011																							
Well	KEMMERER-L	3/15/2012	8.8	7.2	1026	14							3.45		< .03		15.59	0.007	3.65		180.9				0
Well	KEMMERER-L	6/20/2012	21.6	7.2	967	0							3.65		< .03		14.36	0.008	3.54		172.81				0
Well	KEMMERER-L	8/20/2012	23.7	7.1	1170	11							3.12		< .03		14.56	0.008	3.83		190.46				0
Well	KEMMERER-L	11/7/2012	11.9	7	1600	4936.8							2.99		< .03		13.55	0.007	4.58		182.9		138		77
Well	KEMMERER-L	3/21/2013	8.8	7.1	1040	0							3.33		< .03		15.87	0.008	3.88		180.92		138		78
Well	KEMMERER-L	6/4/2013	19.9	7.1	1020	12							3.27		< .03		14.7	0.008	3.71		178.12		131		80
Well	KEMMERER-L	9/24/2013	12.2	7	1850								2.95		< .03		13.85	0.007	3.57		172.83				
Well	KEMMERER-L	12/17/2013	5.1	7.1	1008	12							3.54		< .03		14.89	0.007	3.71		179.22				0
Well	KEMMERER-L	3/14/2014	10.2	7.1	1190	0							21.56		< .03		17.59	0.049	3.56		173.45				0
Well	KEMMERER-L	6/26/2014	20.7	7	1133	0							8.28		< .03		14.64	0.015	3.55		174.88				0
Well	KEMMERER-L	9/19/2014	19.3	7.1	960	0							7.48		< .03		13.4	0.008	3.62		169.36		155		55
Well	KEMMERER-L	12/9/2014	8.2	7	1066	0							6.59		< .03		11.3	0.007	3.64		168.72		157		46
Well	KEMMERER-L	3/16/2015	9.8	7.1	1068								5.94		0.13		11.28	0.008	3.58		171.59		145		55

Emery Water Quality Data - Kmf(l)

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-Sp. Cond. umhos/cm	Flow GPM	L-pH units	TSS mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l
Well	KEMMERER-L	5/18/2015	12.5	6.9	963	0							4.49		< .03		10.87	0.006	3.58		171.61		144		60
Well	KEMMERER-L	9/1/2015	17.9	6.8	1014	0							3.56		< .03		11.34	0.005	3.74		182.39		144		53
Well	KEMMERER-L	12/29/2015	No Access																						
Well	ZZ-L	6/24/1981					8.2	30							19								379.1		<1.
Well	ZZ-L	12/3/1981					8.1																654		<1.
Well	ZZ-L	3/16/1982					7.9																536		<1.
Well	ZZ-L	6/15/1982					7.8																590		<1.
Well	ZZ-L	9/20/1982					7.9																538		<1.
Well	ZZ-L	12/28/1982					7.5																511		<1.
Well	ZZ-L	6/30/1983					8.1																620		<1.
Well	ZZ-L	9/26/1983					8.05																579		<1.
Well	ZZ-L	3/8/1984					7.9	379							0.12								598		<1.
Well	ZZ-L	6/13/1984					7.8																492		<1.
Well	ZZ-L	9/24/1984					7.6																499		<1.
Well	ZZ-L	3/26/1985					7.6																495		<1.
Well	ZZ-L	6/20/1985					7.45	44							<0.05								479		<1.
Well	ZZ-L	9/19/1985					7.3	113							0.15								494		<1.
Well	ZZ-L	6/30/1986					7.9	8							<0.05								496		<1.
Well	ZZ-L	5/18/1989											<1.		0.07		3	<0.01	3		306		356		256
Well	ZZ-L	9/11/1989											1		0.02		4	0.01	4		276		320		240
Well	ZZ-L	6/8/1990							0.53	<0.001	0.43	<0.01	2	<0.01	<0.02	<0.02	4	<0.01	2	<0.001	250	0.98	202		345
Well	ZZ-L	9/18/1990											2		<0.02		4	<0.01	3		301		424		132
Well	ZZ-L	6/17/1991											2		<0.02		4	<0.01	3		254		340		236
Well	ZZ-L	9/23/1991											3		<0.02		7	<0.01	3		320		398		152
Well	ZZ-L	5/26/1992											2		<0.02		4	<0.01	2		254		310		180
Well	ZZ-L	9/2/1992											1		<0.02		3	<0.01	2		257		220		280
Well	ZZ-L	6/7/1993											1		0.07		2	<0.01	3		301		276		336
Well	ZZ-L	9/8/1993											<1.		<0.02		<1.	<0.01	3		303		246		384
Well	ZZ-L	6/6/1994											1		<0.02		1	<0.01	3		302		226		424
Well	ZZ-L	9/7/1994	13.3	9.1	990								1		<0.02		1	<0.01	3		309		246		372
Well	ZZ-L	6/6/1995											3		<0.1		3	<0.1	2		250		80		270
Well	ZZ-L	9/6/1995					10.01						6		0.1		2	<0.1	3		348		118		305
Well	ZZ-L	9/17/2003																							
Well	ZZ-L	12/23/2003																							
Well	ZZ-L	3/18/2004																							
Well	ZZ-L	6/23/2004																							
Well	ZZ-L	9/24/2004																							
Well	ZZ-L	12/28/2004																							
Well	ZZ-L	3/31/2005																							
Well	ZZ-L	5/12/2005																							
Well	ZZ-L	7/20/2005																							
Well	ZZ-L	11/17/2005																							
Well	ZZ-L	3/9/2006																							
Well	ZZ-L	6/30/2006																							
Well	ZZ-L	9/28/2006																							
Well	ZZ-L	11/27/2006																							
Well	ZZ-L	3/22/2007																							
Well	ZZ-L	6/13/2007																							
Well	ZZ-L	9/18/2007																							
Well	ZZ-L	12/10/2007																							
Well	ZZ-L	3/26/2008																							
Well	ZZ-L	6/24/2008																							
Well	ZZ-L	9/30/2008																							
Well	ZZ-L	12/11/2008																							
Well	ZZ-L	2/19/2009																							
Well	ZZ-L	6/4/2009																							
Well	ZZ-L	12/14/2009																							
Well	ZZ-L	12/29/2009																							
Well	ZZ-L	3/24/2010																							
Well	ZZ-L	6/21/2010																							
Well	ZZ-L	7/20/2010																							

Note: Remaining wells dry or have access isues (blockages, etc.)

Number of Observations:	41	41	41	30	29	9	2	2	2	2	63	2	49	2	64	40	65	2	65	2	76	0	69
Maximum:	27.4	10	1850	4936.8	10.01	379	0.53	<0.001	0.43	<0.01	21.56	<0.01	19	<0.02	18.83	0.049	6	<0.001	348	0.98	654	--	424
Minimum:	5.1	6.8	1.03	0	7.3	8	0.45	<0.001	0.17	<0.01	1	<0.01	<0.01	<0.02	0.91	0.001	2	<0.001	168.72	<0.01	80	--	0
Mean:	16.6	8.0	1019.8	173.1	8.2	75.8	0.49	<0.001	0.30	<0.01	4.2	<0.01	1.6	<0.02	10.5	0.009	3.4	<0.001	211.1	0.5	270.4	--	94.7
Standard Deviation:	5.2	1.1	346.0	899.9	0.6	117.6	0.06	<0.001	0.18	<0.01	3.4	<0.01	4.7	<0.02	5.0	0.008	0.6	<0.001	46.9	--	149.8	--	109.1
Equivalent weights of means:											0.2				0.9		0.1		9.2		4.4		

Emery Water Quality Data - Kmf(l)

SITE TYPE	SITE NAME	DATE	Cl mg/l	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	T-Al mg/l	T-As mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	KEMMERER-L	6/24/1981	18	<0.01	<0.01		402	173.3	396.3	1010	800			15.1	12.1	10	9	20	
Well	KEMMERER-L	3/16/1982	22.2	0.037	<0.002	0.383	447		269	1050	783			14.4	16.4	2.05	0.18	19	
Well	KEMMERER-L	6/15/1982	25.7	0.039	<0.002	0.29	449		326	1130	810			15	16.6	1.97	0.19	17	
Well	KEMMERER-L	9/17/1982	13	<0.01	<0.01	0.2	250		308	820	713					1.9	0.1	17.5	
Well	KEMMERER-L	3/22/1983	24	0.026	0.016	0.27	294		117	900	631			10.8	11.9	0.23	0.1	17	
Well	KEMMERER-L	6/30/1983	75	1.38	0.02	0.43	660		575	2200	1320			22.94	22.46	9.8	0.36	79	
Well	KEMMERER-L	12/29/1983	19	0.11	<0.01	0.05	200		92	1050	646			9.39	9.65	2.64	0.2	13	
Well	KEMMERER-L	6/13/1984	21	<0.01	<0.01	0.15	220		83	1090	667			8.13	9.7	1.65	0.05	7	
Well	KEMMERER-L	9/24/1984	18	<0.01	<0.01	0.01	240		75	1050	625			9.8	10.11	0.93	0.2	10	
Well	KEMMERER-L	3/25/1985	18	<0.01	<0.01	0.09	200		74	1100	556			9.41	9.52	2.71	0.1	13	
Well	KEMMERER-L	6/24/1985	21	0.1	0.03	0.08	240		72	1050	645			10.32	10.51	0.58	0.03	11	
Well	KEMMERER-L	9/19/1985	19	<0.01	<0.01	0.04	270		70	975	622			10.65	11	0.37	0.02	12	
Well	KEMMERER-L	6/24/1986	17	0.04	0.01	0.05	230		65	1080	611			10.88	10.9	0.21	0.01	11	
Well	KEMMERER-L	5/18/1989	26				428	246	52		924			13.68	14.64			9	
Well	KEMMERER-L	9/11/1989	19				239	260	43		626			10.47	10.75			8	
Well	KEMMERER-L	6/4/1990	18				253	150	86		646	<0.05	<0.05	9.54	8.82				
Well	KEMMERER-L	9/17/1990	19				226	236	70		614			11.09	10				
Well	KEMMERER-L	6/10/1991	21				233	224	100		580			9.78	9.96				
Well	KEMMERER-L	9/24/1991	20				228	238	28		696			10.56	10.11				
Well	KEMMERER-L	5/26/1992	22				173	246			554			8.99	9.17				
Well	KEMMERER-L	9/2/1992	21				202	214	26		576			9.34	9.11				
Well	KEMMERER-L	6/7/1993	20				200	250	40		602			10.46	9.76				
Well	KEMMERER-L	9/7/1993	20				201	252	30		526			9.51	9.82				
Well	KEMMERER-L	6/6/1994	25				259	268	38		626			9.85	11.5				
Well	KEMMERER-L	9/7/1994	26				239	256	34		578			10.26	10.87				
Well	KEMMERER-L	6/6/1995	23				170	260	60		700			10.2	9.5				
Well	KEMMERER-L	9/5/1995	23				184	255	59		580			10.8	9.6				
Well	KEMMERER-L	6/13/2000	14				248	218	64		613								
Well	KEMMERER-L	3/23/2001																	
Well	KEMMERER-L	6/5/2001	16				267	217	70		601								
Well	KEMMERER-L	9/5/2001	16.1				256	208	64		600								
Well	KEMMERER-L	6/24/2002	12				212	214	59		677			9.1	9				
Well	KEMMERER-L	9/24/2002	13				225		64		578								
Well	KEMMERER-L	9/18/2003	15				242		227	650	579								
Well	KEMMERER-L	6/18/2004	13				255			650	563								
Well	KEMMERER-L	9/25/2004	14				29		533	700	661			10.6	11.7				Diss. metals filtered in lab
Well	KEMMERER-L	5/24/2005	13				257		211	670	610								
Well	KEMMERER-L	7/22/2005	14				248		210	580	571								
Well	KEMMERER-L	6/29/2006	15				238		214	700	603								
Well	KEMMERER-L	9/27/2006	15				216	218	60		770			9.2	9.3				
Well	KEMMERER-L	11/20/2006																	MEASURED IN PSI
Well	KEMMERER-L	3/20/2007																	MEASURED IN PSI
Well	KEMMERER-L	6/13/2007	14				226	214	70		569								
Well	KEMMERER-L	9/18/2007	14				232	219	64		581								
Well	KEMMERER-L	12/10/2007																	Was measered in PSI
Well	KEMMERER-L	3/26/2008																	Measured in PSI
Well	KEMMERER-L	6/16/2008	14				233	210	70		582								
Well	KEMMERER-L	9/18/2008																	Units Measured in PSI
Well	KEMMERER-L	12/12/2008																	
Well	KEMMERER-L	6/4/2009	14				248	212	96		591								
Well	KEMMERER-L	7/14/2009	12				235	212	83		597								
Well	KEMMERER-L	12/29/2009																	Units Measured in PSI
Well	KEMMERER-L	3/25/2010																	Measured in PSI
Well	KEMMERER-L	6/23/2010	13				225	208	65		561								
Well	KEMMERER-L	7/19/2010	13				236	208	63		578								
Well	KEMMERER-L	10/15/2010																	MEASURED IN PSI
Well	KEMMERER-L	3/28/2011	13				232	227	74		608								
Well	KEMMERER-L	6/8/2011	13				224	214	72		584								
Well	KEMMERER-L	9/22/2011	13				231	213	76		572								
Well	KEMMERER-L	12/12/2011																	Discharge Pipe Frozen
Well	KEMMERER-L	3/15/2012	13				229	223	73		543								
Well	KEMMERER-L	6/20/2012	12				215	213	68		533								
Well	KEMMERER-L	8/20/2012	12				223	215	68		573								
Well	KEMMERER-L	11/7/2012	13				219	214	63		540								
Well	KEMMERER-L	3/21/2013	12				226	216	74		595								
Well	KEMMERER-L	6/4/2013	11				234	211	69		553								
Well	KEMMERER-L	9/24/2013	13				237	212	64		552								
Well	KEMMERER-L	12/17/2013	13				230	218	70		564								
Well	KEMMERER-L	3/14/2014	13				262	226	126		666								
Well	KEMMERER-L	6/26/2014	12				246	213	81		602								
Well	KEMMERER-L	9/19/2014	13				226	210	74		547								
Well	KEMMERER-L	12/9/2014	13				230		204	63		594							
Well	KEMMERER-L	3/16/2015	13				227		199	61		558							

Emery Water Quality Data - Kmf(l)

SITE TYPE	SITE NAME	DATE	Cl mg/l	NO3 mg/l	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	T-Al mg/l	T-As mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
Well	KEMMERER-L	5/18/2015	13				218		204	56		555							
Well	KEMMERER-L	9/1/2015	11				223		197	56		561							
Well	KEMMERER-L	12/29/2015																	No Access
Well	ZZ-L	6/24/1981	18.9	<0.01	<0.01		384.2	379.1	340.3	1120	852			17.2	15.8	21	6	9	
Well	ZZ-L	12/3/1981	23.2	0.011	<0.002	0.062	165		383	1050	603			15.6	16.9	0.8	0.09	9	
Well	ZZ-L	3/16/1982	23.1	0.017	<0.002	0.15	210		375	1200	671			15.8	15.5	0.49	0.09	22	
Well	ZZ-L	6/15/1982	24.2	0.16	<0.002	0.136	177		394	1300	600			16.8	16.9	0.36	0.07	20	
Well	ZZ-L	9/20/1982	23.7	0.11	<0.01	0.12	300		411	1200	753					0.4	0.05	21	
Well	ZZ-L	12/28/1982	19.3	0.161	<0.01	0.1			474	910	540			14	14.2	0.4	0.06	18	
Well	ZZ-L	6/30/1983	19	2.18	0.02	0.54	110		61	1850	834			10.52	13.07	1.1	0.03	5	
Well	ZZ-L	9/26/1983	20	0.3	0.02	0.11	175		74	1500	784			11.14	13.72	0.57	0.02	7	
Well	ZZ-L	3/8/1984	17	0.06	<0.01	0.06	120		90	1200	759			12.91	12.8	0.19	<0.01	9	
Well	ZZ-L	6/13/1984	15	<0.01	<0.01	0.08	145		73	1320	815			11.23	13.3	0.6	0.02	7	
Well	ZZ-L	9/24/1984	15	<0.01	<0.01	<0.01	200		90	1310	820			13.29	14.58	1.25	0.04	7	
Well	ZZ-L	3/26/1985	18	<0.01	<0.01	0.08	80		83	1400	670			11.98	12.09	0.6	0.03	9	
Well	ZZ-L	6/20/1985	18	0.02	0.04	0.12	200		72	1380	777			13.69	14.27	0.41	0.02	8	
Well	ZZ-L	9/19/1985	16	<0.01	<0.01	0.07	168		75	1205	779			13.8	13.85	1.07	0.05	8	
Well	ZZ-L	6/30/1986	15	0.41	0.09	0.08	170		60	1310	754			13.91	13.88	<0.05	<0.01	6	
Well	ZZ-L	5/18/1989	15				19	612	10		700			13.74	13.06			6	
Well	ZZ-L	9/11/1989	14				16	560	19		678			12.63	11.93			4	
Well	ZZ-L	6/8/1990	14				23	547	21		720	<0.05	<0.05	11.48	11.82				
Well	ZZ-L	9/18/1990	17				76	556	21		744			13.75	13.19				
Well	ZZ-L	6/17/1991	17				8	576	21		708			11.68	12.16				
Well	ZZ-L	9/23/1991	14				101	550	36		726			14.88	13.51				
Well	ZZ-L	5/26/1992	16				74	490			688			11.66	11.8				
Well	ZZ-L	9/2/1992	47				<2.	500	15		692			11.66	11.27				
Well	ZZ-L	6/7/1993	14				<2.	612	11		710								
Well	ZZ-L	9/8/1993	13				2	630	<7.		840			13.28	13.01				
Well	ZZ-L	6/6/1994	15				<2.	650	7		710			13.5	13.38				
Well	ZZ-L	9/7/1994	15				10	618	7		702			13.81	12.99				
Well	ZZ-L	6/6/1995	14				2	520	20		580			11.3	10.7				
Well	ZZ-L	9/6/1995	16				1	604	23		700			15.6	12.6				
Well	ZZ-L	9/17/2003																	No Access
Well	ZZ-L	12/23/2003																	No Access
Well	ZZ-L	3/18/2004																	No Access
Well	ZZ-L	6/23/2004																	No Access
Well	ZZ-L	9/24/2004																	Broken off. Can't monitor
Well	ZZ-L	12/28/2004																	Site was dry
Well	ZZ-L	3/31/2005																	Pipe Broken
Well	ZZ-L	5/12/2005																	Pipe is broken
Well	ZZ-L	7/20/2005																	Well is Broken
Well	ZZ-L	11/17/2005																	Well is broken
Well	ZZ-L	3/9/2006																	Broken
Well	ZZ-L	6/30/2006																	Broken
Well	ZZ-L	9/28/2006																	Broken pipe
Well	ZZ-L	11/27/2006																	Broken pipe. Can't monitor
Well	ZZ-L	3/22/2007																	No Access
Well	ZZ-L	6/13/2007																	broken
Well	ZZ-L	9/18/2007																	
Well	ZZ-L	12/10/2007																	Broken
Well	ZZ-L	3/26/2008																	No Access
Well	ZZ-L	6/24/2008																	No Access
Well	ZZ-L	9/30/2008																	
Well	ZZ-L	12/11/2008																	Broken
Well	ZZ-L	2/19/2009																	Broken
Well	ZZ-L	6/4/2009																	No Access
Well	ZZ-L	12/14/2009																	No Access
Well	ZZ-L	12/29/2009																	Broken
Well	ZZ-L	3/24/2010																	Broken
Well	ZZ-L	6/21/2010																	Broken
Well	ZZ-L	7/20/2010																	No Access

Note: Remaining wells dry or have access isues (blockages, etc.)

Number of Observations:	93	17	8	25	89	56	89	38	89	2	2	56	56	27	26	32
Maximum:	75	2.18	0.09	0.54	660	650	575	2200	1320	<0.05	<0.05	22.94	22.46	21	9	79
Minimum:	11	0.011	0.01	0.01	1	150	7	56	526	<0.05	<0.05	8.13	8.82	0.19	0.01	4
Mean:	17.5	0.30	0.03	0.15	210.5	312.8	119.1	998.6	659.4	<0.05	<0.05	12.2	12.3	2.4	0.7	13.7
Standard Deviation:	7.9	0.58	0.03	0.13	103.4	156.2	125.2	454.3	114.4	<0.05	<0.05	2.7	2.6	4.5	2.1	13.0
Equivalent weights of means:	0.5				4.4											

Emery Water Quality Data - Kmf(m)

SITE TYPE	SITE NAME	DATE	COMMENTS
Well	AA-M	6/25/2003	
Well	AA-M	9/18/2003	
Well	AA-M	12/19/2003	
Well	AA-M	3/30/2004	
Well	AA-M	6/23/2004	
Well	AA-M	9/23/2004	
Well	AA-M	12/27/2004	
Well	AA-M	3/31/2005	
Well	AA-M	5/23/2005	
Well	AA-M	7/8/2005	
Well	AA-M	11/28/2005	
Well	AA-M	3/6/2006	
Well	AA-M	6/29/2006	
Well	AA-M	9/27/2006	
Well	AA-M	11/20/2006	
Well	AA-M	3/20/2007	
Well	AA-M	6/13/2007	
Well	AA-M	9/20/2007	
Well	AA-M	12/10/2007	
Well	AA-M	3/26/2008	
Well	AA-M	6/24/2008	
Well	AA-M	9/22/2008	
Well	AA-M	12/12/2008	
Well	AA-M	12/15/2009	No Access Oil in well
Well	AA-M	12/29/2009	No Access Oil in well
Well	AA-M	3/24/2010	No Access Oil in well
Well	AA-M	6/22/2010	No Access Oil in well
Well	AA-M	7/20/2010	
Well	I-M	9/17/2003	
Well	I-M	12/19/2003	
Well	I-M	3/30/2004	
Well	I-M	6/18/2004	
Well	I-M	9/25/2004	
Well	I-M	12/28/2004	
Well	I-M	3/25/2005	
Well	I-M	5/23/2005	
Well	I-M	7/20/2005	
Well	I-M	11/22/2005	
Well	I-M	3/9/2006	
Well	I-M	6/29/2006	
Well	I-M	9/27/2006	
Well	I-M	11/27/2006	
Well	I-M	3/20/2007	
Well	I-M	6/14/2007	
Well	I-M	9/20/2007	

SITE TYPE	SITE NAME	DATE	COMMENTS
Well	I-M	12/10/2007	
Well	I-M	3/28/2008	
Well	I-M	6/24/2008	
Well	I-M	9/20/2008	
Well	I-M	12/12/2008	
Well	I-M	12/14/2009	No Access Oil in well
Well	I-M	12/29/2009	No Access Oil in well
Well	I-M	3/24/2010	No Access Oil in well
Well	I-M	6/22/2010	No Access Oil in well
Well	I-M	7/20/2010	No Access Oil in well
Well	I-M	10/5/2010	No Access Oil in well
Well	H-M	9/17/2003	
Well	H-M	12/19/2003	
Well	H-M	3/30/2004	
Well	H-M	6/18/2004	
Well	H-M	9/25/2004	
Well	H-M	12/28/2004	Dry Wells Oil in well
Well	H-M	3/25/2005	Dry Wells Oil in well
Well	H-M	5/23/2005	Dry Wells Oil in well
Well	H-M	7/11/2005	
Well	H-M	11/22/2005	
Well	H-M	3/9/2006	
Well	H-M	6/29/2006	
Well	H-M	9/27/2006	
Well	H-M	11/27/2006	
Well	H-L	9/17/2003	
Well	H-L	12/19/2003	
Well	H-L	3/30/2004	
Well	H-L	6/18/2004	
Well	H-L	9/25/2004	
Well	H-L	12/28/2004	Dry Wells Oil in well
Well	H-L	3/25/2005	Dry Wells Oil in well
Well	H-L	5/23/2005	Dry Wells Oil in well
Well	H-L	7/11/2005	
Well	H-L	11/22/2005	
Well	H-L	3/9/2006	
Well	H-L	6/29/2006	
Well	H-L	9/27/2006	
Well	H-L	11/27/2006	
Well	R2-M	9/17/2003	
Well	R2-M	12/19/2003	
Well	R2-M	3/18/2004	

SITE TYPE	SITE NAME	DATE	COMMENTS
Well	R2-M	6/23/2004	
Well	R2-M	9/20/2004	
Well	R2-M	12/28/2004	
Well	R2-M	3/24/2005	
Well	R2-M	5/23/2005	
Well	R2-M	7/11/2005	
Well	R2-M	11/28/2005	
Well	R2-M	3/7/2006	
Well	R2-M	6/29/2006	
Well	R2-M	9/28/2006	
Well	R2-M	11/20/2006	
Well	R2-M	3/20/2007	
Well	R2-M	6/14/2007	
Well	R2-M	9/18/2007	
Well	R2-M	12/10/2007	
Well	R2-M	3/26/2008	
Well	R2-M	6/24/2008	Dry Wells
Well	R2-M	9/20/2008	
Well	R2-M	12/12/2008	
Well	R2-M	6/3/2009	
Well	R2-M	12/14/2009	
Well	R2-M	12/29/2009	
Well	R2-M	3/25/2010	
Well	R2-M	6/23/2010	
Well	R2-M	7/19/2010	
Well	R2-M	10/15/2010	

Note: All wells have no water quality data because of being dry or having no access.

APPENDIX VI-4

Water Rights

Information added January 2017

APPLICATION FOR TEMPORARY CHANGE OF WATER

STATE OF UTAH

Receipt by:_____

Fee Rec.:_____

Receipt #_____

For the purpose of obtaining permission to make a temporary change of water in the State of Utah, application is hereby made to the State Engineer, based upon the following showing of facts, submitted in accordance with the requirements of Section 73-3-3 Utah Code Annotated 1953, as amended.

***WATER RIGHT NO.**_____-_____ ***APPLICATION NO. t**_____

Changes are proposed in (check those applicable)

☑ point of diversion ☑ place of use ☐ nature of use ☑ period of use ☐ storage.

1. **OWNER INFORMATION** **County Tax ID** 6-115-1 and 6-115-6

Name(s): Shayna Housekeeper and William Boyd Stansfield, Jr. *Interest:_____%
Address: PO Box 553
City: Emery State: UT Zip Code: 84522
Phone Number _____

2. ***PRIORITY OF CHANGE:**_____ ***FILING DATE:**_____

3. **RIGHT EVIDENCED BY:** 94-1178
Prior Approved Temporary Change Applications for this right:_____

**********HERETOFORE**********

4. **QUANTITY OF WATER:** 1.75 cfs and/or _____ ac-ft.
5. **SOURCE:** Quitchumpah Creek
6. **COUNTY:** Sevier
7. **POINT(S) OF DIVERSION:** South 1050 ft, West 85 ft from the East quarter corner of Sec. 24, T 22S, R 5 E, SLBM

Description of Diverting Works: Headgate

8. **POINT(S) OF REDIVERSION**
The water will be rediverted from_____ at a point:_____

Description of Diverting Works:_____

9. **POINT(S) OF RETURN**
The water will be returned to the natural stream/source at a point(s): _____

***These items are to be completed by the Division of Water Rights**

10. NATURE AND PERIOD OF USE

Irrigation:	From 04/01	to 10/31
Stockwatering:	From 01/01	to 12/31
Domestic:	From	to
Municipal:	From	to
Mining:	From	to
Power:	From	to
Other:	From	to

11. PURPOSE AND EXTENT OF USE

Irrigation: Group total = 184.93 acres. Sole supply of _____ acres.

Stockwatering (number and kind): Group total = 2000

Domestic: _____ Families and/or _____ Persons.

Municipal (name): _____

Mining: _____ Mining District in the _____ Mine.

Ores mined: _____

Power Plant name: _____ Type: _____ Capacity: _____

Other (describe): _____

12. PLACE OF USE

Legal description of place of use by 40 acre tract(s):

Sec. 29, T 22 S, R 6 E: NW4 NE4; SW4 SW4; SE4 SW4 Sec. 30, T 22 S, R 6 E: SE4 SW4; NW4 SE4; NE4 SE4; SW4 SE4

Sec. 31, T 22 S, R 6 E: NE4 NW4; NW4 NE4: NE4 NE4; SW4 NE4; SE4 NE4

13. **STORAGE**

Reservoir Name: None Storage Period: from _____ to _____

Capacity: _____ ac-ft. Inundated Area: _____ acres.

Height of dam: _____ feet.

Legal description of inundated area by 40 tract(s): _____

**********THE FOLLOWING CHANGES ARE PROPOSED**********

14. QUANTITY OF WATER: 0.50 cfs and/or _____ ac-ft.

15. SOURCE: Quitchupah Creek

Balance of the water will be abandoned: _____, or will be used as heretofore: xx

16. **COUNTY:** Emery

17. **POINT(S) OF DIVERSION:** North 2000 ft, East 1300 ft from the SW corner of Sec. 33, T 22 S, R 6 E, SLBM

Description of Diverting Works: Pump

COMMON DESCRIPTION: _____

18. POINT(S) OF REDIVERSION

The water will be rediverted from _____ at a point: _____

Description of Diverting Works: _____

19. **POINT(S) OF RETURN**

The water will be returned to the natural stream/source at a point(s): _____

20. NATURE AND PERIOD OF USE

Irrigation:	From _____	to _____
Stockwatering:	From _____	to _____
Domestic:	From _____	to _____
Municipal:	From _____	to _____
Mining:	From 01/01	to 12/31
Power:	From _____	to _____
Other:	From _____	to _____

21. PURPOSE AND EXTENT OF USE

Irrigation: _____ acres. Sole supply of _____ acres.
Stockwatering (number and kind): _____
Domestic: _____ Families and/or _____ Persons.
Municipal (name): _____
Mining: _____ Mining District at the Emery Mine.
Ores mined: Coal
Power Plant name: _____ Type: _____ Capacity: _____
Other (describe): _____

22. PLACE OF USE

Legal description of place of use by 40 acre tract(s): Surface use during construction of surface facilities will occur in SE4 SE4 Sec. 32, T 22 S, R 6 E; NW4 SW4 Section 33, T 22 S, R 6 E; and SW4 SW4 Section 33, T 22 S, R 6 E. Also, underground use during mining will occur in SW4 NE4, NE4 SW4, SE4 SW4, SW4 SE4, SE4 SE4 Sec. 30, T 22 S, R 6 E; NE4 NW4, NW4 NE4, NE4 NE4, SW4 NE4, SE4 NE4 Sec. 31, T 22 S, R 6 E; and NW4 NW4, NE4 NW4, SW4 NW4, SE4 NW4, NW4 SW4, NE4 SW4, NW4 SE4, SW4 SE4, NE4 SE4, SE4 SE4 Sec. 32, T 22 S, R 6 E.

23. STORAGE

Reservoir Name: None Storage Period: from _____ to _____
Capacity: _____ ac-ft. Inundated Area: _____ acres.
Height of dam: _____ feet.
Legal description of inundated area by 40 tract(s): _____

24. **EXPLANATORY**

The following is set forth to define more clearly the full purpose of this application. Include any supplemental water rights used for the same purpose. (Use additional pages of same size if necessary). Water will be used for construction and underground purposes during development and mining at the Emery 2 portal of teh Emery Mine. This water right is part of Supplemental Group No. 617812 comprising 94-320, 94-1178, 94-1179, 94-1180, 94-1181, and 94-1182.

****

The undersigned hereby acknowledges that even though he/she/they may have been assisted in the preparation of the above-numbered application through the courtesy of the employees of the Division of Water Rights, all responsibility for the accuracy of the information contained herein, at the time of filing, including maps and other documents attached, rests with the applicant(s).

Bill Stansfield Jr. Thomas Houskeeper
Signature of Applicant(s)*

*If applicant is a corporation or other organization, signature must be the name of such corporation or organization by its authorized agent, or in the name of the partnership by one of the partners.

_____
Authorized Agent (please print)

_____
Authorized Agent (signature)

APPENDIX VI-10

Groundwater Monitoring –
Water Level Data

Emery Water Level Data - Qal

Well RDA1			Well RDA2			Well RDA3			Well RDA4			Well RDA5		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
4/29/1982	17.30	5941.2	4/29/1982	17.20	5938.5	4/29/1982	23.05	5923.5	4/29/1982			4/29/1982	19.6	5922.8
6/16/1982	16.08	5942.4	6/16/1982	20.00	5935.7	6/16/1982	22.92	5923.6	6/16/1982			6/16/1982	19.75	5922.7
7/26/1982	18.17	5940.3	7/26/1982	20.50	5935.2	7/26/1982	26.00	5920.5	7/26/1982			7/26/1982	22.5	5919.9
8/24/1982	15.58	5942.9	8/24/1982	20.67	5935.0	8/24/1982	23.60	5922.9	8/24/1982			8/13/1982	20.3	5922.1
9/21/1982	15.42	5943.1	9/21/1982	17.75	5938.0	9/21/1982	23.50	5923.0	9/21/1982			9/21/1982	20	5922.4
10/13/1982	17.42	5941.1	10/13/1982	15.67	5940.0	10/13/1982	24.67	5921.8	10/13/1982			10/13/1982	20.50	5921.9
11/19/1982	16.25	5942.3	11/19/1982	17.25	5938.5	11/19/1982	23.00	5923.5	11/19/1982			11/19/1982	20.50	5921.9
12/9/1982	16.16	5942.3	12/9/1982	16.92	5938.8	12/9/1982	22.92	5923.6	12/9/1982			12/9/1982	20.66	5921.7
1/19/1983	16.42	5942.1	1/19/1983	16.92	5938.8	1/19/1983	22.75	5923.8	1/19/1983			1/19/1983	20.42	5922.0
2/17/1983	16.67	5941.8	2/17/1983	17.00	5938.7	2/17/1983	22.92	5923.6	2/17/1983			2/17/1983	20.67	5921.7
3/8/1983	16.58	5941.9	3/8/1983	17.00	5938.7	3/8/1983	22.58	5923.9	3/8/1983			3/8/1983		
4/12/1983	16.75	5941.8	4/12/1983	16.83	5938.9	4/12/1983	22.66	5923.8	4/12/1983			4/12/1983	19.50	5922.9
5/26/1983	16.40	5942.1	5/26/1983	17.00	5938.7	5/26/1983	22.40	5924.1	5/26/1983			5/5/1983	14.75	5927.7
6/7/1983	17.50	5941.0	6/7/1983	17.00	5938.7	6/7/1983	22.50	5924.0	6/7/1983			6/17/1983	19.75	5922.7
7/19/1983	15.83	5942.7	7/19/1983	17.67	5938.0	7/19/1983	22.83	5923.7	7/19/1983			7/19/1983		
8/17/1983	15.70	5942.8	8/17/1983	18.20	5937.5	8/17/1983	22.80	5923.7	8/17/1983			8/17/1983	19.50	5922.9
9/1/1983	15.80	5942.7	9/1/1983	17.60	5938.1	9/1/1983	23.00	5923.5	9/1/1983			9/1/1983	19.75	5922.7
12/6/1983	17.00	5941.5	12/6/1983	17.40	5938.3	12/6/1983	23.00	5923.5	12/6/1983			12/6/1983	20.20	5922.2
3/7/1984	16.10	5942.4	3/17/1984	16.70	5939.0	3/17/1984	22.70	5923.8	3/17/1984			3/17/1984	20.30	5922.1
6/12/1984	15.40	5943.1	6/12/1984	17.00	5938.7	6/12/1984		5924.2	6/12/1984		5922.3	6/12/1984		5922.7
9/11/1984	15.00	5943.5	9/11/1984	16.50	5939.2	9/11/1984		5923.9	9/11/1984		5922.2	9/11/1984		5922.6
12/6/1984	15.00	5943.5	12/6/1984	15.80	5939.9	12/6/1984			12/6/1984			12/6/1984	20.00	5922.4
1/29/1985		5943.5	1/29/1985	15.90	5939.8	1/29/1985		5924.5	1/29/1985		5922.9	1/29/1985		5921.9
4/3/1985	15.40	5943.1	4/3/1985	15.60	5940.1	4/3/1985	15.20	5931.3	4/3/1985	21.8	5922.2	4/3/1985	21.00	5921.4
9/3/1985		5940.7	9/3/1985		5940.7	9/3/1985		5923.3	9/3/1985		5921.0	9/3/1985		5921.4
12/16/1985		5943.4	12/16/1985		5939.8	12/16/1985		5924.0	12/16/1985		5922.1	12/16/1985		5921.8
3/12/1986		5943.1	3/12/1986		5940.5	3/12/1986		5923.5	3/12/1986		5921.8	3/12/1986		5921.6
6/25/1986		5944.5	6/25/1986		5940.4	6/25/1986		5924.5	6/25/1986		5920.2	6/25/1986		5921.4
9/30/1986		5947.4	9/30/1986		5940.3	9/30/1986		5923.3	9/30/1986		5921.5	9/30/1986		5922.2
12/18/1986		5946.5	12/18/1986		5941.6	12/18/1986		5923.8	12/18/1986		5923.9	12/18/1986		5921.7
3/31/1987	15.60	5942.9	3/31/1987	15.50	5940.2	3/31/1987	23.10	5923.4	3/31/1987	19.30	5924.7	3/31/1987	21.90	5920.5
6/10/1987	14.00	5944.5	6/10/1987	14.40	5941.3	6/10/1987	15.30	5931.2	6/10/1987	21.80	5922.2	6/10/1987	21.20	5921.2
9/17/1987	17.20	5941.3	9/17/1987	14.60	5941.1	9/17/1987	22.30	5924.2	9/17/1987	21.60	5922.4	9/17/1987	19.80	5922.6
12/16/1987	13.20	5945.3	12/16/1987	13.70	5942.0	12/16/1987	22.40	5924.1	12/16/1987	21.30	5922.7	12/16/1987	21.00	5921.4
2/17/1988		5945.5	2/17/1988		5942.2	2/17/1988		5925.5	2/17/1988		5923.0	2/17/1988		5923.4
6/8/1988		5945.0	6/8/1988		5941.5	6/8/1988		5924.1	6/8/1988		5922.5	6/8/1988		5922.6
9/26/1988		5944.0	9/26/1988		5938.7	9/26/1988		5925.5	9/26/1988		5923.5	9/26/1988		5924.9
12/19/1988		5944.6	12/19/1988		5941.4	12/19/1988		5923.7	12/19/1988		5922.2	12/19/1988		5922.1
3/1/1989	14.70	5943.5	3/1/1989	14.50	5941.2	3/1/1989	22.90	5923.6	3/1/1989	21.9	5922.1	3/1/1989	20.70	5921.7
5/19/1989	15.00	5943.5	5/19/1989	15.00	5940.7	5/19/1989	23.30	5923.2	5/19/1989	22.0	5922.0	5/19/1989	20.40	5922.0
9/1/1989	15.20	5943.5	9/1/1989	15.00	5940.7	9/1/1989	23.40	5923.1	9/1/1989	22.5	5921.5	9/1/1989	20.60	5921.8
12/1/1989	14.80		12/1/1989	15.40	5940.3	12/1/1989	22.30	5924.2	12/1/1989	20.5	5923.5	12/1/1989	20.40	5922.0

Emery Water Level Data - Qal

Well RDA1			Well RDA2			Well RDA3			Well RDA4			Well RDA5		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/1/1990	15.20	5943.3	3/1/1990	15.20	5940.5	3/1/1990	22.00	5924.5	3/1/1990	21.2	5922.8	3/1/1990	20.40	5922.0
6/4/1990	11.30	5947.2	6/4/1990	15.10	5940.6	6/4/1990	22.40	5924.1	6/4/1990	21.50	5922.5	6/4/1990	20.00	5922.4
9/1/1990	15.70	5942.8	9/1/1990	16.10	5939.6	9/1/1990	23.30	5923.2	9/1/1990	22.00	5922.0	9/1/1990	20.40	5922.0
11/1/1990	15.90	5942.6	11/1/1990	16.00	5939.7	11/1/1990	22.60	5923.9	11/1/1990	21.80	5922.2	11/1/1990	20.70	5921.7
3/1/1991	15.70	5942.8	3/1/1991	15.5	5940.2	3/1/1991	21.90	5924.6	3/1/1991	21	5923.0	3/1/1991	19.9	5922.5
6/6/1991		5943.5	6/6/1991		5939.0	6/6/1991		5924.7	6/6/1991		5923.1	6/5/1991		5923.2
9/19/1991		5943.1	9/19/1991		5937.7	9/19/1991		5924.1	9/19/1991		5922.7	9/19/1991		5922.8
12/1/1991	15.50	5943.0	12/1/1991	15.7	5940.0	12/1/1991	21.30	5925.2	12/1/1991	20.6	5923.4	12/1/1991	20	5922.4
3/1/1992	15.70	5942.8	3/1/1992	15.4	5940.3	3/1/1992	21.00	5925.5	3/1/1992	20	5924.0	3/1/1992	19.1	5923.3
5/26/1992	16.00	5942.5	5/26/1992	15.90	5939.8	5/26/1992	16.20	5930.3	5/26/1992	20.1	5923.9	5/26/1992	18.80	5923.6
9/2/1992	15.20	5943.3	9/2/1992	16.10	5939.6	9/2/1992	21.50	5925.0	9/2/1992	20.50	5923.5	9/2/1992	19.00	5923.4
12/1/1992	15.20	5943.3	12/1/1992	15.50	5940.2	12/1/1992	21.00	5925.5	12/1/1992	20.2	5923.8	12/1/1992	19.50	5922.9
3/1/1993	15.20	5943.3	3/1/1993	15.20	5940.5	3/1/1993	20.50	5926.0	3/1/1993	19.5	5924.5	3/1/1993	18.50	5923.9
6/4/1993		5943.2	6/4/1993		5940.0	6/4/1993		5926.2	6/4/1993		5924.7	6/4/1993		5924.8
9/9/1993		5942.7	9/9/1993		5938.6	9/9/1993		5924.5	9/9/1993		5923.2	9/9/1993		5923.4
12/1/1993	15.00	5943.5	12/1/1993	15.30	5940.4	12/1/1993	21.00	5925.5	12/1/1993	20.0	5924.0	12/1/1993	19.00	5923.4
3/1/1994	15.00	5943.5	3/1/1994	15.10	5940.6	3/1/1994	20.30	5926.2	3/1/1994	19.6	5924.4	3/1/1994	18.50	5923.9
6/6/1994		5943.7	6/6/1994		5940.4	6/6/1994		5925.3	6/6/1994		5924.0	6/6/1994		5923.9
9/8/1994		5943.6	9/8/1994		5940.2	9/8/1994		5925.1	9/8/1994		5923.8	9/8/1994		5923.7
12/1/1994	15.30	5943.2	12/1/1994	15.80	5939.9	12/1/1994	21.20	5925.3	12/1/1994	20.0	5924.0	12/1/1994	18.60	5923.8
3/1/1995	15.40	5943.1	3/1/1995	15.60	5940.1	3/1/1995	20.80	5925.7	3/1/1995	19.8	5924.2	3/1/1995	19.60	5922.8
6/6/1995	14.30	5944.2	6/6/1995	15.60	5940.1	6/6/1995	20.60	5925.9	6/6/1995	19.7	5924.3	6/6/1995	18.40	5924.0
9/1/1995	13.80	5944.7	9/1/1995	15.50	5940.2	9/1/1995	21.50	5925.0	9/1/1995	20.2	5923.8	9/1/1995	18.40	5924.0
12/1/1995	13.10	5945.4	12/1/1995	14.60	5941.1	12/1/1995	20.50	5926.0	12/1/1995	19.6	5924.4	12/1/1995	18.70	5923.7
3/1/1996	13.90	5944.6	3/1/1996	14.40	5941.3	3/1/1996	20.70	5925.8	3/1/1996	19.7	5924.3	3/1/1996	18.20	5924.2
6/1/1996	12.70	5945.8	6/1/1996	14.30	5941.4	6/1/1996	20.80	5925.7	6/1/1996	19.7	5924.3	6/1/1996	18.00	5924.4
9/1/1996	12.70	5945.8	9/1/1996	14.70	5941.0	9/1/1996	22.50	5924.0	9/1/1996	21.4	5922.6	9/1/1996	19.30	5923.1
12/31/1996	13.20	5945.3	12/31/1996	14.30	5941.4	12/31/1996	21.10	5925.4	12/31/1996	20.0	5924.0	12/31/1996	18.80	5923.6
3/1/1997	13.60	5944.9	3/1/1997	14.00	5941.7	3/1/1997	20.60	5925.9	3/1/1997	19.5	5924.5	3/1/1997	18.30	5924.1
6/1/1997	12.40	5946.1	6/1/1997	14.30	5941.4	6/1/1997	20.30	5926.2	6/1/1997	18.9	5925.1	6/1/1997	17.20	5925.2
9/1/1997	11.10	5947.4	9/1/1997	13.30	5942.4	9/1/1997	19.40	5927.1	9/1/1997	18.3	5925.7	9/1/1997	17.00	5925.4
12/1/1997	11.70	5946.8	12/1/1997	13.10	5942.6	12/1/1997	18.90	5927.6	12/1/1997	17.9	5926.1	12/1/1997	16.50	5925.9
3/1/1998	13.70	5944.8	3/1/1998	13.20	5942.5	3/1/1998	18.80	5927.7	3/1/1998	18.0	5926.0	3/1/1998	17.00	5925.4
6/1/1998		5945.6	6/1/1998		5942.1	6/1/1998		5927.4	6/1/1998		5926.0	6/1/1998		5925.8
9/15/1998		5945.1	9/15/1998		5941.5	9/15/1998		5926.7	9/15/1998		5925.7	9/15/1998		5925.4
12/1/1998	13.30	5945.2	12/1/1998	13.70	5942.0	12/1/1998	19.30	5927.2	12/1/1998	19.4	5924.6	12/1/1998	17.10	5925.3
3/1/1999	13.60	5944.9	3/1/1999	13.50	5942.2	3/1/1999	19.10	5927.4	3/1/1999	19.0	5925.0	3/1/1999	17.20	5925.2
6/1/1999	13.20	5945.3	6/1/1999	13.10	5942.6	6/1/1999	19.30	5927.2	6/1/1999	18.0	5926.0	6/1/1999	16.90	5925.5
9/1/1999	14.80	5943.7	9/1/1999	15.30	5940.4	9/1/1999	20.50	5926.0	9/1/1999	18.8	5925.2	9/1/1999	17.40	5925.0
12/1/1999	14.90	5943.6	12/1/1999	15.30	5940.4	12/1/1999	20.60	5925.9	12/1/1999	18.7	5925.3	12/1/1999	16.40	5926.0
3/23/2000		5944.0	3/23/2000		5941.4	3/23/2000		5926.3	3/23/2000		5925.5	3/23/2000		5924.7
6/1/2000			6/1/2000			6/1/2000			6/1/2000			6/1/2000		
9/21/2000		5943.6	9/21/2000		5940.2	9/21/2000		5925.9	9/21/2000		5924.5	9/21/2000		5924.1
12/31/2000	15.0	5943.5	12/31/2000	15.3	5940.4	12/31/2000	20.5	5926.0	12/31/2000	19.1	5924.9	12/31/2000	18.2	5924.2

Emery Water Level Data - Qal

Well RDA1			Well RDA2			Well RDA3			Well RDA4			Well RDA5		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
9/18/2003	18.0	5940.5	9/18/2003	18	5937.7	9/18/2003	21.4	5925.1	9/18/2003	20	5924.0	9/18/2003	18.5	5923.9
12/23/2003	18.0	5940.5	12/23/2003	18	5937.7	12/23/2003	22	5924.5	12/1/2003	21.2	5922.8	12/23/2003	18	5924.4
3/29/2004	17.1	5941.4	3/29/2004	17.3	5938.4	3/29/2004	19.8	5926.7	3/29/2004	17.4	5926.6	3/29/2004	16.9	5925.5
6/2/2004	17.1	5941.4	6/2/2004	17	5938.7	6/2/2004	21	5925.5	6/2/2004	17.4	5926.6	6/2/2004	16.3	5926.1
9/23/2004	18.3	5940.3	9/24/2004	18.75	5937.0	9/23/2004	20.9	5925.6	9/23/2004	20.75	5923.3	9/23/2004	19.8	5922.6
12/27/2004	18.0	5940.5	12/27/2004	17.7	5938.0	12/27/2004	21	5925.5	12/27/2004	20	5924.0	12/27/2004	20.4	5922.0
3/24/2005	17.9	5940.6	3/24/2005	17.5	5938.2	3/24/2005	20.5	5926.0	3/24/2005	19.6	5924.4	3/24/2005	19.5	5922.9
5/12/2005	18.0	5940.5	5/13/2005	17.5	5938.2	5/13/2005	20.5	5926.0	5/13/2005	19.2	5924.8	5/13/2005	19	5923.4
7/9/2005	18.4	5940.1	7/9/2005	18.3	5937.4	7/9/2005	21.3	5925.2	7/9/2005	19.8	5924.2	7/9/2005	19	5923.4
11/22/2005	18.5	5940.0	11/22/2005	18.7	5937.0	11/22/2005	20.9	5925.6	11/22/2005	19.6	5924.4	11/22/2005	18.2	5924.2
3/6/2006	18.0	5940.5	3/6/2006	18.1	5937.6	3/6/2006	20.2	5926.3	3/6/2006	19.4	5924.6	3/6/2006	19.1	5923.3
6/28/2006	18.8	5939.7	6/28/2006	18.9	5936.8	6/28/2006	20	5926.5	6/28/2006	18.6	5925.4	6/28/2006	16.3	5926.1
9/28/2006	19.7	5938.8	9/28/2006	19.5	5936.2	9/28/2006	20.2	5926.3	9/28/2006	18.8	5925.2	9/28/2006	16	5926.4
11/20/2006	19.0	5939.5	11/20/2006	19	5936.7	11/20/2006	20	5926.5	11/20/2006	19	5925.0	11/20/2006	16	5926.4
3/22/2007	19.0	5939.5	3/22/2007	19	5936.7	3/22/2007	20	5926.5	3/22/2007	19	5925.0	3/22/2007	19	5923.4
6/14/2007	20.0	5938.5	6/14/2007	19.5	5936.2	6/14/2007	20.5	5926.0	6/14/2007	19.5	5924.5	6/14/2007	16	5926.4
9/20/2007	20.0	5938.5	9/20/2007	20	5935.7	9/20/2007	21.5	5925.0	9/20/2007	20	5924.0	9/20/2007	16	5926.4
12/10/2007	20.0	5938.5	12/10/2007	20	5935.7	12/10/2007	20	5926.5	12/10/2007	18.5	5925.5	12/10/2007	15.5	5926.9
3/28/2008	19.0	5939.5	3/28/2008	19	5936.7	3/28/2008	19	5927.5	3/28/2008	18	5926.0	3/28/2008	15	5927.4
6/16/2008	19.0	5939.5	6/16/2008	19	5936.7	6/16/2008	19	5927.5	6/16/2008	18	5926.0	6/16/2008	15	5927.4
9/20/2008	19.5	5939.0	9/20/2008	20	5935.7	9/20/2008	20	5926.5	9/20/2008	18	5926.0	9/20/2008	15	5927.4
12/13/2008	20.0	5938.5	12/13/2008	20	5935.7	12/13/2008	19	5927.5	12/13/2008	18	5926.0	12/13/2008	15	5927.4
6/4/2009	17.0	5941.5	6/4/2009	18	5937.7	6/4/2009	19	5927.5	6/4/2009	18	5926.0	6/4/2009	18	5924.4
12/14/2009	19.0	5939.5	12/14/2009	19	5936.7	12/14/2009	21	5925.5	12/14/2009	19	5925.0	12/14/2009	19	5923.4
12/29/2009	20.0	5938.5	12/29/2009	19	5936.7	12/29/2009	20	5926.5	12/29/2009	19	5925.0			
3/26/2010	18.0	5940.5	3/26/2010	20	5935.7	3/26/2010	20	5926.5	3/26/2010	18	5926.0	3/26/2010	16	5926.4
6/24/2010	19.0	5939.5	6/24/2010	19	5936.7	6/24/2010	20	5926.5	6/24/2010	18	5926.0	6/24/2010	16	5926.4
7/19/2010	20.0	5938.5	7/19/2010	20	5935.7	7/19/2010	21	5925.5	7/19/2010	18	5926.0	7/19/2010	16	5926.4
10/15/2010	20.0	5938.5	10/15/2010	20	5935.7	10/15/2010	20	5926.5	10/15/2010	19	5925.0	10/15/2010	16	5926.4
3/29/2011	19.5	5939.0	3/29/2011	19.0	5936.7	3/29/2011	19.5	5927.0	3/29/2011	18.5	5925.5	3/29/2011	17.0	5925.4
6/8/2011	19.5	5939.0	6/8/2011	19.2	5936.5	6/8/2011	19.7	5926.8	6/8/2011	18.9	5925.1	6/8/2011	17.8	5924.6
9/28/2011	21.0	5937.5	9/28/2011	20.5	5935.2	9/28/2011	21.0	5925.5	9/28/2011	20.5	5923.5	9/28/2011	19.5	5922.9
12/12/2011	20.5	5938.0	12/12/2011	20.0	5935.7	12/12/2011	21.0	5925.5	12/12/2011	20.5	5923.5	12/12/2011	20.5	5921.9

Emery Water Level Data - Qal

Well RDA1			Well RDA2			Well RDA3			Well RDA4			Well RDA5		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/16/2012	20.5	5938.0	3/16/2012	19.0	5936.7	3/16/2012	20.0	5926.5	3/16/2012	21.0	5923.0	3/16/2012	20.0	5922.4
			6/20/2012	21.0	5934.7				6/20/2012	22.0	5922.0			
			8/20/2012	20.2	5935.5				8/20/2012	20.5	5923.5			
			11/6/2012	21.2	5934.5				11/6/2012	21.1	5922.9			
			3/28/2013	20.2	5935.5				3/28/2013	21.3	5922.7			
			6/4/2013	20.5	5935.2				6/4/2013	21.8	5922.2			
			9/19/2013	20.3	5935.4				9/19/2013	21.6	5922.4			
			12/1/2013	20.2	5935.5				12/1/2013	21.6	5922.4			
			3/19/2014	20.5	5935.2				3/19/2014	21.3	5922.7			
			6/26/2014	22.7	5933.0				6/26/2014	22.7	5921.3			
			9/16/2014	21.6	5934.1				9/16/2014	23	5921.0			
			12/12/2014	21.4	5934.3				12/12/2014	22.9	5921.1			
			3/12/2015	20.9	5934.8				3/12/2015	23.4	5920.6			
			6/26/2015	21.4	5934.3				6/26/2015	23.3	5920.7			
			9/22/2015	22.1	5933.6				9/22/2015	23.9	5920.1			
			12/2/2015	22.3	5933.4				12/2/2015	23.9	5920.1			

Maximum	5926.6
Minimum	5920.1

Emery Water Level Data - Qal

Well RDA6			Well SM1-1			Well SM1-2			Well SM1-3			Well SM1-4		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
4/29/1982	13.80	5928.2	4/23/1982	18.10	6053.5	04/28/82	8.50	6043.3	04/30/82	19.60	6036.9	04/28/82	12.40	5929.2
6/16/1982	13.90	5928.1												
7/26/1982	14.33	5927.7												
8/24/1982	14.60	5927.4												
9/21/1982	14.40	5927.6	9/14/1982	5.75	6065.9	08/30/82	6.00	6045.8	08/30/82	11.90	6044.6	08/30/82	15.40	5926.2
10/13/1982	14.40	5927.6												
11/19/1982	14.90	5927.1	11/17/1982	8.27	6063.3	11/17/82	4.42	6047.4	11/17/82	9.67	6046.8	11/29/82	12.60	5929.0
12/9/1982	14.50	5927.5												
1/19/1983	14.50	5927.5												
2/17/1983	14.67	5927.3	2/15/1983	9.67	6061.9	02/15/83	6.42	6045.4				02/15/83	12.80	5928.8
3/8/1983														
4/12/1983	13.92	5928.1												
5/5/1983	15.08	5926.9												
6/7/1983			6/28/1983	8.30	6063.3	06/28/83	8.30	6043.5	06/28/83	1.10	6055.4	06/28/83	13.30	5928.3
7/19/1983	14.75	5927.3												
8/17/1983	14.70	5927.3	8/29/1983	8.70	6062.9	08/29/83	1.50	6050.3	08/29/83	9.20	6047.3	08/29/83	12.80	5928.8
9/1/1983	14.65	5927.4												
12/6/1983	14.80	5927.2	11/7/1983			11/07/83			11/07/83			11/07/83		
3/7/1984	15.00	5927.0	2/21/1984	10.60	6061.0	02/21/84	6.30	6045.5	02/21/84	10.10	6046.4	02/21/84	13.10	5928.5
6/12/1984		5922.5	5/3/1984	7.10	6064.5	05/03/84		6044.8	05/03/84	9.50	6047.0	05/03/84		5934.7
9/11/1984		5926.8	8/22/1984	6.80	6064.8	08/22/84		6049.0	08/02/84	8.80	6047.7	08/02/84		5929.0
12/6/1984	15.40	5926.6	11/19/1984	3.50	6068.1	11/19/84		6051.8	11/19/84	9.90	6046.6	11/19/84	14.30	5927.3
1/29/1985		5926.8	2/26/1985	4.60	6067.0	02/26/85		6044.8	02/26/85		6046.1	02/27/85		5928.7
4/3/1985	19.90	5922.1	5/8/1985	5.00	6066.6	05/08/85		6050.3	05/08/85		6047.3	05/08/85		5927.7
9/3/1985		5927.7	8/14/1985	2.00	6069.6	08/14/85	0.40	6051.4	08/14/85		6048.2	08/14/85		5930.9
12/16/1985		5926.4	11/21/1985	4.30	6067.3	11/21/85		6051.8	11/21/85		6048.1	11/21/85	13.30	5928.3
3/12/1986		5927.0	3/20/1986	3.60	6068.0	03/20/86		6048.0	03/13/86		6048.2	03/20/86		5923.0
6/25/1986		5926.8	6/30/1986		6067.1	06/30/86		6050.3	06/30/86		6048.5	06/30/86		5935.6
9/30/1986		5926.5	9/4/1986		6066.6	09/04/86		6049.8	09/04/86		6048.6	09/04/86		5928.3
12/18/1986		5926.1	12/23/1986		6067.2	12/23/86		6048.1	12/23/86		6047.8	12/23/86		5931.1
3/31/1987	16.90	5925.1	4/2/1987	4.00	6067.6	04/02/87	3.50	6048.3	04/02/87	8.70	6047.8	04/02/87	15.50	5926.1
6/10/1987	19.20	5922.8	6/1/1987	3.60	6068.0	06/01/87	1.20	6050.6	06/01/87	7.40	6049.1	06/01/87	12.70	5928.9
9/17/1987	16.00	5926.0	9/17/1987	6.60	6065.0	09/17/87	5.10	6046.7	09/17/87	7.70	6048.8	09/17/87	14.00	5927.6
12/16/1987	15.00	5927.0	12/15/1987	6.10	6065.5	12/15/87			12/12/87	8.00	6048.5	12/12/87	14.20	5927.4
2/17/1988		5930.0	3/21/1988	9.00	6062.6	03/21/88	8.00	6043.8	03/21/88	8.00	6048.5	03/21/88	13.00	5928.6
6/8/1988		5926.5	6/10/1988	3.70	6067.9	06/10/88	4.7	6047.1	06/10/88	7.30	6049.2	06/10/88	12.80	5928.8
9/26/1988		5924.5	9/22/1988	18.00	6053.6	09/22/88	5.9	6045.9	09/22/88	8.30	6048.2	09/22/88	14.30	5927.3
12/19/1988		5926.1	12/1/1988	9.80	6061.8				12/1/1988	8.60	6047.9	12/1/1988	13.10	5928.5
3/1/1989	16.00	5926.0	3/1/1989	10.30	6061.3	3/1/1989	9.00	6042.8	3/1/1989	8.50	6048.0	3/1/1989	12.80	5928.8
5/19/1989	15.80	5926.2	5/18/1989	10.50	6061.1	5/18/1989	9.80	6042.0	5/18/1989	7.3	6049.2	5/18/1989	12.80	5928.8
9/1/1989	16.00	5926.0	9/12/1989	11.20	6060.4	9/12/1989	13.90	6037.9	9/12/1989	7.30	6049.2	9/12/1989	14.50	5927.1
12/1/1989	15.90	5926.1	12/1/1989	8.70	6062.9	12/1/1989	14.40	6037.4	12/1/1989	8.00	6048.5	12/1/1989	13.60	5928.0

Emery Water Level Data - Qal

Well RDA6			Well SM1-1			Well SM1-2			Well SM1-3			Well SM1-4		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/1/1990	15.10	5926.9	3/1/1990	11.40	6060.2	3/1/1990	13.80	6038.0	3/1/1990	8.30	6048.2	3/1/1990	13.00	5928.6
6/4/1990	14.10	5927.9	6/4/1990	11.80	6059.8	6/4/1990	11.8	6040.0	6/4/1990	7.60	6048.9	6/4/1990	14.30	5927.3
9/1/1990	16.20	5925.8	9/19/1990	6.50	6065.1	9/19/1990	14.3	6037.5	9/19/1990	8.30	6048.2	9/19/1990	15.8	5925.8
11/1/1990	16.30	5925.7	12/1/1990	13.20	6058.4	12/1/1990	14.20	6037.6	12/1/1990	8.50	6048.0	12/1/1990	15.70	5925.9
3/1/1991	16.20	5925.8	3/1/1991	12.90	6058.7	3/1/1991	14.10	6037.7	3/1/1991	8.60	6047.9	3/1/1991	13.70	5927.9
6/5/1991		5925.9	6/1/1991	13.50	6058.1	6/1/1991	13.90	6037.9	6/1/1991	7.60	6048.9	6/1/1991	13.60	5928.0
9/19/1991		5926.2	9/24/1991	12.50	6059.1	09/24/91	14.70	6037.1	09/24/91	7.8	6048.7	09/24/91	15.9	5925.7
12/1/1991	16.00	5926.0	12/1/1991	12.50	6059.1	12/1/1991	14.10	6037.7	12/1/1991	8.30	6048.2	12/1/1991	14.40	5927.2
3/1/1992	15.90	5926.1	3/1/1992	12.90	6058.7	3/1/1992	14.00	6037.8	3/1/1992	8.80	6047.7	3/1/1992	13.10	5928.5
5/26/1992	15.50	5926.5	5/26/1992	12.80	6058.8	5/26/1992	13.60	6038.2	5/26/1992	7.20	6049.3	5/26/1992	13.90	5927.7
9/2/1992	16.00	5926.0	9/2/1992	13.50	6058.1	9/2/1992	14.60	6037.2	9/2/1992	7.50	6049.0	9/2/1992	15.10	5926.5
12/1/1992	16.20	5925.8	12/1/1992	13.70	6057.9	12/1/1992	14.00	6037.8	12/1/1992	8.00	6048.5	12/1/1992	14.60	5927.0
3/1/1993	16.00	5926.0	3/1/1993	13.30	6058.3	3/1/1993	13.90	6037.9	3/1/1993	8.50	6048.0	3/1/1993	13.20	5928.4
6/4/1993		5926.5	6/2/1993	13.50	6058.1	6/2/1993	13.20	6038.6	6/2/1993	7.00	6049.5	6/2/1993	14.20	5927.4
9/9/1993		5925.8	9/8/1993	11.00	6060.6	9/8/1993	9.50	6042.3	9/8/1993	7.90	6048.6			
12/1/1993	16.10	5925.9	12/1/1993	11.20	6060.4	12/1/1993	12.60	6039.2	12/1/1993	7.60	6048.9	12/1/1993	13.70	5927.9
3/1/1994	16.00	5926.0	3/1/1994	11.30	6060.3	3/1/1994	12.30	6039.5	3/1/1994	7.80	6048.7	3/1/1994	13.00	5928.6
6/6/1994		5926.2	6/6/1994	12.30	6059.3	6/6/1994	12.80	6039.0	6/6/1994	8.70	6047.8	6/6/1994	13.80	5927.8
9/8/1994		5925.8	9/1/1994	12.90	6058.7	9/1/1994	13.20	6038.6	9/1/1994	11.00	6045.5	9/1/1994	13.90	5927.7
12/1/1994	16.10	5925.9	12/1/1994	14.10	6057.5	12/1/1994	13.60	6038.2	12/1/1994	9.40	6047.1	12/1/1994	14.00	5927.6
3/1/1995	15.00	5927.0	3/1/1995	13.90	6057.7	3/1/1995	13.30	6038.5	3/1/1995	9.10	6047.4	3/1/1995	13.90	5927.7
6/6/1995	14.90	5927.1	6/6/1995	13.90	6057.7	6/6/1995	13.70	6038.1	6/6/1995	8.1	6048.4	6/6/1995	13.80	5927.8
9/1/1995	15.00	5927.0	9/6/1995	13.80	6057.8	9/6/1995	*		9/6/1995	8.1	6048.4	9/6/1995	15.00	5926.6
12/1/1995	14.80	5927.2	12/1/1995	13.10	6058.5	12/1/1995	8.80	6043.0	12/1/1995	8.90	6047.6	12/1/1995	13.80	5927.8
3/1/1996	15.20	5926.8	3/1/1996	13.50	6058.1	3/1/1996	9.70	6042.1	3/1/1996	9.20	6047.3	3/1/1996	13.50	5928.1
6/1/1996	14.70	5927.3	6/1/1996	12.10	6059.5	6/1/1996	8.00	6043.8	6/1/1996	8.40	6048.1	6/1/1996	13.50	5928.1
9/1/1996	15.10	5926.9	9/1/1996	11.00	6060.6	9/1/1996	9.10	6042.7	9/1/1996	8.30	6048.2	9/1/1996	16.10	5925.5
12/31/1996	14.80	5927.2	12/1/1996	11.20	6060.4	12/1/1996	9.00	6042.8	12/1/1996	9.00	6047.5	12/1/1996	14.80	5926.8
3/1/1997	14.80	5927.2	3/1/1997	11.40	6060.2	3/1/1997	9.00	6042.8	3/1/1997	8.80	6047.7	3/1/1997	13.50	5928.1
6/1/1997	15.00	5927.0	6/1/1997	11.20	6060.4	6/1/1997	9.50	6042.3	6/1/1997	7.40	6049.1	6/1/1997	13.70	5927.9
9/1/1997	13.90	5928.1	9/1/1997	10.30	6061.3	9/1/1997	2.30	6049.5	9/1/1997	6.50	6050.0	9/1/1997	13.30	5928.3
12/1/1997	14.70	5927.3	12/1/1997	9.20	6062.4	12/1/1997	8.20	6043.6	12/1/1997	7.00	6049.5	12/1/1997	13.20	5928.4
3/1/1998	14.60	5927.4	3/1/1998	10.10	6061.5	3/1/1998	9.10	6042.7	3/1/1998	8.20	6048.3	3/1/1998	13.00	5928.6
6/1/1998		5928.2	6/2/1998	8.30	6063.3	06/02/98	1.2	6050.6	06/02/98	7	6049.5	06/01/98	13.20	5928.4
9/15/1998		5928.5	9/21/1998	5.20	6066.4	09/08/98	1.8	6050.0	09/08/98	8.00	6048.5	09/08/98	14.80	5926.8
12/1/1998	13.00	5929.0	12/1/1998	4.70	6066.9	12/1/1998	5.7	6046.1	12/1/1998	7.50	6049.0	12/1/1998	13.00	5928.6
3/1/1999	13.40	5928.6	3/1/1999	10.20	6061.4	3/1/1999	9.1	6042.7	3/1/1999	8.40	6048.1	3/1/1999	13.00	5928.6
6/1/1999	13.20	5928.8	6/1/1999	3.80	6067.8	6/1/1999	1.7	6050.1	6/1/1999	6.70	6049.8	6/1/1999	12.30	5929.3
9/1/1999	13.60	5928.4	9/1/1999	4.20	6067.4	9/1/1999	1.2	6050.6	9/1/1999	8.20	6048.3	9/1/1999	13.50	5928.1
12/1/1999	13.40	5928.6	12/1/1999	6.70	6064.9	12/1/1999	6.2	6045.6	12/1/1999	7.50	6049.0	12/1/1999	13.10	5928.5
3/23/2000		5928.6	3/24/2000	6.6	6065.0	03/24/00	8.9	6042.9	03/24/00	7.70	6048.8	03/15/00	12.80	5928.8
6/1/2000														
9/21/2000		5927.9	9/22/2000	7.5	6064.1	09/18/00	12.1	6039.7	09/18/00	7.00	6049.5	09/18/00	16.5	5925.1
12/31/2000	14.2	5927.8	12/1/2000	8.00	6063.6	12/1/2000	12.7	6039.1	12/1/2000	7.80	6048.7	12/1/2000	14.4	5927.2

Emery Water Level Data - Qal

Well RDA6			Well SM1-1			Well SM1-2			Well SM1-3			Well SM1-4		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
						03/22/01	9.9	6041.9						
						09/05/01	9.7	6042.1						
						12/19/01	11.1	6040.7						
						03/21/02	10.8	6041.0						
						06/24/02	9.6	6042.2						
						09/24/02	9.1	6042.7						
						12/26/02	Dry Wells							
						02/15/03	No Access							
						06/30/03	No Access							
9/18/2003	14.58	5927.4				09/17/03	No Access		9/18/2003	7.5	6049.0	9/18/2003	18	5923.6
12/23/2003	15	5927.0	12/22/2003	13.2	6058.4	12/22/03	No Access		12/22/2003	7.5	6049.0	12/22/2003	18	5923.6
3/29/2004	12.9	5929.1	3/18/2004	13	6058.6	03/18/04	No Access		3/18/2004	8	6048.5	3/10/2004	13.5	5928.1
6/2/2004	13.7	5928.3	6/23/2004	12.8	6058.8	06/23/04	No Access		6/18/2004	7.2	6049.3	6/18/2004	13.5	5928.1
9/23/2004	14.2	5927.8	9/25/2004	15	6056.6	09/24/04			9/25/2004	7.1	6049.4	9/25/2004	14.8	5926.8
12/27/2004	15.7	5926.3	12/27/2004	13	6058.6	12/20/04	Dry Wells		12/27/2004	7	6049.5	12/28/2004	13.5	5928.1
3/24/2005	15.7	5926.3	3/25/2005	12.5	6059.1	03/25/05	No Access		3/25/2005	6.7	6049.8	3/25/2005	12.9	5928.7
5/13/2005	15.2	5926.8	5/12/2005	11	6060.6	05/11/05	Dry Wells		5/11/2005	7	6049.5	5/23/2005	13.5	5928.1
7/9/2005	16.2	5925.8				07/20/05	No Access		7/20/2005	6.8	6049.7	7/20/2005	13.8	5927.8
11/22/2005	16.3	5925.7	11/17/2005	11.6	6060.0	11/22/05	No Access		11/17/2005	7.6	6048.9	11/17/2005	13	5928.6
3/6/2006	15.6	5926.4	3/7/2006	11.1	6060.5	03/09/06	No Access		3/9/2006	8.2	6048.3	3/9/2006	12.8	5928.8
6/28/2006	14.5	5927.5	6/28/2006	11.7	6059.9	06/28/06	Dry Wells		6/28/2006	6.8	6049.7	6/28/2006	12.5	5929.1
9/28/2006	14	5928.0	9/28/2006	12	6059.6	09/28/06			9/28/2006	7	6049.5	9/28/2006	13.5	5928.1
11/20/2006	14	5928.0	11/27/2006	11	6060.6	11/27/06			11/27/2006	7	6049.5	11/27/2006	13	5928.6
3/22/2007	20	5922.0	3/22/2007	11	6060.6	03/22/07	No Access		3/22/2007	7	6049.5	3/22/2007	13	5928.6
6/14/2007	13	5929.0	6/14/2007	11	6060.6	06/15/07	No Access		6/13/2007	12.5	6044.0	6/14/2007	13.5	5928.1
9/20/2007	13	5929.0	9/18/2007	0	6071.6	09/18/07			9/18/2007	8.5	6048.0	9/18/2007	14.5	5927.1
12/10/2007	17	5925.0	12/10/2007	19	6052.6	12/10/07	No Access		12/10/2007	7	6049.5	12/11/2007	13.5	5928.1
3/28/2008	12	5930.0	3/20/2008	12	6059.6	03/20/08	No Access		3/20/2008	8	6048.5	3/28/2008	12	5929.6
6/16/2008	12	5930.0	6/24/2008	Dry Wells		06/24/08	No Access		6/16/2008	7.5	6049.0	6/16/2008	13	5928.6
9/20/2008	11	5931.0	9/20/2008	13	6058.6	09/20/08			9/18/2008	8.5	6048.0	9/18/2008	14	5927.6
12/13/2008	12	5930.0	12/13/2008	Dry Wells		12/13/08	No Access		12/13/2008	13	6043.5	12/11/2008	9	5932.6
			2/20/2009	Dry Wells		02/20/09	No Access		2/19/2009	Dry Wells		2/19/2009	Dry Wells	
12/14/2009	12	5930.0	12/14/2009	13	6058.6	06/04/09	No Access		6/5/2009	9	6047.5	6/3/2009	Dry Wells	
									7/14/2009	7	6049.5	7/15/2009	13	5928.6
12/29/2009	12	5930.0	12/29/2009	15	6056.6	12/14/09	No Access		12/29/2009	8	6048.5	12/29/2009	12	5929.6
3/24/2010	No Access		3/26/2010	10	6061.6	03/24/10	No Access		3/26/2010	7	6049.5	3/26/2010	15	5926.6
6/24/2010	12	5930.0	6/21/2010	10	6061.6	06/22/10	No Access		6/21/2010	7	6049.5	6/21/2010	14	5927.6
7/19/2010	12	5930.0	7/20/2010	10	6061.6	07/20/10	No Access		7/19/2010	7	6049.5	7/19/2010	14	5927.6
10/15/2010	11	5931.0	11/5/2010	10.5	6061.1	11/24/10	No Access		10/14/2010	8	6048.5	10/14/2010	15	5926.6
3/29/2011	Dry Wells		3/29/2011	Dry Wells		3/25/2011	No Access		3/25/2011	5.6	6050.9	3/25/2011	12.6	5929.0
6/8/2011	Dry Wells		6/21/2011	7.5	6064.1	6/8/2011	No Access		6/8/2011	7.0	6049.5	6/8/2011	12.7	5928.9
9/28/2011	Dry Wells		9/27/2011	7.5	6064.1	9/22/2011	No Access		9/22/2011	7.5	6049.0	9/27/2011	14.0	5927.6
12/12/2011	14.5	5927.5	12/13/2011	8.0	6063.6	12/12/2011	No Access		12/13/2011	8.0	6048.5	12/13/2011	12.0	5929.6

Emery Water Level Data - Qal

Well RDA6			Well SM1-1			Well SM1-2			Well SM1-3			Well SM1-4		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/16/2012	Dry Wells		3/15/2012	Dry Wells		3/15/2012	No Access		3/15/2012	8.5	6048.0	3/15/2012	13.0	5928.6
6/20/2012	Dry Wells								6/20/2012	8.5	6048.0			
8/20/2012	14.5	5927.5							8/20/2012	8	6048.5			
11/6/2012	16.0	5926.0							11/7/2012	8.5	6048.0			
3/28/2013	19.0	5923.0							3/21/2013	8.3	6048.2			
6/4/2013	19.0	5923.0							6/4/2013	7.3	6049.2			
9/19/2013	19.0	5923.0							9/24/2013	8.2	6048.3			
12/1/2013	19	5923.0							12/17/2013	7.9	6048.6			
3/19/2014	19	5923.0							3/14/2014	7.9	6048.6			
6/26/2014									6/26/2014	8.1	6048.4			
9/16/2014	19	5923.0							9/19/2014	8.2	6048.3			
12/12/2014	19	5923.0							12/11/2014	8.3	6048.2			
3/12/2015	19	5923							3/16/2015	8.3	6048.2			
6/26/2015	20.9	5921.1							6/8/2015	6.6	6049.9			
9/22/2015	21.1	5920.9							9/29/2015	7.1	6049.4			
12/2/2015	21.6	5920.4												
		5931.0												Max
		5920.9												Min

Emery Water Level Data - Blue Gate

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
7/1/1979											
11/16/1979	27.50	5942.2	11/16/1979	38.5	6193.1	11/16/1979	14	6095.6	11/16/1979	55.3	5976.4
3/17/1980	33.00	5936.7	3/17/1980	35.9	6195.7	3/17/1980	12.8	6096.8	3/17/1980	50.6	5981.1
6/11/1980	34.50	5935.2	6/11/1980	34.9	6196.7	6/11/1980	13.2	6096.4	6/11/1980	50.9	5980.8
9/16/1980	37.10	5932.6	9/16/1980	33.8	6197.8	9/16/1980	12.5	6097.1	9/16/1980	47.5	5984.2
11/7/1980	38.30	5931.4	11/7/1980	34.3	6197.3	11/7/1980	11.8	6097.8	11/7/1980	46.1	5985.6
3/16/1981	38.50	5931.2	3/16/1981	35.3	6196.3	3/16/1981	12.3	6097.3	3/16/1981	51.1	5980.6
5/11/1981	36.10	5933.6	5/11/1981	35.4	6196.2	5/11/1981	12.6	6097.0	5/11/1981	50.7	5981.0
8/15/1981	52.60	5917.1	8/15/1981	33.8	6197.8	8/15/1981	12.8	6096.8	8/15/1981	52.2	5979.5
11/24/1981	52.40	5917.3	11/24/1981	33.6	6198.0	11/24/1981	12.9	6096.7	11/24/1981	53.3	5978.4
3/12/1982	52.70	5917.0	3/12/1982	31.9	6199.7	3/12/1982	14.4	6095.2	3/12/1982	51.3	5980.4
6/21/1982	52.40	5917.3	6/21/1982	34.6	6197.0	6/21/1982	16.3	6093.3	6/21/1982	52.4	5979.3
9/15/1982	59.20	5910.5	9/15/1982	34.5	6197.1	9/15/1982	15.9	6093.7	9/15/1982	54	5977.7
12/29/1982	52.40	5917.3	12/29/1982	33.7	6197.9	12/29/1982	12.5	6097.1	12/29/1982	53.3	5978.4
3/30/1983	52.80	5916.9	3/30/1983	34.4	6197.2	3/30/1983	13.4	6096.2	3/30/1983	49.5	5982.2
7/1/1983	52.10	5917.6	7/1/1983	33.2	6198.4				7/1/1983	48.8	5982.9
9/12/1983	53.10	5916.6	9/12/1983	31.9	6199.7				9/12/1983	47.8	5983.9
12/8/1983	57.50	5912.2				12/8/1983	10.7	6098.9	12/8/1983	47.6	5984.1
4/18/1984	58.50	5911.2	4/18/1984	34.3	6197.3	4/18/1984	10.6	6099.0	4/18/1984	48.6	5983.1
6/11/1984	58.30	5911.4	6/11/1984	34.6	6197.0				6/11/1984	46.5	5985.2
9/26/1984	57.50	5912.2				9/26/1984	12.5	6097.1	9/26/1984	52.3	5979.4
12/5/1984	58.10	5911.6	12/5/1984	32.9	6198.7	12/5/1984	15.0	6094.6	12/5/1984	46.1	5985.6
4/5/1985	58.20	5911.5	4/5/1985	34.0	6197.6	4/5/1985	16.8	6092.8	4/5/1985	25.3	6006.4
6/18/1985	57.90	5911.8	6/13/1985	34.9	6196.7	6/13/1985	17.7	6091.9	6/18/1985	28.4	6003.3
9/3/1985	58.30	5911.4	9/26/1985	30.6	6201.0	9/26/1985	18.8	6090.8	9/20/1985	31.6	6000.1
12/11/1985	58.60	5911.1	12/11/1985	31.9	6199.7	12/11/1985	19.6	6090.0	12/11/1985	46.2	5985.5
3/6/1986	58.80	5910.9	3/6/1986	32.5	6199.1	3/6/1986	21.0	6088.6	3/6/1986	48.3	5983.4
6/27/1986	59.00	5910.7	6/30/1986	32.6	6199.0	6/27/1986	21.8	6087.8	6/27/1986	45.0	5986.7
9/3/1986	59.50	5910.2	9/4/1986	31.8	6199.8	9/3/1986	23.4	6086.2	9/3/1986	48.2	5983.5
12/23/1986	60.00	5909.7	12/23/1986	31.7	6199.9	12/23/1986	22.4	6087.2	12/23/1986	52.2	5979.5
3/26/1987	60.50	5909.2	4/2/1987	32.1	6199.5				3/25/1987	55.6	5976.1
5/22/1987	59.50	5910.2	5/22/1987	33.0	6198.6	5/22/1987	27.0	6082.6	5/14/1987	58.5	5973.2
9/25/1987	59.80	5909.9	9/25/1987	32.0	6199.6	9/25/1987	30.5	6079.1	9/25/1987	62.8	5968.9
12/29/1987	59.50	5910.2	12/29/1987	34.2	6197.4	12/29/1987	31.9	6077.7	12/30/1987	62.2	5969.5

Emery Water Level Data - Blue Gate

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/22/1988	59.50	5910.2	3/22/1988	35.1	6196.5	3/22/1988	40.1	6069.5	3/22/1988	64.3	5967.4
6/30/1988	60.00	5909.7	6/30/1988	33.6	6198.0	6/30/1988	36.0	6073.6			
10/19/1988	59.80	5909.9	10/19/1988	33.9	6197.7	10/19/1988	26.0	6083.6	10/25/1988	74.0	5957.7
12/19/1988	57.00	5912.7				12/19/1988	38.0	6071.6	12/29/1988	76.8	5954.9
3/30/1989	60.00	5909.7	3/30/1989	35.4	6196.2	3/30/1989	40.5	6069.1	3/30/1989	82.0	5949.7
5/18/1989	60.50	5909.2	5/18/1989	35.8	6195.8	5/18/1989	40.8	6068.8	5/26/1989	83.0	5948.7
9/11/1989	59.90	5909.8	9/11/1989	36.3	6195.3	9/11/1989	42.8	6066.8	9/11/1989	85.2	5946.5
12/6/1989	61.10	5908.6	12/6/1989	36.5	6195.1	12/6/1989	44.2	6065.4	12/6/1989	86.5	5945.2
3/15/1990	60.00	5909.7	3/15/1990	36.3	6195.3	3/15/1990	45.2	6064.4	3/15/1990	84.3	5947.4
6/11/1990	60.00	5909.7	6/11/1990	36.6	6195.0	6/11/1990	45.6	6064.0	6/11/1990	85.9	5945.8
9/19/1990	58.80	5910.9	9/19/1990	36.2	6195.4	9/19/1990	45.7	6063.9	9/19/1990	85.8	5945.9
12/1/1990	60.20	5909.5	12/1/1990	36.3	6195.3	12/1/1990	47.3	6062.3	12/1/1990	85.6	5946.1
3/1/1991	60.10	5909.6	3/29/1991	37.8	6193.8	3/29/1991	48.8	6060.8	3/29/1991	85.2	5946.5
6/17/1991	60.00	5909.7	6/14/1991	38.0	6193.6	6/13/1991	49.0	6060.6	6/14/1991	84.8	5946.9
9/18/1991	59.90	5909.8	9/18/1991	36.4	6195.2	9/17/1991	50.7	6058.9	9/18/1991	84.2	5947.5
12/1/1991	59.90	5909.8	12/18/1991	35.4	6196.2	12/18/1991	50.8	6058.8	12/18/1991	88.4	5943.3
3/13/1992	59.90	5909.8	3/13/1992	34.1	6197.5	3/13/1992	48.4	6061.2	3/13/1992	84.1	5947.6
5/22/1992	60.10	5909.6	5/20/1992	35.7	6195.9	5/20/1992	52.0	6057.6	5/22/1992	84.6	5947.1
9/1/1992	59.80	5909.9	9/1/1992	35.0	6196.6	9/1/1992	53.2	6056.4	9/1/1992	85.0	5946.7
12/1/1992	59.80	5909.9	12/1/1992	35.0	6196.6	12/1/1992	55.0	6054.6	12/3/1992	84.9	5946.8
3/1/1993	60.00	5909.7	3/1/1993	35.5	6196.1	3/1/1993	56.0	6053.6	3/1/1993	84.9	5946.8
6/2/1993	59.60	5910.1	6/2/1993	36.2	6195.4	6/2/1993	57.0	6053.6	6/2/1993	82.8	5948.9
9/8/1993	60.00	5909.7	9/10/1993	33.6	6198.0	9/9/1993	56.4	6052.6	9/9/1993	85.0	5946.7
12/1/1993	58.00	5911.7	12/8/1993	32.2	6199.4	12/8/1993	56.4	6053.2	12/7/1993	67.0	5964.7
3/9/1994	60.10	5909.6	3/9/1994	34.3	6197.3	3/9/1994	56.2	6053.4	3/9/1994	64.8	5966.9
6/7/1994	59.80	5909.9	6/8/1994	34.7	6196.9	6/7/1994	53.8	6055.8	6/7/1994	82.1	5949.6
9/9/1994	60.40	5909.3	9/9/1994	34.8	6196.8	9/8/1994	60.2	6049.4	9/8/1994	84.9	5946.8
12/1/1994	58.80	5910.9	12/1/1994	33.1	6198.5	12/1/1994	60.3	6049.3	12/1/1994	85.3	5946.4
3/3/1995	59.90	5909.8	3/3/1995	32.9	6198.7	3/3/1995	61.4	6048.2	3/3/1995	85.0	5946.7
6/7/1995	59.60	5910.1	6/7/1995	35.0	6196.6	6/7/1995	62	6047.6	6/1/1995	85.0	5946.7
9/5/1995	59.90	5909.8	9/5/1995	36.8	6194.8	9/5/1995	62.5	6047.1	9/5/1995	85.1	5946.6
12/1/1995	59.30	5910.4	12/6/1995	33.5	6198.1	12/6/1995	62.7	6046.9	12/5/1995	85.1	5946.6
3/22/1996	58.80	5910.9	3/22/1996	33.3	6198.3	3/22/1996	62.1	6047.5	3/22/1996	85.3	5946.4
6/4/1996	57.40	5912.3	6/4/1996	33.3	6198.3	6/4/1996	61.4	6048.2	6/4/1996	85.2	5946.5

Emery Water Level Data - Blue Gate

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
9/9/1996	59.70	5910.0	9/9/1996	34.3	6197.3	9/9/1996	64.4	6045.2	9/9/1996	86.1	5945.6
12/1/1996	60.00	5909.7	12/1/1996	34.1	6197.5	12/1/1996	63.5	6046.1	12/1/1996	84.3	5947.4
3/21/1997		5909.5	3/6/1997	34.5	6197.1	3/6/1997	65.0	6044.6	3/3/1997	84.4	5947.3
6/20/1997		5909.8	6/20/1997	34.8	6196.8	6/20/1997	65.3	6044.3	6/20/1997	86.3	5945.4
9/29/1997		5910.2	9/29/1997	34.4	6197.2	9/29/1997	64.9	6044.7	9/30/1997	86.2	5945.5
12/18/1997	59.90	5909.8	12/16/1997	32.3	6199.3	12/12/1997	65.2	6044.4	12/5/1997	85.3	5946.4
3/24/1998		5909.9				3/31/1998		6041.6	3/31/1998		5946.5
6/26/1998		5910.2	6/26/1998	31.4	6200.2	6/26/1998	68.0	6041.6	6/26/1998	88.1	5943.6
9/16/1998		5909.6				9/8/1998		6041.6	9/15/1998		5946.5
12/7/1998		5909.5				12/10/1998		6043.6	12/10/1998		5946.8
3/15/1999	60.20	5909.5	3/15/1999	32.9	6198.7	3/15/1999	66.0	6043.6	3/15/1999	85.1	5946.6
6/11/1999	60.20	5909.5	6/11/1999	32.3	6199.3	6/11/1999	66.0	6043.6	6/11/1999	81.9	5949.8
9/28/1999	59.40	5910.3	9/28/1999	32.8	6198.8	9/28/1999	66.0	6043.6	9/28/1999	79.8	5951.9
12/8/1999	59.80	5909.9	12/16/1999	33.0	6198.6	12/15/1999	66.0	6043.6	12/15/1999	82.8	5948.9
3/23/2000	59.2	5910.5	3/23/2000	33.1	6198.5	3/23/2000	66.0	6043.6	3/23/2000	76.3	5955.4
6/1/2000											
9/22/2000	61.70	5908.0	9/28/2000	33.0	6198.6	9/28/2000	66.0	6043.6	9/25/2000	81.9	5949.8
12/1/2000	60.30	5909.4	12/1/2000	33.2	6198.4	12/1/2000	66.0	6043.6	12/1/2000	75.9	5955.8
3/23/2001		5910.3	3/22/2001	35.0	6196.6	3/22/2001	66.0	6043.6	3/22/2001	76.1	5955.6
6/13/2001		5909.8	6/13/2001	33.3	6198.3	6/13/2001	66.0	6043.6	6/13/2001	79.6	5952.1
9/12/2001		5908.5	9/12/2001	33.7	6197.9	9/12/2001	66.0	6043.6	9/12/2001	81.2	5950.5
12/17/2001		5908.5	12/12/2001	33.7	6197.9	12/12/2001	66.0	6043.6	12/17/2001	81.8	5949.9
3/27/2002		5909.2	3/21/2002	35.7	6195.9	3/21/2002	66.0	6043.6	3/21/2002	79.7	5952.0
6/24/2002		5908.3	6/27/2002	35.5	6196.1	6/27/2002	66.0	6043.6	6/27/2002	79.9	5951.8
9/28/2002		5908.5	9/23/2002	35.1	6196.5	9/23/2002	66.0	6043.6	9/28/2002	81.0	5950.7
12/21/2002			12/21/2002	33.0	6198.6	12/21/2002	65.5	6044.1	12/21/2002	75.8	5956.0
6/25/2003	49.2	5920.5									
9/18/2003	59.2	5910.5	9/17/2003	37.5	6194.1	9/17/2003	66.0	6043.6	9/17/2003	95.2	5936.5
12/19/2003	60.1	5909.6	12/19/2003	37.5	6194.1	12/19/2003	66.0	6043.6	12/19/2003	96.0	5935.7
3/30/2004	60.8	5908.9	3/30/2004	34.1	6197.5	3/18/2004	67.0	6042.6	3/18/2004	81.0	5950.7
6/23/2004	61.1	5908.6	6/18/2004	37.2	6194.4	6/18/2004	66.0	6043.6	6/23/2004	80.6	5951.1
9/23/2004	59.75	5910.0	9/25/2004	36.8	6194.8	9/25/2004	66.0	6043.6	9/20/2004	95.0	5936.7
12/27/2004	59.8	5909.9							12/28/2004	86.0	5945.7
3/31/2005	59.7	5910.0	3/25/2005	45.0	6186.6				3/24/2005	85.7	5946.0

Emery Water Level Data - Blue Gate

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
5/23/2005	62.5	5907.2	5/23/2005	36.4	6195.2				5/23/2005	84.2	5947.5
7/8/2005	54	5915.7	7/11/2005	32.5	6199.1	7/20/2005	69.3	6040.3	7/11/2005	75.8	5955.9
11/28/2005	58	5911.7	11/22/2005	32.4	6199.2	11/17/2005	69.9	6039.7	11/28/2005	83.0	5948.7
3/6/2006	56.8	5912.9	3/9/2006	34.8	6196.8	3/9/2006	70.0	6039.6	3/7/2006	83.5	5948.2
6/29/2006	59.7	5910.0	6/29/2006	36.0	6195.6	6/29/2006	68.8	6040.8	6/29/2006	83.8	5947.9
9/27/2006			9/27/2006	38.5	6193.1	9/27/2006			9/28/2006	84.2	5947.5
11/20/2006	57	5912.7	11/27/2006	39.0	6192.6	11/27/2006			11/20/2006	85.0	5946.7
3/20/2007	57	5912.7	3/20/2007	137	6094.6	3/20/2007			3/20/2007	86.0	5945.7
6/13/2007	57	5912.7	6/14/2007	37	6194.6	6/14/2007			6/14/2007	85.5	5946.2
9/20/2007	57	5912.7	9/20/2007	138	6093.6	9/20/2007			9/18/2007	86.5	5945.2
12/10/2007	57	5912.7	12/10/2007	141	6090.6	12/10/2007	No Access		12/10/2007	87.0	5944.7
3/26/2008	57	5912.7	3/28/2008	68	6163.6	3/28/2008			3/26/2008	87.0	5944.7
6/24/2008	57	5912.7	6/24/2008	142	6089.6	6/24/2008			6/24/2008	87.0	5944.7
9/22/2008	57	5912.7	9/20/2008	67	6164.6	9/20/2008			9/20/2008		
12/12/2008	Dry Wells		11/28/2008	145	6086.6	12/12/2008			12/12/2008	90.0	5941.7
2/25/2009	Dry Wells		6/3/2009	15	6216.6	6/3/2009	No Access		6/3/2009	91.0	5940.7
6/3/2009	Dry Wells		12/14/2009	No Access		12/14/2009	No Access		12/14/2009	91.0	5940.7
12/15/2009	57	5912.7	12/29/2009	70	6161.6	12/29/2009	No Access		12/29/2009	91.0	5940.7
12/29/2009	58	5911.7									
3/24/2010	Dry Wells		3/24/2010	No Access		3/24/2010	No Access		3/25/2010	90.0	5941.7
6/22/2010	Dry Wells		6/23/2010	Dry Wells		6/22/2010	No Access		6/23/2010	92.0	5939.7
7/20/2010	56	5913.7	7/21/2010	60	6171.6	7/20/2010	No Access		7/19/2010	92.0	5939.7
11/24/2010	Dry Wells		11/24/2010	Dry Wells		10/15/2010	No Access		10/15/2010	92.0	5939.7
3/28/2011	Dry Wells		3/29/2011	Dry Wells		3/29/2011	No Access		3/25/2011	92.8	5938.90
6/8/2011	Dry Wells		6/21/2011	No Access		6/8/2011	No Access		6/21/2011	93.1	5938.60
9/28/2011	Dry Wells		9/27/2011	No Access		9/27/2011	No Access		9/27/2011	93.5	5938.20
12/12/2011	Dry Wells		12/12/2011	0.0	6231.6	12/12/2011	0.0	6109.6	12/13/2011	93.5	5938.20
3/16/2012	Dry Wells		3/21/2012	Dry Wells		3/21/2012	Dry Wells		3/21/2012	94.0	5937.70
									6/20/2012	94.0	5937.70
									9/6/2012	94.2	5937.50
									11/6/2012	94.1	5937.60
									3/28/2013	93.8	5937.90
									6/5/2013	96.5	5935.20
									9/19/2013	101.5	5930.20

Emery Water Level Data - Blue Gate

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
									12/6/2013	101.2	5930.5
									3/19/2014	101.5	5930.2
									6/9/2014	101.3	5930.4
									9/15/2014	101.2	5930.5
									12/5/2014	101.2	5930.50
									3/13/2015	98.7	5933
									5/21/2015	90.8	5940.9
									9/2/2015	90.4	5941.3
									12/3/2015	90.2	

Emery Water Level Data - Blue Gate

Well T1			Well T2			Well USGS 3-1			Well USGS 4-1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
						7/2/1979	18.1	6029.4	7/2/1979	18.5	6029.0
						11/16/1979	18.5	6029.0	11/16/1979	18.9	6028.6
						3/17/1980	18.9	6028.6	3/17/1980	19.2	6028.3
						6/11/1980	18.4	6029.1	6/11/1980	19.4	6028.1
						9/16/1980	17.9	6029.6	9/16/1980	19.2	6028.3
						11/7/1980	17.7	6029.8	11/7/1980	19.1	6028.4
						3/16/1981	18.6	6028.9	3/16/1981	18.9	6028.6
						5/11/1981	18.6	6028.9	5/11/1981	19.0	6028.5
8/15/1981	17	5986.2	8/15/1981	15.5	5987.5	8/15/1981	18.7	6028.8	8/15/1981	18.8	6028.7
						11/24/1981	17.9	6029.6	11/24/1981	18.6	6028.9
3/12/1982	12.8	5990.4	3/12/1982	13.4	5989.6	3/12/1982	18.1	6029.4	3/12/1982	18.6	6028.9
5/14/1982	16.5	5986.7	6/21/1982	13.9	5989.1	6/21/1982	18.3	6029.2	6/21/1982	18.5	6029.0
						9/15/1982	18.4	6029.1	9/15/1982	21.1	6026.4
						12/29/1982	18.2	6029.3	12/29/1982	18.7	6028.8
						3/30/1983	18.2	6029.3	3/30/1983	17.1	6030.4
						7/1/1983	18.3	6029.2	7/1/1983	19.8	6027.7
						9/12/1983	18.5	6029.0	9/12/1983	28.2	6019.3
11/15/1983	13.8	5989.4	11/15/1983	13.3	5989.7				12/8/1983	18.2	6029.3
									4/18/1984	18.7	6028.8
									6/11/1984	18.6	6028.9
9/26/1984	12.6	5990.6	9/26/1984	13.3	5989.7				9/26/1984	18.5	6029.0
									12/5/1984	18.4	6029.1
									4/5/1985	17.9	6029.6
									6/20/1985	16.7	6030.8
9/26/1985	13	5990.2	9/26/1985	13.20	5989.8				9/20/1985	18.1	6029.4
12/11/1985	12.8	5990.4	12/19/1985	13.20	5989.8				12/19/1985	18.3	6029.2
3/6/1986	12.2	5991.0	3/6/1986	12.60	5990.4				3/12/1986	18.0	6029.5
6/27/1986	12.00	5991.2	6/30/1986	13.00	5990				6/24/1986	18.0	6029.5
9/3/1986	11.90	5991.3	9/5/1986	12.50	5990.5				9/4/1986	19.1	6028.4
12/23/1986	12.4	5990.8	12/23/1986	12.50	5990.5				12/23/1986	19.2	6028.3
4/2/1987	11.60	5991.6	4/2/1987	11.60	5991.4				3/26/1987	19.4	6028.1
5/18/1987	13.00	5990.2	5/18/1987	13.20	5989.8	5/20/1987	17.9	6027.4	5/20/1987	18.2	6029.3
10/1/1987	12.70	5990.5	10/1/1987	12.7	5990.3	10/7/1987	18.7	6027.5	10/7/1987	19.1	6028.4
12/30/1987	12.9	5990.3	12/30/1987	12.9	5990.1	12/30/1987	18.3	6029.2	12/30/1987	18.6	6028.9

Emery Water Level Data - Blue Gate

Well T1			Well T2			Well USGS 3-1			Well USGS 4-1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/22/1988	12.5	5990.7	3/22/1988	12.9	5990.1	3/22/1988	18.2	6028.7	3/22/1988	18.0	6029.5
6/30/1988	13.50	5989.7	6/30/1988	13.3	5989.7	6/9/1988	18.3	6028.6	6/9/1988	18.3	6029.2
10/19/1988	13.5	5989.7	10/19/1988	13.5	5989.5	10/20/1988	20.5	6026.4	10/20/1988	18.8	6028.7
12/19/1988	13.20	5990.0	12/19/1988	13	5990.0	12/29/1988	18.7	6028.2	12/29/1988	20.6	6026.9
3/30/1989	18	5985.2	3/30/1989	18	5985.0	3/30/1989	18.1	6029.4	3/30/1989	18.1	6029.4
5/18/1989	12.80	5990.4	5/26/1989	12.80	5990.2	5/18/1989	18.5	6029.0	5/18/1989	18.5	6029.0
9/11/1989	13.20	5990.0	9/11/1989	13.60	5989.4	9/11/1989	19.2	6028.3	9/11/1989	18.7	6028.8
12/6/1989	13.00	5990.2	12/6/1989	12.5	5990.5	12/6/1989	19.6	6027.9	12/6/1989	19.6	6027.9
3/15/1990	13.8	5989.4	3/15/1990	14	5989.0	3/15/1990	18.0	6029.5	3/15/1990	16.7	6030.8
6/11/1990	14.30	5988.9	6/11/1990	11.00	5992.0	6/11/1990	19.8	6027.7	6/11/1990	19.9	6027.6
9/19/1990	15.20	5988.0	9/19/1990	15.6	5987.4	9/19/1990	20.5	6026.4	9/19/1990	20.1	6027.4
12/1/1990	15.70	5987.5	12/1/1990	13.7	5989.3	12/1/1990	20.4	6026.5	12/1/1990	19.8	6027.7
3/29/1991	18.00	5985.2	3/29/1991	15.9	5987.1	3/29/1991	19.9	6027.0	3/29/1991	20.0	6027.5
6/17/1991	7.50	5995.7	6/13/1991	16.20	5986.8	6/10/1991	20.0	6026.9	6/10/1991	20.7	6026.8
9/23/1991	14.80	5988.4	9/18/1991	15	5988.0	9/18/1991	19.8	6027.1	9/18/1991	20.2	6027.3
12/18/1991	12.70	5990.5	12/18/1991	12.7	5990.3	12/18/1991	19.9	6027.0	12/18/1991	20.8	6026.7
3/13/1992	13.20	5990.0	3/13/1992	13.2	5989.8	3/13/1992	19.9	6027.0	3/13/1992	20.2	6027.3
5/26/1992	12.30	5990.9	5/26/1992	13.6	5989.4	5/26/1992	19.9	6027.0	5/26/1992	20.8	6026.7
9/2/1992	13.10	5990.1	9/2/1992	13.1	5989.9	9/2/1992	20.0	6026.9	9/2/1992	20.6	6026.9
12/3/1992	13.00	5990.2	12/3/1992	12.5	5990.5	12/3/1992	19.8	6027.1	12/3/1992	20.6	6026.9
3/1/1993	11.80	5991.4	3/1/1993	13	5990	3/1/1993	20.0	6026.9	3/1/1993	20.9	6026.6
6/4/1993	13.20	5990.0	6/4/1993	13.20	5989.8	6/2/1993	20.8	6026.1	6/2/1993	20.7	6026.8
9/8/1993	13.2	5990.0	9/8/1993	14.00	5989	9/8/1993	20.0	6026.9	9/8/1993	20.9	6026.6
12/7/1993	12.80	5990.4	12/7/1993	12.9	5990.1	12/7/1993	20.2	6026.7	12/7/1993	20.8	6026.7
3/9/1994	15.6	5987.6	3/9/1994	14.2	5988.8	3/9/1994	20.3	6026.6	3/9/1994	20.6	6026.9
6/6/1994	15.2	5988.0	6/6/1994	14.8	5988.2	6/6/1994	20.1	6026.8	6/6/1994	20.8	6026.7
9/7/1994	11.5	5991.7	9/7/1994	15	5988	9/7/1994	20.2	6026.7	9/7/1994	20.5	6027.0
12/1/1994	11	5992.2	12/1/1994	15.1	5987.9	12/1/1994	20.1	6026.8	12/1/1994	20.8	6026.7
3/3/1995	14.40	5988.8	3/3/1995	15.5	5987.5	3/3/1995	20.0	6026.9	3/3/1995	20.3	6027.2
6/6/1995	14.80	5988.4	6/6/1995	15.3	5987.7	6/6/1995	20.2	6026.7	6/6/1995	20.6	6026.9
9/6/1995	15.20	5988.0	9/6/1995	11.5	5991.5	9/6/1995	20.0	6026.9	9/6/1995	20.7	6026.8
12/5/1995	15.3	5987.9	12/6/1995	11.3	5991.7	12/5/1995	20.0	6026.9	12/5/1995	20.7	6026.8
3/22/1996	12.2	5991.0	3/22/1996	12.2	5990.8	3/22/1996	20.1	6026.8	3/22/1996	20.8	6026.7
6/4/1996	12.2	5991.0	6/4/1996	12.1	5990.9	6/4/1996	20.0	6026.9	6/4/1996	20.5	6027.0

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Well T1			Well T2			Well USGS 3-1			Well USGS 4-1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
9/9/1996	11.8	5991.4	9/9/1996	12.1	5990.9	9/9/1996	19.8	6027.1	9/9/1996	20.5	6027.0
12/1/1996	12.5	5990.7	12/1/1996	12.3	5990.7	12/1/1996	19.8	6027.1	12/1/1996	19.9	6027.6
3/3/1997	12.3	5990.9	3/6/1997	12.7	5990.3	3/6/1997	19.7	6027.2	3/6/1997	19.5	6028.0
6/20/1997	12.2	5991.0	6/3/1997	12.6	5990.4	6/3/1997	19.7	6027.2	6/3/1997	20.2	6027.3
9/30/1997	12.3	5990.9	9/8/1997	12.3	5990.7	9/8/1997	19.8	6027.1	9/8/1997	19.9	6027.6
12/5/1997	12	5991.2	12/5/1997	12.4	5990.6	12/16/1997	19.7	6027.2	12/16/1997	20.1	6027.4
3/31/1998	13.7	5989.5	3/24/1998	13.4	5989.6	3/10/1998	19.5	6027.4	3/10/1998	19.2	6028.3
6/1/1998	06/01/98	5989.9	6/2/1998	14	5989	6/1/1998	19.4	6027.5	6/1/1998	21.3	6026.2
9/8/1998	09/08/98	5990.2	9/8/1998		5989.8	9/8/1998	19.4	6027.5	9/8/1998	19.9	6027.6
12/10/1998	13.5	5989.7	12/7/1998	13.4	5989.6	12/8/1998	19.7	6027.2	12/8/1998	20.7	6026.8
3/15/1999	13.4	5989.8	3/8/1999	13.3	5989.7	3/17/1999	19.6	6027.3	3/17/1999	19.5	6028.0
6/11/1999	14	5989.2	6/11/1999	13.8	5989.2	6/11/1999	19.4	6027.5	6/11/1999	20.8	6026.7
9/28/1999	13.7	5989.5	9/28/1999	13.3	5989.7	9/28/1999	19.4	6027.5	9/28/1999	20.3	6027.2
12/15/1999	14.2	5989.0	12/15/1999	14	5989	12/15/1999	19.8	6027.1	12/15/1999	20.5	6027.0
3/15/2000	14.4	5988.8	3/15/2000	14.2	5988.8	3/24/2000	19.7	6027.2	3/24/2000	20.3	6027.2
9/18/2000	13.4	5989.8	9/18/2000	15.1	5987.9	9/21/2000	19.7	6027.2	9/21/2000	21.3	6026.2
12/1/2000	14.1	5989.1	12/1/2000	15.5	5987.5	12/1/2000	19.9	6027.0	12/1/2000	20.5	6027.0
			3/22/2001	15.1	5987.9	3/22/2001	19.7	6027.2	3/22/2001	20.6	6026.9
			6/4/2001	15	5988	6/5/2001	19.2	6027.7	6/5/2001	20.1	6027.4
			9/5/2001	15.2	5987.8	9/5/2001	20.0	6026.9	9/5/2001	20.5	6027.0
			12/13/2001	15.5	5987.5	12/19/2001	19.9	6027.0	12/10/2001	20.7	6026.8
			3/21/2002	15.2	5987.8	3/27/2002	19.4	6027.5	3/21/2002	20.5	6027.0
			6/24/2002	15.5	5987.5	6/24/2002	17.4	6029.5	6/24/2002	21.2	6026.3
			9/23/2002	15.3	5987.7	9/23/2002	20.1	6026.8	9/23/2002	21.2	6026.3
			12/26/2002	16.0	5987.0				12/26/2002	21.0	6026.5
						6/30/2003	34.0	6012.9			
9/17/2003	15.2	5988.0	9/17/2003	16.0	5987.0	9/17/2003	20.0	6026.9	9/17/2003	21.0	6026.5
12/22/2003	15.2	5988.0	12/22/2003	16.6	5986.4	12/22/2003	19.7	6027.2	12/22/2003	20.2	6027.3
3/18/2004	15	5988.2	3/18/2004	16.0	5987.0	3/18/2004	20.0	6026.9	3/18/2004	21.0	6026.5
6/18/2004	15.2	5988.0	6/18/2004	15.8	5987.2	6/18/2004	20.2	6026.7	6/18/2004	20.5	6027.0
9/25/2004	15	5988.2	9/25/2004	16.0	5987.0				9/24/2004	20.5	6027.0
12/28/2004	15	5988.2	12/28/2004	15.5	5987.5				12/28/2004	21.1	6026.4
3/31/2005	15.3	5987.9	3/31/2005	15.1	5987.9	3/25/2005	20.1	6026.8	3/25/2005	20.6	6026.9

Emery Water Level Data - Blue Gate

Well T1			Well T2			Well USGS 3-1			Well USGS 4-1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
5/11/2005	15.2	5988.0	5/11/2005	15.0	5988.0				5/11/2005	21.4	6026.1
			7/11/2005	15.1	5987.9				7/19/2005	21.5	6026.0
11/22/2005	15	5988.2	11/22/2005	15.0	5988.0	11/17/2005	20.3	6026.6	11/17/2005	21.6	6025.9
3/9/2006	14.9	5988.3	3/9/2006	15.0	5988.0	3/9/2006	20.3	6026.6	3/9/2006	21.1	6026.4
6/28/2006	15	5988.2	6/28/2006	15.0	5988.0				6/28/2006	26.5	6021.0
9/28/2006	15	5988.2	9/28/2006	15.5	5987.5	9/28/2006	30.0	6016.9	9/28/2006	27.0	6020.5
11/20/2006	15	5988.2	11/20/2006	13.0	5990.0	11/27/2006	30.0	6016.9	11/27/2006	28.0	6019.5
3/20/2007	15	5988.2	3/20/2007	15.0	5988.0	3/22/2007	109.0	5937.9	3/22/2007	29.0	6018.5
6/14/2007	15	5988.2	6/14/2007	16.0	5987.0	6/15/2007	120.0	5926.9	6/15/2007	29.0	6018.5
9/18/2007	15	5988.2	9/18/2007	16.0	5987.0	9/18/2007	110.0	5936.9	9/18/2007	29.0	6018.5
12/10/2007	15	5988.2	12/10/2007	16.0	5987.0	12/11/2007	120.0	5926.9	12/10/2007	29.0	6018.5
3/26/2008	15	5988.2	3/26/2008	15.0	5988.0	3/26/2008	106.0	5940.9	3/26/2008	29.0	6018.5
6/24/2008	15	5988.2	6/24/2008	15.0	5988.0	6/24/2008	Dry Wells		6/24/2008	29.0	6018.5
9/30/2008	13	5990.2	9/30/2008	13.0	5990.0	9/30/2008	106.0	5940.9	9/30/2008	29.5	6018.0
12/11/2008	13	5990.2	12/12/2008	13.0	5990.0	12/13/2008	Dry Wells		12/13/2008	30.0	6017.5
6/4/2009	13	5990.2	6/4/2009	13.0	5990.0	2/25/2009	Dry Wells		2/25/2009	Dry Wells	
7/14/2009	13	5990.2	12/14/2009	13.0	5990.0	6/4/2009	Dry Wells		6/4/2009	Dry Wells	
12/29/2009	13	5990.2	12/29/2009	13.0	5990.0	12/14/2009	Dry Wells		12/14/2009	Dry Wells	
			3/26/2010	12.0	5991.0	12/29/2009	Dry Wells		12/29/2009	Dry Wells	
3/26/2010	12	5991.2	6/23/2010	11.0	5992.0	3/24/2010	Dry Wells		3/24/2010	Dry Wells	
6/24/2010	10	5993.2	7/19/2010	11.0	5992.0	6/21/2010	Dry Wells		6/21/2010	Dry Wells	
7/19/2010	10	5993.2	10/15/2010	11.0	5992.0	7/19/2010	30.0	6016.9	7/19/2010	29.0	6018.5
10/15/2010	11	5992.2				11/5/2010	Dry Wells		11/1/2010	Dry Wells	
3/25/2011	9.6	5993.6	3/25/2011	11.0	5992.0	3/28/2011	Dry Wells		3/28/2011	Dry Wells	
6/8/2011	9.7	5993.5	6/8/2011	11.0	5992.0	6/8/2011	Dry Wells		6/8/2011	Dry Wells	
9/22/2011	11.4	5991.8	9/20/2011	11.0	5992.0	9/20/2011	Dry Wells		9/20/2011	Dry Wells	
12/13/2011	9	5994.2	12/13/2011	10.5	5992.5	12/13/2011	Dry Wells		12/13/2011	Dry Wells	
3/15/2012	9	5994.2	3/15/2012	10.7	5992.3	3/16/2012	Dry Wells		3/16/2012	Dry Wells	
6/20/2012	10	5993.2							6/20/2012	Dry Wells	
8/20/2012	10.4	5992.8							9/6/2012	Dry Wells	
11/7/2012	10.3	5992.9							11/6/2012	29	6018.5
3/21/2013	9.8	5993.4							3/21/2013	Dry Wells	
6/4/2013	9.9	5993.3							6/4/2013	29	6018.5
9/17/2013	10.2	5993							9/17/2013	29	6018.5

Emery Water Level Data - Blue Gate

Well T1			Well T2			Well USGS 3-1			Well USGS 4-1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
12/17/2013	10.1	5993.1							12/5/2013	29	6018.5
3/14/2014	10.2	5993							3/14/2014	29	6018.5
6/26/2014	10.3	5992.9							6/26/2014		
9/16/2014	9.9	5993.3							9/15/2014	29	6018.5
12/9/2014	9.9	5993.3							12/2/2014	29	6018.5
3/16/2015	9.8	5993.4							3/16/2015	29	6018.5
6/8/2015	9.1	5994.1							6/8/2015		
9/29/2015	9.5	5993.7							9/4/2015		

Emery Water Level Data - Ferron Sandstone (Upper)

Well AA			Bryant Well			Well H			Well I2			Lewis Well			Well Muddy #1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
10/7/1976			10/7/1976	0.20	6024.3	10/7/1976			10/7/1976			10/7/1976			10/7/1976		
12/1/1976																	
3/1/1977																	
6/1/1977			6/2/1977	0.20	6024.3												
9/1/1977			9/21/1977	-0.10	6024.6												
11/8/1977			11/8/1977	-0.10	6024.7												
3/1/1978																	
6/1/1978																	
9/1/1978																	
12/1/1978																	
3/1/1979																	
6/1/1979															7/2/1979	142.8	5925.4
9/1/1979												10/18/1979	-8.6	6029.0	10/30/1979	136.4	5931.8
12/1/1979						11/15/1979	65.9	6164.5							12/1/1979		
3/1/1980						3/14/1980	53.3	6177.1							3/14/1980	131.1	5937.1
6/1/1980						6/10/1980	59.3	6171.1							6/11/1980	127.8	5940.4
9/1/1980						9/16/1980	61.4	6169.0							9/17/1980	129.1	5939.1
12/1/1980						11/8/1980	62.7	6167.7							11/9/1980	129.1	5939.1
3/1/1981						3/16/1981	57.5	6172.9							3/16/1981	128.4	5939.8
6/1/1981						6/22/1981	55.2	6175.2							6/22/1981	129	5939.2
9/1/1981						9/19/1981	54.8	6175.6							9/19/1981	129.2	5939.0
12/1/1981						11/24/1981	56.2	6174.2							11/24/1981	129.2	5939.0
3/11/1982	53.55	5916.3				3/11/1982	61	6169.4							3/11/1982	129	5939.2
6/21/1982	88.00	5881.8	6/8/1982	210.00	5814.5	6/21/1982	68.5	6161.9				6/1/1982	174.2	5846.2	6/21/1982	128.7	5939.5
9/15/1982	97.20	5872.6	9/15/1982	217.40	5807.1	9/15/1982	69	6161.4							9/15/1982	131.4	5936.8
11/9/1982	98.50	5871.3	11/19/1982	217.67	5806.8	11/10/1982	69	6161.4							11/10/1982	128.2	5940.0
2/14/1983	101.25	5868.6	1/31/1983	217.58	5806.9	2/16/1983	71.2	6159.2							2/16/1983	127.9	5940.3
7/1/1983	104.08	5865.7				7/1/1983	70.5	6159.9							7/1/1983	128.1	5940.1
10/25/1983	106.80	5863.0				9/23/1983	72.1	6158.3							9/23/1983	128.3	5939.9
12/7/1983						10/25/1983	80	6150.4							12/7/1983	128.4	5939.8
4/18/1984	107.00	5862.8	2/16/1984	230.50	5794.0	4/24/1984	66.7	6163.7							4/24/1984	128.4	5939.8
6/11/1984	107.00	5862.8				6/11/1984	59.5	6170.9							6/11/1984	129.5	5938.7
9/26/1984	105.00	5864.8													9/24/1984	129.1	5939.1
12/5/1984						12/5/1984	57.4	6173.0							12/5/1984	129.7	5938.5
4/5/1985	106.80	5863.0				4/1/1985	57.6	6172.8							3/26/1985	129.6	5938.6
6/18/1985	107.20	5862.6				6/13/1985	57.80	6172.6							6/20/1985	129.20	5939.0
9/3/1985	107.40	5862.4				9/26/1985	57.40	6173.0							9/20/1985	128.30	5939.9
12/1/1985	108.50	5861.3				12/1/1985	57.5	6172.9							12/1/1985	128.4	5939.8
3/1/1986	109.60	5860.2				3/20/1986	57.3	6173.1							3/13/1986	127.80	5940.4
6/27/1986	108.80	5861.0	5/2/1986	301.60	5722.9	6/30/1986	57.80	6172.6				5/2/1986	259.5	5760.9	6/30/1986	129.00	5939.2
9/3/1986	108.50	5861.3	9/3/1986	310.40	5714.1	9/4/1986	57.30	6173.1				9/4/1986	265.40	5755.0	9/4/1986	128.60	5939.6
12/23/1986	109.00	5860.8	12/23/1986	318.20	5706.3	12/31/1986	57	6173.4				12/18/1986	269.20	5751.2	12/23/1986	128.4	5939.8
3/1/1987	109.10	5860.7				4/2/1987	57.40	6173.0	3/26/1987	394.00	5711.0				3/27/1987	128.70	5939.5
5/22/1987	109.00	5860.8				5/22/1987	57.50	6172.9	5/22/1987	393.50	5711.5				5/19/1987	126.70	5941.5
9/25/1987	109.30	5860.5	10/20/1987	293.50	5731.0	9/25/1987	57.60	6172.8	9/25/1987	402.50	5702.5				10/9/1987	127.00	5941.2
12/29/1987	109.00	5860.8	12/29/1987	291.30	5733.2	12/29/1987	58.00	6172.4	12/29/1987	398.20	5706.8				12/30/1987	128.50	5939.7
3/22/1988	109.00	5860.8	3/22/1988	294.10	5730.4	3/22/1988	58	6172.4	3/22/1988	397.9	5707.1				3/22/1988	127.50	5940.7
6/30/1988	108.00	5861.8	6/30/1988	318.00	5706.5	6/30/1988	57.3	6173.1	6/30/1988	397	5708.0				6/30/1988	127.7	5940.5
10/19/1988	112.50	5857.3	10/19/1988	291.10	5733.4	10/20/1988	57.7	6172.7							10/19/1988	128.6	5939.6
12/19/1988	109.00	5860.8	12/19/1988	292	5732.5	12/23/1988	56.9	6173.5							12/19/1988	128.40	5939.8
3/30/1989	113.10	5856.7	3/30/1989	289.00	5735.5	3/27/1989	47	6183.4	4/21/1989	395	5710.0				3/27/1989	128.80	5939.4
5/18/1989	112.20	5857.6	5/19/1989	298.40	5726.1	5/18/1989	56.90	6173.5	5/18/1989	400.8	5704.2	5/19/1989	261.00	5759.4	5/18/1989	128.00	5940.2
9/11/1989	111.80	5858.0	9/11/1989	290.80	5733.7	9/12/1989	57.10	6173.3	9/11/1989	399.8	5705.2	9/11/1989	257.70	5762.7	9/11/1989	128.30	5939.9
12/1/1989	111.60	5858.2	12/6/1989	290.60	5733.9	12/6/1989	56.8	6173.6				12/6/1989	258.00	5762.4	12/6/1989	128.2	5940.0

Emery Water Level Data - Ferron Sandstone (Upper)

Well AA			Bryant Well			Well H			Well I2			Lewis Well			Well Muddy #1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/15/1990	111.50	5858.3	3/15/1990	291.80	5732.7	3/1/1990	57.5	6172.9				3/12/1990	260.50	5759.9	3/12/1990	128.2	5940.0
6/11/1990	111.60	5858.2	6/8/1990	292.50	5732.0	6/11/1990	54.20	6176.2				6/8/1990	261.00	5759.4	6/8/1990	128.6	5939.6
9/19/1990	111.80	5858.0	9/17/1990	294.50	5730.0	9/17/1990	57	6173.4	9/17/1990	399	5706.0	9/17/1990	262.00	5758.4	9/18/1990	130.2	5938.0
12/1/1990	111.70	5858.1	12/1/1990	294.1	5730.4	12/1/1990	57	6173.4	12/1/1990	402	5703.0	11/8/1990	262.7	5757.7	11/7/1990	129.6	5938.6
3/29/1991	111.70	5858.1				3/29/1991	57.10	6173.3				3/20/1991	263.70	5756.7	3/29/1991	129.00	5939.2
6/17/1991	111.20	5858.6	6/17/1991	295.50	5729.0	6/14/1991	57.10	6173.3							6/10/1991	128.70	5939.5
9/18/1991	111.30	5858.5	9/30/1991	293.80	5730.7	9/18/1991	57.30	6173.1							9/23/1991	128.80	5939.4
12/18/1991	111.10	5858.7	12/18/1991	288.60	5735.9	12/18/1991	56.90	6173.5				12/11/1991	260.00	5760.4	12/18/1991	128.90	5939.3
3/13/1992	111.20	5858.6	3/1/1992	294	5730.5	3/1/1992	57	6173.4	3/1/1992	403.5	5701.5	3/13/1992	263.40	5757.0	3/12/1992	129.3	5938.9
5/22/1992	111.00	5858.8	6/15/1992	294.80	5729.7	5/20/1992	57.00	6173.4							5/20/1992	129.1	5939.1
9/1/1992	113.10	5856.7	9/2/1992	293.70	5730.8	9/1/1992	57.00	6173.4				9/2/1992	266.00	5754.4	9/1/1992	130	5938.2
12/1/1992	113.00	5856.8	12/1/1992	293.8	5730.7	12/1/1992	57	6173.4				12/1/1992	266.5	5753.9	12/3/1992	129.8	5938.4
3/1/1993	112.60	5857.2	3/3/1993	294.6	5729.9	3/3/1993	56	6174.4				3/3/1993	264.10	5756.3	3/3/1993	131.60	5936.6
6/2/1993	112.50	5857.3	6/7/1993	293.70	5730.8	6/2/1993	57.20	6173.2				6/2/1993	263.80	5756.6	6/2/1993	130.80	5937.4
9/8/1993	113.00	5856.8	9/8/1993	294.00	5730.5	9/10/1993	57.00	6173.4	9/9/1993	397.50	5707.5	9/7/1993	264.00	5756.4	9/8/1993	131.60	5936.6
12/1/1993	113.10	5856.7	12/8/1993	295.4	5729.1	12/8/1993	56.2	6174.2	12/8/1993	396.2	5708.8	12/8/1993	267	5753.4	12/7/1993	132.2	5936.0
3/9/1994	113.00	5856.8	3/9/1994	296.2	5728.3	3/9/1994	57.2	6173.2	3/8/1994	410.2	5694.8	3/8/1994	268.5	5751.9	3/7/1994	132.3	5935.9
6/7/1994	112.40	5857.4	6/7/1994	293.90	5730.6	6/7/1994	57.7	6172.7	6/7/1994	410.3	5694.7	6/7/1994	268.80	5751.6	6/7/1994	131.2	5937.0
9/9/1994	112.80	5857.0	9/9/1994	299.30	5725.2	9/9/1994	57.7	6172.7	9/9/1994	411.5	5693.5	9/9/1994	270.30	5750.1	9/8/1994	132.1	5936.1
12/1/1994	112.30	5857.5	12/1/1994	299.9	5724.6	12/1/1994	57.3	6173.1	12/1/1994	411.2	5693.8	12/1/1994	271.1	5749.3	12/1/1994	132.6	5935.6
3/3/1995	112.60	5857.2	3/6/1995	299.2	5725.3	3/1/1995	56.1	6174.3	3/1/1995	412.1	5692.9	3/1/1995	271.1	5749.3	3/1/1995	132.3	5935.9
6/7/1995	112.70	5857.1	6/1/1995	299.40	5725.1	6/1/1995	57.1	6173.3	6/1/1995	430	5675.0	6/6/1995	270.80	5749.6	6/1/1995	132.50	5935.7
9/5/1995	112.80	5857.0	9/5/1995	298.90	5725.6	9/1/1995	56.2	6174.2	9/1/1995	430	5675.0	9/5/1995	271.00	5749.4	9/6/1995	133.10	5935.1
12/5/1995	113.00	5856.8	12/5/1995	298.3	5726.2	12/5/1995	57.9	6172.5	12/5/1995	430	5675.0	12/5/1995	270.3	5750.1	12/5/1995	132.80	5935.4
3/22/1996	112.80	5857.0	3/22/1996	300.70	5723.8	3/22/1996	56.3	6174.1				3/22/1996	272.30	5748.1	3/25/1996	133.2	5935.0
6/4/1996	113.90	5855.9	6/4/1996	303.10	5721.4	6/10/1996	57.8	6172.6				6/4/1996	275.00	5745.4	6/4/1996	133.20	5935.0
9/9/1996	111.50	5858.3	9/4/1996	305.00	5719.5	9/9/1996	57.5	6172.9				9/4/1996	270.00	5750.4	9/4/1996	133.20	5935.0
12/5/1996	110.80	5859.0	12/5/1996	307.00	5717.5	12/27/1996	57.5	6172.9				12/5/1996	278.30	5742.1	12/5/1996	133.30	5934.9
3/21/1997	111.50	5858.3	3/5/1997	308.20	5716.3	3/6/1997	57.9	6172.5				3/6/1997	278.8	5741.6	3/6/1997	133.20	5935.0
6/20/1997	112.20	5857.6	6/3/1997	308.20	5716.3	6/20/1997	56.8	6173.6				6/3/1997	280.00	5740.4	6/3/1997	133.20	5935.0
9/29/1997	111.80	5858.0	9/8/1997	301.20	5723.3	9/29/1997	56.8	6173.6				9/8/1997	280.90	5739.5	9/8/1997	134.00	5934.2
12/18/1997	112.80	5857.0	12/18/1997	300.90	5723.6	12/16/1997	58.6	6171.8				12/16/1997	280.8	5739.6	12/12/1997	134.20	5934.0
3/24/1998	113.00	5856.8	3/24/1998	308.2	5716.3	3/31/1998	57.2	6173.2				3/24/1998	281.2	5739.2	3/10/1998	133.80	5934.4
6/26/1998	112.50	5857.3	6/2/1998	305.6	5718.9	6/26/1998	57.8	6172.6				6/2/1998	281.20	5739.2	6/1/1998	133.80	5934.4
9/16/1998	112.60	5857.2	9/8/1998	302.50	5722.0	9/16/1998	57.60	6172.8				9/8/1998	281.20	5739.2	9/8/1998	131.9	5936.3
12/7/1998	112.50	5857.3	12/7/1998	301.90	5722.6	12/10/1998	57.5	6172.9				12/10/1998	281.5	5738.9	12/8/1998	135.00	5933.2
3/15/1999	112.20	5857.6	3/15/1999	308.20	5716.3	3/15/1999	57.4	6173.0				3/15/1999	281.50	5738.9	3/17/1999	133.8	5934.4
6/11/1999	112.80	5857.0	6/7/1999	309.70	5714.8	6/11/1999	57.2	6173.2				6/7/1999	275.40	5745.0	6/14/1999	133.5	5934.7
9/28/1999	112.80	5857.0	9/1/1999	310.90	5713.6	9/28/1999	57.3	6173.1				9/1/1999	285.30	5735.1	9/3/1999	133.9	5934.3
12/8/1999	112.20	5857.6	12/8/1999	309.90	5714.6	12/16/1999	57.4	6173.0				12/7/1999	282.80	5737.6	12/15/1999	134.1	5934.1
3/23/2000	112.70	5857.1	3/23/2000	310.40	5714.1	3/23/2000	57.4	6173.0				3/23/2000	274.9	5745.5	3/24/2000	132.2	5936.0
6/15/2000																	
9/22/2000	112.90	5856.9	9/22/2000	312.8	5711.7	9/28/2000	58.2	6172.2							9/18/2000	134.5	5933.7
12/7/2000	114.00	5855.8	12/7/2000	310.9	5713.6	12/7/2000	58.7	6172.2							12/7/2000	135	5933.2
3/23/2001		5857.1				3/22/2001	56.3	6174.1							3/22/2001	135.90	5932.3
6/13/2001		5856.9	6/5/2001			6/13/2001	57.1	6173.3							6/5/2001	134.50	5933.7
9/12/2001		5859.1	9/5/2001		5711.8	9/12/2001	57.8	6172.6							9/5/2001	134.50	5933.7
12/17/2001		5858.6				12/12/2001	58.2	6172.2							12/19/2001	134.70	5933.5
3/27/2002		5858.0	3/27/2002		5713.3	3/21/2002	57.3	6173.1							3/21/2002	134.70	5933.5
6/27/2002			6/24/2002		5711.7	6/27/2002	57.7	6172.7							6/24/2002	134.80	5933.4
9/28/2002		5854.9	9/24/2002		5711.8	9/23/2002	57.7	6172.7							9/24/2002	134.70	5933.5
12/21/2002		5858.0				12/21/2002	59.08	6171.3							12/26/2002	135.33	5932.9
3/15/2003																	
6/25/2003	118	5851.8													6/30/2003	133.4	5934.8

Emery Water Level Data - Ferron Sandstone (Upper)

Well AA			Bryant Well			Well H			Well I2			Lewis Well			Well Muddy #1		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
9/18/2003	111.7	5858.1	9/18/2003	313.2	5711.3	9/17/2003	61	6169.4				9/17/2003	275	5745.4	9/17/2003	133	5935.2
12/19/2003	112	5857.8	12/19/2003	315	5709.5	12/19/2003	62.5	6167.9				12/19/2003	275	5745.4	12/22/2003	133.5	5934.7
3/30/2004	112.1	5857.7	3/29/2004	309.9	5714.6	3/30/2004	59.5	6170.9				3/29/2004	215	5805.4	3/18/2004	135	5933.2
6/23/2004	112.1	5857.7	6/18/2004	312	5712.5	6/18/2004	60.6	6169.8				6/18/2004	215	5805.4	6/23/2004	135.2	5933.0
9/23/2004	111.1	5858.7	9/25/2004	311.4	5713.1	9/25/2004	61.75	6168.7				9/25/2004	215	5805.4	9/24/2004	127.5	5940.7
12/27/2004	111	5858.8				12/28/2004	53.5	6176.9				12/27/2004	Dry Wells		12/28/2004	133.5	5934.7
3/31/2005	111	5858.8				3/25/2005	41.4	6189.0				3/31/2005	Dry Wells		3/25/2005	133.8	5934.4
5/23/2005	110.7	5859.1				5/23/2005	59.7	6170.7				5/23/2005	Dry Wells		5/12/2005	132.5	5935.7
7/8/2005	108.8	5861.0	7/22/2005	294.6	5729.9	7/11/2005	32.5	6197.9				7/22/2005	Dry Wells		7/20/2005	133.8	5934.4
11/28/2005	111	5858.8	11/28/2005	294.7	5729.8	11/22/2005	32.4	6198.0				11/28/2005	No Access		11/17/2005	137	5931.2
3/6/2006	110.4	5859.4	3/6/2006	293.1	5731.4	3/9/2006	34.8	6195.6	3/9/2006	417	5690.8	3/6/2006	No Access		3/9/2006	136.9	5931.3
6/29/2006	110.4	5859.4	6/30/2006	296.3	5728.2	6/29/2006	36	6194.4	6/29/2006	418.3	5689.5	6/29/2006	No Access		6/30/2006	139.5	5928.7
9/27/2006	91	5878.8	9/27/2006	298	5726.5	9/27/2006	38.5	6191.9	9/27/2006	405	5702.8	9/27/2006			9/28/2006	138.5	5929.7
11/20/2006	111	5858.8	11/20/2006	298	5726.5	11/27/2006	39	6191.4	11/27/2006	418	5689.8	11/20/2006			11/27/2006	137	5931.2
3/20/2007	110	5859.8	3/20/2007	295	5729.5	3/20/2007	43.5	6186.9	3/20/2007	419	5688.8	3/22/2007	No Access		3/22/2007	138	5930.2
6/13/2007	110.5	5859.3	9/20/2007	301	5723.5	6/14/2007	47	6183.4	6/14/2007	419	5688.8	6/13/2007	No Access		6/15/2007	156	5912.2
9/20/2007	111	5858.8	12/10/2007	302	5722.5	9/20/2007	51	6179.4	9/20/2007	419	5688.8	9/20/2007			9/18/2007	137	5931.2
12/10/2007	111	5858.8				12/10/2007	53	6177.4	12/10/2007	420	5687.8	12/10/2007	No Access		12/10/2007	137	5931.2
3/26/2008	110	5859.8	3/26/2008	291	5733.5	3/28/2008	56	6174.4	3/28/2008	418	5689.8	3/26/2008	No Access		3/26/2008	137	5931.2
6/24/2008	111	5858.8	6/24/2008	303	5721.5	6/24/2008	60	6170.4	6/24/2008	419	5688.8	6/24/2008	No Access		6/24/2008	139	5929.2
9/22/2008	11	5958.8	9/22/2008	298	5726.5	9/20/2008	54	6176.4	9/22/2008	417	5690.8	9/22/2008	No Access		9/22/2008	138	5930.2
12/12/2008	111	5858.8	12/12/2008			12/12/2008	65	6165.4	12/12/2008	389	5718.8	12/12/2008	No Access		12/13/2008	138	5930.2
												2/25/2009	No Access				
6/3/2009	113	5856.8	6/3/2009	300	5724.5	6/3/2009	69	6161.4	6/3/2009	385	5722.8	6/3/2009	No Access		6/4/2009	125	5943.2
12/15/2009	112	5857.8	12/14/2009	Dry Wells		12/14/2009	69	6161.4	12/14/2009	383	5724.8				12/14/2009	125	5943.2
12/29/2009	112	5857.8	12/29/2009	Dry Wells		12/29/2009	70	6160.4	12/29/2009	383	5724.8	12/14/2009	No Access		12/29/2009	126	5942.2
3/25/2010	11	5958.8	3/24/2010	Dry Wells		3/25/2010	80	6150.4	3/25/2010	382	5725.8	3/25/2010	No Access		3/25/2010	138	5930.2
6/22/2010	111	5858.8	6/24/2010	Dry Wells		6/23/2010	80	6150.4	6/23/2010	382	5725.8	6/22/2010	No Access		6/21/2010	138	5930.2
7/20/2010	111	5858.8	7/20/2010			7/21/2010	80	6150.4	7/20/2010	384	5723.8	7/20/2010	No Access		7/19/2010	138	5930.2
11/24/2010	111	5858.8	11/24/2010	Dry Wells		11/24/2010	85	6145.4	10/15/2010	384	5723.8	11/24/2010	No Access		11/24/2010	138	5930.2
3/28/2011	111.0	5858.8	3/28/2011	No Access		3/29/2011	88.0	6142.4	3/29/2011	421.1	5686.7	3/28/2011	No Access		3/29/2011	138.0	5930.2
6/8/2011	111.0	5858.8	6/8/2011	No Access		6/21/2011	90.8	6139.6	6/8/2011	422.6	5685.2	6/8/2011	No Access		6/21/2011	138.3	5929.9
9/28/2011	110.5	5859.3	9/28/2011	272.0	5752.5	9/27/2011	90.5	6139.9	9/27/2011	418.5	5689.3	9/22/2011	No Access		9/20/2011	138.5	5929.7
12/12/2011	111.5	5858.3	12/12/2011	274	5750.5	12/12/2011	90	6140.4	12/12/2011	418	5689.8	12/12/2011	No Access		12/13/2011	138.5	5929.7
3/16/2012	112.0	5857.8	3/15/2012	267.5	5757.0	3/21/2012	90	6140.4	3/21/2012	427	5680.8	3/15/2012	No Access		3/21/2012	138	5930.2
						6/20/2012	101.5	6128.9							6/20/2012	139	5929.2
						9/6/2012	102.9	6127.5							9/6/2012	139.2	5929.0
						11/6/2012	104	6126.4							11/6/2012	139.3	5928.9
						3/28/2013	106	6124.4							3/28/2013	138.9	5929.3
						6/5/2013	107.3	6123.1							6/5/2013	139	5929.2
						9/19/2013	107.6	6122.8							9/19/2013	139.2	5929.0
						12/6/2013	107.2	6123.2							12/6/2013	137.9	5930.3
						3/19/2014	106.8	6123.6							3/19/2014	139.4	5928.8
						6/9/2014	106.9	6123.5							6/9/2014	139.5	5928.7
						9/16/2014	106.4	6124.0							9/15/2014	138.9	5929.3
						12/2/2014	106.5	6123.9							12/2/2014	139.8	5928.4
						3/13/2015	159.4	6071.0							3/13/2015	139.5	5928.7
						6/2/2015	182.4	6048.0							5/21/2015	139.9	5928.3
						9/4/2015	207.6	6022.8							9/4/2015	139.8	5928.4
						12/14/2015	212.6	6017.8							12/14/2015	139.9	5928.3

Emery Water Level Data - Ferron Sandstone (Upper)

Well Muddy #2			Well R2			Well T1			Well T2			Well TP			Well USGS1-2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
10/7/1976			10/7/1976			10/7/1976			10/7/1976			10/7/1976			10/7/1976		
															12/6/1978	37.41	6008.9
															3/7/1979	41.05	6005.3
7/2/1979	44.5	6002.3													7/2/1979	44.39	6001.9
10/30/1979	49.8	5997.0													10/30/1979	54.71	5991.6
3/14/1980	64.9	5981.9	3/14/1980	-14	6045.7										2/29/1980	68.00	5978.3
6/11/1980	71.6	5975.2	6/11/1980	-9.4	6041.1										5/21/1980	76.30	5970.0
9/17/1980	59.9	5986.9	9/17/1980	-19.8	6051.5										9/15/1980	77.40	5968.9
11/9/1980	63	5983.8	11/9/1980	-24.7	6056.4										12/9/1980	80.00	5966.3
3/16/1981	81.6	5965.2	3/16/1981	-45.7	6077.4										3/16/1981	81.2	5965.1
6/22/1981	83.2	5963.6	6/22/1981	-34.4	6066.1										6/22/1981	87.50	5958.8
9/19/1981	81.2	5965.6	9/19/1981	-23	6054.7	9/17/1981	235.1	5768.1	9/17/1981	42.4	5955.3	9/17/1981	88.9	5913.8	9/19/1981	81.4	5964.9
11/24/1981	82.6	5964.2	11/24/1981	-18.4	6050.1										12/30/1981	88.72	5957.6
3/11/1982	81.4	5965.4	3/11/1982	-34.6	6066.3	3/29/1982	242.7	5760.5	3/29/1982	90.9	5906.8	3/29/1982	123.3	5879.4	3/12/1982	88.88	5957.4
7/23/1982	70	5976.8	6/21/1982	-5.7	6037.4	5/14/1982	278.5	5724.7	5/14/1982	234.6	5763.1	5/14/1982	271.7	5731.0	6/15/1982	89.00	5957.3
9/15/1982	71.1	5975.7	9/15/1982	-5.7	6037.4										8/13/1982	88.4	5957.9
11/10/1982	59.6	5987.2	11/10/1982	-10.4	6042.1										12/10/1982	88.20	5958.1
2/16/1983	71.4	5975.4	2/16/1983	-11.5	6043.2										3/22/1983	88.92	5957.4
6/30/1983	71.8	5975.0	7/1/1983	-1.6	6033.3										6/30/1983	88.50	5957.8
9/26/1983	68.4	5978.4	8/12/1983	-1.4	6033.1										9/26/1983	88.50	5957.8
12/7/1983	73.1	5973.7	12/8/1983	-4.6	6036.3	11/15/1983	334.7	5668.5	11/15/1983	279.2	5718.5	11/15/1983	295.3	5707.4	12/29/1983	87.80	5958.5
4/24/1984	89.8	5957.0	4/24/1984	-1.2	6032.9										4/23/1984		5956.7
6/11/1984	88.5	5958.3	6/11/1984	-5.8	6037.5										6/13/1984		5957.2
9/24/1984	61.6	5985.2	9/26/1984	123	5908.7	9/28/1984	340.2	5663	9/28/1984	273	5724.7				9/26/1984		5959.3
12/5/1984	78.3	5968.5	12/3/1984	125	5906.7										12/4/1984	87.7	5958.6
3/26/1985	90.4	5956.4	4/5/1985	132	5899.7	4/5/1985	340	5663.2	4/5/1985	273.8	5723.9	4/5/1985	286	5716.7	3/27/1985		5957.9
6/20/1985	78.20	5968.6	6/18/1985	139.2	5892.5	6/18/1985	340.3	5662.9	6/18/1985	275	5722.7	7/31/1985	286.30	5716.4	6/20/1985		5958.6
9/20/1985	87.40	5959.4	9/20/1985	140.8	5890.9	9/26/1985	343.1	5660.1	9/26/1985	276.7	5721.0	9/26/1985	288.7	5714.0	9/19/1985		5958.0
12/1/1985	82.1	5964.7	12/19/1985	154.70	5877.0	12/19/1985	348.1	5655.1	12/19/1985	278.6	5719.1	12/19/1985	289.5	5713.2	12/12/1985	87.9	5958.4
3/13/1986	90.60	5956.2				3/12/1986	348	5655.2	3/12/1986	313.9	5683.8	3/12/1986	333.8	5668.9	3/12/1986	88.60	5957.7
6/30/1986	91.50	5955.3	6/27/1986	210.00	5821.7	6/27/1986	348.5	5654.7	6/27/1986	327	5670.7				6/24/1986	88.40	5957.9
9/4/1986	89.00	5957.8	9/4/1986	210.5	5821.2				9/5/1986	333.3	5664.4	9/5/1986	350.00	5652.7	9/4/1986	88.30	5958.0
12/23/1986	91.2	5955.6	12/23/1986	209.8	5821.9	12/31/1986	358.2	5645	12/31/1986	340	5657.7	12/31/1986	357.2	5645.5	12/23/1986	88.30	5958.0
3/23/1987	94.30	5952.5	3/25/1987	202.60	5829.1	4/2/1987	369.9	5633.3	4/2/1987	345.9	5651.8	4/2/1987	359.2	5643.5	3/26/1987	86.90	5959.4
5/20/1987	92.20	5954.6	5/14/1987	195.90	5835.8	5/14/1987	329	5674.2	5/14/1987	336.5	5661.2	5/19/1987	346.40	5656.3	5/20/1987	88.80	5957.5
9/23/1987	93.30	5953.5	9/25/1987	197.00	5834.7				9/25/1987	326.1	5671.6	10/9/1987	337.00	5665.7	10/7/1987	88.60	5957.7
12/30/1987	93.4	5953.4	12/30/1987	197.50	5834.2				12/30/1987	326.8	5670.9				12/30/1987	89.90	5956.4
3/22/1988	93.6	5953.2	3/22/1988	198.00	5833.7				3/22/1988	325.7	5672.0	3/22/1988	333	5669.7	3/22/1988	88.80	5957.5
6/30/1988	91.1	5955.7							6/30/1988	322.7	5675.0	6/30/1988	332.90	5669.8	6/9/1988	89.60	5956.7
10/19/1988	87.7	5959.1							10/19/1988	353.3	5644.4				10/20/1988	90.50	5955.8
12/19/1988	76.5	5970.3													12/29/1988	92.70	5953.6
3/27/1989	66.3	5980.5	3/27/1989	359	5672.7				3/27/1989	352	5645.7	3/27/1989	335	5667.7	3/27/1989	95.1	5951.2
5/18/1989	95.20	5951.6													5/19/1989	96.80	5949.5
9/11/1989	96.90	5949.9	9/11/1989	483.3	5548.4	9/11/1989	337	5666.2	9/11/1989	313	5684.7	9/11/1989	343.00	5659.7	9/11/1989	98.40	5947.9
12/6/1989	97.7	5949.1	12/6/1989	482	5549.7				12/6/1989	307.2	5690.5	12/6/1989	365	5637.7	12/6/1989	100.4	5945.9

Emery Water Level Data - Ferron Sandstone (Upper)

Well Muddy #2			Well R2			Well T1			Well T2			Well TP			Well USGS1-2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/12/1990	97.00	5949.8	3/1/1990	481.7	5550.0	3/1/1990	334	5669.2	3/1/1990	299.5	5698.2	3/1/1990	361	5641.7	3/1/1990	101	5945.3
6/4/1990	98.50	5948.3				6/1/1990	349	5654.2				6/8/1990	366.70	5636.0	6/1/1990	102.2	5944.1
9/18/1990	105.00	5941.8				9/18/1990	369	5634.2				9/18/1990	372.00	5630.7	9/18/1990	103.40	5942.9
11/7/1990	99.50	5947.3	12/1/1990	483	5548.7	12/1/1990	398	5605.2				12/1/1990	371	5631.7	12/1/1990	103.80	5942.5
3/29/1991	99.50	5947.3				3/20/1991	348.3	5654.9	3/20/1991	324.1	5673.6				3/20/1991	104.2	5942.1
6/10/1991	99.50	5947.3										6/17/1991	375.30	5627.4	6/17/1991	104.80	5941.5
9/18/1991	99.50	5947.3										9/23/1991	378.80	5623.9	9/24/1991	104.90	5941.4
12/18/1991	99.60	5947.2				12/4/1991	353.6	5649.6	12/4/1991	286.7	5711.0	12/4/1991	385	5617.7	12/4/1991	105.3	5941.0
3/12/1992	99.50	5947.3							3/12/1992	275.1	5722.6	3/1/1992	383.8	5618.9	3/1/1992	105.2	5941.1
5/20/1992	99.50	5947.3				5/20/1992	348	5655.2	5/20/1992	277.6	5720.1	5/26/1992	386.60	5616.1	6/24/1992	105.80	5940.5
9/1/1992	99.80	5947.0				9/1/1992	350	5653.2	9/1/1992	277	5720.7	9/2/1992	390.00	5612.7	9/2/1992	106.00	5940.3
12/9/1992	100.00	5946.8										12/1/1992	394	5608.7	12/1/1992	106.4	5939.9
3/3/1993	100.1	5946.7							3/3/1993	250	5747.7	3/10/1993	395.4	5604.7	3/10/1993	106.8	5939.5
6/2/1993	100.30	5946.5										6/4/1993	398.00	5604.7	6/7/1993	106.90	5939.4
9/8/1993	100.20	5946.6							9/8/1993	286.00	5711.7	9/8/1993	389.00	5613.7	9/8/1993	106.20	5940.1
12/7/1993	100.2	5946.6							12/7/1993	282	5715.7	12/7/1993	396.4	5606.3	12/7/1993	105.4	5940.9
3/7/1994	100.1	5946.7							3/9/1994	255	5742.7	3/9/1994	399	5603.7	3/9/1994	105.8	5940.5
6/7/1994	100	5946.8							6/7/1994	249.9	5747.8	6/6/1994	401.30	5601.4	6/6/1994	106.60	5939.7
9/8/1994	100.3	5946.5							9/8/1994	257.3	5740.4	9/7/1994	402.70	5600.0	9/7/1994	105.60	5940.7
12/1/1994	100.3	5946.5							12/1/1994	256.1	5741.6	12/1/1994	403.5	5599.2	12/1/1994	107	5939.3
3/1/1995	100	5946.8							3/1/1995	256	5741.7	3/1/1995	402.3	5600.4	3/1/1995	107.3	5939.0
6/1/1995	100.1	5946.7							6/1/1995	251.2	5746.5	6/1/1995	402.3	5600.4	6/1/1995	107.20	5939.1
9/18/1995	96.3	5950.5							9/1/1995	235.5	5762.2	9/1/1995	406	5596.7	9/1/1995	106.00	5940.3
12/5/1995	65.7	5981.1							12/5/1995	285	5712.7	12/5/1995	405.8	5596.9	12/5/1995	104.5	5941.8
3/8/1996	99.5	5947.3							3/8/1996	286.3	5711.4	3/25/1996	406.2	5596.5	3/25/1996	103.3	5943.0
6/10/1996	96.90	5949.9							6/10/1996	286.8	5710.9	6/4/1996	406	5596.7	6/4/1996	103	5943.3
9/4/1996	99.10	5947.7							9/4/1996	286.3	5711.4	9/4/1996	406	5596.7	9/4/1996	101.3	5945.0
12/5/1996	99.5	5947.3							12/5/1996	290	5707.7	12/26/1996	405.2	5597.5	12/26/1996	100.8	5945.5
3/6/1997	99.50	5947.3							3/6/1997	290	5707.7	3/6/1997	405	5597.7	3/6/1997	102	5944.3
6/20/1997	99.30	5947.5							6/3/1997	290	5707.7	6/3/1997	405	5597.7	6/3/1997	102.2	5944.1
9/29/1997	99.10	5947.7							9/8/1997	291	5706.7	9/8/1997	405.9	5596.8	9/8/1997	101.6	5944.7
12/16/1997	98.10	5948.7							12/5/1997	291	5706.7	12/5/1997	406.2	5596.5	12/5/1997	97.3	5949.0
3/10/1998	99.50	5947.3							3/24/1998	290	5707.7	3/24/1998	405.8	5596.9	3/10/1998	97.8	5948.5
6/26/1998	98.70	5948.1							6/2/1998	290	5707.7	6/2/1998	405.9	5596.8	6/1/1998	97.50	5948.8
9/16/1998	97.8	5949.0							9/8/1998	290.00	5707.7	9/8/1998	405.8	5596.9	9/28/1998	96.80	5949.5
12/8/1998	98.20	5948.6							12/7/1998	290	5707.7	12/7/1998	405.9	5596.8	12/8/1998	96.7	5949.6
3/17/1999	99.5	5947.3							3/8/1999	290	5707.7	3/17/1999	405.8	5596.9	3/17/1999	96.4	5949.9
6/14/1999	98	5948.8							6/11/1999	274	5723.7	6/11/1999	405	5597.7	6/17/1999	92.3	5954.0
9/30/1999	99.3	5947.5							9/3/1999	274	5723.7	9/3/1999	405.8	5596.9	9/3/1999	94.4	5951.9
12/15/1999	99.7	5947.1							12/15/1999	274	5723.7	12/15/1999	405	5597.7	12/15/1999	86.9	5959.4
3/24/2000	99.2	5947.6							3/15/2000	274	5723.7	3/15/2000	405	5597.7	3/24/2000	91.2	5955.1
9/18/2000	100.2	5946.6							9/18/2000	274	5723.7	9/18/2000	405	5597.7	9/18/2000	90.3	5956.0
12/20/2000	98.2	5948.6							12/4/2000	274	5723.7	12/4/2000	405	5597.7	12/20/2000	89.1	5957.2
3/22/2001	97.60	5949.2							3/22/2001	274	5723.7				3/22/2001	91.9	5954.4
6/12/2001	98.20	5948.6							6/4/2001	275	5722.7						
9/5/2001	99.80	5947.0							9/5/2001	275	5722.7				9/5/2001	93.6	5952.7
12/19/2001	99.00	5947.8							12/17/2001	275	5722.7				12/19/2001	92.1	5954.2
3/21/2002	97.80	5949.0										3/21/2002	405	5597.7	3/21/2002	95.6	5950.7
6/24/2002	99.20	5947.6							6/24/2002	275	5722.7				6/24/2002	96.8	5949.5
9/24/2002	99.75	5947.1							9/23/2002	275	5722.7				9/23/2002	99.3	5947.0
12/26/2002	97.75	5949.1							12/26/2002	273	5724.7				12/26/2002	88.75	5957.6
															3/13/2003	32.17	6014.1
6/30/2003	99.4	5947.4															

Emery Water Level Data - Ferron Sandstone (Upper)

Well Muddy #2			Well R2			Well T1			Well T2			Well TP			Well USGS1-2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
9/19/2003	128.2	5918.6	9/17/2003	488	5543.7	9/17/2003	350	5653.2	9/17/2003	273	5724.7				9/17/2003	105	5941.3
12/22/2003	129	5917.8	12/19/2003	488	5543.7							12/22/2003	405	5597.7	12/22/2003	105	5941.3
3/29/2004	131	5915.8				3/29/2004	295	5708.2	3/29/2004	285	5712.7	3/29/2004	405	5597.7	3/18/2004	107	5939.3
6/23/2004	99.2	5947.6	6/23/2004	488	5543.7	6/18/2004	360	5643.2	6/18/2004	275	5722.7	6/18/2004	405	5597.7	6/18/2004	107	5939.3
9/24/2004	119	5927.8										9/23/2004	405	5597.7	9/24/2004	103.6	5942.7
						12/28/2004									12/28/2004	Dry Wells	
						3/31/2005									3/25/2005	20.1	6026.2
						5/11/2005	355	5648.2	5/11/2005	47.4	5950.3				5/11/2005	Dry Wells	
			7/11/2005	602.6	5429.1	7/11/2005	382	5621.2	7/11/2005	47.4	5950.3				7/19/2005	Dry Wells	
			11/28/2005	550.7	5481.0	11/22/2005			11/22/2005	52	5945.7				11/17/2005	20.3	6026.0
			3/7/2006	531	5500.7										3/9/2006	20.3	6026.0
															6/28/2006	Dry Wells	
9/28/2006	62.5	5984.3	9/28/2006	488	5543.7	9/28/2006	383	5620.2	9/28/2006	145	5852.7	9/28/2006	406	5596.7	9/28/2006	30	6016.3
11/27/2006	61	5985.8	11/20/2006	488	5543.7	11/20/2006	383	5620.2	11/20/2006	152	5845.7	11/20/2006	406	5596.7	11/27/2006	30	6016.3
3/22/2007	61	5985.8	3/20/2007	488	5543.7	3/20/2007	383	5620.2	3/20/2007	151	5846.7	3/20/2007	406	5596.7	3/22/2007	30	6016.3
6/15/2007	61	5985.8	6/14/2007	563	5468.7	6/14/2007	383	5620.2	6/14/2007	151	5846.7	6/14/2007	398	5604.7	6/15/2007	30	6016.3
9/18/2007	61	5985.8	9/18/2007	537	5494.7	9/18/2007	383	5620.2	9/18/2007	151	5846.7	9/18/2007	405	5597.7	9/18/2007	30	6016.3
12/10/2007	27	6019.8	12/10/2007	575	5456.7	12/10/2007	383	5620.2	12/10/2007	No Access		12/10/2007	405	5597.7	12/10/2007	30	6016.3
3/26/2008	28	6018.8	3/26/2008	567	5464.7	3/26/2008			3/26/2008	260	5737.7	3/26/2008			3/26/2008	30	6016.3
6/24/2008	Dry Wells		6/24/2008	570	5461.7	6/24/2008			6/24/2008	318	5679.7	6/24/2008			6/24/2008	120	5926.3
9/22/2008			9/20/2008	562	5469.7	9/30/2008			9/30/2008	23	5974.7	9/30/2008			9/30/2008	30	6016.3
12/13/2008	Dry Wells		12/12/2008	550	5481.7	12/12/2008	Dry Wells		12/12/2008	No Access		12/12/2008			12/13/2008	Dry Wells	
						2/20/2009	Dry Wells		2/20/2009	No Access					2/25/2009	Dry Wells	
6/4/2009	Dry Wells		6/3/2009	532	5499.7	6/4/2009	Dry Wells		6/4/2009	Dry Wells		6/4/2009	Dry Wells		6/4/2009	Dry Wells	
12/14/2009	Dry Wells		12/14/2009	532	5499.7	12/14/2009	Dry Wells		12/14/2009	Dry Wells		12/14/2009	No Access				
12/29/2009	Dry Wells		12/29/2009	535	5496.7	12/29/2009	Dry Wells		12/29/2009	Dry Wells		12/29/2009	No Access		12/14/2009	Dry Wells	
3/24/2010	Dry Wells		3/25/2010	505	5526.7	3/24/2010	Dry Wells		3/24/2010	Dry Wells		3/24/2010	Dry Wells		3/24/2010	Dry Wells	
6/21/2010	Dry Wells		6/23/2010	500	5531.7	6/23/2010	Dry Wells		6/23/2010	368	5629.7	6/23/2010	Dry Wells		6/21/2010	Dry Wells	
7/19/2010	25	6021.8	7/19/2010	503	5528.7	7/19/2010	386	5617.2	7/19/2010	386	5611.7	7/19/2010	408	5594.7	7/19/2010	30	6016.3
11/24/2010	Dry Wells		10/15/2010	510	5521.7	10/15/2010	Dry Wells		10/15/2010	Dry Wells		10/15/2010	Dry Wells		11/5/2010	Dry Wells	
3/28/2011	Dry Wells		3/25/2011	506.8	5524.9	3/25/2011	Dry Wells					3/25/2011	Dry Wells		3/28/2011	Dry Wells	
6/21/2011	Dry Wells		6/21/2011	510.11	5521.59	6/8/2011	Dry Wells					6/8/2011	Dry Wells		6/8/2011	Dry Wells	
9/20/2011	Dry Wells		9/27/2011	497	5534.7	9/20/2011	Dry Wells					9/20/2011	Dry Wells		9/20/2011	Dry Wells	
12/13/2011	26.5	6020.3	12/13/2011	535.5	5496.2	12/13/2011	Dry Wells		12/13/2011	Dry Wells		12/13/2011	Dry Wells		12/13/2011	Dry Wells	
3/16/2012	Dry Wells		3/21/2012	Dry Wells		3/21/2012	Dry Wells		3/15/2012	Dry Wells		3/15/2012	Dry Wells		3/16/2012	Dry Wells	
						6/20/2012	Dry Wells										
						8/20/2012	Dry Wells										
						11/1/2012	43										
						3/21/2013	Dry Wells										
						6/4/2013	43										
						9/17/2013	43										
						12/5/2013	43										
						3/14/2014	43										
						6/26/2014	Dry Wells										
						9/16/2014	43										
						12/9/2014	43										
						3/16/2015	43	5960.2									
						6/8/2015											
						9/29/2015											

Emery Water Level Data - Ferron Sandstone (Middle)

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
11/16/1979	-1.41	5968.7									
3/17/1980	-20.93	5988.2									
6/11/1980	-16.30	5983.6									
9/16/1980	-20.77	5988.1									
12/9/1980	-19.85	5987.2									
3/16/1981	-21.00	5988.3									
7/17/1981	-19.82	5987.1									
9/1/1981											
11/1/1981											
3/12/1982	-80.73	6048.0									
6/21/1982	-71.40	6038.7									
9/15/1982	-16.00	5983.3									
11/9/1982	-8.07	5975.4									
3/30/1983	-4.61	5971.9									
7/1/1983	-5.78	5973.1									
10/25/1983	-5.50	5972.8									
12/1/1993											
4/18/1984	63.40	5905.8									
6/11/1984	63.20	5906.0									
9/26/1984	63.50	5905.7									
12/1/1984											
4/5/1985	66.10	5903.1	4/5/1985	53.8	6176.6	4/5/1985	159.9	5949.0	4/5/1985	-131.7	6162.8
6/18/1985	66.20	5903.0	6/18/1985	55.2	6175.2	6/18/1985	162.4	5946.5	6/18/1985	-130.50	6161.6
9/3/1985	67.30	5901.9	9/3/1985	57.6	6172.8	9/3/1985	168.2	5940.7	9/3/1985	-110.90	6142.0
12/1/1985	66.80	5901.9	12/1/1985	61.6	6168.8	12/1/1985	167.2	5940.7	12/1/1985	-109.30	6140.4
3/31/1986	69.00	5896.7	3/31/1986	62.5	6167.9	3/31/1986	205.3	5903.6	3/31/1986	-107.40	6138.5
6/27/1986	72.50	5896.7	6/27/1986	61.8	6168.6	6/27/1986	204.6	5904.3	6/27/1986	-87.80	6118.9
9/3/1986	72.60	5896.6	9/3/1986			9/3/1986	216.1	5892.8	9/3/1986	-70.50	6101.6
12/23/1986	91.50	5877.7	12/23/1986	73.4	6157.0	12/23/1986	222.4	5886.5	12/23/1986	-67.00	6098.1
3/1/1987			3/1/1987	72.40	6158.0	3/1/1987	222.40	5886.5	3/1/1987		
5/22/1987	89.20	5880.0	5/22/1987	80.00	6150.4	5/22/1987	219.70	5889.2	5/14/1987	-71.50	6102.6
9/25/1987	82.00	5887.2	9/25/1987	80.00	6150.4	9/25/1987	221.00	5887.9	9/25/1987	-73.80	6104.9
12/29/1987	85.60	5883.6	12/29/1987	94.60	6135.8	12/29/1987	223.30	5885.6	12/30/1987	-73.80	6104.9
3/22/1988	86.00	5883.2	3/22/1988	94.60	6135.8	3/22/1988	223.3	5885.6	3/22/1988	-69.20	6100.3
6/30/1988	83.50	5885.7	6/30/1988	183.10	6047.3	6/30/1988	223.3	5885.6	6/30/1988		
10/19/1988	85.00	5884.2	10/19/1988	220	6010.4	10/19/1988	223.8	5885.1	10/19/1988		
12/19/1988	84.00	5885.2	12/19/1988			12/19/1988	223.5	5885.4	12/19/1988		

Emery Water Level Data - Ferron Sandstone (Middle)

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/30/1989	86.00	5883.2	3/30/1989	212.8	6017.6	3/30/1989	224	5884.9	3/30/1989		
5/18/1989	85.20	5884.0	5/18/1989	298	5932.4	5/18/1989	225.4	5883.5	5/18/1989	410.10	5621.0
9/11/1989	84.50	5884.7	9/11/1989	308	5922.4	9/11/1989	227.3	5881.6	9/11/1989	408.00	5623.1
12/1/1989	80.70	5884.7	12/1/1989	331	5899.4	12/1/1989	229.3	5879.6	12/1/1989		
3/15/1990	85.40	5883.8	3/15/1990	348.7	5881.7	3/15/1990	228.5	5880.4	3/15/1990	400.80	5630.3
6/11/1990	86.00	5883.2	6/11/1990	367.00	5863.4	6/11/1990	231.80	5877.1	6/11/1990	403.90	5627.2
9/19/1990	84.50	5884.7	9/19/1990	367.00	5863.4	9/19/1990	233.4	5875.5	9/19/1990	405.80	5625.3
12/1/1990	84.50	5884.7	11/8/1990	375.00	5855.4	11/8/1990	235.5	5873.4	11/8/1990	405.00	5626.1
4/1/1991	89.00	5879.7	4/1/1991			4/1/1991			4/1/1991		
6/17/1991	89.50	5879.7	6/17/1991	385.10	5845.3	6/17/1991	236.1	5872.8	6/17/1991	409.00	5622.1
9/18/1991	89.20	5879.7	9/18/1991	389.80	5840.6	9/18/1991	236.5	5872.8	9/18/1991	407.00	5624.1
12/1/1991	89.10	5879.7	12/1/1991	389.30	5841.1	12/1/1991	236.9	5872.8	12/1/1991	407.50	5623.6
3/13/1992	89.00	5880.2	3/13/1992	392.8	5837.6	3/13/1992	233.1	5875.8	3/13/1992	403.7	5627.4
5/22/1992	90.70	5878.5	5/22/1992	390.00	5840.4	5/22/1992	236.30	5872.6	5/22/1992	402	5629.1
9/1/1992	93.70	5875.5	9/1/1992	404.00	5826.4	9/1/1992	237.00	5871.9	9/1/1992	402	5629.1
12/3/1992	91.20	5878.0	12/3/1992	402	5828.4	12/3/1992	237	5871.9	12/3/1992	385.7	5645.4
3/1/1993	85.30	5883.9	3/1/1993	400	5830.4	3/1/1993	237.2	5871.7	3/1/1993	402	5629.1
6/2/1993	87.60	5881.6	6/2/1993	399.2	5831.2	6/2/1993	238.4	5870.5	6/2/1993	401.20	5629.9
9/8/1993	90.00	5879.2	9/8/1993	405.3	5825.1	9/8/1993	237.5	5871.4	9/8/1993	403.20	5627.9
12/1/1993	87.20	5882.0	12/1/1993	402.1	5828.3	12/1/1993	236.8	5872.1	12/1/1993	409.20	5621.9
3/9/1994	91.10	5878.1	12/8/1993	402.1	5828.3	12/8/1993	236.8	5872.1	12/7/1993	409.2	5621.9
6/7/1994	90.30	5878.9	6/8/1994	410.2	5820.2	6/7/1994	243.4	5865.5	6/7/1994	410	5621.1
9/9/1994	92.20	5877.0	9/9/1994	405.2	5825.2	9/8/1994	244.1	5864.8	9/8/1994	408.3	5622.8
12/1/1994	91.30	5877.9	12/1/1994	406.2	5824.2	12/1/1994	243.8	5865.1	12/1/1994	406	5625.1
3/3/1995	92.80	5876.4	3/3/1995	406	5824.4	3/3/1995	242.8	5866.1	3/3/1995	392.3	5638.8
6/7/1995	92.50	5876.7	6/7/1995	411.2	5819.2	6/7/1995	242.3	5866.6	6/7/1995	412	5619.1
9/5/1995	92.70	5876.5	9/5/1995	415.2	5815.2	9/5/1995	242.2	5866.7	9/5/1995	411.9	5619.2
12/5/1995	90.50	5878.7	12/5/1995	414.9	5815.5	12/5/1995	242.2	5866.7	12/5/1995	407	5624.1
3/22/1996	88.90	5880.3	3/22/1996	418.3	5812.1	3/22/1996	241.5	5867.4	3/22/1996	402.8	5628.3
6/4/1996	88.90	5880.3	6/4/1996	412.8	5817.6	6/4/1996	241.3	5867.6	6/4/1996	410.9	5620.2
9/9/1996	89.90	5879.3	9/9/1996	408.5	5821.9	9/9/1996	240.7	5868.2	9/9/1996	412.7	5618.4
12/1/1996	90.20		12/1/1996	410.4	5820.0	12/1/1996	241.2	5867.7	12/1/1996	412.1	5619.0
3/21/1997		5878.5	3/6/1997	409.9	5820.5	3/6/1997		5868.4	3/3/1997	412.80	5618.3
6/20/1997		5879.0	6/20/1997	410.1	5820.3	6/20/1997		5869.4	6/20/1997	412.73	5618.4
9/29/1997	89.80	5879.4	9/29/1997	409.9	5820.5	9/29/1997		5868.9	9/30/1997	412.70	5618.4
12/18/1997		5876.5	12/16/1997		5816.2	12/12/1997		5869.7	12/5/1997		5619.3

Emery Water Level Data - Ferron Sandstone (Middle)

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/24/1998		5880.7	3/31/1998		5816.7	3/31/1998		5871.1	3/31/1998		5619.6
6/26/1998		5881.4	6/26/1998	413.5	5816.9	6/26/1998		5869.4	6/26/1998	409.80	5621.3
9/16/1998		5880.7	9/16/1998		5813.4	9/8/1998		5870.7	9/15/1998		5625.9
12/7/1998		5880.4	12/10/1998		5813.9	12/10/1998		5871.2	12/10/1998		5627.2
3/15/1999	88.50	5880.7	3/15/1999	413.2	5817.2	3/17/1999	238.2	5870.7	3/15/1999	411.10	5620.0
6/11/1999	88.90	5880.3	6/11/1999	416	5814.4	6/11/1999	238.3	5870.6	6/11/1999	409.5	5621.6
9/28/1999	90.00	5879.2	9/28/1999	414.6	5815.8	9/28/1999	238.5	5870.4	9/28/1999	408.6	5622.5
12/8/1999	89.80	5879.4	12/16/1999	415.9	5814.5	12/15/1999	238	5870.9	12/15/1999	407.7	5623.4
3/23/2000		5879.2	3/23/2000		5815.2	3/23/2000		5870.2	3/23/2000		5621.7
6/1/2000											
9/22/2000		5879.2	9/28/2000		5815.5	9/28/2000		5870.3	9/25/2000		5619.9
12/1/2000											
3/23/2001		5883.0	3/22/2001	404	5826.4	3/22/2001	237.3	5871.6	3/22/2001	408.20	5622.9
6/13/2001		5881.4	6/13/2001	412.7	5817.7	6/13/2001	237.6	5871.3	6/13/2001	408.90	5622.2
9/12/2001		5879.2	9/12/2001	414.8	5815.6	9/12/2001	238.9	5870.0	9/12/2001	410.80	5620.3
12/17/2001			12/12/2001	415.1	5815.3	12/12/2001	238.8	5870.1	12/17/2001	410.80	5620.3
3/27/2002		5878.0	3/21/2002	409.9	5820.5	3/21/2002	238.1	5870.8	3/21/2002	409.40	5621.7
6/24/2002		5878.9	6/27/2002	412.3	5818.1	6/27/2002	238	5870.9	6/27/2002	409.30	5621.8
9/28/2002		5878.2	9/23/2002	412.2	5818.2	9/23/2002	238.8	5870.1	9/28/2002	410.70	5620.4
12/21/2002			12/21/2002	414.83	5815.6	12/21/2002	239.33	5869.6	12/21/2002	407.50	5623.6
3/15/2003											
6/25/2003	89.5	5879.7									
9/18/2003	84.75	5884.5	9/17/2003	414	5816.4	9/17/2003	263	5845.9	9/17/2003	380	5651.1
12/19/2003	86	5883.2	12/19/2003	415	5815.4	12/19/2003	262	5846.9	12/19/2003	380	5651.1
3/30/2004	89.6	5879.6	3/30/2004	414.8	5815.6	3/30/2004	249.3	5859.6	3/18/2004	391	5640.1
6/23/2004	89.3	5879.9	6/18/2004	416	5814.4	6/18/2004	240.2	5868.7	6/23/2004	395.2	5635.9
9/23/2004	96.75	5872.5	9/25/2004			9/25/2004	262.9	5846.0	9/20/2004	379.5	5651.6
12/27/2004	96.9	5872.3	12/28/2004			12/28/2004	262	5846.9	12/28/2004	391	5640.1
3/31/2005	97.5	5871.7	3/25/2005	Dry Wells		3/25/2005	234.6	5874.3	3/24/2005	392.5	5638.6
5/23/2005	97.3	5871.9	5/23/2005	Dry Wells		5/23/2005	233.8	5875.1	5/23/2005	391.5	5639.6
7/8/2005	97.3	5871.9	7/11/2005			7/20/2005	237.8	5871.1	7/11/2005	376.4	5654.7
11/28/2005	97.1	5872.1	11/22/2005			11/22/2005	389	5719.9	11/28/2005	346.2	5684.9
3/6/2006	96.9	5872.3	3/9/2006	300	5930.4	3/9/2006	390.9	5718.0	3/7/2006	333.6	5697.5
6/29/2006	100	5869.2	6/29/2006	321	5909.4	6/29/2006	393.6	5715.3	6/29/2006	341.8	5689.3
9/27/2006			9/27/2006			9/27/2006	395	5713.9	9/28/2006	343.8	5687.3
11/20/2006			11/27/2006			11/27/2006	395	5713.9	11/20/2006	351	5680.1

Emery Water Level Data - Ferron Sandstone (Middle)

Well AA			Well H			Well I			Well R2		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/20/2007			3/20/2007			3/20/2007	396	5712.9	3/20/2007	351	5680.1
6/13/2007	97	5872.2	6/14/2007			6/14/2007	396	5712.9	6/14/2007	355	5676.1
9/20/2007			9/20/2007			9/20/2007	13	6095.9	9/18/2007	339	5692.1
12/10/2007			12/11/2007			12/10/2007	394	5714.9	12/10/2007	358	5673.1
3/26/2008			3/28/2008			3/28/2008	394	5714.9	3/26/2008	360	5671.1
6/24/2008			6/24/2008			6/24/2008	395	5713.9	6/24/2008	Dry Wells	
9/22/2008			9/20/2008			9/20/2008			9/20/2008	285	5746.1
12/12/2008			12/12/2008			12/12/2008			12/12/2008	350	5681.1
12/15/2009	No Access		6/3/2009	No Access					6/3/2009	339	5692.1
12/29/2009	No Access		12/14/2009	No Access		12/14/2009	No Access		12/14/2009	285	5746.1
			12/29/2009	No Access		12/29/2009	No Access		12/29/2009	285	5746.1
3/24/2010	No Access		3/24/2010	No Access		3/24/2010	No Access		3/25/2010	315	5716.1
6/22/2010	No Access		6/22/2010	No Access		6/22/2010	No Access		6/23/2010	317	5714.1
7/20/2010			7/20/2010	No Access		7/20/2010	No Access		7/19/2010	321	5710.1
11/24/2010	No Access		11/24/2010	No Access		10/5/2010	No Access		10/15/2010	324	5707.1
3/28/2011	No Access		3/29/2011	No Access		3/29/2011	No Access		3/25/2011	320.5	5710.6
6/8/2011	No Access		6/21/2011	No Access		6/8/2011	No Access		6/21/2011	320.4	5710.7
9/28/2011	No Access		9/27/2011	No Access		9/27/2011	No Access		9/27/2011	317.5	5713.6
12/12/2011	No Access		12/12/2011	No Access		12/12/2011	No Access		12/13/2011	338.5	5692.6
3/16/2012	110.0	5859.2	3/21/2012	449	5781.40	3/21/2012	Dry Wells		3/21/2012	350.5	5680.6
									6/20/2012	361.5	5669.6
									9/6/2012	394.7	5636.4
									11/6/2012	407.5	5623.6
									3/28/2013	407.1	5624
									6/5/2013	409.5	5621.6
									9/19/2013	367.2	5663.9
									12/6/2013	369.1	5662
									3/19/2014	308.1	5723
									6/9/2014	307.4	5723.7
									9/15/2014	309.1	5722
									12/5/2014	309.9	5721.2
									3/13/2015	291.2	5739.9
									5/21/2015	276.1	5755
									9/2/2015	266.9	5764.2
									12/3/2015	254.9	5776.2

Emery Water Level Data - Ferron Sandstone (Lower)

Well AA			Well H			Well I			Well Kemmerer			Well R1			Well WW1			Well ZZ		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
2/1/1973									02/01/73	72.03	6358.7									
9/10/1975									09/10/75	46.03	6332.7									
12/30/1975									12/30/75	46	6332.7									
3/18/1976									03/18/76	47	6333.7									
11/15/1976									11/15/76	45	6331.7									
2/15/1977									02/15/77	43.5	6330.2									
3/30/1977									03/30/77	43.5	6330.2									
5/6/1977									05/06/77	44.5	6331.2									
6/2/1977									06/02/77	45	6331.7									
9/21/1977									09/21/77	44	6330.7									
10/21/1977									10/21/77	43	6329.7									
1/8/1978									01/08/78	46	6332.7									
5/3/1978									05/03/78	44	6330.7									
7/5/1978									07/05/78	44	6330.7									
9/29/1978									09/29/78	42.3	6329.0									
12/9/1978									12/09/78	42.9	6329.6									
2/5/1979									02/05/79	42.5	6329.2									
3/5/1979									03/05/79	42	6328.7									
6/4/1979									06/04/79	41	6327.7									
9/6/1979									09/06/79	41	6327.7									
10/30/1979									10/30/79	40	6326.7							9/28/1979	145.16	5923.5
11/16/1979	74.55	5894.1																10/30/1979	142.79	5925.9
3/17/1980	74.57	5894.0							03/14/80	43.7	6330.4							2/8/1980	142.71	5926.0
6/11/1980	74.74	5893.9																3/17/1980	142.72	5926.0
9/16/1980	74.68	5893.9																4/18/1980	143.05	5925.7
																		5/21/1980	142.82	5925.9
																		6/11/1980	142.69	5926.0
																		7/16/1980	142.85	5925.9
																		8/11/1980	142.78	5925.9
																		9/17/1980	142.71	5926.0
																		10/13/1980	142.78	5925.9
																		11/8/1980	142.8	5925.9
12/9/1980	75.42	5893.2																12/9/1980	142.65	5926.1
3/16/1981	75.23	5893.4							03/16/81	40.03	6326.7							1/8/1981	142.64	5926.1
5/11/1981	75.87	5892.7							05/11/81	39.03	6325.7							2/9/1981	142.7	5926.0
7/17/1981	76.92	5891.7																3/16/1981	143.3	5925.4
																		4/11/1981	148.6	5920.1
																		5/11/1981	143.66	5925.0
11/1/1981																		6/22/1981	143.73	5925.0
3/12/1982	76.12	5892.5							03/11/82	38.03	6324.7									
6/15/1982																				
8/24/1982	79.20	5889.4																		
11/9/1982	77.50	5891.1																		
3/30/1983	76.75	5891.9							03/22/83	32.00	6318.7									
7/1/1983	76.58	5892.0							07/01/83	32.00	6318.7									
10/25/1983	79.90	5888.7																		
12/1/1983									12/29/83	32.00	6318.7									
4/18/1984	81.50	5887.1	04/23/84	11	6219.4	04/23/84	12.9	6095.9	04/23/84	31.00	6317.7									
6/11/1984	80.60	5888.0	06/11/84	14	6216.4				06/13/84	31.00	6317.7									
9/26/1984	80.30	5888.3				09/26/84	13.5	6094.8	09/24/84	32.00	6318.7									
12/1/1984																				
4/5/1985	81.20	5887.4	04/05/85	19.10	6211.3		14		04/05/85	30.00	6316.7	04/05/85	-198.7	6232.9						
6/18/1985	81.40	5887.2	06/18/85	19.80	6210.6	06/18/85	13.30	6095.5	06/18/85	30.00	6316.7	06/18/85	-198.70	6232.9						
9/3/1985	81.90	5886.7	09/26/85	21.10	6209.3	09/26/85	13.30	6095.4	09/25/85	30.00	6316.7	09/20/85	-189.40	6223.6						
12/1/1985	83.00	5885.6	12/11/85	23.5	6206.9	12/11/85	12.5	6096.3	12/11/85	35.00	6321.7	12/11/85	-188.6	6222.8	12/1/1985	65.70	5854.3			
3/20/1986	84.60	5884.0	03/20/86	23.9	6206.5	03/20/86	13.4	6095.4	03/12/86	30.00	6316.7	03/12/86	-295.7	6329.9	3/20/1986	64.70	5855.3			
6/27/1986	82.90	5885.7	06/30/86	24.20	6206.2	06/30/86	13.60	6095.2	06/24/86	30.00	6316.7	06/27/86	-272.60	6306.8	6/27/1986	64.90	5855.1			
9/3/1986	83.10	5885.5				09/04/86	13.00	6095.8	09/04/86	30.00	6316.7	09/04/86	-272.60	6306.8	9/3/1986	66.30	5853.7			
12/23/1986	87.80	5880.8	12/31/86	30.00	6200.4	12/31/86	12.60	6096.2	12/23/86	27	6313.7	12/23/86	-263.3	6297.5	12/23/1986	65.7	5854.3			
4/1/1987	88.30	5880.3	04/02/87	30.00	6200.4	03/26/87	12.40	6096.4	03/26/87	27.00	6313.7	03/25/87	-253.80	6288.0						
5/22/1987	89.20	5879.4	05/22/87	35.70	6194.7	05/22/87	14.80	6094.0	05/18/87	26.00	6312.7	05/14/87	-253.80	6288.0						
9/25/1987	88.60	5880.0	09/25/87	37.50	6192.9	09/25/87	13.50	6095.3	09/25/87	26	6312.7	09/25/87	-258.40	6292.6						
12/29/1987	88.60	5880.0	12/29/87	40.20	6190.2	12/29/87	13.50	6095.3	12/29/87	24.00	6310.7	12/30/87	-258.40	6292.6						

Emery Water Level Data - Ferron Sandstone (Lower)

Well AA			Well H			Well I			Well Kemmerer			Well R1			Well WW1			Well ZZ		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/22/1988	87.30	5881.3	03/22/88	40.4	6190.0	03/22/88	13.5	6095.3	03/22/88	24.00	6310.7	03/22/88	-258.40	6292.6						
6/30/1988	86.50	5882.1	06/30/88	44	6186.4	06/30/88	14.6	6094.2	06/09/88	24.00	6310.7	06/30/88	-263.00	6297.2	6/30/1988	66.2	5853.8			
10/19/1988	88.00	5880.6	10/19/88	43.9	6186.5	10/19/88	13.8	6095.0	10/20/88	24.00	6310.7	10/25/88	-267.70	6301.9	10/19/1988	67.9	5852.1			
12/19/1988	86.40	5882.2				12/19/88	13.8	6095.0	12/20/88	23.00	6309.7	12/29/88	-226.10	6260.3						
3/30/1989	86.00	5882.6	03/27/89	48.5	6181.9	03/27/89	15.1	6093.7	03/27/89	25.00	6311.7	03/27/89	-235.3	6269.5	3/30/1989	67.8	5852.2			
5/18/1989		5870.4	05/18/89		6177.3	05/19/89		6094.5	05/18/89	25.00	6311.7	05/26/89		6269.5	5/18/1989		5852.0	5/18/1989	148.8	5919.9
9/11/1989		5881.8	09/12/89		6176.0	09/12/89		6092.4	09/11/89	25.00	6311.7	09/11/89		6281.1	9/11/1989		5851.7	9/11/1989	149.8	5918.9
12/1/1989	87.40	5881.2	12/01/89	53.6	6176.8	12/01/89	17	6091.8	12/01/89	21	6307.7	12/01/89	-242.2	6276.4	12/1/1989	67.7	5852.3			
3/15/1990	87.30	5881.3	03/15/90	54.6	6175.8	03/15/90	17	6091.8	03/12/90	20.00	6306.7	03/12/90	-235.3	6269.5	3/15/1990	67.30	5852.7			
6/11/1990	87.30	5881.3	06/11/90	56.50	6173.9	06/01/90	17.80	6091.0	06/04/90	20.00	6306.7	06/04/90	-235.3	6269.5	6/11/1990	68.00	5852.0	6/8/1990	149.9	5918.8
9/19/1990	88.70	5879.9	09/19/90	58.8	6171.6	09/19/90	16.8	6092.0	09/17/90	17.00	6303.7	09/17/90	-235.3	6269.5	9/19/1990	68.50	5851.5	9/18/1990	150.6	5918.1
11/7/1990	88.50	5880.1	11/07/90	67.2	6163.2	11/07/90	18	6090.8	11/07/90	17.00	6303.7	11/07/90	-235.3	6269.5	11/7/1990	68.00	5852.0			
3/1/1991	88.10	5880.5	03/29/91	63.10	6167.3	03/29/91	18.00	6090.8	03/01/91	17	6303.7	03/01/91	-228.4	6262.6	3/1/1991	67.5	5852.5			
6/17/1991	87.90	5880.7	06/14/91	64.60	6165.8	06/13/91	18.20	6090.5	06/10/91	17.00	6303.7	06/14/91	-226.10	6260.3	6/17/1991	67.10	5852.9			
9/18/1991	88.20	5880.4	09/18/91	66.30	6164.1	09/17/91	18.50	6090.2	09/24/91	10.00	6296.7	09/18/91	-226.10	6260.3	9/18/1991	67.80	5852.2			
12/1/1991	88.50	5880.1	12/18/91	68.20	6162.2	12/18/91	16.30	6092.5	12/11/91	11.00	6297.7	12/11/91	-226.6	6260.8	12/1/1991	67.3	5852.7			
3/13/1992	87.30	5881.3	03/13/92	71.5	6158.9	03/13/92	13.4	6095.4	03/13/92	11.00	6297.7	03/13/92	-216.90	6251.1	3/13/1992	66.50	5853.5	3/12/1992	149.3	5919.4
5/22/1992	88.10	5880.5	05/20/92	73.70	6156.7	05/20/92	16.10	6092.7	05/26/92	9.00	6295.7	05/22/92	-136.10	6170.3	5/22/1992	67.00	5853.0			
9/1/1992	87.70	5880.9	09/01/92	78.00	6152.4	09/01/92	16.10	6092.7	09/02/92	9.00	6295.7	09/01/92	-126.90	6161.1	9/1/1992	68.10	5851.9	9/2/1992	154.1	5914.6
12/1/1992	88.50	5880.1	12/03/92	76	6154.4	12/03/92	16.3	6092.5	12/03/92	9	6295.7	12/03/92	-57.70	6091.9	12/1/1992	66.80	5853.2			
3/1/1993	87.90	5880.7	03/03/93	75.1	6155.3	03/03/93	16.8	6092.0	03/03/93	9.00	6295.7	03/03/93	-126.9	6161.1	3/1/1993	66.9	5853.1	3/8/1993	148.9	5919.8
6/2/1993	89.30	5879.3	06/02/93		6154.6	06/02/93	16.90	6091.8	06/07/93	9.50	6296.2	06/02/93	-120.00	6154.2	6/2/1993		5852.5	6/2/1993	148.2	5920.5
9/8/1993	89.00	5879.6	09/10/93		6151.9	09/09/93	16.50	6092.2	09/07/93	9.00	6295.7	09/08/93	-117.70	6151.9	9/8/1993		5851.8	9/8/1993	150.1	5918.6
12/1/1993	88.90	5879.7	12/08/93	77.5	6152.9	12/08/93	16.1	6092.7	12/07/93	11.00	6297.7	12/07/93	-122.3	6156.5	12/1/1993	67.8	5852.2	12/7/1993	150.3	5918.4
3/9/1994	88.50	5880.1	03/08/94	80	6150.4	03/08/94	16.7	6092.1	03/08/94	10.00	6296.7	03/08/94	-52	6086.2	3/9/1994	67.70	5852.3	3/7/1994	150.2	5918.5
6/7/1994	88.30	5880.3	06/08/94	81.2	6149.2	06/07/94	16.8	6092.0	06/06/94	3.00	6289.7	06/07/94	-60	6094.2	6/7/1994	67.20	5852.8	6/6/1994	149.9	5918.8
9/9/1994	88.80	5879.8	09/09/94	80.3	6150.1	09/08/94	16.2	6092.6	09/07/94	3.00	6289.7	09/08/94	-60	6094.2	9/9/1994	68.30	5851.7	9/7/1994	150.4	5918.3
12/1/1994	88.60	5880.0	12/01/94	81.8	6148.6	12/01/94	17.3	6091.5	12/01/94	3.00	6289.7	12/01/94	-60	6094.2	12/1/1994	67.80	5852.2	12/1/1994	150.5	5918.2
3/3/1995	88.30	5880.3	03/03/95	80.8	6149.6	03/03/95	17	6091.8	03/02/95	2.00	6288.7	03/02/95	-60	6094.2	3/3/1995	67.2	5852.8	3/2/1995	150.3	5918.4
6/7/1995	87.80	5880.8	06/07/95	81	6149.4	06/07/95	17.1	6091.7	06/06/95	2.00	6288.7	06/01/95	-60	6094.2	6/7/1995	66.70	5853.3	6/1/1995	150.4	5918.3
9/5/1995	88.40	5880.2	09/05/95	91	6139.4	09/05/95	17.1	6091.7	09/05/95	0.00	6286.7	09/05/95	-60	6094.2	9/5/1995	67.5	5852.5	9/6/1995	150.6	5918.1
12/5/1995	88.10	5880.5	12/06/95	84.7	6145.7	12/06/95	15.8	6093.0	12/04/95	0.00	6286.7	12/05/95	-60	6094.2	12/5/1995	67.5	5852.5	12/5/1995		5918.5
3/22/1996	88.00	5880.6	03/22/96	83.3	6147.1	03/22/96	15.3	6093.5	03/22/96	0.00	6286.7	03/22/96	-75	6109.2	3/22/1996	66.7	5853.3			
6/4/1996	88.40	5880.2	06/04/96	83.1	6147.3	06/04/96	15.5	6093.3	06/04/96	0.00	6286.7	06/04/96	-75	6109.2	6/4/1996	66.8	5853.2	6/4/1996	150.5	5918.2
9/9/1996	89.50	5879.1	09/09/96	83.4	6147.0	09/09/96	15	6093.8	09/09/96	0	6286.7	09/09/96	-72	6106.2	9/9/1996	68.2	5851.8	9/4/1996	150.7	5918.0
12/1/1996	90.00	5878.6	12/01/96	83.7	6146.7	12/01/96	15.8	6093.0	12/01/96	0	6286.7	12/01/96	-71.00	6105.2	12/1/1996	67.4	5852.6	12/4/1996	150.5	5918.2
3/21/1997	91.10	5877.5	03/06/97	83.6	6146.8	03/06/97	15.5	6093.2	03/21/97	0	6286.7	03/21/97	-60.00	6094.2	3/21/1997	67	5853.0	3/6/1997	151.1	5917.6
6/20/1997	88.80	5879.8	06/20/97	84.4	6146.0	06/20/97	15.5	6093.3	06/20/97	0	6286.7	06/20/97	-53.00	6087.2	6/20/1997	67.5	5852.5	6/3/1997	151.2	5917.5
9/29/1997	88.30	5880.3	09/29/97	84.2	6146.2	09/29/97	15.4	6093.3	09/29/97	0	6286.7	09/29/97	-55.00	6089.2	9/29/1997	65.1	5854.9	9/8/1997	151.8	5916.9
12/18/1997	89.70	5879.1	12/16/97	83.5	6146.9	12/12/97	14.2	6094.5	12/18/97	0	6286.7	12/18/97	-60.00	6094.2	12/18/1997	66.3	5853.7	12/12/1997		5916.8
3/24/1998	88.80	5879.8	03/31/98	82.9	6147.5	03/31/98	14	6094.7	03/24/98	0	6286.7	03/31/98	-60.00	6094.2	3/24/1998	65.2	5854.8	3/10/1998		5917.3
6/26/1998	88.80	5879.8	06/26/98	83.9	6146.5	06/26/98	15.1	6093.6	06/15/98	3	6283.7	06/26/98	-55.00	6089.2	6/26/1998	66.7	5853.3	6/1/1998	151.3	5917.4
9/16/1998	89.10	5879.5	09/16/98	83.40	6147.0	09/08/98	14.00	6094.7	09/08/98	5	6281.7	09/16/98	-60.00	6094.2	9/16/1998	66.10	5853.9	9/8/1998	148.6	5920.1
12/7/1998	89.90	5875.7	12/10/98	84	6146.4	12/10/98	15	6093.7	12/07/98	5	6281.7	12/07/98	-60.00	6094.2	12/7/1998	66	5854.0	12/8/1998		5920.2
3/15/1999		5879.7	03/15/99	82.8	6147.6	03/15/99	15.1	6093.7	03/15/99	5	6281.7	03/15/99	-60	6094.2	3/15/1999	65.2	5854.8	3/29/1999		5917.2
6/11/1999	88.80	5879.8	06/11/99	85.3	6145.1	06/11/99	14.9	6093.9	06/11/99	7	6279.7	06/11/99	-50	6084.2	6/11/1999	66.2	5853.8			
9/28/1999	89.10	5879.5	09/28/99	83	6147.4	09/28/99	15.2	6093.6	09/28/99	6	6280.7	09/28/99	-50	6084.2	9/28/1999	66	5853.8			
12/8/1999	89.30	5879.3	12/16/99	84	6146.4	12/15/99	14.7	6094.1	12/08/99	6	6280.7	12/15/99	-50	6084.2	12/8/1999	66.1	5853.8			
3/23/2000		5879.3	03/23/00		6146.6	03/23/00		6093.9				03/23/00	-60	6094.2	3/23/2000	66.2	5853.8			
6/1/2000																				
9/22/2000		5879.3	09/28/00		6146.1	09/28/00		6093.5				09/25/00	-60	6094.2	9/22/2000		5853.1			
12/1/2000	91.2	5877.4	12/01/00	84.1	6146.3	12/01/00	15.7	6093.1	12/01/00	11	6275.7	12/01/00	-60	6094.2	12/1/2000	66.2	5853.8			
3/23/2001		5881.0	03/22/01	80.8	6149.6	03/22/01	17.9	6090.9				03/23/01	-60.00	6094.2	3/23/2001	65.2	5854.8	3/22/2001	148.5	5920.2
6/13/2001		5880.4	06/13/01	83.8	6146.6	06/13/01	15.2	6093.6				06/13/01	50.00	6084.2	6/13/2001	66.2	5853.8	6/5/2001	148.5	5920.2
9/12/2001		5878.7	09/12/01	84.2	6146.2	09/12/01	15.5	6093.3							9/12/2001	66.7	5853.3	9/5/2001	155.9	5912.8
12/1/2001			12/12/01	84.3	6146.1	12/12/01	15.8	6093.0							12/1/2001	66.7	5853.3			
3/27/2002		5877.8	03/21/02	82	6148.4	03/21/02	18	6090.8				03/21/02	60.00	6094.2	3/27/2002	66.2	5853.8	3/21/2002	148.9	5919.8
6/24/2002		5878.6	06/27/02	83.9	6146.5	06/27/02	17.8	6091.0				06/24/02	50.00	6084.2	6/24/2002	66.8	5853.2			
9/28/2002		5878.3	09/23/02	83.75	6146.7	09/23/02	16.75	6092.1							9/28/2002	66.9	5853.1			
12/21/2002			12/21/02	84.33	6146.1	12/21/02	16	6092.8							12/21/2002	66.4	5853.6	12/26/2002	Dry Wells	

Emery Water Level Data - Ferron Sandstone (Lower)

Well AA			Well H			Well I			Well Kemmerer			Well R1			Well WW1			Well ZZ		
Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation	Date	Depth	Elevation
3/15/2003																		3/26/2003	No Access	
6/25/2003	89	5879.6																5/29/2003	No Access	
9/18/2003	91.75	5876.9				9/17/2003	19.7	6089.1	9/18/2003	8	6278.7	9/17/2003	55	6089.2	9/18/2003	68	5852.0	9/17/2003	No Access	
12/19/2003	92.4	5876.2	12/19/2003	79.7	6150.7	12/19/2003	21.2	6087.6	12/19/2003	8	6278.7	12/19/2003	55	6089.2	12/23/2003	68.4	5851.6	12/23/2003	No Access	
3/30/2004	90.9	5877.7	3/30/2004	84.3	6146.1	3/18/2004	21	6087.8	3/29/2004	10	6276.7	3/18/2004	60	6094.2	3/18/2004	65	5855.0	3/18/2004	No Access	
6/23/2004	90	5878.6	6/18/2004	80.3	6150.1	6/18/2004	18.5	6090.3	6/18/2004	10	6276.7	6/23/2004	60	6094.2	6/23/2004	65.3	5854.7	6/23/2004	No Access	
9/23/2004	89.9	5878.7				9/26/2004	19	6089.8				9/26/2004	55	6089.2	9/24/2004	68	5852.0	9/24/2004	No Access	
12/27/2004	87.6	5881.0				12/28/2004	18.6	6090.2							12/28/2004	60	5860.0	12/28/2004	Dry Wells	
3/31/2005	90	5878.6				3/25/2005	19.1	6089.7	3/31/2005	6	6280.7	3/31/2005	50	6084.2	3/31/2005	65.7	5854.3	3/31/2005	No Access	
5/23/2005	89	5879.6				5/23/2005	18.3	6090.5				5/23/2005	60	6094.2	5/23/2005	65.1	5854.9	5/12/2005	Dry Wells	
7/8/2005	89.3	5879.3	7/11/2005	80.5	6149.9	7/20/2005	18.8	6090.0							7/11/2005	66.2	5853.8	7/20/2005	No Access	
11/28/2005	89.9	5878.7	11/22/2005	80.8	6149.6	11/17/2005	18	6090.8							11/17/2005	67	5853.0	11/17/2005	No Access	
3/6/2006	89.1	5879.5	3/9/2006	80.2	6150.2	3/9/2006	17.6	6091.2							3/9/2006	65.8	5854.2	3/9/2006	No Access	
6/29/2006	90	5878.6	6/29/2006	81	6149.4	6/29/2006	18.3	6090.5							6/30/2006	65.2	5854.8	6/30/2006	No Access	
9/27/2006	110.5	5858.1	9/27/2006			9/27/2006	17.5	6091.3	9/27/2006	10	6276.7	9/28/2006	50	6084.2	9/28/2006	68	5852.0	9/28/2006		
11/20/2006	90.5	5878.1	11/27/2006			11/27/2006	17	6091.8	11/20/2006	10	6276.7	11/20/2006	35	6069.2	11/27/2006	67.5	5852.5	11/27/2006		
3/20/2007	89	5879.6	3/20/2007			3/20/2007	17	6091.7	3/20/2007	5	6281.7	3/20/2007	45	6079.2	3/22/2007	65.5	5854.2	3/22/2007	No Access	
6/13/2007	89	5879.6	6/14/2007			6/14/2007	13	6095.7	6/13/2007			6/14/2007	48	6082.2	6/15/2007	66	5853.7	6/13/2007	No Access	
9/20/2007	90	5878.6	9/20/2007	51	6179.4	9/20/2007			9/18/2007	5	6281.7	9/18/2007	50	6084.2	9/18/2007	67	5852.7	9/18/2007		
12/10/2007	90	5878.6	12/11/2007			12/10/2007	18	6090.7	12/10/2007	5	6281.7	12/11/2007	45	6079.2	12/11/2007	66	5853.7	12/10/2007	No Access	
3/26/2008	90	5878.6	3/28/2008			3/28/2008	17	6091.7	3/26/2008	17	6269.7	3/26/2008	42	6076.2	3/28/2008	64	5855.7	3/26/2008	No Access	
6/24/2008	91	5877.6	6/24/2008			6/24/2008	17	6091.7	6/16/2008	18	6268.7	6/24/2008	40	6074.2	6/24/2008	65	5854.7	6/24/2008	No Access	
9/22/2008	91	5877.6	9/20/2008			9/22/2008	17	6091.7	9/18/2008	18	6268.7				9/18/2008	67	5852.7	9/30/2008		
12/12/2008	92.5	5876.1	12/12/2008			12/12/2008	18	6090.7	12/12/2008	16	6270.7	12/12/2008	43	6077.2	12/11/2008	67	5852.7	12/11/2008	No Access	
																		2/19/2009	No Access	
6/3/2009	92	5876.6				6/3/2009	18	6090.7	6/4/2009	51	6235.7				6/30/2009	67	5852.7	6/4/2009	No Access	
12/15/2009	93	5875.6	12/14/2009	No Access		12/14/2009	18	6090.7	7/14/2009						12/15/2009	67	5852.7	12/14/2009	No Access	
12/29/2009	93	5875.6	12/29/2009	No Access		12/29/2009	18	6090.7				12/14/2009	45	6079.2	12/29/2009	67	5852.7	12/29/2009	No Access	
3/25/2010	93	5875.6	3/24/2010	No Access		3/25/2010	18	6090.7				3/25/2010		6034.2	3/26/2010	66	5853.7	3/24/2010	No Access	
6/22/2010	92	5876.6	6/22/2010	No Access		6/23/2010	18	6090.7	6/23/2010	59	6227.7	6/23/2010	59	6093.2				6/21/2010	No Access	
7/20/2010	92	5876.6	7/20/2010	No Access		7/20/2010	18	6090.7	7/19/2010	98	6188.7	7/19/2010	57	6091.2	7/19/2010	67	5852.7	7/20/2010	No Access	
11/24/2010	92	5876.6	11/24/2010	No Access		10/15/2010	18	6090.8	10/15/2010	100	6186.7	10/15/2010	60	6094.2	10/15/2010	67	5852.7			
3/28/2011	96.7	5871.9	3/29/2011	No Access		3/29/2011	18.0	6090.70	3/28/2011	0	6286.7	3/25/2011	114	6148.2	3/29/2011	66.5	5853.20			
6/8/2011	92.4	5876.2	6/21/2011	No Access		6/8/2011	18.0	6090.70	6/8/2011	0	6286.7	6/21/2011	112	6146.2	6/21/2011	65.7	5854.00			
9/28/2011	96	5872.6	9/27/2011	No Access		9/27/2011	18.5	6090.20	9/22/2011	0	6286.7	9/27/2011	110	6144.2	9/20/2011	66.5	5853.20			
12/12/2011	98	5870.6	12/12/2011	0.0	6230.40	12/12/2011	19.0	6089.70	12/12/2011	No Access		12/13/2011	100	6134.2	12/13/2011	66.5	5853.20			
3/16/2012	101	5867.6	3/21/2012	109.0	6121.40	3/21/2012	17.5	6091.20	3/15/2012	0	6286.7	3/21/2012	40	6074.2	3/21/2012	67.0	5852.70			
									6/20/2012	11	6275.7	6/20/2012	40	6074.2						
									8/20/2012	0	6286.7	9/6/2012	41	6075.2						
									11/7/2012	0	6286.7	11/6/2012	42	6076.2						
									3/21/2013	11	6275.7	3/28/2013	172	6206.2						
									6/4/2013	0	6286.7	6/5/2013	170	6204.2						
									9/24/2013			9/19/2013	170	6204.2						
									12/17/2013	0	6286.7	12/6/2013	170	6204.2						
									3/14/2014	0	6286.7	3/19/2014	190	6224.2						
									6/26/2014	0	6286.7	6/9/2014								
									9/19/2014	0	6286.7	9/15/2014	190	6224.2						
									12/9/2014	0	6286.7	12/5/2014	0	6034.2						
									3/16/2015			3/13/2015	0	6034.2						
									5/18/2015	-27.72	6314.42	5/21/2015	-46.2	6080.4						
									9/1/2015	27.7	6259	9/2/2015	-46.2	6080.4						
									12/29/2015			12/3/2015	-46.2	6080.4						

APPENDIX VI-12

UPDES Monitoring Data

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	4/13/1981						8.5	6	<0.5							0.01													
UPDES	UT0022616-001	5/18/1981						8.4	35	1.6							<0.03								403.2		12.6	195		<0.002
UPDES	UT0022616-001	6/23/1981						8.2	212.5	3.8																				
UPDES	UT0022616-001	6/23/1981						8.2	127	0.6																				
UPDES	UT0022616-001	7/1/1981								<0.5							7.5								272.6		6.9	184		0.065
UPDES	UT0022616-001	7/1/1981								1							9.35								280.6		<1.	175		0.055
UPDES	UT0022616-001	7/17/1981						8.4	1	<0.5																				
UPDES	UT0022616-001	8/20/1981								<0.5							0.23								422		<1.	154		0.047
UPDES	UT0022616-001	9/28/1981						8.3	9	1.4																				
UPDES	UT0022616-001	10/30/1981						8.4	195	<0.5																				
UPDES	UT0022616-001	11/30/1981						8.5	10	<0.5																				
UPDES	UT0022616-001	12/29/1981						8.2	4																490		<1.	196		<0.002
UPDES	UT0022616-001	1/30/1982						8.1	6	<0.5																				
UPDES	UT0022616-001	2/23/1982						8.1	17	2.6																				
UPDES	UT0022616-001	3/16/1982	8.3	7.6	11.3	459	40	8.1	5.5																410		<1.	186		<0.002
UPDES	UT0022616-001	4/30/1982						8.0	256	<0.5																				
UPDES	UT0022616-001	5/28/1982						7.8	220	<0.5																				
UPDES	UT0022616-001	6/17/1982						8.2	20																368		<1.	184		<0.002
UPDES	UT0022616-001	7/28/1982						8.0	11	<0.5																				
UPDES	UT0022616-001	8/24/1982						8.1	10	<0.5																				
UPDES	UT0022616-001	9/17/1982						8.1	21																344		<1.	73.8		0.1
UPDES	UT0022616-001	11/16/1982						7.7	4.5	<0.5																				
UPDES	UT0022616-001	12/28/1982						7.5	4.5	<0.5															351		<1.	133		<0.01
UPDES	UT0022616-001	1/14/1983						7.6	5	<0.5																				
UPDES	UT0022616-001	2/17/1983						7.6	4	<0.5																				
UPDES	UT0022616-001	3/15/1983						8.1	3	<0.5															314		<1.	104		0.099
UPDES	UT0022616-001	4/26/1983						8.0	2.5	<0.5																				
UPDES	UT0022616-001	5/26/1983						8.0	2	1.2																				
UPDES	UT0022616-001	6/22/1983						8.3	5																			170		0.042
UPDES	UT0022616-001	7/21/1983						8.15	3.5	0.5																				
UPDES	UT0022616-001	8/17/1983						8.2	0.5	<0.5																				
UPDES	UT0022616-001	9/19/1983						8.3	3	<0.5																				
UPDES	UT0022616-001	10/20/1983						8.35	1	<0.5																				
UPDES	UT0022616-001	11/21/1983						8.4	10	<0.5																				
UPDES	UT0022616-001	12/13/1983						8.4	<0.5	<0.5															440		<1.	97		0.56
UPDES	UT0022616-001	3/12/1984						8.4	4	1.2																				
UPDES	UT0022616-001	3/16/1984						8.2	4																415		<1.	109		0.16
UPDES	UT0022616-001	6/13/1984						7.6	16	<0.5																				
UPDES	UT0022616-001	8/28/1984						7.8	5	<0.5																				
UPDES	UT0022616-001	8/28/1984						8.4	6																					
UPDES	UT0022616-001	9/3/1984						8.25	6																					
UPDES	UT0022616-001	9/19/1984						8.3	6	<0.5																				
UPDES	UT0022616-001	10/10/1984						7.7	11	0.5																				
UPDES	UT0022616-001	10/10/1984						8.2	4																					
UPDES	UT0022616-001	11/29/1984						7.7	8	0.7																				
UPDES	UT0022616-001	12/3/1984						8.25	1																					
UPDES	UT0022616-001	12/18/1984						7.6	1	<0.5																				
UPDES	UT0022616-001	12/18/1984						8.2	1																					
UPDES	UT0022616-001	1/7/1985						8.3	7																					
UPDES	UT0022616-001	1/17/1985						8.3	2																					
UPDES	UT0022616-001	1/17/1985						7.8	3	<0.5							<0.05													
UPDES	UT0022616-001	2/25/1985						7.25	15	<0.5																				
UPDES	UT0022616-001	3/25/1985						8.2	6	<0.5																				
UPDES	UT0022616-001	4/30/1985						7.95	5	<0.5																				
UPDES	UT0022616-001	5/28/1985						7.5	5	<0.5																				
UPDES	UT0022616-001	6/24/1985						7.9	6.5	0.9																				
UPDES	UT0022616-001	7/31/1985						7.8	1	3																				
UPDES	UT0022616-001	8/26/1985						8.2	7	<0.5																				
UPDES	UT0022616-001	9/19/1985						7.9	<0.5	<0.5																				
UPDES	UT0022616-001	10/24/1985							6	<0.5																				
UPDES	UT0022616-001	11/30/1985						8.3	6																					
UPDES	UT0022616-001	1/15/1986						8.1	18	<0.5																				
UPDES	UT0022616-001	2/26/1986						8.0	15	<0.5																				
UPDES	UT0022616-001	3/12/1986						7.6	15	<0.5																				
UPDES	UT0022616-001	4/10/1986						7.75	19	<0.5																				
UPDES	UT0022616-001	5/28/1986						7.2	17	<0.5																				
UPDES	UT0022616-001	6/19/1986						7.8	<0.5	<0.5																				
UPDES	UT0022616-001	6/26/1986						8.08	18																					
UPDES	UT0022616-001	6/27/1986						7.94	10																					
UPDES	UT0022616-001	6/30/1986						7.95	8																					
UPDES	UT0022616-001	9/30/1986						7.95	7	1.2																				
UPDES	UT0022616-001	2/1/1987					0																							

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	4/13/1981			1975					4149						0.03	0.02		
UPDES	UT0022616-001	5/18/1981	<0.002		2222.1	0.031	415.8	575.9		4304						0.3	0.28	46.8	
UPDES	UT0022616-001	6/23/1981			1646					3555						0.33	0.02		
UPDES	UT0022616-001	6/23/1981			1909.4					3963						0.53	0.03		
UPDES	UT0022616-001	7/1/1981	0.01			<0.002	279.5	771.2										101.5	
UPDES	UT0022616-001	7/1/1981	0.01			0.027	280.6	861.1										102	
UPDES	UT0022616-001	7/17/1981			1810					3804						0.1	0.11		
UPDES	UT0022616-001	8/20/1981	0.017			0.094	422	838						28.1	16.5			72	
UPDES	UT0022616-001	9/28/1981			1563					2783						0.48	0.11		
UPDES	UT0022616-001	10/30/1981			2111					3507						0.57	0.07		
UPDES	UT0022616-001	11/30/1981			2259					3546						0.3	0.08		
UPDES	UT0022616-001	12/29/1981	<0.002	0.002	2022			1729	4800	3762				46.4	57.2	0.07	0.08	127	
UPDES	UT0022616-001	1/30/1982			2140				5000	3770						0.44	0.15		
UPDES	UT0022616-001	2/23/1982			2000				5100	3734						0.3	0.1		
UPDES	UT0022616-001	3/16/1982	<0.002	0.008	2066			874	4780	3764				49.4	56.2	0.24	0.08	99	
UPDES	UT0022616-001	4/30/1982			1662				3460	2719						0.44	0.14		
UPDES	UT0022616-001	5/28/1982			1494				4000	2683						0.47	0.1		
UPDES	UT0022616-001	6/17/1982	<0.002	<0.002	1646			936	4490	2822				45.1	46.8	0.22	0.06	100	
UPDES	UT0022616-001	7/28/1982			1363				4000	3036						0.43	0.07		
UPDES	UT0022616-001	8/24/1982			1000				2100	1393						0.41	0.06		
UPDES	UT0022616-001	9/17/1982	<0.01	<0.01	2000			1152	4320	3138						0.21	0.06	110	
UPDES	UT0022616-001	11/16/1982			1500				4140	2891						0.21	0.07		
UPDES	UT0022616-001	12/28/1982	<0.01	<0.01	1550			882	4290	2942				39.5	43.1	0.23	0.05	93	
UPDES	UT0022616-001	1/14/1983			1200				4100	2380						0.2	0.06		
UPDES	UT0022616-001	2/17/1983			2200				4610	3031						0.31	0.09		
UPDES	UT0022616-001	3/15/1983	<0.01	0.01	1770			681	4150	3074				47.3	46.1	0.3	0.12	100	
UPDES	UT0022616-001	4/26/1983			2600				4850	3552						0.07	0.03		
UPDES	UT0022616-001	5/26/1983			400				4300	3085						0.1	0.01		
UPDES	UT0022616-001	6/22/1983	0.018	0.07	1800		344	794	4600	3330				47.75	49.15	0.06	0.01	119	
UPDES	UT0022616-001	7/21/1983			2400				4550	3156						0.12	<0.01		
UPDES	UT0022616-001	8/17/1983			1050				4900	3231						0.08	<0.01		
UPDES	UT0022616-001	9/19/1983			2100				4600	3034						0.08	0.02		
UPDES	UT0022616-001	10/20/1983			2400				4500	3129						0.05	0.01		
UPDES	UT0022616-001	11/21/1983			1950				3800	2738						<0.05	0.03		
UPDES	UT0022616-001	12/13/1983		<0.01	1650		361	785	4200	3059				43.77	44.31	<0.05	0.01	113	
UPDES	UT0022616-001	3/12/1984			1800				4000	3152						0.05	<0.01		
UPDES	UT0022616-001	3/16/1984		<0.01	1650		340	755	3800	3136				45.73	45.74	<0.05	<0.01	117	
UPDES	UT0022616-001	6/13/1984							4300	3065						<0.05			
UPDES	UT0022616-001	8/28/1984							4100	3003						0.1			
UPDES	UT0022616-001	8/28/1984								3136						<0.2			
UPDES	UT0022616-001	9/3/1984								3150						<0.2			
UPDES	UT0022616-001	9/19/1984							4050	3052						<0.05			
UPDES	UT0022616-001	10/10/1984							4000	3016						<0.05	<0.01		
UPDES	UT0022616-001	10/10/1984								3010						<0.2	<0.2		
UPDES	UT0022616-001	11/29/1984							3900	3159						0.15	0.02		
UPDES	UT0022616-001	12/3/1984								3106						<0.2	<0.2		
UPDES	UT0022616-001	12/18/1984							4000	3000						0.06	<0.01		
UPDES	UT0022616-001	12/18/1984								3084						<0.2	<0.2		
UPDES	UT0022616-001	1/7/1985								3200						<0.2	<0.2		
UPDES	UT0022616-001	1/17/1985								3000						<0.2	<0.2		
UPDES	UT0022616-001	1/17/1985							4000	2932						4.44	<0.01		
UPDES	UT0022616-001	2/25/1985							3650	3063						0.08	0.02		
UPDES	UT0022616-001	3/25/1985							5150	3070						0.2	<0.01		
UPDES	UT0022616-001	4/30/1985							3900	2917						<0.05	<0.01		
UPDES	UT0022616-001	5/28/1985							4100	3051						0.08	0.03		
UPDES	UT0022616-001	6/24/1985							4100	2942						0.07	<0.01		
UPDES	UT0022616-001	7/31/1985							3750	2438						0.09	0.1		
UPDES	UT0022616-001	8/26/1985							3980	2947						0.16	<0.01		
UPDES	UT0022616-001	9/19/1985							3650	2913						0.05	0.01		
UPDES	UT0022616-001	10/24/1985								2988						0.05	<0.01		
UPDES	UT0022616-001	11/30/1985								3062						<0.2	<0.2		
UPDES	UT0022616-001	1/15/1986							4000	2828						0.18	0.02		
UPDES	UT0022616-001	2/26/1986							3500	2557						0.21	0.02		
UPDES	UT0022616-001	3/12/1986							3920	2534						0.14	0.01		
UPDES	UT0022616-001	4/10/1986							3625	2546						0.06	<0.01		
UPDES	UT0022616-001	5/28/1986							3980	2808						0.13	0.02		
UPDES	UT0022616-001	6/19/1986							3800	2738						0.11	0.02		
UPDES	UT0022616-001	6/26/1986								2796						<0.2	<0.2		
UPDES	UT0022616-001	6/27/1986								2836						<0.2	<0.2		
UPDES	UT0022616-001	6/30/1986								2836						<0.2	<0.2		
UPDES	UT0022616-001	9/30/1986							5050	3756						0.05	0.02		
UPDES	UT0022616-001	2/1/1987																	

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	2/26/1987					13	7.91	34	<2.																				
UPDES	UT0022616-001	3/10/1989						7.6	8	<1.																				
UPDES	UT0022616-001	4/17/1989						7.6	<2.	<1.																				
UPDES	UT0022616-001	7/31/1989						7.88	3																					
UPDES	UT0022616-001	9/6/1989						7.86	7																					
UPDES	UT0022616-001	9/11/1989		7.7				8.6	10	1																				
UPDES	UT0022616-001	10/4/1989						8.29	5																					
UPDES	UT0022616-001	10/31/1989						7.8	<2.	<1.																				
UPDES	UT0022616-001	11/21/1989						8.1	4	<1.																				
UPDES	UT0022616-001	12/4/1989						7.87	13																					
UPDES	UT0022616-001	12/13/1989						7.9	12	<1.																				
UPDES	UT0022616-001	1/2/1990						7.79	12																					
UPDES	UT0022616-001	1/10/1990						7.6	6	<1.																				
UPDES	UT0022616-001	2/7/1990						8.02	1																					
UPDES	UT0022616-001	2/22/1990						8.4	8	1																				
UPDES	UT0022616-001	3/5/1990						8.06	1																					
UPDES	UT0022616-001	3/12/1990						8.1	12	<1.																				
UPDES	UT0022616-001	3/22/1990							8	<1.	0.45	0.004	0.78	<0.005	152	<0.01	0.47	<0.02	141	0.04	8	<0.001	902	<0.01	430			114		
UPDES	UT0022616-001	4/6/1990						8.12	4																					
UPDES	UT0022616-001	4/18/1990						8.2	<2.	1																				
UPDES	UT0022616-001	5/21/1990						8.1	2	<1.	0.42	0.003	0.74	<0.01	186	<0.01	0.07	<0.02	163	<0.01	7	<0.001	774	<0.01	436		16	120		
UPDES	UT0022616-001	6/1/1990						8.12	11																					
UPDES	UT0022616-001	6/14/1990						8.3	8	<1.																				
UPDES	UT0022616-001	7/12/1990						8.01	5																					
UPDES	UT0022616-001	7/20/1990						8.1	28	2																				
UPDES	UT0022616-001	8/1/1990						8.0	7																					
UPDES	UT0022616-001	8/13/1990						8.1	12	<1.																				
UPDES	UT0022616-001	9/20/1990						8.0	6	1																				
UPDES	UT0022616-001	10/1/1990					341	8.04	10																					
UPDES	UT0022616-001	10/17/1990					664	8.0	<2.	<1.																				
UPDES	UT0022616-001	11/6/1990						7.7	4	1																				
UPDES	UT0022616-001	12/19/1990						8.3	<2.	<1.																				
UPDES	UT0022616-001	1/2/1991						8.14	8																					
UPDES	UT0022616-001	1/14/1991						7.5	<2.	<1.																				
UPDES	UT0022616-001	2/1/1991						7.88	6																					
UPDES	UT0022616-001	2/27/1991						7.9	4	<1.																				
UPDES	UT0022616-001	3/6/1991						8.13	7																					
UPDES	UT0022616-001	3/20/1991						7.9	<2.	2																				
UPDES	UT0022616-001	4/4/1991					247	8.37	10																					
UPDES	UT0022616-001	4/18/1991					247	8.3	12	<1.																				
UPDES	UT0022616-001	5/1/1991					404	8.06	11																					
UPDES	UT0022616-001	5/14/1991						8.1	<2.	2603																				
UPDES	UT0022616-001	6/3/1991					135	8.24	4																					
UPDES	UT0022616-001	6/17/1991					377	8.0	8	1																				
UPDES	UT0022616-001	7/1/1991	18.9	7.6		5340	314	8.0	<2.																					
UPDES	UT0022616-001	7/10/1991						8.18	7																					
UPDES	UT0022616-001	8/5/1991						8.1	13																					
UPDES	UT0022616-001	8/14/1991						8.3	24	<1.																				
UPDES	UT0022616-001	9/5/1991						8.11	10																					
UPDES	UT0022616-001	9/30/1991						8.1	2	117																				
UPDES	UT0022616-001	10/1/1991					220	8.24	8																			122		
UPDES	UT0022616-001	10/14/1991	16.1	7.5		4730	76	8.0	2	2																				
UPDES	UT0022616-001	11/1/1991					0																							
UPDES	UT0022616-001	12/30/1991					157	8.1	13																			90		
UPDES	UT0022616-001	12/31/1991	8.2	6.7		3860	117	7.6	<2.	1																				
UPDES	UT0022616-001	1/2/1992					220	8.05	10																			100		
UPDES	UT0022616-001	1/24/1992					404	7.9	10	9																				
UPDES	UT0022616-001	2/3/1992					732	7.8	6																					
UPDES	UT0022616-001	2/18/1992					40	8.1	8	9																				
UPDES	UT0022616-001	3/2/1992					99	8.1	4																					
UPDES	UT0022616-001	3/31/1992					341	7.9	18	<1.																				
UPDES	UT0022616-001	4/7/1992	13.7	7.2		4510	229	8.2	16																					
UPDES	UT0022616-001	4/28/1992	19.8	7.5		5360	678	8.0	4	<1.																				
UPDES	UT0022616-001	7/15/1992	21.3	7.1		5490	714	8.2	10	<1.																				
UPDES	UT0022616-001	8/3/1992	25.3	7.7		4800	117	8.3	38																					
UPDES	UT0022616-001	8/18/1992	22.5	6.9		4600	350	8.3	18	<1.																				
UPDES	UT0022616-001	9/2/1992	18.2	7.1		4760	799	8.1	2																					
UPDES	UT0022616-001	9/16/1992	20	7.2		4100	633	8.1	14	2																				
UPDES	UT0022616-001	10/5/1992	14.5	7.2		4370	889	8.2	16																					
UPDES	UT0022616-001	11/1/1992					0																							
UPDES	UT0022616-001	12/8/1992	4	7.2		3260	1073	7.5	20																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	2/26/1987							4490	3380						0.1	0.02		
UPDES	UT0022616-001	3/10/1989							3830	2880						0.73	0.05		
UPDES	UT0022616-001	4/17/1989							3630	3004						0.36	0.05		
UPDES	UT0022616-001	7/31/1989								3262						<0.2	<0.2		
UPDES	UT0022616-001	9/6/1989			1907					3150						0.7	<0.2		
UPDES	UT0022616-001	9/11/1989							4400	3326						0.43	0.02		
UPDES	UT0022616-001	10/4/1989			956					3378						<0.2	<0.2		
UPDES	UT0022616-001	10/31/1989							3710	3376						0.65	0.03		
UPDES	UT0022616-001	11/21/1989							4020	3518						0.78	0.03		
UPDES	UT0022616-001	12/4/1989			1984					3466						0.45	<0.2		
UPDES	UT0022616-001	12/13/1989							4340	3408						0.14	0.01		
UPDES	UT0022616-001	1/2/1990			1952					3306						0.5	<0.2		
UPDES	UT0022616-001	1/10/1990							4330	3492						0.66	0.06		
UPDES	UT0022616-001	2/7/1990			1987					3506						<0.2	<0.2		
UPDES	UT0022616-001	2/22/1990							4230	3524						0.55	0.02		
UPDES	UT0022616-001	3/5/1990			2101					3462						0.28	<0.2		
UPDES	UT0022616-001	3/12/1990							4350	3566						0.57	0.05		
UPDES	UT0022616-001	3/22/1990		<0.1	2140		430	958		3624	<0.2	<0.05	<0.05	59.06	56.73	0.48	0.05	142	
UPDES	UT0022616-001	4/6/1990			2056					3510						0.23	<0.2		
UPDES	UT0022616-001	4/18/1990							4250	3604						0.31	0.04		
UPDES	UT0022616-001	5/21/1990			2256		452	1133	4810	3722	<0.3	<0.05	<0.05	56.9	59.78	0.43	0.03		
UPDES	UT0022616-001	6/1/1990			2014					3602						0.22	<0.2		
UPDES	UT0022616-001	6/14/1990							4570	3820						0.41	0.01		
UPDES	UT0022616-001	7/12/1990			2207					3948						0.28	<0.2		
UPDES	UT0022616-001	7/20/1990							4730	3912						0.52	0.02		
UPDES	UT0022616-001	8/1/1990			2309					4022						0.29	<0.2		
UPDES	UT0022616-001	8/13/1990							4690	3988						0.25	<0.01		
UPDES	UT0022616-001	9/20/1990							4740	3920						0.24	<0.01		
UPDES	UT0022616-001	10/1/1990			2218					3854						<0.2	<0.2		
UPDES	UT0022616-001	10/17/1990							4720	3988						0.91	0.02		
UPDES	UT0022616-001	11/6/1990							4880	4044						0.62	0.02		
UPDES	UT0022616-001	12/19/1990							5111	3850						0.71	0.06		
UPDES	UT0022616-001	1/2/1991								3878						0.56	<0.2		
UPDES	UT0022616-001	1/14/1991							4590	3788						0.69	0.09		
UPDES	UT0022616-001	2/1/1991			2148					3724						<0.2	<0.2		
UPDES	UT0022616-001	2/27/1991							4120	3916						0.5	0.02		
UPDES	UT0022616-001	3/6/1991			2278					3878						0.28	<0.2		
UPDES	UT0022616-001	3/20/1991							4520	3866						0.47	0.01		
UPDES	UT0022616-001	4/4/1991			2208					3882						<0.2	<0.2		
UPDES	UT0022616-001	4/18/1991							4900	4170						0.54	<0.01		
UPDES	UT0022616-001	5/1/1991								3856						<0.2	<0.2		
UPDES	UT0022616-001	5/14/1991							5220	3754						0.35	0.01		
UPDES	UT0022616-001	6/3/1991			2209					3822						0.35	<0.2		
UPDES	UT0022616-001	6/17/1991							4540	3932						0.4	<0.01		
UPDES	UT0022616-001	7/1/1991							4830	4072						0.74	0.04		
UPDES	UT0022616-001	7/10/1991			2201					3922						0.46	<0.2		
UPDES	UT0022616-001	8/5/1991			2229				4604	3852						0.5	<0.2		
UPDES	UT0022616-001	8/14/1991							3870	3874						0.52	0.03		
UPDES	UT0022616-001	9/5/1991			2169					3938						0.61	<0.2		
UPDES	UT0022616-001	9/30/1991							4600	3712						0.62	<0.01		
UPDES	UT0022616-001	10/1/1991			2176		440		4400	3666						<0.2	<0.2	141	
UPDES	UT0022616-001	10/14/1991							4820	3758						0.51	<0.01		
UPDES	UT0022616-001	11/1/1991																	
UPDES	UT0022616-001	12/30/1991			2166		341			4004						1.04	<0.2	143	
UPDES	UT0022616-001	12/31/1991							4740	3902						1.81	0.13		
UPDES	UT0022616-001	1/2/1992			2177		393			3962						0.81	<0.2	144	
UPDES	UT0022616-001	1/24/1992							5710	3972						1.39	0.14		
UPDES	UT0022616-001	2/3/1992							4930	3822						1.48	0.11		
UPDES	UT0022616-001	2/18/1992							5230	3860						0.72	0.03		
UPDES	UT0022616-001	3/2/1992							4860	3950						0.88	0.03		
UPDES	UT0022616-001	3/31/1992							4850	3820						1.03	0.07		
UPDES	UT0022616-001	4/7/1992							4670	3790						0.82	0.04		
UPDES	UT0022616-001	4/28/1992							4500	3930						0.53	0.03		
UPDES	UT0022616-001	7/15/1992							4090	3246						0.64	0.02		
UPDES	UT0022616-001	8/3/1992							4580	4012						0.64	0.03		
UPDES	UT0022616-001	8/18/1992							4470	4080						0.6	0.02		
UPDES	UT0022616-001	9/2/1992							5110	3960						0.78	<0.01		
UPDES	UT0022616-001	9/16/1992							4240	3802						0.38	<0.01		
UPDES	UT0022616-001	10/5/1992							4820	3910						0.58	<0.01		
UPDES	UT0022616-001	11/1/1992																	
UPDES	UT0022616-001	12/8/1992							5350	3950						1.5	0.13		

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	12/14/1992	6.6	6.5		4500	835	7.9	20	<1.																				
UPDES	UT0022616-001	1/11/1993	6.5	6.6		4200	633	7.2	8																					
UPDES	UT0022616-001	1/18/1993	9.7	7.5		4400	539	7.8	16	<1.																				
UPDES	UT0022616-001	2/1/1993	9.4	7.1		4200	633	8.0	8	1																				
UPDES	UT0022616-001	2/16/1993	8.1	7.7		3800	404	8.0	<2.																					
UPDES	UT0022616-001	3/2/1993	11.6	6.9		4700	278	8.1	14	3																				
UPDES	UT0022616-001	3/15/1993	12.5	7		4800	664	8.0	4																					
UPDES	UT0022616-001	4/5/1993	13.3	7		4450	507	8.6	6	1																				
UPDES	UT0022616-001	4/19/1993	10.8	7		4800	404	8.2	4																					
UPDES	UT0022616-001	5/3/1993	17.4	8.3		5000	341	8.1	2	<1.																				
UPDES	UT0022616-001	6/1/1993					0																							
UPDES	UT0022616-001	7/12/1993	19.5	8.7		5630	539	8.1	4	1																				
UPDES	UT0022616-001	7/19/1993	22.9	8.7		5920	633	8.2	24																					
UPDES	UT0022616-001	8/9/1993	21.3	10.2		5650	476	8.2	8	3																				
UPDES	UT0022616-001	8/16/1993	20.2	8.3		5450	565	8.3	14																					
UPDES	UT0022616-001	9/1/1993					0																							
UPDES	UT0022616-001	10/11/1993	12.2	8.8		4800	476	7.9	12	<1.																				
UPDES	UT0022616-001	10/20/1993	13	9.1		4300	696	8.2	10																					
UPDES	UT0022616-001	11/1/1993	8.7	8.6		4000	696	8.3	4	2																				
UPDES	UT0022616-001	11/22/1993	6.3	8.8		3900	449	8.2	2																					
UPDES	UT0022616-001	12/7/1993	6.9	7.7		4200	476	8.0	2	<1.																				
UPDES	UT0022616-001	12/20/1993	6.3	8.4		3800	633	7.9	<2.																					
UPDES	UT0022616-001	1/3/1994	7.5	8.3		4200	732	7.7	<2.	<1.																				
UPDES	UT0022616-001	1/17/1994	8.2	8.3		4200	552	8.1	<2.																					
UPDES	UT0022616-001	2/2/1994	4.8	8.4		4100	404	8.1	14	1																				
UPDES	UT0022616-001	2/14/1994	6	8.3		4200	220	8.1	20																					
UPDES	UT0022616-001	3/1/1994	9.7	8.2		4300	462	8.3	<2.	<1.																				
UPDES	UT0022616-001	3/21/1994	14.4	8.1		4480	714	8.4	<2.																					
UPDES	UT0022616-001	4/4/1994	11.4	7.3		4420	664	8.0	<2.	<1.																				
UPDES	UT0022616-001	4/18/1994	18.1	8		5020	184	8.3	<2.																					
UPDES	UT0022616-001	5/4/1994	16.5	7.8		4450	633	8.1	24	<1.																				
UPDES	UT0022616-001	5/16/1994	19.1	8.1		4880	278	8.3	8																					
UPDES	UT0022616-001	6/1/1994	22.3	7.8		5610	476	8.2	2	<1.																				
UPDES	UT0022616-001	6/20/1994	22	7.9		5640	220	8.3	18																					
UPDES	UT0022616-001	8/1/1994	20.1	8.2		5520	220	8.3	6	<1.																				
UPDES	UT0022616-001	8/15/1994	22.9	7.9		5740	278	8.4	4																					
UPDES	UT0022616-001	9/6/1994	20.2	7.6		5400	242	8.4	10	38																				
UPDES	UT0022616-001	9/19/1994	19.7	8.1		5160	341	8.3	<2.																					
UPDES	UT0022616-001	10/3/1994	16	7.9		4720	364	8.1	4	<1.																				
UPDES	UT0022616-001	10/17/1994	13.6	8.2		4540	278	8.3	16																					
UPDES	UT0022616-001	11/1/1994						8.3	<5.	32																				
UPDES	UT0022616-001	11/14/1994	8	7.7		3910	341	7.8	<5.																					
UPDES	UT0022616-001	1/3/1995	6.1	8.2		3850	341	7.9	<5.																					
UPDES	UT0022616-001	2/1/1995					0																							
UPDES	UT0022616-001	3/7/1995	10.1	7.5		4200	422		<10.								<0.1													
UPDES	UT0022616-001	3/20/1995	14.8	7.3		4840	422		<5.																					
UPDES	UT0022616-001	4/3/1995	13.5	7.2		4510	390		5																					
UPDES	UT0022616-001	4/24/1995	14.1	7.1		4740	364		<5.																					
UPDES	UT0022616-001	5/1/1995	17.4	7.4		4900	364		10																					
UPDES	UT0022616-001	5/15/1995	16.6	7.5		4900	341		<5.																					
UPDES	UT0022616-001	6/5/1995	20.7	7.8			341		10																					
UPDES	UT0022616-001	6/19/1995	17.7	7.4		5460	301		<5.																					
UPDES	UT0022616-001	7/11/1995	22	7.5		5850	197		5																					
UPDES	UT0022616-001	7/25/1995	23.2	7.6		6100	220		10																					
UPDES	UT0022616-001	8/1/1995	23.5	7.8		6280	197		<5.																					
UPDES	UT0022616-001	8/3/1995	25.3	7.7		4800	117	8.3	38																					
UPDES	UT0022616-001	8/15/1995	23.6	7.7		6310	220		5																					
UPDES	UT0022616-001	9/5/1995	21.5	7		5650	197		10																					
UPDES	UT0022616-001	9/18/1995	19	7.3		5630	197		<5.																					
UPDES	UT0022616-001	10/2/1995	16.1	7.5		5060	206		5																					
UPDES	UT0022616-001	10/24/1995	8.9	7.3		4310	90		<5.																					
UPDES	UT0022616-001	11/6/1995	10.8	8		5090	76		10																					
UPDES	UT0022616-001	11/15/1995	10.3	8.1		5430	117		<5.																					
UPDES	UT0022616-001	12/6/1995	8.3	7.7		4830	9.0																							
UPDES	UT0022616-001	1/1/1996					0																							
UPDES	UT0022616-001	2/27/1996	6.9	8.1		4450	1055		8																					
UPDES	UT0022616-001	2/29/1996	8.5	8.1		4720	978		<5.																					
UPDES	UT0022616-001	3/4/1996	9.5	8.1		4690	197		<5.																					
UPDES	UT0022616-001	3/28/1996	11.4	7.6		5150	633		<5.																					
UPDES	UT0022616-001	4/2/1996	11.4	8.1		5130	678		5																					
UPDES	UT0022616-001	4/22/1996	14.1	8		5250	732		5																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	12/14/1992							4510	4126						1.66	0.12		
UPDES	UT0022616-001	1/11/1993							4550	3958						0.93	0.12		
UPDES	UT0022616-001	1/18/1993							4570	3944						0.67	0.1		
UPDES	UT0022616-001	2/1/1993							4270	3908						0.58	0.04		
UPDES	UT0022616-001	2/16/1993							4830	4162						0.44	0.03		
UPDES	UT0022616-001	3/2/1993							5380	4068						0.34	0.02		
UPDES	UT0022616-001	3/15/1993							4650	4040						0.44	0.05		
UPDES	UT0022616-001	4/5/1993							4410	4074						0.73	0.04		
UPDES	UT0022616-001	4/19/1993							4570	4100						0.77	0.04		
UPDES	UT0022616-001	5/3/1993							4490	4172						0.53	0.03		
UPDES	UT0022616-001	6/1/1993																	
UPDES	UT0022616-001	7/12/1993							5900	4212						0.49	0.02		
UPDES	UT0022616-001	7/19/1993							5100	4140						0.46	0.02		
UPDES	UT0022616-001	8/9/1993							6020	4030						0.38	0.00012		
UPDES	UT0022616-001	8/16/1993							5420	4118						0.69	0.1		
UPDES	UT0022616-001	9/1/1993																	
UPDES	UT0022616-001	10/11/1993							5030	4006						0.84	0.06		
UPDES	UT0022616-001	10/20/1993							4830	3834						0.76	0.04		
UPDES	UT0022616-001	11/1/1993							4960	4058						0.57	<0.01		
UPDES	UT0022616-001	11/22/1993							4880	4242						0.58	0.02		
UPDES	UT0022616-001	12/7/1993							5030	4090						0.66	0.05		
UPDES	UT0022616-001	12/20/1993							5090	4092						0.68	0.05		
UPDES	UT0022616-001	1/3/1994							4990	3970						0.77	0.09		
UPDES	UT0022616-001	1/17/1994							5030	4076						0.41	0.04		
UPDES	UT0022616-001	2/2/1994							5040	4024						0.38	0.02		
UPDES	UT0022616-001	2/14/1994							4830	3996						0.24	<0.01		
UPDES	UT0022616-001	3/1/1994							5040	4012						0.35	0.02		
UPDES	UT0022616-001	3/21/1994							5070	4020						0.22	<0.01		
UPDES	UT0022616-001	4/4/1994							4940	4174						0.48	0.01		
UPDES	UT0022616-001	4/18/1994							5150	4114						0.52	0.01		
UPDES	UT0022616-001	5/4/1994							5090	4028						0.58	0.03		
UPDES	UT0022616-001	5/16/1994							5200	2100						0.2	<0.01		
UPDES	UT0022616-001	6/1/1994							5250	4166						0.15	<0.01		
UPDES	UT0022616-001	6/20/1994							5300	4328						0.16	<0.01		
UPDES	UT0022616-001	8/1/1994							5360	4422						0.13	0.02		
UPDES	UT0022616-001	8/15/1994							5260	4366						0.1	<0.01		
UPDES	UT0022616-001	9/6/1994							5330	4226						0.25	<0.01		
UPDES	UT0022616-001	9/19/1994							5310	4314						0.24	<0.01		
UPDES	UT0022616-001	10/3/1994							5200	4140						0.13	<0.01		
UPDES	UT0022616-001	10/17/1994							5140	4170						<0.01	<0.01		
UPDES	UT0022616-001	11/1/1994							5160	4320						0.1	<0.005		
UPDES	UT0022616-001	11/14/1994							5210	4240						0.21	<0.005		
UPDES	UT0022616-001	1/3/1995							3300	2350						0.32	0.011		
UPDES	UT0022616-001	2/1/1995																	
UPDES	UT0022616-001	3/7/1995								4280									
UPDES	UT0022616-001	3/20/1995								4210						0.4			
UPDES	UT0022616-001	4/3/1995								4220						0.3			
UPDES	UT0022616-001	4/24/1995								4200						<0.1			
UPDES	UT0022616-001	5/1/1995								4190						0.2			
UPDES	UT0022616-001	5/15/1995								4180						0.6			
UPDES	UT0022616-001	6/5/1995								4370						<0.1			
UPDES	UT0022616-001	6/19/1995								4330						0.1			
UPDES	UT0022616-001	7/11/1995								4520						<0.1			
UPDES	UT0022616-001	7/25/1995								4470						<0.1			
UPDES	UT0022616-001	8/1/1995								4610						<0.1			
UPDES	UT0022616-001	8/3/1995							4580	4012						0.64	0.03		
UPDES	UT0022616-001	8/15/1995								4540						<0.1			
UPDES	UT0022616-001	9/5/1995								4560						0.1			
UPDES	UT0022616-001	9/18/1995								580						0.2			
UPDES	UT0022616-001	10/2/1995								4560						0.1			
UPDES	UT0022616-001	10/24/1995								4630						<0.1			
UPDES	UT0022616-001	11/6/1995								4590						<0.1			
UPDES	UT0022616-001	11/15/1995								4470						<0.1			
UPDES	UT0022616-001	12/6/1995																	
UPDES	UT0022616-001	1/1/1996																	
UPDES	UT0022616-001	2/27/1996								4514						1.4			
UPDES	UT0022616-001	2/29/1996								4496						1.6			
UPDES	UT0022616-001	3/4/1996								4484						1.2			
UPDES	UT0022616-001	3/28/1996								4470						0.69			
UPDES	UT0022616-001	4/2/1996								4485						0.63			
UPDES	UT0022616-001	4/22/1996								4347						0.81			

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	5/1/1996	17.5	8.1		5650	678		7																					
UPDES	UT0022616-001	5/20/1996	17.5	7.6		5850	696		9																					
UPDES	UT0022616-001	6/3/1996	21.5	7.9		6390	462		<5.																					
UPDES	UT0022616-001	6/18/1996	21.1	8.2		6560	301		<5.																					
UPDES	UT0022616-001	7/1/1996	22.6	8.2		6240	763		9																					
UPDES	UT0022616-001	7/16/1996	21.5	8.1		6190	476		<5.																					
UPDES	UT0022616-001	8/1/1996	21.6	7.8		6360	583		7																					
UPDES	UT0022616-001	8/19/1996	21	7.9		6250	364		<5.																					
UPDES	UT0022616-001	9/3/1996	21	8.1		6340	507		<5.																					
UPDES	UT0022616-001	9/16/1996	16.1	7.7		5530	301		8																					
UPDES	UT0022616-001	10/2/1996	15.9	7.7		5370	521		<5.																					
UPDES	UT0022616-001	10/15/1996	14.8	7.5		5350	664		<5.																					
UPDES	UT0022616-001	11/5/1996	9.5	7.9		4900	404		<5.																					
UPDES	UT0022616-001	11/19/1996	7.3	8		4700	422		<5.																					
UPDES	UT0022616-001	12/2/1996	5.9	8		4000	404		<5.																					
UPDES	UT0022616-001	12/16/1996	4.6	7.8		3950	404		<5.																					
UPDES	UT0022616-001	1/2/1997	6.5	7.9		4040	422		<5.																					
UPDES	UT0022616-001	1/16/1997	4.5	7.7		3850	597		<5.																					
UPDES	UT0022616-001	2/3/1997	6	7.5		3860	565		<5.																					
UPDES	UT0022616-001	2/19/1997	7.5	7.9		3910	220		5																					
UPDES	UT0022616-001	3/3/1997	8.1	7.6		4010	664		<5.																					
UPDES	UT0022616-001	3/3/1997	8.1	7.6		4010	664																							
UPDES	UT0022616-001	3/17/1997	13.2	8		4680	1.1		<5.																					
UPDES	UT0022616-001	4/1/1997	11.6	7.9		4560	242		<5.																					
UPDES	UT0022616-001	4/15/1997	13.1	7.5		4620	565		<5.																					
UPDES	UT0022616-001	5/1/1997	13.1	8		4660	664		5																					
UPDES	UT0022616-001	5/15/1997	18.3	8		4470	449		<5.																					
UPDES	UT0022616-001	6/2/1997	19.6	8.1		4930	229		<5.																					
UPDES	UT0022616-001	6/16/1997	17.9	7.9		4820	664		<5.																					
UPDES	UT0022616-001	7/1/1997	17.4	7.4		4790	76		5																					
UPDES	UT0022616-001	7/15/1997	20.6	7.7		4710	476		<5.																					
UPDES	UT0022616-001	8/1/1997	21.6	7.8		4650	435		<5.																					
UPDES	UT0022616-001	8/15/1997	20.4	7.6		4730	507		<5.																					
UPDES	UT0022616-001	9/3/1997	19.3	7.6		4740	646		<5.																					
UPDES	UT0022616-001	9/16/1997	18.1	7.6		4660	494		5																					
UPDES	UT0022616-001	10/1/1997	15.6	8		4790	521		<5.																					
UPDES	UT0022616-001	10/15/1997	9.3	7.7		4880	462		<5.																					
UPDES	UT0022616-001	11/3/1997	8.5	7.6		4910	422		5																					
UPDES	UT0022616-001	11/17/1997	5.5	7.5		4960	404		<5.																					
UPDES	UT0022616-001	12/1/1997	6.1	7.6		5050	597		8																					
UPDES	UT0022616-001	12/15/1997	4.8	7.8		5750	449		<5.																					
UPDES	UT0022616-001	1/2/1998	5.1	8		5110	633		<5.																					
UPDES	UT0022616-001	1/16/1998	5	8.2		4830	449		<5.																					
UPDES	UT0022616-001	2/2/1998	5.1	8.4		4890	422		<5.																					
UPDES	UT0022616-001	2/17/1998	6.4	8.3		4740	341		<4.																					
UPDES	UT0022616-001	3/2/1998	6.7	8.1		4790	265		<4.																					
UPDES	UT0022616-001	3/16/1998	10.5	8.2		4670	507		<4.																					
UPDES	UT0022616-001	4/2/1998	10.2	8.2		4690	1.3		<4.																					
UPDES	UT0022616-001	4/15/1998	9.7	8.3		4720	287		<4.																					
UPDES	UT0022616-001	5/1/1998	15.3	7.6		4660	301																							
UPDES	UT0022616-001	5/18/1998	14.3	8.2		4740	314		<4.																					
UPDES	UT0022616-001	5/27/1998	15.5	7.8		4740	390		<4.																					
UPDES	UT0022616-001	6/1/1998	17.4	7.6		4630	377		<4.																					
UPDES	UT0022616-001	6/15/1998	16	7.8		4970	22		<5.																					
UPDES	UT0022616-001	7/1/1998	21.4	7.7		4940	265		<5.																					
UPDES	UT0022616-001	7/17/1998	23.1	7.9		4880	278		<5.																					
UPDES	UT0022616-001	8/3/1998	21.1	7.7		4860	364		<5.																					
UPDES	UT0022616-001	8/17/1998	21.2	7.5		4930	377		6																					
UPDES	UT0022616-001	9/1/1998	20.7	7.6		4820	220		6																					
UPDES	UT0022616-001	9/1/1998	20.7	7.6		4820	220																							
UPDES	UT0022616-001	9/9/1998	20.4	7.7		4670	350		6																					
UPDES	UT0022616-001	10/23/1998	8.2	7.5		4760	364		<5.																					
UPDES	UT0022616-001	10/29/1998	10.2	7.6		4810	714		<5.																					
UPDES	UT0022616-001	11/9/1998	7.8	7.6		4790	364		<5.																					
UPDES	UT0022616-001	11/23/1998	7.1	7.3		4900	476		<5.																					
UPDES	UT0022616-001	12/1/1998	5.6	7.2		4910	664		12																					
UPDES	UT0022616-001	12/15/1998	4.9	7.9		5070	507		5																					
UPDES	UT0022616-001	1/4/1999	5.3	7.9		5050	287		<5.																					
UPDES	UT0022616-001	1/19/1999	5.8	8		5240	390		<5.																					
UPDES	UT0022616-001	2/1/1999	5.2	8.2		5210	507		<5.																					
UPDES	UT0022616-001	2/15/1999	6.3	7.9		5190	565		<5.																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	5/1/1996								4325						0.73			
UPDES	UT0022616-001	5/20/1996								4400						0.38			
UPDES	UT0022616-001	6/3/1996								4329						0.2			
UPDES	UT0022616-001	6/18/1996								4310						0.2			
UPDES	UT0022616-001	7/1/1996								4316						0.3			
UPDES	UT0022616-001	7/16/1996								4322						0.3			
UPDES	UT0022616-001	8/1/1996								4281						0.2			
UPDES	UT0022616-001	8/19/1996								4297						0.4			
UPDES	UT0022616-001	9/3/1996								4260						0.4			
UPDES	UT0022616-001	9/16/1996								4138						0.5			
UPDES	UT0022616-001	10/2/1996								4096						0.3			
UPDES	UT0022616-001	10/15/1996								4163						0.2			
UPDES	UT0022616-001	11/5/1996								4168						0.3			
UPDES	UT0022616-001	11/19/1996								4037						0.3			
UPDES	UT0022616-001	12/2/1996								4037						0.3			
UPDES	UT0022616-001	12/16/1996								4076						0.4			
UPDES	UT0022616-001	1/2/1997								3942						0.7			
UPDES	UT0022616-001	1/16/1997								3975						0.5			
UPDES	UT0022616-001	2/3/1997								3810						0.8			
UPDES	UT0022616-001	2/19/1997								3864						0.6			
UPDES	UT0022616-001	3/3/1997								3960						0.7			
UPDES	UT0022616-001	3/3/1997																	
UPDES	UT0022616-001	3/17/1997								3990						0.3			
UPDES	UT0022616-001	4/1/1997								4080						0.6			
UPDES	UT0022616-001	4/15/1997								4030						0.9			
UPDES	UT0022616-001	5/1/1997								4060						0.6			
UPDES	UT0022616-001	5/15/1997								4060						0.3			
UPDES	UT0022616-001	6/2/1997								4040						0.4			
UPDES	UT0022616-001	6/16/1997								4040						0.2			
UPDES	UT0022616-001	7/1/1997								3990						0.5			
UPDES	UT0022616-001	7/15/1997								3960						0.2			
UPDES	UT0022616-001	8/1/1997								3820						0.2			
UPDES	UT0022616-001	8/15/1997								3930						0.3			
UPDES	UT0022616-001	9/3/1997								3870						0.3			
UPDES	UT0022616-001	9/16/1997								3930						0.3			
UPDES	UT0022616-001	10/1/1997								4010						0.4			
UPDES	UT0022616-001	10/15/1997								4140						0.2			
UPDES	UT0022616-001	11/3/1997								3920						0.3			
UPDES	UT0022616-001	11/17/1997								4000						0.3			
UPDES	UT0022616-001	12/1/1997								4100						0.4			
UPDES	UT0022616-001	12/15/1997								4090						0.6			
UPDES	UT0022616-001	1/2/1998								4010						0.4			
UPDES	UT0022616-001	1/16/1998								3920						0.6			
UPDES	UT0022616-001	2/2/1998								3870						0.4			
UPDES	UT0022616-001	2/17/1998								3790						0.4			
UPDES	UT0022616-001	3/2/1998								3780						0.4			
UPDES	UT0022616-001	3/16/1998								3732						0.3			
UPDES	UT0022616-001	4/2/1998								2886						0.4			
UPDES	UT0022616-001	4/15/1998								3805						0.5			
UPDES	UT0022616-001	5/1/1998								3768						0.4			
UPDES	UT0022616-001	5/18/1998								3837						0.4			
UPDES	UT0022616-001	5/27/1998								3905						0.3			
UPDES	UT0022616-001	6/1/1998								3861						0.2			
UPDES	UT0022616-001	6/15/1998								3841						0.2			
UPDES	UT0022616-001	7/1/1998								3844						0.1			
UPDES	UT0022616-001	7/17/1998								3785						0.1			
UPDES	UT0022616-001	8/3/1998								4787						0.2			
UPDES	UT0022616-001	8/17/1998								3899						0.1			
UPDES	UT0022616-001	9/1/1998								3767						0.2			
UPDES	UT0022616-001	9/1/1998																	
UPDES	UT0022616-001	9/9/1998								3729						0.2			
UPDES	UT0022616-001	10/23/1998								3840						0.6			
UPDES	UT0022616-001	10/29/1998								3860						0.3			
UPDES	UT0022616-001	11/9/1998								3819						0.3			
UPDES	UT0022616-001	11/23/1998								3847						0.2			
UPDES	UT0022616-001	12/1/1998								3821						0.3			
UPDES	UT0022616-001	12/15/1998								3891						0.4			
UPDES	UT0022616-001	1/4/1999								4015						0.7			
UPDES	UT0022616-001	1/19/1999								3996						0.6			
UPDES	UT0022616-001	2/1/1999								4088						0.4			
UPDES	UT0022616-001	2/15/1999								4110						0.3			

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	3/1/1999	8.2	7.4		5130	664		<5.																					
UPDES	UT0022616-001	3/15/1999	8.2	8.4		4980	476		<5.																					
UPDES	UT0022616-001	4/5/1999	7.2	8.1		5050	422		<5.																					
UPDES	UT0022616-001	4/16/1999	10.5	7.5		5130	265		<5.																					
UPDES	UT0022616-001	5/3/1999	12.7	8.3		4920	494		<5.																					
UPDES	UT0022616-001	5/17/1999	13.9	8.3		5100	220																							
UPDES	UT0022616-001	6/1/1999	17	7.7		4850	449		<5.																					
UPDES	UT0022616-001	6/15/1999	20.5	8.4		4850	287		<5.																					
UPDES	UT0022616-001	7/1/1999	21.4	8.2		4890	449		<5.																					
UPDES	UT0022616-001	10/4/1999	13.1	7.8		4970	341		<5.																					
UPDES	UT0022616-001	12/3/1999	4.2	7.6		5020	565		<5.																					
UPDES	UT0022616-001	1/4/2000	4	7.3		5120	476		<5.																					
UPDES	UT0022616-001	2/2/2000	5.2	8		5130	539		<5.																					
UPDES	UT0022616-001	4/3/2000	11	8.1		4760	341		6																					
UPDES	UT0024040-001	6/8/2001	19.2	7.5		5310	404		<5.																					
UPDES	UT0022616-001	7/10/2001	23.2	7.3		5250			<5.																					
UPDES	UT0024040-001	10/3/2001	15.5	7.4		5120	462		<5.																					
UPDES	UT0024040-001	12/10/2001	3.4	7.1		5220	565		<5.																	<5.				
UPDES	UT0022616-001	4/11/2002	13.9	7.1		5530	745		6																					
UPDES	UT0022616-001	5/7/2002	15.3	6.9		5420	597		<5.	0																				
UPDES	UT0022616-001	6/19/2002	19.8	7.8			341		<5.																					
UPDES	UT0022616-001	7/15/2002	21.6	7		5980	422		<5.	0																				
UPDES	UT0022616-001	8/8/2002	19.4	7.3		6080	198		9																					
UPDES	UT0022616-001	9/16/2002	16.6	7.1		3320	224		<3.8																					
UPDES	UT0024040-001	10/22/2002	11.7	7.6		5830	449		<5.																					
UPDES	UT0022616-001	7/31/2003					0																							
UPDES	UT0022616-001	8/29/2003					0																							
UPDES	UT0022616-001	9/16/2003	17.9	8		5.6	566		< 5.																					
UPDES	UT0022616-001	10/28/2003					0																							
UPDES	UT0022616-001	11/24/2003					0																							
UPDES	UT0022616-001	12/31/2003					0																							
UPDES	UT0022616-001	1/27/2004					0																							
UPDES	UT0022616-001	2/25/2004					0																							
UPDES	UT0022616-001	3/10/2004					0																							
UPDES	UT0022616-001	4/6/2004	12.8	8		5.31	202		< 5.																					
UPDES	UT0022616-001	5/10/2004					0																							
UPDES	UT0022616-001	6/2/2004					0																							
UPDES	UT0022616-001	7/8/2004	21.3	8.3		5620	202		< 5.																					
UPDES	UT0022616-001	8/8/2004					0																							
UPDES	UT0022616-001	9/8/2004					0																							
UPDES	UT0022616-001	10/1/2004					0																							
UPDES	UT0022616-001	11/1/2004					0																							
UPDES	UT0022616-001	12/1/2004					0																							
UPDES	UT0022616-001	1/5/2005					0																							
UPDES	UT0022616-001	2/1/2005					0																							
UPDES	UT0022616-001	3/1/2005	13.3	8.6			337		5																					
UPDES	UT0022616-001	4/1/2005	11	8.5		5930	229		< 5.																					
UPDES	UT0022616-001	5/2/2005					0																							
UPDES	UT0022616-001	6/1/2005					0																							
UPDES	UT0022616-001	7/15/2005					0																							
UPDES	UT0022616-001	8/18/2005					0																							
UPDES	UT0022616-001	9/16/2005					0																							
UPDES	UT0022616-001	10/3/2005					0																							
UPDES	UT0022616-001	11/1/2005	11.7	8		5660	189		7																					
UPDES	UT0022616-001	11/15/2005	7.7	8.1		5610	90		< 5.																					
UPDES	UT0022616-001	12/1/2005	1.4	8.7		5920	4.5		< 5.																					
UPDES	UT0022616-001	1/3/2006					0																							
UPDES	UT0022616-001	2/1/2006					0																							
UPDES	UT0022616-001	3/1/2006					0																							
UPDES	UT0022616-001	4/3/2006	13.7	7.6		5430	94		5	0																				
UPDES	UT0022616-001	4/17/2006	12.3	8.2		5430	94		5	0																				
UPDES	UT0022616-001	5/1/2006	15.2	8.1		5470	105	8.13	< 5.	0																< 5.		144		
UPDES	UT0022616-001	5/15/2006	18	8		5350	105		< 5.	0																				
UPDES	UT0022616-001	6/1/2006	18.7	8.3		5510	86		< 5.	0																				
UPDES	UT0022616-001	6/15/2006	18.7	8.2		5410	86		< 5.	0																				
UPDES	UT0022616-001	6/30/2006	24.1	8.2		5250	43		< 5.	< 2.																				
UPDES	UT0022616-001	7/14/2006	21.1	8.4		5270	43		8	0																				
UPDES	UT0022616-001	8/1/2006	21.7	8.4		5170	43		< 5.	0																				
UPDES	UT0022616-001	8/15/2006	20.1	8.3		5230	70		< 5.	0																				
UPDES	UT0022616-001	9/1/2006	21.6	8.1		5210	70		6	0																				
UPDES	UT0022616-001	9/15/2006	16.1	8.6		5130	14		5	0																				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	3/1/1999								4146						0.3			
UPDES	UT0022616-001	3/15/1999								4158						0.3			
UPDES	UT0022616-001	4/5/1999								4066						0.4			
UPDES	UT0022616-001	4/16/1999								3954						0.3			
UPDES	UT0022616-001	5/3/1999								3865						0.2			
UPDES	UT0022616-001	5/17/1999								3925						0.2			
UPDES	UT0022616-001	6/1/1999								4037						0.2			
UPDES	UT0022616-001	6/15/1999								3976						0.1			
UPDES	UT0022616-001	7/1/1999								4011						0.1			
UPDES	UT0022616-001	10/4/1999								3913						0.2			
UPDES	UT0022616-001	12/3/1999								3908						0.4			
UPDES	UT0022616-001	1/4/2000								3853						0.4			
UPDES	UT0022616-001	2/2/2000								3745						0.3			
UPDES	UT0022616-001	4/3/2000								3755						0.2			
UPDES	UT0024040-001	6/8/2001								4179						<0.1			
UPDES	UT0022616-001	7/10/2001								4256						0.1			
UPDES	UT0024040-001	10/3/2001								4201						<0.1			
UPDES	UT0024040-001	12/10/2001								4069						0.1			
UPDES	UT0022616-001	4/11/2002																	
UPDES	UT0022616-001	5/7/2002								4465						0.2			
UPDES	UT0022616-001	6/19/2002								4590						<0.1			
UPDES	UT0022616-001	7/15/2002								4774						0.2			
UPDES	UT0022616-001	8/8/2002								5048						0.3			
UPDES	UT0022616-001	9/16/2002								4658						0.2			
UPDES	UT0024040-001	10/22/2002								4774						<0.1			
UPDES	UT0022616-001	7/31/2003																	
UPDES	UT0022616-001	8/29/2003																	
UPDES	UT0022616-001	9/16/2003								4625						0.233			
UPDES	UT0022616-001	10/28/2003																	
UPDES	UT0022616-001	11/24/2003																	
UPDES	UT0022616-001	12/31/2003																	pump off
UPDES	UT0022616-001	1/27/2004																	
UPDES	UT0022616-001	2/25/2004																	
UPDES	UT0022616-001	3/10/2004																	
UPDES	UT0022616-001	4/6/2004								4267						0.527	0.05		
UPDES	UT0022616-001	5/10/2004																	
UPDES	UT0022616-001	6/2/2004																	
UPDES	UT0022616-001	7/8/2004								4490						0.19			
UPDES	UT0022616-001	8/8/2004																	
UPDES	UT0022616-001	9/8/2004																	
UPDES	UT0022616-001	10/1/2004																	Site was dry
UPDES	UT0022616-001	11/1/2004																	Site was dry
UPDES	UT0022616-001	12/1/2004																	Site was dry
UPDES	UT0022616-001	1/5/2005																	No Oil of Froth
UPDES	UT0022616-001	2/1/2005																	No Oil or Froth
UPDES	UT0022616-001	3/1/2005								4549						0.73			
UPDES	UT0022616-001	4/1/2005								4804						0.24			
UPDES	UT0022616-001	5/2/2005																	No discharge in May
UPDES	UT0022616-001	6/1/2005																	No Discharge in June
UPDES	UT0022616-001	7/15/2005																	
UPDES	UT0022616-001	8/18/2005																	Did not Discharge in August
UPDES	UT0022616-001	9/16/2005																	Did not Discharge in September
UPDES	UT0022616-001	10/3/2005																	No Discharge for the month of October
UPDES	UT0022616-001	11/1/2005								4751						0.37			
UPDES	UT0022616-001	11/15/2005								4675						0.22			
UPDES	UT0022616-001	12/1/2005								4709						0.27			
UPDES	UT0022616-001	1/3/2006																	No Discharge in 1st. Quarter.
UPDES	UT0022616-001	2/1/2006																	No Discharge in February.
UPDES	UT0022616-001	3/1/2006																	No Discharge in March.
UPDES	UT0022616-001	4/3/2006								4436						0.84			
UPDES	UT0022616-001	4/17/2006								4590						0.4			
UPDES	UT0022616-001	5/1/2006			2603		476			4524						0.18	0.099	181	
UPDES	UT0022616-001	5/15/2006								4487						0.19			
UPDES	UT0022616-001	6/1/2006								4453						0.23			
UPDES	UT0022616-001	6/15/2006								4448						0.23			
UPDES	UT0022616-001	6/30/2006								4403						0.23	0.015		
UPDES	UT0022616-001	7/14/2006								4330						0.17			
UPDES	UT0022616-001	8/1/2006								4335						0.23			
UPDES	UT0022616-001	8/15/2006								4324						0.17			
UPDES	UT0022616-001	9/1/2006								4243						0.13			
UPDES	UT0022616-001	9/15/2006								4223						0.11			

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	10/2/2006	13.9	8.6		5210	25		15	0																				
UPDES	UT0022616-001	10/16/2006	14	8.9		5050	1.3		5	0																				
UPDES	UT0022616-001	11/1/2006					0																							
UPDES	UT0022616-001	12/1/2006					0																							
UPDES	UT0022616-001	2/1/2007					0																							
UPDES	UT0022616-001	3/1/2007					0																							
UPDES	UT0022616-001	4/16/2007	13.6	8		5410	66																							
UPDES	UT0022616-001	5/1/2007	19	7.9		5270	51																							
UPDES	UT0022616-001	5/15/2007	17.5	8.4		5270	0																							
UPDES	UT0022616-001	6/1/2007	17.7	8.3		5410	39																							
UPDES	UT0022616-001	6/14/2007	18.7	8.2		5420	43																							
UPDES	UT0022616-001	7/2/2007	21.7	8.2		5390	43																							
UPDES	UT0022616-001	7/16/2007	20.5	8.3		5470	20																							
UPDES	UT0022616-001	8/6/2007	21.3	8.5		5440	17																							
UPDES	UT0022616-001	8/16/2007	20.6	8.4		5550	18																							
UPDES	UT0022616-001	8/31/2007	19.6	8.5		5470	18																							
UPDES	UT0022616-001	9/18/2007	16.3	7.9		5440	17																							
UPDES	UT0022616-001	10/1/2007	9.7	8.4		5480	17																							
UPDES	UT0022616-001	10/15/2007	11.3	7.6		5360	18																							
UPDES	UT0022616-001	11/1/2007	7.2	7.5		5220	24																							
UPDES	UT0022616-001	11/16/2007	4.7	7.8		5320	45																							
UPDES	UT0022616-001	12/3/2007	3.9	7.4		5550	37																							
UPDES	UT0022616-001	12/18/2007	1.7	7.8		5580	36																							
UPDES	UT0022616-001	1/2/2008	2.2	8		5670	41																							
UPDES	UT0022616-001	1/15/2008		7.5			42																							
UPDES	UT0022616-001	2/15/2008	3.6	8.3		5230	48																							
UPDES	UT0022616-001	3/3/2008	6.7	7.2		5080	58																							
UPDES	UT0022616-001	3/17/2008	6.9	8.1		5170	85																							
UPDES	UT0022616-001	4/1/2008	8.3	7.4		5190	25																							
UPDES	UT0022616-001	4/15/2008	12.6	8.6		5250	43																							
UPDES	UT0022616-001	5/2/2008	12.8	8.4		5240	11																							
UPDES	UT0022616-001	5/16/2008	13.1	8.4		5200	18																							
UPDES	UT0022616-001	6/2/2008	17.6	8.4		5240	31																							
UPDES	UT0022616-001	6/16/2008	19.7	7.4		5050	34																							
UPDES	UT0022616-001	7/1/2008	21.4	6.8		5120	29																							
UPDES	UT0022616-001	7/15/2008	21.5	7.8		4960	29																							
UPDES	UT0022616-001	8/1/2008	21.1	8.2		4980	6																							
UPDES	UT0022616-001	8/15/2008	20.5	8.1		4980	33																							
UPDES	UT0022616-001	9/2/2008	17.4	8		5090	26																							
UPDES	UT0022616-001	9/15/2008	15	8.2		5060	20																							
UPDES	UT0022616-001	10/1/2008	16	7.8		4930	0																							
UPDES	UT0022616-001	10/15/2008	12	6.9		5.25	0																							
UPDES	UT0022616-001	11/3/2008	8.7	8.1		5.12	0																							
UPDES	UT0022616-001	11/17/2008	7.7	0		4.22	0																							
UPDES	UT0022616-001	12/1/2008	6.5	8.9		5120	0																							
UPDES	UT0022616-001	12/15/2008	1.7	8		5310	0																							
UPDES	UT0022616-001	2/1/2007					0																							
UPDES	UT0022616-001	3/1/2007					0																							
UPDES	UT0022616-001	4/16/2007	13.6	8		5410	66.0		7																					
UPDES	UT0022616-001	5/1/2007	19	7.9		5270	51.3		< 5.																					
UPDES	UT0022616-001	5/15/2007	17.5	8.4		5270	0.1		< 5.																					
UPDES	UT0022616-001	6/1/2007	17.7	8.3		5410	38.6		9																					
UPDES	UT0022616-001	6/14/2007	18.7	8.2		5420	42.6		10																					
UPDES	UT0022616-001	7/2/2007	21.7	8.2		5390	42.6		6																					
UPDES	UT0022616-001	7/16/2007	20.5	8.3		5470	19.7		< 5.																					
UPDES	UT0022616-001	8/6/2007	21.3	8.5		5440	17.1		< 5.																					
UPDES	UT0022616-001	8/16/2007	20.6	8.4		5550	18.0		< 5.																					
UPDES	UT0022616-001	8/31/2007	19.6	8.5		5470	18.0		< 5.																					
UPDES	UT0022616-001	9/18/2007	16.3	7.9		5440	17.1		< 5.																					
UPDES	UT0022616-001	10/1/2007	9.7	8.4		5480	17.3		< 5.																					
UPDES	UT0022616-001	10/15/2007	11.3	7.6		5360	18.2		< 5.																					
UPDES	UT0022616-001	11/1/2007	7.2	7.5		5220	23.8		< 5.																					
UPDES	UT0022616-001	11/16/2007	4.7	7.8		5320	45.1		< 5.																					
UPDES	UT0022616-001	12/3/2007	3.9	7.4		5550	37.0		< 5.																					
UPDES	UT0022616-001	12/18/2007	1.7	7.8		5580	35.9		< 5.																					
UPDES	UT0022616-001	1/2/2008	2.2	8		5670	40.8		< 5.																					
UPDES	UT0022616-001	1/15/2008		7.5			42.2		< 5.																					
UPDES	UT0022616-001	2/15/2008	3.6	8.3		5230	48.3		< 5.																					
UPDES	UT0022616-001	3/3/2008	6.7	7.2		5080	57.9		12																					
UPDES	UT0022616-001	3/17/2008	6.9	8.1		5170	84.8		< 5.																					
UPDES	UT0022616-001	4/1/2008	8.3	7.4		5190	25.0		< 5.																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	10/2/2006								4195						0.1			DIS.METALS FILTERED @ LAB
UPDES	UT0022616-001	10/16/2006								4122						0.12			
UPDES	UT0022616-001	11/1/2006																	
UPDES	UT0022616-001	12/1/2006																	
UPDES	UT0022616-001	2/1/2007																	
UPDES	UT0022616-001	3/1/2007																	
UPDES	UT0022616-001	4/16/2007								4450						0.6			
UPDES	UT0022616-001	5/1/2007								4365						0.39			
UPDES	UT0022616-001	5/15/2007								4324						0.35			
UPDES	UT0022616-001	6/1/2007								4417						0.28			
UPDES	UT0022616-001	6/14/2007								4566						0.24			
UPDES	UT0022616-001	7/2/2007								4474						0.3			
UPDES	UT0022616-001	7/16/2007								4504						0.21			
UPDES	UT0022616-001	8/6/2007								4443						0.23			
UPDES	UT0022616-001	8/16/2007								4512						0.18			
UPDES	UT0022616-001	8/31/2007								4475						0.08			
UPDES	UT0022616-001	9/18/2007								4489						0.17			
UPDES	UT0022616-001	10/1/2007								4396						0.19			
UPDES	UT0022616-001	10/15/2007								4341						0.08			
UPDES	UT0022616-001	11/1/2007								4464						0.1			
UPDES	UT0022616-001	11/16/2007								4476						0.14			
UPDES	UT0022616-001	12/3/2007								4611						0.25			
UPDES	UT0022616-001	12/18/2007								4697						0.23			
UPDES	UT0022616-001	1/2/2008								4708						0.31			
UPDES	UT0022616-001	1/15/2008								4486						0.42			
UPDES	UT0022616-001	2/15/2008								4326						0.32			
UPDES	UT0022616-001	3/3/2008								4177						0.32			
UPDES	UT0022616-001	3/17/2008								4460						0.52			
UPDES	UT0022616-001	4/1/2008								4346						0.28			
UPDES	UT0022616-001	4/15/2008								4400						0.19			
UPDES	UT0022616-001	5/2/2008								4511						0.18			
UPDES	UT0022616-001	5/16/2008								4544						0.4			
UPDES	UT0022616-001	6/2/2008								4531						0.39			
UPDES	UT0022616-001	6/16/2008								4407						0.23			
UPDES	UT0022616-001	7/1/2008								4525						0.17			
UPDES	UT0022616-001	7/15/2008								4394						0.17			
UPDES	UT0022616-001	8/1/2008								4479						0.2			
UPDES	UT0022616-001	8/15/2008								4448						0.19			
UPDES	UT0022616-001	9/2/2008								4570						0.19			
UPDES	UT0022616-001	9/15/2008								4502						0.14			
UPDES	UT0022616-001	10/1/2008								4536						< .05			
UPDES	UT0022616-001	10/15/2008								4456						0.32			
UPDES	UT0022616-001	11/3/2008								4315						0.18			
UPDES	UT0022616-001	11/17/2008								4542						0.1			
UPDES	UT0022616-001	12/1/2008								4446						0.16			
UPDES	UT0022616-001	12/15/2008								4511						0.26			
UPDES	UT0022616-001	2/1/2007																	
UPDES	UT0022616-001	3/1/2007																	
UPDES	UT0022616-001	4/16/2007							4450						0.6				
UPDES	UT0022616-001	5/1/2007							4365						0.39				
UPDES	UT0022616-001	5/15/2007							4324						0.35				
UPDES	UT0022616-001	6/1/2007							4417						0.28				
UPDES	UT0022616-001	6/14/2007							4566						0.24				
UPDES	UT0022616-001	7/2/2007							4474						0.3				
UPDES	UT0022616-001	7/16/2007							4504						0.21				
UPDES	UT0022616-001	8/6/2007							4443						0.23				
UPDES	UT0022616-001	8/16/2007							4512						0.18				
UPDES	UT0022616-001	8/31/2007							4475						0.08				
UPDES	UT0022616-001	9/18/2007							4489						0.17				
UPDES	UT0022616-001	10/1/2007							4396						0.19				
UPDES	UT0022616-001	10/15/2007							4341						0.08				
UPDES	UT0022616-001	11/1/2007							4464						0.1				
UPDES	UT0022616-001	11/16/2007							4476						0.14				
UPDES	UT0022616-001	12/3/2007							4611						0.25				
UPDES	UT0022616-001	12/18/2007							4697						0.23				
UPDES	UT0022616-001	1/2/2008							4708						0.31				
UPDES	UT0022616-001	1/15/2008							4486						0.42				
UPDES	UT0022616-001	2/15/2008							4326						0.32				
UPDES	UT0022616-001	3/3/2008							4177						0.32				
UPDES	UT0022616-001	3/17/2008							4460						0.52				
UPDES	UT0022616-001	4/1/2008							4346						0.28				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	4/15/2008	12.6	8.6		5250	43.2		< 5.																					
UPDES	UT0022616-001	5/2/2008	12.8	8.4		5240	10.5		< 5.																					
UPDES	UT0022616-001	5/16/2008	13.1	8.4		5200	17.8		< 5.																					
UPDES	UT0022616-001	6/2/2008	17.6	8.4		5240	31.2		< 5.																					
UPDES	UT0022616-001	6/16/2008	19.7	7.4		5050	33.7		< 5.																					
UPDES	UT0022616-001	7/1/2008	21.4	6.8		5120	29.4		< 5.																					
UPDES	UT0022616-001	7/15/2008	21.5	7.8		4960	29.4		< 5.																					
UPDES	UT0022616-001	8/1/2008	21.1	8.2		4980	6.2		< 5.																					
UPDES	UT0022616-001	8/15/2008	20.5	8.1		4980	33.3		< 5.																					
UPDES	UT0022616-001	9/2/2008	17.4	8		5090	26.4		< 5.																					
UPDES	UT0022616-001	9/15/2008	15	8.2		5060	20.1		< 5.																					
UPDES	UT0022616-001	10/1/2008	16	7.8		4930	0		< 5.																					
UPDES	UT0022616-001	10/15/2008	12	6.9		5.25	0		< 5.																					
UPDES	UT0022616-001	11/3/2008	8.7	8.1		5.12	0		5																					
UPDES	UT0022616-001	11/17/2008	7.7	0		4.22	0		5																					
UPDES	UT0022616-001	12/1/2008	6.5	8.9		5120	0		< 5.																					
UPDES	UT0022616-001	12/15/2008	1.7	8		5310	0		< 5.																					
UPDES	UT0022616-001	3/2/2009	9.5	7.4		4900	0.1		< 5.																					
UPDES	UT0022616-001	3/16/2009	10.5	7.9		4870	0.1		< 5.																					
UPDES	UT0022616-001	5/1/2009	14.8	8		4870	68.7		< 5.																					
UPDES	UT0022616-001	5/15/2009	15.5	7.8		4900	0.1		< 5.																					
UPDES	UT0022616-001	6/1/2009	22.7	8.2		4850	51.2		< 5.																					
UPDES	UT0022616-001	6/15/2009	19.8			4680			< 5.																					
UPDES	UT0022616-001	7/15/2009	23.3	7.4		4980	0		10																					
UPDES	UT0022616-001	8/3/2009	22.8	7.2		5150	0		< 5.																					
UPDES	UT0022616-001	8/17/2009	19.6	8.1		5060	0		< 5.																					
UPDES	UT0022616-001	9/2/2009	22	7.5		5010	0		< 5.																					
UPDES	UT0022616-001	9/15/2009	19.5	7.7		5020	0		< 5.																					
UPDES	UT0022616-001	10/2/2009	14.3	7.1		5020	16.6		< 5.																					
UPDES	UT0022616-001	10/16/2009	11.8	7.7		5020	4.9		< 5.																					
UPDES	UT0022616-001	11/2/2009	10.1	7.9		4910	21.5		< 5.																					
UPDES	UT0022616-001	11/18/2009	6	7.9		5060	27.8		< 5.																					
UPDES	UT0022616-001	12/2/2009	5.2	8		4930	21.5		< 5.																					
UPDES	UT0022616-001	12/16/2009	3.8	8.1		5090	46.2		< 5.																					
UPDES	UT0022616-001	1/6/2010	3.7	8.4		4890	0		< 5.																					
UPDES	UT0022616-001	1/18/2010	5	8.4		4860	0		< 5.																					
UPDES	UT0022616-001	2/3/2010	4.5	6.7		4760	0		< 5.																					
UPDES	UT0022616-001	2/15/2010	4.8	6.9		4780	0		< 5.																					
UPDES	UT0022616-001	3/2/2010	7	7.2		4660	0		< 5.																					
UPDES	UT0022616-001	4/19/2010	17.4	6.8		4740	13.9		> 5.																					
UPDES	UT0022616-001	5/3/2010	12.3	7.4		4760	16.6		< 5.																					
UPDES	UT0022616-001	5/17/2010	18.1	7.3		4750	16.2		< 5.																					
UPDES	UT0022616-001	6/2/2010	15.8	7.2		4810	14.4		< 5.																					
UPDES	UT0022616-001	6/16/2010	20.2	7.3		4840	14.4		< 5.																					
UPDES	UT0022616-001	7/2/2010	20.3	7.4		4970	30.1		< 5.																					
UPDES	UT0022616-001	7/19/2010		7.3			25.1		< 5.																					
UPDES	UT0022616-001	8/3/2010		7.4			24.2		< 5.																					
UPDES	UT0022616-001	8/16/2010		7.2			48.5		< 5.																					
UPDES	UT0022616-001	9/3/2010		6.5			4.5		< 5.																					
UPDES	UT0022616-001	9/16/2010		7.4			4.5		< 5.																					
UPDES	UT0022616-001	10/11/2010	16.4	7.6		4770	3.6		< 5.																					
UPDES	UT0022616-001	10/22/2010	9.3	7.6		4700	4.0		< 5.																					
UPDES	UT0022616-001	11/2/2010	12	7.9		4900	4.5		< 5.																					
UPDES	UT0022616-001	11/17/2010	6	7.5		5130	7.6		< 5.																					
UPDES	UT0022616-001	12/1/2010	4	7.6		5020	7.2		< 5.																					
UPDES	UT0022616-001	12/15/2010	6	7.6		5080	7.6		13																					
UPDES	UT0022616-001	1/5/2011	3	7.6		5680	4.5		< 5.																					
UPDES	UT0022616-001	1/18/2011	6.4	7.8		5360	9.0		< 5.																					
UPDES	UT0022616-001	2/1/2011	6.3	7.9		5640	1.8		7																					
UPDES	UT0022616-001	2/15/2011	7.4	7.6		5190	4.5		9																					
UPDES	UT0022616-001	3/1/2011					0																							
UPDES	UT0022616-001	4/1/2011					0																							
UPDES	UT0022616-001	5/1/2011					0																							
UPDES	UT0022616-001	6/17/2011	16.5	7.8		5700	46.7		13																					
UPDES	UT0022616-001	7/5/2011	20.6	8.3		5190	0.0		5																					
UPDES	UT0022616-001	8/1/2011					0																							
UPDES	UT0022616-001	9/1/2011					0																							
UPDES	UT0022616-001	10/1/2011					0																							
UPDES	UT0022616-001	11/1/2011					0																							
UPDES	UT0022616-001	12/1/2011					0																							
UPDES	UT0022616-001	1/1/2012					0																							

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	4/15/2008							4400						0.19				
UPDES	UT0022616-001	5/2/2008							4511						0.18				
UPDES	UT0022616-001	5/16/2008							4544						0.4				
UPDES	UT0022616-001	6/2/2008							4531						0.39				
UPDES	UT0022616-001	6/16/2008							4407						0.23				
UPDES	UT0022616-001	7/1/2008							4525						0.17				
UPDES	UT0022616-001	7/15/2008							4394						0.17				
UPDES	UT0022616-001	8/1/2008							4479						0.2				
UPDES	UT0022616-001	8/15/2008							4448						0.19				
UPDES	UT0022616-001	9/2/2008							4570						0.19				
UPDES	UT0022616-001	9/15/2008							4502						0.14				
UPDES	UT0022616-001	10/1/2008							4536						< .05				
UPDES	UT0022616-001	10/15/2008							4456						0.32				
UPDES	UT0022616-001	11/3/2008							4315						0.18				
UPDES	UT0022616-001	11/17/2008							4542						0.1				
UPDES	UT0022616-001	12/1/2008							4446						0.16				
UPDES	UT0022616-001	12/15/2008							4511						0.26				
UPDES	UT0022616-001	3/2/2009							4432						0.27			Verified in Field Notes	
UPDES	UT0022616-001	3/16/2009							4435						0.2				
UPDES	UT0022616-001	5/1/2009							4572						0.24				
UPDES	UT0022616-001	5/15/2009							4589						0.18				
UPDES	UT0022616-001	6/1/2009							4487						0.1				
UPDES	UT0022616-001	6/15/2009							4423						< .05				
UPDES	UT0022616-001	7/15/2009							4654						0.14				
UPDES	UT0022616-001	8/3/2009							4745						0.26				
UPDES	UT0022616-001	8/17/2009							4708						0.12				
UPDES	UT0022616-001	9/2/2009							4661						0.1				
UPDES	UT0022616-001	9/15/2009							4648						0.16				
UPDES	UT0022616-001	10/2/2009							4552						0.21				
UPDES	UT0022616-001	10/16/2009							4654						0.15				
UPDES	UT0022616-001	11/2/2009							4533						1.18				
UPDES	UT0022616-001	11/18/2009			2513				4479						0.34				
UPDES	UT0022616-001	12/2/2009			2544				4479						0.18				
UPDES	UT0022616-001	12/16/2009			2466				4445						0.27				
UPDES	UT0022616-001	1/6/2010			2285				4276						0.31				
UPDES	UT0022616-001	1/18/2010			2259				4205						0.25				
UPDES	UT0022616-001	2/3/2010			2115				3705						0.14				
UPDES	UT0022616-001	2/15/2010			2354				4154						0.22				
UPDES	UT0022616-001	3/2/2010			2239				4163						0.14				
UPDES	UT0022616-001	4/19/2010			2345				4238						0.12				
UPDES	UT0022616-001	5/3/2010			2507				4317						0.59				
UPDES	UT0022616-001	5/17/2010			2432				4280						0.11				
UPDES	UT0022616-001	6/2/2010			2477				4381						0.1				
UPDES	UT0022616-001	6/16/2010			2480				4334						0.1				
UPDES	UT0022616-001	7/2/2010			2519				4428						0.05				
UPDES	UT0022616-001	7/19/2010							4471						< .05				
UPDES	UT0022616-001	8/3/2010							4424						0.11				
UPDES	UT0022616-001	8/16/2010							4522						0.13				
UPDES	UT0022616-001	9/3/2010							4469						0.17				
UPDES	UT0022616-001	9/16/2010							4501						0.09				
UPDES	UT0022616-001	10/11/2010			2505				4322						0.09				
UPDES	UT0022616-001	10/22/2010			2483				4317						0.07				
UPDES	UT0022616-001	11/2/2010			2483				4376						0.09				
UPDES	UT0022616-001	11/17/2010			2528				4565						0.07				
UPDES	UT0022616-001	12/1/2010			2500				4436						0.2				
UPDES	UT0022616-001	12/15/2010			2463				4303						< .05				
UPDES	UT0022616-001	1/5/2011			2522				4448						0.29				
UPDES	UT0022616-001	1/18/2011			2410				4267						0.23				
UPDES	UT0022616-001	2/1/2011			2450				4347						0.18				
UPDES	UT0022616-001	2/15/2011			2414				4403						0.33				
UPDES	UT0022616-001	3/1/2011																	
UPDES	UT0022616-001	4/1/2011																	
UPDES	UT0022616-001	5/1/2011																	
UPDES	UT0022616-001	6/17/2011			2730				4905						0.78				
UPDES	UT0022616-001	7/5/2011			2368				4306						0.21				
UPDES	UT0022616-001	8/1/2011																	
UPDES	UT0022616-001	9/1/2011																	
UPDES	UT0022616-001	10/1/2011																	
UPDES	UT0022616-001	11/1/2011																	
UPDES	UT0022616-001	12/1/2011																	
UPDES	UT0022616-001	1/1/2012																	

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-001	2/1/2012					0																							
UPDES	UT0022616-001	3/1/2012					0																							
UPDES	UT0022616-001	4/1/2012					0																							
UPDES	UT0022616-001	5/1/2012					0																							
UPDES	UT0022616-001	6/1/2012					0																							
UPDES	UT0022616-001	7/1/2012					0																							
UPDES	UT0022616-001	7/15/2012					0																							
UPDES	UT0022616-001	8/1/2012					0																							
UPDES	UT0022616-001	9/1/2012					0																							
UPDES	UT0022616-001	10/1/2012					0																							
UPDES	UT0022616-001	11/1/2012					0																							
UPDES	UT0022616-001	12/3/2012					0																							
UPDES	UT0022616-001	1/2/2013					0																							
UPDES	UT0022616-001	2/1/2013					0																							
UPDES	UT0022616-001	3/1/2013					0																							
UPDES	UT0022616-001	4/1/2013					0																							
UPDES	UT0022616-001	5/1/2013					0																							
UPDES	UT0022616-001	6/3/2013					0																							
UPDES	UT0022616-001	7/1/2013					0																							
UPDES	UT0022616-001	8/1/2013					0																							
UPDES	UT0022616-001	9/3/2013					0																							
UPDES	UT0022616-001	10/1/2013					0																							
UPDES	UT0022616-001	11/1/2013					0																							
UPDES	UT0022616-001	12/1/2013					0																							
UPDES	UT0022616-001	1/3/2014					0																							
UPDES	UT0022616-001	2/3/2014					0																							
UPDES	UT0022616-001	3/3/2014					0																							
UPDES	UT0022616-001	4/1/2014					0																							
UPDES	UT0022616-001	5/1/2014					0																							
UPDES	UT0022616-001	6/2/2014					0																							
UPDES	UT0022616-001	7/1/2014					0																							
UPDES	UT0022616-001	8/1/2014					0																							
UPDES	UT0022616-001	9/1/2014					0																							
UPDES	UT0022616-001	10/1/2014					0																							
UPDES	UT0022616-001	11/3/2014					0																							
UPDES	UT0022616-001	12/1/2014					0																							
UPDES	UT0022616-001	1/1/2015					0																							
UPDES	UT0022616-001	2/2/2015					0																							
UPDES	UT0022616-001	3/2/2015					0																							
UPDES	UT0022616-001	4/1/2015					0																							
UPDES	UT0022616-001	5/4/2015					0																							
UPDES	UT0022616-001	6/1/2015					0																							
UPDES	UT0022616-001	7/1/2015																												
UPDES	UT0022616-001	8/3/2015																												
UPDES	UT0022616-001	9/1/2015																												
UPDES	UT0022616-001	10/1/2015																												
UPDES	UT0022616-001	11/1/2015																												
UPDES	UT0022616-001	12/1/2015																												
		No. of Obs.:	315	322	1	312	426	178	207	53	2	2	2	0	2	0	6	0	2	1	2	0	2	0	14	0	3	19	0	8
		Maximum:	25.3	10.2	11.3	6560	1072.63	8.6	256	2603	0.45	0.004	0.78	0	186	0	9.35	0	163	0.04	8	0	902	0	490	0	16	196	0	0.56
		Minimum:	1.4	0	11.3	4.22	0	7.2	0.5	0	0.42	0.003	0.74	0	152	0	0.01	0	141	0.04	7	0	774	0	272.6	0	6.9	73.8	0	0.042
		Mean:	13.6	7.8	11.3	4893.1	199.5	8.1	13.4	53.9	0.4	0.0	0.8		169.0		2.9		152.0	0.0	7.5		838.0		384.0		11.8	139.5		0.1
		Std. Dev.:	6.2	0.8		980.5	243.3	0.3	31.1	357.3	0.0	0.0	0.0		24.0		4.3		15.6		0.7		90.5		64.2		4.6	39.8		0.2
		Equivalent weights of means:													8.43				12.51		0.19		36.45		6.29		0.39	3.94		

UPDES UT0022616-002 No discharge for period of record (10/1/1979 through 12/31/2015)

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-001	2/1/2012																	
UPDES	UT0022616-001	3/1/2012																	
UPDES	UT0022616-001	4/1/2012																	
UPDES	UT0022616-001	5/1/2012																	
UPDES	UT0022616-001	6/1/2012																	
UPDES	UT0022616-001	7/1/2012																	
UPDES	UT0022616-001	7/15/2012																	
UPDES	UT0022616-001	8/1/2012																	
UPDES	UT0022616-001	9/1/2012																	
UPDES	UT0022616-001	10/1/2012																	
UPDES	UT0022616-001	11/1/2012																	
UPDES	UT0022616-001	12/3/2012																	
UPDES	UT0022616-001	1/2/2013																	
UPDES	UT0022616-001	2/1/2013																	
UPDES	UT0022616-001	3/1/2013																	
UPDES	UT0022616-001	4/1/2013																	
UPDES	UT0022616-001	5/1/2013																	
UPDES	UT0022616-001	6/3/2013																	
UPDES	UT0022616-001	7/1/2013																	
UPDES	UT0022616-001	8/1/2013																	
UPDES	UT0022616-001	9/3/2013																	
UPDES	UT0022616-001	10/1/2013																	
UPDES	UT0022616-001	11/1/2013																	
UPDES	UT0022616-001	12/1/2013																	
UPDES	UT0022616-001	1/3/2014																	
UPDES	UT0022616-001	2/3/2014																	
UPDES	UT0022616-001	3/3/2014																	
UPDES	UT0022616-001	4/1/2014																	
UPDES	UT0022616-001	5/1/2014																	
UPDES	UT0022616-001	6/2/2014																	
UPDES	UT0022616-001	7/1/2014																	
UPDES	UT0022616-001	8/1/2014																	
UPDES	UT0022616-001	9/1/2014																	
UPDES	UT0022616-001	10/1/2014																	
UPDES	UT0022616-001	11/3/2014																	
UPDES	UT0022616-001	12/1/2014																	
UPDES	UT0022616-001	1/1/2015																	
UPDES	UT0022616-001	2/2/2015																	
UPDES	UT0022616-001	3/2/2015																	
UPDES	UT0022616-001	4/1/2015																	
UPDES	UT0022616-001	5/4/2015																	
UPDES	UT0022616-001	6/1/2015																	
UPDES	UT0022616-001	7/1/2015																	
UPDES	UT0022616-001	8/3/2015																	
UPDES	UT0022616-001	9/1/2015																	
UPDES	UT0022616-001	10/1/2015																	
UPDES	UT0022616-001	11/1/2015																	
UPDES	UT0022616-001	12/1/2015																	
		No. of Obs.:	4	4	84	3	13	15	221	358	0	0	0	11	92	316	109	18	
		Maximum:	0.018	0.07	2730	0.094	476	1729	6020	5048	0	0	0	59.06	59.78	4.44	0.28	181	
		Minimum:	0.01	0.002	400	0.027	279.5	575.9	2100	580	0	0	0	28.1	0.05	0.03	0.00012	46.8	
		Mean:	0.0	0.0	2082.7	0.1	382.7	915.0	4516.7	3885.4				46.3	5.9	0.4	0.0	114.0	
		Std. Dev.:	0.0	0.0	425.3	0.0	63.5	270.9	463.9	581.3				8.2	15.9	0.4	0.0	30.3	
		Equivalent wei			43.36														
UPDES	UT0022616-002																		

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	10/1/1979					0																							
UPDES	UT0022616-003	11/1/1979					0																							
UPDES	UT0022616-003	12/1/1979					0																							
UPDES	UT0022616-003	1/1/1980					0																							
UPDES	UT0022616-003	2/1/1980					0																							
UPDES	UT0022616-003	3/1/1980					0																							
UPDES	UT0022616-003	4/1/1980					0																							
UPDES	UT0022616-003	5/1/1980					0																							
UPDES	UT0022616-003	6/1/1980					0																							
UPDES	UT0022616-003	7/1/1980					0																							
UPDES	UT0022616-003	8/1/1980					0																							
UPDES	UT0022616-003	9/1/1980					0																							
UPDES	UT0022616-003	10/1/1980					0																							
UPDES	UT0022616-003	11/1/1980					0																							
UPDES	UT0022616-003	12/1/1980					0																							
UPDES	UT0022616-003	1/1/1981					0																							
UPDES	UT0022616-003	2/1/1981					0																							
UPDES	UT0022616-003	3/1/1981					0																							
UPDES	UT0022616-003	4/1/1981					0																							
UPDES	UT0022616-003	5/1/1981					0																							
UPDES	UT0022616-003	6/1/1981					0																							
UPDES	UT0022616-003	7/1/1981					0																							
UPDES	UT0022616-003	8/1/1981					0																							
UPDES	UT0022616-003	9/1/1981					0																							
UPDES	UT0022616-003	10/1/1981					0																							
UPDES	UT0022616-003	11/1/1981					0																							
UPDES	UT0022616-003	12/1/1981					0																							
UPDES	UT0022616-003	1/1/1982					0																							
UPDES	UT0022616-003	2/1/1982					0																							
UPDES	UT0022616-003	3/1/1982					0																							
UPDES	UT0022616-003	5/1/1989					0																							
UPDES	UT0022616-003	6/1/1989					0																							
UPDES	UT0022616-003	7/28/1989						8.4	18	<1.																				
UPDES	UT0022616-003	7/31/1989						8.32	10																					
UPDES	UT0022616-003	9/6/1989		8.4				8.39	11																					
UPDES	UT0022616-003	9/11/1989		8.2				9	12	1																				
UPDES	UT0022616-003	10/4/1989						8.09	14																					
UPDES	UT0022616-003	10/31/1989						8.3	10	<1.																				
UPDES	UT0022616-003	11/21/1989					108	8.7	8	<1.																				
UPDES	UT0022616-003	12/4/1989						8.6	5																					
UPDES	UT0022616-003	12/13/1989						8.5	18	2																				
UPDES	UT0022616-003	1/2/1990						8.6	22																					
UPDES	UT0022616-003	1/10/1990						8.6	12	<1.																				
UPDES	UT0022616-003	2/7/1990						8.69	37																					
UPDES	UT0022616-003	2/22/1990						8.7	18	1																				
UPDES	UT0022616-003	3/5/1990						8.64	16																					
UPDES	UT0022616-003	3/13/1990						8.7	20	1																				
UPDES	UT0022616-003	3/22/1990							10	<1.	0.08	<0.001	0.56	<0.005	26	<0.01	0.1	<0.02	20	<0.01	3	<0.001	471	<0.01	296		32	54		
UPDES	UT0022616-003	4/6/1990						8.64	7																					
UPDES	UT0022616-003	4/18/1990						8.6	2	<1.																				
UPDES	UT0022616-003	5/21/1990						8.3	10	<1.	0.2	0.001	0.55	<0.01	51	<0.01	<0.02	<0.02	43	<0.01	4	<0.001	455	<0.01	352		32	64		
UPDES	UT0022616-003	6/1/1990						8.35	8																					
UPDES	UT0022616-003	6/14/1990						8.4	10	<1.																				
UPDES	UT0022616-003	7/12/1990						8.18	5																					
UPDES	UT0022616-003	7/20/1990						8.4	14	1																				
UPDES	UT0022616-003	8/1/1990						8.22	6																					
UPDES	UT0022616-003	9/20/1990						8.3	4	6																				
UPDES	UT0022616-003	10/1/1990					476	8.12	7																					
UPDES	UT0022616-003	10/17/1990					646	8.1	14	<1.																				
UPDES	UT0022616-003	11/6/1990						8	4	2																				
UPDES	UT0022616-003	12/19/1990						8.6	<2.	<1.																				
UPDES	UT0022616-003	1/2/1991						8.46	7																					
UPDES	UT0022616-003	1/14/1991						8.1	4	<1.																				
UPDES	UT0022616-003	2/1/1991						8.02	4																					
UPDES	UT0022616-003	2/27/1991						8.2	10	<1.																				
UPDES	UT0022616-003	3/6/1991						8.25	10																					
UPDES	UT0022616-003	3/20/1991						8.1	2	2																				
UPDES	UT0022616-003	4/4/1991					251	8.47	10																					
UPDES	UT0022616-003	4/18/1991					251	8.5	10	<1.																				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	10/1/1979																	
UPDES	UT0022616-003	11/1/1979																	
UPDES	UT0022616-003	12/1/1979																	
UPDES	UT0022616-003	1/1/1980																	
UPDES	UT0022616-003	2/1/1980																	
UPDES	UT0022616-003	3/1/1980																	
UPDES	UT0022616-003	4/1/1980																	
UPDES	UT0022616-003	5/1/1980																	
UPDES	UT0022616-003	6/1/1980																	
UPDES	UT0022616-003	7/1/1980																	
UPDES	UT0022616-003	8/1/1980																	
UPDES	UT0022616-003	9/1/1980																	
UPDES	UT0022616-003	10/1/1980																	
UPDES	UT0022616-003	11/1/1980																	
UPDES	UT0022616-003	12/1/1980																	
UPDES	UT0022616-003	1/1/1981																	
UPDES	UT0022616-003	2/1/1981																	
UPDES	UT0022616-003	3/1/1981																	
UPDES	UT0022616-003	4/1/1981																	
UPDES	UT0022616-003	5/1/1981																	
UPDES	UT0022616-003	6/1/1981																	
UPDES	UT0022616-003	7/1/1981																	
UPDES	UT0022616-003	8/1/1981																	
UPDES	UT0022616-003	9/1/1981																	
UPDES	UT0022616-003	10/1/1981																	
UPDES	UT0022616-003	11/1/1981																	
UPDES	UT0022616-003	12/1/1981																	
UPDES	UT0022616-003	1/1/1982																	
UPDES	UT0022616-003	2/1/1982																	
UPDES	UT0022616-003	3/1/1982																	
UPDES	UT0022616-003	5/1/1989																	
UPDES	UT0022616-003	6/1/1989																	
UPDES	UT0022616-003	7/28/1989							2050	1364						0.19	<0.01		
UPDES	UT0022616-003	7/31/1989								1328						0.23	<0.05		
UPDES	UT0022616-003	9/6/1989			819					1532						0.39	<0.2		
UPDES	UT0022616-003	9/11/1989							2520	1682						0.21	<0.01		
UPDES	UT0022616-003	10/4/1989			1830					1908						0.36	<0.2		
UPDES	UT0022616-003	10/31/1989							2580	2122						0.15	<0.01		
UPDES	UT0022616-003	11/21/1989							2060	1468						0.28	<0.01		
UPDES	UT0022616-003	12/4/1989			685					1440						0.23	<0.05		
UPDES	UT0022616-003	12/13/1989							2260	1522						0.25	<0.01		
UPDES	UT0022616-003	1/2/1990			715					1414						0.3	<0.05		
UPDES	UT0022616-003	1/10/1990							2140	1446						0.53	<0.01		
UPDES	UT0022616-003	2/7/1990			657					1364						0.27	<0.05		
UPDES	UT0022616-003	2/22/1990							1980	1386						0.45	0.01		
UPDES	UT0022616-003	3/5/1990			582					1364						0.3	<0.05		
UPDES	UT0022616-003	3/13/1990							2080	1448						0.48	<0.01		
UPDES	UT0022616-003	3/22/1990		<0.1	708		328	147		1434	<0.2	0.46	<0.05	23.74	22.94	0.33	<0.01	22	
UPDES	UT0022616-003	4/6/1990			658					1376						0.06	<0.05		
UPDES	UT0022616-003	4/18/1990							1890	1316						0.11	0.01		
UPDES	UT0022616-003	5/21/1990			840		384	304	2610	1742	<0.3	<0.05	<0.05	26.2	27.11	0.24	<0.01		
UPDES	UT0022616-003	6/1/1990			875					1732						<0.05	<0.05		
UPDES	UT0022616-003	6/14/1990							3030	2308						0.13	0.01		
UPDES	UT0022616-003	7/12/1990			1132					2218						<0.2	<0.2		
UPDES	UT0022616-003	7/20/1990							3030	2264						0.07	0.01		
UPDES	UT0022616-003	8/1/1990			1196					2306						<0.2	<0.2		
UPDES	UT0022616-003	9/20/1990							2920	2222						0.07	<0.01		
UPDES	UT0022616-003	10/1/1990			1318					2306						0.08	<0.05		
UPDES	UT0022616-003	10/17/1990							3090	2350						0.33	0.02		
UPDES	UT0022616-003	11/6/1990							2640	1854						0.12	<0.01		
UPDES	UT0022616-003	12/19/1990							3400	2372						0.1	0.01		
UPDES	UT0022616-003	1/2/1991								2284						0.16	<0.05		
UPDES	UT0022616-003	1/14/1991							3070	2270						0.42	0.02		
UPDES	UT0022616-003	2/1/1991			1204					2302						<0.05	<0.05		
UPDES	UT0022616-003	2/27/1991							2780	2304						0.09	0.01		
UPDES	UT0022616-003	3/6/1991			1313					2380						<0.05	<0.05		
UPDES	UT0022616-003	3/20/1991							2970	2226						0.06	<0.01		
UPDES	UT0022616-003	4/4/1991			1247					2420						<0.05	<0.05		
UPDES	UT0022616-003	4/18/1991							2710	1876						0.1	<0.01		

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	5/1/1991					889	8.05	6																					
UPDES	UT0022616-003	5/14/1991						8.1	<2.	1																				
UPDES	UT0022616-003	6/3/1991					925	8.33	15																					
UPDES	UT0022616-003	6/17/1991						7.8	14	<1.																				
UPDES	UT0022616-003	7/1/1991	18.3	7.1		3320	651	8	8																					
UPDES	UT0022616-003	7/10/1991						8.16	2																					
UPDES	UT0022616-003	8/5/1991						8.67	10																					
UPDES	UT0022616-003	8/14/1991						8.7	14	1																				
UPDES	UT0022616-003	9/6/1991						8.78	5																					
UPDES	UT0022616-003	10/1/1991					588	8.43	5																			74		
UPDES	UT0022616-003	10/14/1991	17	7.8		3200	359	8.2	<2.	1																				
UPDES	UT0022616-003	11/1/1991					184	8.11	4																			50		
UPDES	UT0022616-003	11/20/1991	9.4	7.8		2650	588	8.1	<2.	<1.																				
UPDES	UT0022616-003	12/2/1991					435	8.26	<1.																			90		
UPDES	UT0022616-003	12/30/1991					390	8.27	6																			15		
UPDES	UT0022616-003	12/31/1991	7.4	7.3		2400	310	8	2	1																				
UPDES	UT0022616-003	1/2/1992					13	8.41	8																			10		
UPDES	UT0022616-003	1/24/1992					700	8	8	1																				
UPDES	UT0022616-003	2/3/1992					678	7.9	<2.																					
UPDES	UT0022616-003	2/18/1992					687	8.1	4	4																				
UPDES	UT0022616-003	3/2/1992					350	8	4																					
UPDES	UT0022616-003	3/31/1992					525	8	<2.	<1.																				
UPDES	UT0022616-003	7/15/1992	19.7	7.5		3510	588	8	2	1																				
UPDES	UT0022616-003	8/3/1992	24.1	6.9		3000	139	8.1	26																					
UPDES	UT0022616-003	8/18/1992	19.7	7.5		3000	588	7.9	10	<1.																				
UPDES	UT0022616-003	9/2/1992	18.3	7.4		3240	610	8	<2.																					
UPDES	UT0022616-003	9/16/1992	18.8	7		3050	651	8.1	4	2																				
UPDES	UT0022616-003	10/5/1992	15.5	6.9		3000	651	7.9	10																					
UPDES	UT0022616-003	11/1/1992					0																							
UPDES	UT0022616-003	12/8/1992	10.7			2670	22	7.6	14																					
UPDES	UT0022616-003	12/14/1992	5.3	6.7		2800	651	7.9	12	<1.																				
UPDES	UT0022616-003	1/11/1993	12.5	5.9		2800	651	7.7	4																					
UPDES	UT0022616-003	1/18/1993	11.5	6.9		2800	359	7.8	6	<1.																				
UPDES	UT0022616-003	2/1/1993	13.2	7		2800	525	7.9	12	<1.																				
UPDES	UT0022616-003	2/16/1993	9.5	7.1		2600	588	7.9	<2.																					
UPDES	UT0022616-003	3/2/1993	12.4	7.2		3000	588	8.1	10	3																				
UPDES	UT0022616-003	3/15/1993	12.6	7.3		2700	139	8.3	<2.																					
UPDES	UT0022616-003	4/5/1993	15	7.5		2990	561	8.4	2	2																				
UPDES	UT0022616-003	4/19/1993	12.8	6.9		2790	503	8.1	4																					
UPDES	UT0022616-003	5/3/1993	17.8	8.5		3240	94	8.1	<2.	<1.																				
UPDES	UT0022616-003	6/1/1993					0																							
UPDES	UT0022616-003	7/12/1993	17.6	8.7		3070	678	7.8	<8.	1																				
UPDES	UT0022616-003	7/19/1993	21.5	8.3		3400	714	7.9	20																					
UPDES	UT0022616-003	8/9/1993	20	8.9		3350	781	7.9	10	2																				
UPDES	UT0022616-003	8/16/1993	18.9	9.2		3310	714	8.5	<2.																					
UPDES	UT0022616-003	9/1/1993					0																							
UPDES	UT0022616-003	10/11/1993	13.3	8.5		2800	588	7.8	6	<1.																				
UPDES	UT0022616-003	10/20/1993	13.7	8.5		2600	767	8.2	<2.																					
UPDES	UT0022616-003	11/1/1993	12.9	9.5		2700	525	8	2	2																				
UPDES	UT0022616-003	11/22/1993	10.4	8.4		2500	525	7.9	<2.																					
UPDES	UT0022616-003	12/7/1993	9.5	7.7		2500	651	7.9	<2.	<1.																				
UPDES	UT0022616-003	12/20/1993	6.1	8		2320	651	7.9	<2.																					
UPDES	UT0022616-003	1/3/1994	9.8	7.5			539	7.9	<2.	<1.																				
UPDES	UT0022616-003	1/17/1994	7	8.3		2410	651	8	<2.																					
UPDES	UT0022616-003	2/2/1994	7.3	7.1		2470	525	7.8	6	1																				
UPDES	UT0022616-003	2/14/1994	7.7	7.9		2400	525	7.7	8																					
UPDES	UT0022616-003	3/1/1994	10.3	7.7		2660	812	8.2	<2.	1																				
UPDES	UT0022616-003	3/21/1994	14.3	7.5		2880	588	8.1	2																					
UPDES	UT0022616-003	4/4/1994	11.4	8.1		2730	413	7.7	<2.	<1.																				
UPDES	UT0022616-003	4/18/1994	16.1	8.1		3190	503	8.1	<2.																					
UPDES	UT0022616-003	5/4/1994	17	8.6		2540	467	8	22	3																				
UPDES	UT0022616-003	5/16/1994	19.8	7.9		3360	139	8.2	12																					
UPDES	UT0022616-003	6/1/1994	21.6	7.5		3430	467	8.1	<2.																					
UPDES	UT0022616-003	6/20/1994	19.9	8.3		3210	467	8.2	6																					
UPDES	UT0022616-003	8/1/1994	19.5	7.9		3230	368	8.1	<2.	<1.																				
UPDES	UT0022616-003	8/15/1994	20.5	7.6		3380	413	8.1	4																					
UPDES	UT0022616-003	9/6/1994	19.8	7.3		3090	350	8.4	4	33																				
UPDES	UT0022616-003	9/19/1994	17.7	7.8		3140	444	8.1	<2.																					
UPDES	UT0022616-003	10/3/1994	16.4	8.2		2860	435	8	<2.	<1.																				
UPDES	UT0022616-003	10/17/1994	12.8	8		2770	413	8.1	14																					
UPDES	UT0022616-003	11/1/1994						8.1	<5.	18																				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	5/1/1991								2268						<0.05	<0.05		
UPDES	UT0022616-003	5/14/1991							3445	2276						0.06	<0.01		
UPDES	UT0022616-003	6/3/1991			1267					2354						<0.05	<0.05		
UPDES	UT0022616-003	6/17/1991							3000	2326						0.04	<0.01		
UPDES	UT0022616-003	7/1/1991							3100	2318						0.07	<0.01		
UPDES	UT0022616-003	7/10/1991			1272					2448						0.06	<0.05		
UPDES	UT0022616-003	8/5/1991			988				2544	1896						<0.05	<0.05		
UPDES	UT0022616-003	8/14/1991							2280	1982						0.04	<0.01		
UPDES	UT0022616-003	9/6/1991			1133					1980						<0.05	<0.05		
UPDES	UT0022616-003	10/1/1991			1229		420		3057	2274						<0.05	<0.05	65.3	
UPDES	UT0022616-003	10/14/1991							3190	2300						0.03	<0.01		
UPDES	UT0022616-003	11/1/1991			1251		366		3078	2316						<0.05	<0.05	68.6	
UPDES	UT0022616-003	11/20/1991							3120	2274						0.03	0.01		
UPDES	UT0022616-003	12/2/1991			1252		414			2394						0.19	<0.05	68.3	
UPDES	UT0022616-003	12/30/1991			1212		369			2318						<0.2	<0.2	62.6	
UPDES	UT0022616-003	12/31/1991							3060	2308						0.1	0.02		
UPDES	UT0022616-003	1/2/1992			1217		318			2282						<0.2	<0.2	63.1	
UPDES	UT0022616-003	1/24/1992							3720	2340						0.11	0.06		
UPDES	UT0022616-003	2/3/1992							3220	2340						0.19	0.03		
UPDES	UT0022616-003	2/18/1992							3460	2372						0.14	0.02		
UPDES	UT0022616-003	3/2/1992							3150	2248						0.04	0.01		
UPDES	UT0022616-003	3/31/1992							3210	2174						0.12	<0.01		
UPDES	UT0022616-003	7/15/1992							2760	2252						0.04	<0.01		
UPDES	UT0022616-003	8/3/1992							2950	2328						0.07	<0.01		
UPDES	UT0022616-003	8/18/1992							2900	2274						0.1	0.01		
UPDES	UT0022616-003	9/2/1992							3470	2386						0.05	<0.01		
UPDES	UT0022616-003	9/16/1992							2800	2258						0.03	<0.01		
UPDES	UT0022616-003	10/5/1992							3180	2290						0.08	<0.01		
UPDES	UT0022616-003	11/1/1992																	
UPDES	UT0022616-003	12/8/1992							3310	2308						2.4	0.03		
UPDES	UT0022616-003	12/14/1992							2830	2270						1.08	0.1		
UPDES	UT0022616-003	1/11/1993							2920	2258						0.56	0.06		
UPDES	UT0022616-003	1/18/1993							3020	2256						0.5	0.04		
UPDES	UT0022616-003	2/1/1993							2820	2276						0.69	0.03		
UPDES	UT0022616-003	2/16/1993							3160	2316						0.49	0.03		
UPDES	UT0022616-003	3/2/1993							3550	2348						0.24	0.03		
UPDES	UT0022616-003	3/15/1993							3000	2242						0.1	0.03		
UPDES	UT0022616-003	4/5/1993							2380	2220						0.21	0.02		
UPDES	UT0022616-003	4/19/1993							2450	2280						0.14	0.01		
UPDES	UT0022616-003	5/3/1993							3310	2292						0.02	<0.01		
UPDES	UT0022616-003	6/1/1993																	
UPDES	UT0022616-003	7/12/1993							3280	2022						0.83	0.03		
UPDES	UT0022616-003	7/19/1993							2970	2112						0.68	0.02		
UPDES	UT0022616-003	8/9/1993							3970	2190						0.16	0.01		
UPDES	UT0022616-003	8/16/1993							3410	2196						0.13	<0.01		
UPDES	UT0022616-003	9/1/1993																	
UPDES	UT0022616-003	10/11/1993							3080	2172						0.75	0.03		
UPDES	UT0022616-003	10/20/1993							3160	2212						1.03	0.04		
UPDES	UT0022616-003	11/1/1993							3180	2292						0.26	<0.01		
UPDES	UT0022616-003	11/22/1993							3060	2130						0.25	<0.01		
UPDES	UT0022616-003	12/7/1993							3090	2214						0.21	<0.01		
UPDES	UT0022616-003	12/20/1993							3200	2338						0.2	0.01		
UPDES	UT0022616-003	1/3/1994							3150	2206						0.2	0.01		
UPDES	UT0022616-003	1/17/1994							3210	2246						0.17	<0.01		
UPDES	UT0022616-003	2/2/1994							3200	2270						0.14	0.01		
UPDES	UT0022616-003	2/14/1994							3136	2228						0.14	<0.01		
UPDES	UT0022616-003	3/1/1994							3160	2298						0.18	0.01		
UPDES	UT0022616-003	3/21/1994							3100	2236						0.19	0.02		
UPDES	UT0022616-003	4/4/1994							3120	2226						0.13	<0.01		
UPDES	UT0022616-003	4/18/1994							3280	2346						0.15	0.02		
UPDES	UT0022616-003	5/4/1994							3180	2264						0.12	<0.01		
UPDES	UT0022616-003	5/16/1994							3300	2378						0.15	<0.01		
UPDES	UT0022616-003	6/1/1994							3220	2314						0.1	0.02		
UPDES	UT0022616-003	6/20/1994							3180	2218						0.28	<0.01		
UPDES	UT0022616-003	8/1/1994							3190	2282						0.15	0.02		
UPDES	UT0022616-003	8/15/1994							3220	2380						0.13	<0.1		
UPDES	UT0022616-003	9/6/1994							2970	2090						0.09	<0.01		
UPDES	UT0022616-003	9/19/1994							3220	2350						0.14	<0.01		
UPDES	UT0022616-003	10/3/1994							3130	2198						0.11	<0.01		
UPDES	UT0022616-003	10/17/1994							3200	2240						0.14	0.01		
UPDES	UT0022616-003	11/1/1994							3190	2340						0.14	<0.005		

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	11/14/1994	9.2	7.8		2480	467	8	<5.																					
UPDES	UT0022616-003	1/3/1995	8.1	8		2570	435	7.9	<5.																					
UPDES	UT0022616-003	2/1/1995					0																							
UPDES	UT0022616-003	3/7/1995	12	7.7		2700	714		<10.								<0.1													
UPDES	UT0022616-003	3/20/1995	14.1	7.3		2930	714		<5.																					
UPDES	UT0022616-003	4/3/1995	12.9	7.5		2810	624		<5.																					
UPDES	UT0022616-003	4/24/1995	15.1	7.3		3190	781		<5.																					
UPDES	UT0022616-003	5/1/1995	16.9	7.5		3200	781		10																					
UPDES	UT0022616-003	5/15/1995	17	7.3		2850	714		<5.																					
UPDES	UT0022616-003	6/5/1995	20.9	7.7		3410	588		20																					
UPDES	UT0022616-003	6/19/1995	17.9	7.3		3390	422		<5.																					
UPDES	UT0022616-003	7/11/1995	21.9	7.3		3550	525		<5.																					
UPDES	UT0022616-003	7/25/1995	21.7	7.4		3400	193		<5.																					
UPDES	UT0022616-003	8/1/1995	23.2	7.7		3110	310		<5.																					
UPDES	UT0022616-003	8/15/1995	23.1	7.4		3280	390		<5.																					
UPDES	UT0022616-003	9/5/1995	20.9	7.2		3150	359		5																					
UPDES	UT0022616-003	9/18/1995	19.3	7.8		2950	539		25																					
UPDES	UT0022616-003	10/2/1995	15.2	7.2		3100	539		5																					
UPDES	UT0022616-003	10/24/1995	9.3	7.5		2840	260		<5.																					
UPDES	UT0022616-003	11/6/1995	10.6	7.9		3290	525		<5.																					
UPDES	UT0022616-003	11/15/1995	14.2	7.9		3580	525		<5.																					
UPDES	UT0022616-003	12/6/1995	9.6	7.9		3350	458																							
UPDES	UT0022616-003	1/2/1996	12.7	7.8		3010	90		10																					
UPDES	UT0022616-003	1/30/1996	10.2	8.1		3540	826		<5.																					
UPDES	UT0022616-003	2/5/1996	10.5	8		3550	812		5																					
UPDES	UT0022616-003	2/27/1996	8.9	7.9		3280	714		5																					
UPDES	UT0022616-003	3/4/1996	12.3	8		3680	480		<5.																					
UPDES	UT0022616-003	3/28/1996	13.5	7.4		3.55	781		<5.																					
UPDES	UT0022616-003	4/2/1996	13.2	7.9		3480	664		<5.																					
UPDES	UT0022616-003	4/22/1996	14.4	8.2		3450	193		<5.																					
UPDES	UT0022616-003	5/1/1996	16.4	7.9		3640	610		<5.																					
UPDES	UT0022616-003	5/20/1996	18.5	8.1		3830	601		<5.																					
UPDES	UT0022616-003	6/3/1996	21.8	8		3980	651		<5.																					
UPDES	UT0022616-003	6/18/1996	19.6	8.1		3920	624		<5.																					
UPDES	UT0022616-003	7/1/1996	21.9	7.9		3990	588		7																					
UPDES	UT0022616-003	7/16/1996	21.3	7.9		3670	552		<5.																					
UPDES	UT0022616-003	8/1/1996	20.8	7.9		3860	561		<5.																					
UPDES	UT0022616-003	8/19/1996	21	7.7		3900	610		<5.																					
UPDES	UT0022616-003	9/3/1996	21.5	8.3		3960	601		<5.																					
UPDES	UT0022616-003	9/16/1996	15.4	7.9		2420	574		6																					
UPDES	UT0022616-003	10/2/1996	17.3	7.5		3520	574		<5.																					
UPDES	UT0022616-003	10/15/1996	15.2	7.8		3430	525		<5.																					
UPDES	UT0022616-003	11/5/1996	10.9	7.8		3190	664		<5.																					
UPDES	UT0022616-003	11/19/1996	10.9	8.1		3140	610		<5.																					
UPDES	UT0022616-003	12/2/1996	6.9	8.2		2770	503		<5.																					
UPDES	UT0022616-003	12/16/1996	9.8	7.9		2760	525		<5.																					
UPDES	UT0022616-003	1/2/1997	9.1	8.2		2860	503		<5.																					
UPDES	UT0022616-003	1/16/1997	8.1	7.9		2830	624		<5.																					
UPDES	UT0022616-003	2/3/1997	7.6	7.6		2870	525		<5.																					
UPDES	UT0022616-003	2/19/1997	9	7.7		2900	399		<5.																					
UPDES	UT0022616-003	3/3/1997	10.2	7.7		2950	574		<5.																					
UPDES	UT0022616-003	3/3/1997	10.2	7.7		2950	574																							
UPDES	UT0022616-003	3/17/1997	13.6	7.7		3300	467		<5.																					
UPDES	UT0022616-003	4/1/1997	12	7.9		3150	413		<5.																					
UPDES	UT0022616-003	4/15/1997	14.2	8		3270	435		<5.																					
UPDES	UT0022616-003	5/1/1997	13.2	7.9		3170	422		<5.																					
UPDES	UT0022616-003	5/15/1997	18.5	8		2950	435		<5.																					
UPDES	UT0022616-003	6/2/1997	19.4	7.9		3260	435		<5.																					
UPDES	UT0022616-003	6/16/1997	17.8	7.8		3250	552		<5.																					
UPDES	UT0022616-003	7/1/1997	17.6	7.7		3200	328		<5.																					
UPDES	UT0022616-003	7/15/1997	20.5	7.8		3190	435		<5.																					
UPDES	UT0022616-003	8/1/1997	20.5	7.7		3210	467		<5.																					
UPDES	UT0022616-003	8/15/1997	20.6	7.6		3250	467		<5.																					
UPDES	UT0022616-003	9/3/1997	19.5	7.6		3200	588		<5.																					
UPDES	UT0022616-003	9/16/1997	17.9	7.5		3220	458		5																					
UPDES	UT0022616-003	10/1/1997	16.5	7.6		3210	458		<5.																					
UPDES	UT0022616-003	10/15/1997	11.1	7.4		3250	435		<5.																					
UPDES	UT0022616-003	11/3/1997	11.4	7.5		3250	552		5																					
UPDES	UT0022616-003	11/17/1997	8.4	7.4		3360	539		<5.																					
UPDES	UT0022616-003	12/1/1997	9.6	7.6		3420	503		<5.																					
UPDES	UT0022616-003	12/15/1997	6.6	7.4		3530	435		<5.																					

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SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	11/14/1994							3210	2330						0.2	<0.005		
UPDES	UT0022616-003	1/3/1995							5220	4250						0.49	0.05		
UPDES	UT0022616-003	2/1/1995																	
UPDES	UT0022616-003	3/7/1995								2360									
UPDES	UT0022616-003	3/20/1995								2290						0.8			
UPDES	UT0022616-003	4/3/1995								2360						0.5			
UPDES	UT0022616-003	4/24/1995								2450						0.6			
UPDES	UT0022616-003	5/1/1995								2330						0.2			
UPDES	UT0022616-003	5/15/1995								2350						0.6			
UPDES	UT0022616-003	6/5/1995								2400						0.1			
UPDES	UT0022616-003	6/19/1995								2400						0.3			
UPDES	UT0022616-003	7/11/1995								2370						<0.1			
UPDES	UT0022616-003	7/25/1995								2150						0.2			
UPDES	UT0022616-003	8/1/1995								1860						<0.1			
UPDES	UT0022616-003	8/15/1995								2040						0.3			
UPDES	UT0022616-003	9/5/1995								2080						0.1			
UPDES	UT0022616-003	9/18/1995								2080						0.4			
UPDES	UT0022616-003	10/2/1995								2390						0.3			
UPDES	UT0022616-003	10/24/1995								2550						0.1			
UPDES	UT0022616-003	11/6/1995								2590						0.6			
UPDES	UT0022616-003	11/15/1995								2590						<0.1			
UPDES	UT0022616-003	12/6/1995																	
UPDES	UT0022616-003	1/2/1996								2710						0.1			
UPDES	UT0022616-003	1/30/1996								2790						0.5			
UPDES	UT0022616-003	2/5/1996								2930						0.9			
UPDES	UT0022616-003	2/27/1996								2725						1			
UPDES	UT0022616-003	3/4/1996								2680						0.8			
UPDES	UT0022616-003	3/28/1996								2523						0.65			
UPDES	UT0022616-003	4/2/1996								2539						0.71			
UPDES	UT0022616-003	4/22/1996								2414						0.52			
UPDES	UT0022616-003	5/1/1996								2398						0.32			
UPDES	UT0022616-003	5/20/1996								2490						0.33			
UPDES	UT0022616-003	6/3/1996								2377						0.3			
UPDES	UT0022616-003	6/18/1996								2333						0.3			
UPDES	UT0022616-003	7/1/1996								2365						0.1			
UPDES	UT0022616-003	7/16/1996								2350						0.2			
UPDES	UT0022616-003	8/1/1996								2410						0.1			
UPDES	UT0022616-003	8/19/1996								2388						0.2			
UPDES	UT0022616-003	9/3/1996								2445						0.3			
UPDES	UT0022616-003	9/16/1996								2368						0.2			
UPDES	UT0022616-003	10/2/1996								2406						0.2			
UPDES	UT0022616-003	10/15/1996								2403						0.2			
UPDES	UT0022616-003	11/5/1996								2397						0.1			
UPDES	UT0022616-003	11/19/1996								2382						0.1			
UPDES	UT0022616-003	12/2/1996								2380						<0.1			
UPDES	UT0022616-003	12/16/1996								2487						0.1			
UPDES	UT0022616-003	1/2/1997								2432						<0.1			
UPDES	UT0022616-003	1/16/1997								2416						0.1			
UPDES	UT0022616-003	2/3/1997								2370						0.2			
UPDES	UT0022616-003	2/19/1997								2418						0.2			
UPDES	UT0022616-003	3/3/1997								2370						0.2			
UPDES	UT0022616-003	3/3/1997																	
UPDES	UT0022616-003	3/17/1997								2360						<0.1			
UPDES	UT0022616-003	4/1/1997								2400						0.1			
UPDES	UT0022616-003	4/15/1997								2360						0.1			
UPDES	UT0022616-003	5/1/1997								2330						0.1			
UPDES	UT0022616-003	5/15/1997								2320						0.1			
UPDES	UT0022616-003	6/2/1997								2300						0.1			
UPDES	UT0022616-003	6/16/1997								2300						0.5			
UPDES	UT0022616-003	7/1/1997								2320						0.2			
UPDES	UT0022616-003	7/15/1997								2280						0.1			
UPDES	UT0022616-003	8/1/1997								2260						0.3			
UPDES	UT0022616-003	8/15/1997								2340						0.1			
UPDES	UT0022616-003	9/3/1997								2290						0.1			
UPDES	UT0022616-003	9/16/1997								2320						0.2			
UPDES	UT0022616-003	10/1/1997								2410						0.2			
UPDES	UT0022616-003	10/15/1997								2420						0.8			
UPDES	UT0022616-003	11/3/1997								2430						0.1			
UPDES	UT0022616-003	11/17/1997								2340						0.1			
UPDES	UT0022616-003	12/1/1997								2380						<0.1			
UPDES	UT0022616-003	12/15/1997								2410						0.1			

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SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	1/2/1998	7.6	7.4		3450	525		8																					
UPDES	UT0022616-003	1/16/1998	7.7	7.5		3450	422		<5.																					
UPDES	UT0022616-003	2/2/1998	8.9	7.7		3410	413		<5.																					
UPDES	UT0022616-003	2/17/1998	9.5	8.1		3400	525		<4.																					
UPDES	UT0022616-003	3/2/1998	8.2	8.2		3390	310		<4.																					
UPDES	UT0022616-003	3/16/1998	12.7	7.7		3370	458		<4.																					
UPDES	UT0022616-003	4/2/1998	10.5	8.1		3350	444		<4.																					
UPDES	UT0022616-003	4/15/1998	10.6	8		3400	350		<4.																					
UPDES	UT0022616-003	5/1/1998	16.2	7.5		3360	381																							
UPDES	UT0022616-003	5/18/1998	15.1	7.7		3390	328		<4.																					
UPDES	UT0022616-003	5/27/1998	15.7	7.6		3350	359		<4.																					
UPDES	UT0022616-003	6/1/1998	18.3	7.8		3400	399		<4.																					
UPDES	UT0022616-003	6/15/1998	16.5	7.7		3440	278		8																					
UPDES	UT0022616-003	7/1/1998	20.1	7.6		3400	310		<5.																					
UPDES	UT0022616-003	7/17/1998	21.6	8		3480	301		<5.																					
UPDES	UT0022616-003	8/3/1998	19.8	7.6		3450	278		<5.																					
UPDES	UT0022616-003	8/17/1998	20.7	7.6		3520	251		<5.																					
UPDES	UT0022616-003	9/1/1998	19	7.4		3400	310		<5.																					
UPDES	UT0022616-003	9/1/1998	19	7.4		3400	310																							
UPDES	UT0022616-003	9/9/1998	19.8	7.5		3340	310		<5.																					
UPDES	UT0022616-003	10/23/1998	11.1	7.6		3670	139		<5.																					
UPDES	UT0022616-003	10/29/1998	13	7.5		3620	503		8																					
UPDES	UT0022616-003	11/9/1998	9.5	7.7		3630	359		<5.																					
UPDES	UT0022616-003	11/23/1998	10.3	7.4		3590	480		<5.																					
UPDES	UT0022616-003	12/1/1998	10.8	7.4		3460	525		5																					
UPDES	UT0022616-003	12/15/1998	8.1	7.3		3460	444		<5.																					
UPDES	UT0022616-003	1/4/1999	6.2	7.4		3510	588		7																					
UPDES	UT0022616-003	1/19/1999	8	7.4		3590	328		<5.																					
UPDES	UT0022616-003	2/1/1999	7.4	7.3		3550	458		5																					
UPDES	UT0022616-003	2/15/1999	8.3	7.2		3570	435		<5.																					
UPDES	UT0022616-003	3/1/1999	11.2	7.2		3460	467		<5.																					
UPDES	UT0022616-003	3/15/1999	11.2	7.2		3460	467																							
UPDES	UT0022616-003	4/5/1999	10.5	7.4		3450	310		<5.																					
UPDES	UT0022616-003	4/16/1999	11.4	7.3		3500	310		<5.																					
UPDES	UT0022616-003	5/3/1999	13.1	7.7		3390	359		<5.																					
UPDES	UT0022616-003	5/17/1999	14.1	7.6		3410	310		<5.																					
UPDES	UT0022616-003	6/1/1999	17.3	7.3		3340	310		<5.																					
UPDES	UT0022616-003	6/15/1999	20.1	8		3370	390		<5.																					
UPDES	UT0022616-003	7/1/1999	21	8.3		3440	310		<5.																					
UPDES	UT0022616-003	10/4/1999	14.5	7.5		3690	184		<5.																					
UPDES	UT0022616-003	12/3/1999	6.6	7.1		3660	588		<5.																					
UPDES	UT0022616-003	1/4/2000	6	7		3540	489		<5.																					
UPDES	UT0022616-003	2/2/2000	6.8	7.7		3540	444		<5.																					
UPDES	UT0022616-003	4/3/2000	12.7	7.6		3520	368		<5.																					
UPDES	UT0022616-003	5/24/2000	17.9	7.7		3510	552		6																					
UPDES	UT0022616-003	6/14/2000	17.4	7.7		3790	449		<5.																					
UPDES	UT0022616-003	6/8/2001	19.7	7.4		3380	467		<5.																					
UPDES	UT0022616-003	7/10/2001	22.1	7.4		3410	162		<5.																					
UPDES	UT0022616-003	12/10/2001	7.2	7		3430	435		5																					
UPDES	UT0022616-003	4/11/2002	14.5	7.1		3420	503		5																					
UPDES	UT0022616-003	5/7/2002	16.1	7		3370	413		<5.																					
UPDES	UT0022616-003	6/19/2002	19.5	7.3		3390	162		5																					
UPDES	UT0022616-003	7/15/2002	20.6	7.1		3530	175		<5.																					
UPDES	UT0022616-003	8/8/2002	19.3	7.2		3360	112		5																					
UPDES	UT0022616-003	9/16/2002	18.7	7.2		3340	435		<3.8																					
UPDES	UT0022616-003	10/22/2002	13	7		3390	413		<5.																					
UPDES	UT0022616-003	7/1/2003																												
UPDES	UT0022616-003	8/29/2003	26	8.5		3560	144		< 5.																					
UPDES	UT0022616-003	9/16/2003	17.7	7.7		3610	310		< 5.																					
UPDES	UT0022616-003	10/28/2003																												
UPDES	UT0022616-003	11/24/2003																												
UPDES	UT0022616-003	12/31/2003					0																							
UPDES	UT0022616-003	1/27/2004																												
UPDES	UT0022616-003	2/25/2004																												
UPDES	UT0022616-003	3/10/2004																												
UPDES	UT0022616-003	4/6/2004																												
UPDES	UT0022616-003	5/10/2004																												
UPDES	UT0022616-003	6/2/2004	16.5	8.2		3500	67		34																					
UPDES	UT0022616-003	7/8/2004	21.1	8.2		3490	225		< 5.																					
UPDES	UT0022616-003	8/8/2004					0																							
UPDES	UT0022616-003	9/8/2004					0																							

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	1/2/1998								2440						<0.1			
UPDES	UT0022616-003	1/16/1998								2440						0.1			
UPDES	UT0022616-003	2/2/1998								2440						<0.1			
UPDES	UT0022616-003	2/17/1998								2410						0.1			
UPDES	UT0022616-003	3/2/1998								2420						<0.1			
UPDES	UT0022616-003	3/16/1998								2418						<0.1			
UPDES	UT0022616-003	4/2/1998								2451						<0.1			
UPDES	UT0022616-003	4/15/1998								2453						0.1			
UPDES	UT0022616-003	5/1/1998								2407						<0.1			
UPDES	UT0022616-003	5/18/1998								2425						<0.1			
UPDES	UT0022616-003	5/27/1998								2483						0.1			
UPDES	UT0022616-003	6/1/1998								2440						0.1			
UPDES	UT0022616-003	6/15/1998								2404						0.1			
UPDES	UT0022616-003	7/1/1998								2336						<0.1			
UPDES	UT0022616-003	7/17/1998								996						<0.1			
UPDES	UT0022616-003	8/3/1998								2450						0.1			
UPDES	UT0022616-003	8/17/1998								2463						<0.1			
UPDES	UT0022616-003	9/1/1998								2446						0.1			
UPDES	UT0022616-003	9/1/1998																	
UPDES	UT0022616-003	9/9/1998								2426						<0.1			
UPDES	UT0022616-003	10/23/1998								2550						1			
UPDES	UT0022616-003	10/29/1998								2588						1			
UPDES	UT0022616-003	11/9/1998								2518						0.6			
UPDES	UT0022616-003	11/23/1998								2545						0.6			
UPDES	UT0022616-003	12/1/1998								2553						0.5			
UPDES	UT0022616-003	12/15/1998								2445						0.3			
UPDES	UT0022616-003	1/4/1999								2505						0.2			
UPDES	UT0022616-003	1/19/1999								2527						0.2			
UPDES	UT0022616-003	2/1/1999								2516						0.3			
UPDES	UT0022616-003	2/15/1999								2523						0.2			
UPDES	UT0022616-003	3/1/1999								2500						<0.1			
UPDES	UT0022616-003	3/15/1999																	
UPDES	UT0022616-003	4/5/1999								2476						0.1			
UPDES	UT0022616-003	4/16/1999								2407						<0.1			
UPDES	UT0022616-003	5/3/1999								2358						<0.1			
UPDES	UT0022616-003	5/17/1999								2408						<0.1			
UPDES	UT0022616-003	6/1/1999								2440						0.2			
UPDES	UT0022616-003	6/15/1999								2433						0.1			
UPDES	UT0022616-003	7/1/1999								2473						0.1			
UPDES	UT0022616-003	10/4/1999								2543						0.2			
UPDES	UT0022616-003	12/3/1999								2582						0.5			
UPDES	UT0022616-003	1/4/2000								2511						0.1			
UPDES	UT0022616-003	2/2/2000								2496						0.1			
UPDES	UT0022616-003	4/3/2000								2519						<0.1			
UPDES	UT0022616-003	5/24/2000								2527						<0.1			
UPDES	UT0022616-003	6/14/2000								2495						<0.1			
UPDES	UT0022616-003	6/8/2001								2417						<0.1			
UPDES	UT0022616-003	7/10/2001								2459						<0.1			
UPDES	UT0022616-003	12/10/2001								2450						<0.1			
UPDES	UT0022616-003	4/11/2002								2383						0.1			
UPDES	UT0022616-003	5/7/2002								2411						<0.1			
UPDES	UT0022616-003	6/19/2002								2406						<0.1			
UPDES	UT0022616-003	7/15/2002								2370						<0.1			
UPDES	UT0022616-003	8/8/2002								2390						0.1			
UPDES	UT0022616-003	9/16/2002								2325						<0.1			
UPDES	UT0022616-003	10/22/2002								2334						<0.1			
UPDES	UT0022616-003	7/1/2003																	
UPDES	UT0022616-003	8/29/2003								2375						0.129			
UPDES	UT0022616-003	9/16/2003								2512						0.511			
UPDES	UT0022616-003	10/28/2003																	
UPDES	UT0022616-003	11/24/2003																	
UPDES	UT0022616-003	12/31/2003																	pump down could not sample
UPDES	UT0022616-003	1/27/2004																	
UPDES	UT0022616-003	2/25/2004																	
UPDES	UT0022616-003	3/10/2004																	
UPDES	UT0022616-003	4/6/2004																	
UPDES	UT0022616-003	5/10/2004																	
UPDES	UT0022616-003	6/2/2004								2456						0.36			
UPDES	UT0022616-003	7/8/2004								2428						0.36			
UPDES	UT0022616-003	8/8/2004																	
UPDES	UT0022616-003	9/8/2004																	

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	10/28/2004	12.7	8		3570	337		< 5.																					
UPDES	UT0022616-003	11/1/2004	12	8.2		3460	382		< 5.																					
UPDES	UT0022616-003	12/1/2004	4.3	8.3		3360	382		< 5.																					
UPDES	UT0022616-003	1/3/2005	11	8		3950	247		5																					
UPDES	UT0022616-003	2/1/2005	9	8.5			265		0																					
UPDES	UT0022616-003	3/1/2005	11	8.5		5680	224		5																					
UPDES	UT0022616-003	4/1/2005	13.3	8.6		3990	337		< 5.																					
UPDES	UT0022616-003	5/2/2005					0																							
UPDES	UT0022616-003	6/1/2005					0																							
UPDES	UT0022616-003	7/15/2005					0																							
UPDES	UT0022616-003	8/18/2005					0																							
UPDES	UT0022616-003	9/2/2005	18.3	7.8		4360	314		10																					
UPDES	UT0022616-003	10/3/2005	13.7	8.2		4430	202		< 5.																					
UPDES	UT0022616-003	11/1/2005	15	8.2		4500	382		10																					
UPDES	UT0022616-003	11/15/2005	10.5	7.8		4430	359		< 5.																					
UPDES	UT0022616-003	12/1/2005	7.3	8		4410	314		< 5.																					
UPDES	UT0022616-003	12/15/2005							< 5.																					
UPDES	UT0022616-003	1/3/2006	8.1	8.4		4260	314		< 5.																					
UPDES	UT0022616-003	1/16/2006	4.6	8.6		4360			< 5.																					
UPDES	UT0022616-003	2/1/2006		8.4			395		7																					
UPDES	UT0022616-003	2/15/2006	9.9	7.8		4310			< 5.																					
UPDES	UT0022616-003	3/1/2006	11.5	8.2		4320			< 5.																					
UPDES	UT0022616-003	3/15/2006	11.4	8		4280			< 5.																					
UPDES	UT0022616-003	4/3/2006	13.8	8.1		4310	422		< 5.	0																				
UPDES	UT0022616-003	4/17/2006	13.3	8.2		4350	422		6	0																				
UPDES	UT0022616-003	5/1/2006	13.8	8		4350	391	7.9	< 5.	0																< 5.		126		
UPDES	UT0022616-003	5/15/2006	17.9	7.2		4340	391		< 5.	0																				
UPDES	UT0022616-003	6/1/2006	20	8.1		4330	382		5	0																				
UPDES	UT0022616-003	6/15/2006	17.3	8.2		4310	382		< 5.	0																				
UPDES	UT0022616-003	6/30/2006	21.4	8		4320	408		< 5.	0																				
UPDES	UT0022616-003	7/14/2006	17.9	8.1		4240	402		5	0																				
UPDES	UT0022616-003	8/1/2006	21	7.9		4390	412		< 5.	0																				
UPDES	UT0022616-003	8/15/2006	18.3	8.1		4490	70		< 5.	0																				
UPDES	UT0022616-003	9/1/2006	20	8.1		4390	486		< 5.	0																				
UPDES	UT0022616-003	9/15/2006	15.1	8.6		4300	497		< 5.	0																				
UPDES	UT0022616-003	10/2/2006	13.9	8.4		4360	433		43	0																				
UPDES	UT0022616-003	10/16/2006	13.4	8.8		4300	678		< 5.	0																				
UPDES	UT0022616-003	11/1/2006	12.7	8.1		4400	648		< 5.	0																				
UPDES	UT0022616-003	11/16/2006	9.5	7.6		4350	670		< 5.	0																				
UPDES	UT0022616-003	12/1/2006	7.6	7.4		4280	608		6	0																				
UPDES	UT0022616-003	12/15/2006	10	8		4350	645		12	0																				
UPDES	UT0022616-003	1/2/2007	9.4	8.2		4260	478																							
UPDES	UT0022616-003	1/15/2007	6.9	8.2		4380	480																							
UPDES	UT0022616-003	2/1/2007	5.9	8.7		4310	447																							
UPDES	UT0022616-003	2/15/2007	8.5	8.3		4490	588																							
UPDES	UT0022616-003	3/1/2007	9	8.6		4540	592																							
UPDES	UT0022616-003	3/13/2007	12.6	8.2		4600	675																							
UPDES	UT0022616-003	4/3/2007	13.5	8.3		4660	602																							
UPDES	UT0022616-003	4/16/2007	14.6	8.4		4590	471																							
UPDES	UT0022616-003	5/1/2007	19.9	8.6		4490	416																							
UPDES	UT0022616-003	5/15/2007	12.4	8.5		4400	253																							
UPDES	UT0022616-003	6/1/2007	17.5	8.8		4370	245																							
UPDES	UT0022616-003	6/15/2007	20	7.7		4350	410																							
UPDES	UT0022616-003	7/2/2007	21.1	8.2		4340	455																							
UPDES	UT0022616-003	7/16/2007	19.7	8.2		4320	418																							
UPDES	UT0022616-003	8/6/2007	20.2	8.3		4230	28																							
UPDES	UT0022616-003	8/16/2007	20.6	8.6		4250	324																							
UPDES	UT0022616-003	8/31/2007	19.4	8.4		4220	246																							
UPDES	UT0022616-003	9/18/2007	19.4	8.2		4180	898																							
UPDES	UT0022616-003	10/1/2007	12.1	8.2		4200	526																							
UPDES	UT0022616-003	10/15/2007	12.5	7.4		4130	569																							
UPDES	UT0022616-003	11/1/2007	11.3	7.6		3880	468																							
UPDES	UT0022616-003	11/16/2007	9.6	7.6		3880	482																							
UPDES	UT0022616-003	12/3/2007	8	7.4		3940	477																							
UPDES	UT0022616-003	12/18/2007	5.8	7.8		4320	493																							
UPDES	UT0022616-003	1/2/2008	6.6	7.7		4390	502																							
UPDES	UT0022616-003	1/15/2008	8.1	7.4		4640	430																							
UPDES	UT0022616-003	2/1/2008	6.8	8		4740	432																							
UPDES	UT0022616-003	2/15/2008	6.7	7.8		4920	432																							
UPDES	UT0022616-003	3/3/2008	10.3	7		5130	445																							
UPDES	UT0022616-003	3/17/2008	8.8	8.4		5050	431																							

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	10/28/2004								2481						0.92			
UPDES	UT0022616-003	11/1/2004								2483						0.92			
UPDES	UT0022616-003	12/1/2004								2590						0.77			
UPDES	UT0022616-003	1/3/2005								2834						0.23			
UPDES	UT0022616-003	2/1/2005								2889						0.23			
UPDES	UT0022616-003	3/1/2005								2995						0.12			
UPDES	UT0022616-003	4/1/2005								2774						0.24			
UPDES	UT0022616-003	5/2/2005																	
UPDES	UT0022616-003	6/1/2005																	No Discharge in June
UPDES	UT0022616-003	7/15/2005																	No Flow
UPDES	UT0022616-003	8/18/2005																	Did not Discharge in August
UPDES	UT0022616-003	9/2/2005								3300						0.36			
UPDES	UT0022616-003	10/3/2005								3508						0.25			
UPDES	UT0022616-003	11/1/2005								3361						1.55			
UPDES	UT0022616-003	11/15/2005								3378						1.29			
UPDES	UT0022616-003	12/1/2005								3390						0.45			
UPDES	UT0022616-003	12/15/2005								3391						0.53			
UPDES	UT0022616-003	1/3/2006								3311						0.29			
UPDES	UT0022616-003	1/16/2006								3277						0.31			
UPDES	UT0022616-003	2/1/2006								3326						0.38			
UPDES	UT0022616-003	2/15/2006								3199						0.7			
UPDES	UT0022616-003	3/1/2006								3261						0.54			
UPDES	UT0022616-003	3/15/2006								3258						0.4			
UPDES	UT0022616-003	4/3/2006								3231						0.57			
UPDES	UT0022616-003	4/17/2006								3263						0.57			
UPDES	UT0022616-003	5/1/2006			1837		423			3282						0.53	0.022	110	
UPDES	UT0022616-003	5/15/2006								3267						0.38			
UPDES	UT0022616-003	6/1/2006								3239						0.66	0.025		
UPDES	UT0022616-003	6/15/2006								3258						0.55			BH
UPDES	UT0022616-003	6/30/2006								3213						0.32	0.077		
UPDES	UT0022616-003	7/14/2006								3244						0.26			
UPDES	UT0022616-003	8/1/2006								3297						0.34			
UPDES	UT0022616-003	8/15/2006								3359						0.2			
UPDES	UT0022616-003	9/1/2006								3359						0.17			
UPDES	UT0022616-003	9/15/2006								3327						0.15			
UPDES	UT0022616-003	10/2/2006								3424						0.13			DIS.METALS FILTERED @ LAB
UPDES	UT0022616-003	10/16/2006								3333						0.18			
UPDES	UT0022616-003	11/1/2006								3407						0.4			
UPDES	UT0022616-003	11/16/2006								3289						0.75			
UPDES	UT0022616-003	12/1/2006								3296						0.53			
UPDES	UT0022616-003	12/15/2006								3234						0.48			
UPDES	UT0022616-003	1/2/2007								3180						0.8			
UPDES	UT0022616-003	1/15/2007								3283						1.03			
UPDES	UT0022616-003	2/1/2007								3253						0.79			
UPDES	UT0022616-003	2/15/2007								3374						0.32			
UPDES	UT0022616-003	3/1/2007								3509						0.28			
UPDES	UT0022616-003	3/13/2007								3581						0.25			
UPDES	UT0022616-003	4/3/2007								3560						0.26			
UPDES	UT0022616-003	4/16/2007								3531						0.24			
UPDES	UT0022616-003	5/1/2007								3532						0.31			
UPDES	UT0022616-003	5/15/2007								3456						0.18			
UPDES	UT0022616-003	6/1/2007								3430						0.14			
UPDES	UT0022616-003	6/15/2007								3442						0.16			
UPDES	UT0022616-003	7/2/2007								3455						0.15			
UPDES	UT0022616-003	7/16/2007								3461						< .05			
UPDES	UT0022616-003	8/6/2007								3372						< .05			
UPDES	UT0022616-003	8/16/2007								3414						< .05			
UPDES	UT0022616-003	8/31/2007								3344						< .05			
UPDES	UT0022616-003	9/18/2007								3327						0.35			
UPDES	UT0022616-003	10/1/2007								3334						0.21			
UPDES	UT0022616-003	10/15/2007								3176						0.44			
UPDES	UT0022616-003	11/1/2007								3078						0.35			
UPDES	UT0022616-003	11/16/2007								3112						0.47			
UPDES	UT0022616-003	12/3/2007								3163						0.39			
UPDES	UT0022616-003	12/18/2007								3409						0.45			
UPDES	UT0022616-003	1/2/2008								3720						0.61			
UPDES	UT0022616-003	1/15/2008								3868						0.5			
UPDES	UT0022616-003	2/1/2008								4080						0.59			
UPDES	UT0022616-003	2/15/2008								4161						0.66			
UPDES	UT0022616-003	3/3/2008								4374						0.49			
UPDES	UT0022616-003	3/17/2008								4416						0.29			

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	4/1/2008	10.9	7.6		5070	395																							
UPDES	UT0022616-003	4/15/2008	15.4	8.4		5120	461																							
UPDES	UT0022616-003	5/2/2008	13.4	7.8		5020	412																							
UPDES	UT0022616-003	5/16/2008	13.9	7.9		4820	438																							
UPDES	UT0022616-003	6/2/2008	17.8	7.7		4790	385																							
UPDES	UT0022616-003	6/16/2008	19.7	7.3		4740	419																							
UPDES	UT0022616-003	7/1/2008	20	6.8		4830	402																							
UPDES	UT0022616-003	7/15/2008	19.3	7.7		4550	402																							
UPDES	UT0022616-003	8/1/2008	19	7.9		4450	6																							
UPDES	UT0022616-003	8/15/2008	18.8	7.8		4400	33																							
UPDES	UT0022616-003	9/2/2008	16.1	7.7		4410	26																							
UPDES	UT0022616-003	9/15/2008	13.4	8.2		4490	20																							
UPDES	UT0022616-003	10/1/2008	16.2	7.4		4450	429																							
UPDES	UT0022616-003	10/15/2008	14.1	8.4		24.6	0																							
UPDES	UT0022616-003	11/3/2008	10.9	8.4		4.66	0																							
UPDES	UT0022616-003	11/18/2008		0			0																							
UPDES	UT0022616-003	12/1/2008	10.5	9		4760	0																							
UPDES	UT0022616-003	12/15/2008	5.7	7.6		4760	0																							
UPDES	UT0022616-003	1/2/2007	9.4	8.2		4260	478.1		7																					
UPDES	UT0022616-003	1/15/2007	6.9	8.2		4380	480.2		17																					
UPDES	UT0022616-003	2/1/2007	5.9	8.7		4310	446.9		9																					
UPDES	UT0022616-003	2/15/2007	8.5	8.3		4490	588.4		< 5.																					
UPDES	UT0022616-003	3/1/2007	9	8.6		4540	591.6		< 5.																					
UPDES	UT0022616-003	3/13/2007	12.6	8.2		4600	674.8		< 5.																					
UPDES	UT0022616-003	4/3/2007	13.5	8.3		4660	601.6		< 5.																					
UPDES	UT0022616-003	4/16/2007	14.6	8.4		4590	471.0		6																					
UPDES	UT0022616-003	5/1/2007	19.9	8.6		4490	416.3		< 5.																					
UPDES	UT0022616-003	5/15/2007	12.4	8.5		4400	252.9		< 5.																					
UPDES	UT0022616-003	6/1/2007	17.5	8.8		4370	244.7		5																					
UPDES	UT0022616-003	6/15/2007	20	7.7		4350	410.4		17																					
UPDES	UT0022616-003	7/2/2007	21.1	8.2		4340	455.1		7																					
UPDES	UT0022616-003	7/16/2007	19.7	8.2		4320	418.3		< 5.																					
UPDES	UT0022616-003	8/6/2007	20.2	8.3		4230	28.1		< 5.																					
UPDES	UT0022616-003	8/16/2007	20.6	8.6		4250	324.0		< 5.																					
UPDES	UT0022616-003	8/31/2007	19.4	8.4		4220	246.4		< 5.																					
UPDES	UT0022616-003	9/18/2007	19.4	8.2		4180	898.5		< 5.																					
UPDES	UT0022616-003	10/1/2007	12.1	8.2		4200	525.7		< 5.																					
UPDES	UT0022616-003	10/15/2007	12.5	7.4		4130	569.3		< 5.																					
UPDES	UT0022616-003	11/1/2007	11.3	7.6		3880	467.9		< 5.																					
UPDES	UT0022616-003	11/16/2007	9.6	7.6		3880	481.6		< 5.																					
UPDES	UT0022616-003	12/3/2007	8	7.4		3940	476.9		< 5.																					
UPDES	UT0022616-003	12/18/2007	5.8	7.8		4320	492.7		5																					
UPDES	UT0022616-003	1/2/2008	6.6	7.7		4390	502.2		5																					
UPDES	UT0022616-003	1/15/2008	8.1	7.4		4640	429.5		< 5.																					
UPDES	UT0022616-003	2/1/2008	6.8	8		4740	432.2		< 5.																					
UPDES	UT0022616-003	2/15/2008	6.7	7.8		4920	432.2		5																					
UPDES	UT0022616-003	3/3/2008	10.3	7		5130	445.2		8																					
UPDES	UT0022616-003	3/17/2008	8.8	8.4		5050	431.3		< 5.																					
UPDES	UT0022616-003	4/1/2008	10.9	7.6		5070	395.1		< 5.																					
UPDES	UT0022616-003	4/15/2008	15.4	8.4		5120	460.5		< 5.																					
UPDES	UT0022616-003	5/2/2008	13.4	7.8		5020	411.6		< 5.																					
UPDES	UT0022616-003	5/16/2008	13.9	7.9		4820	437.7		< 5.																					
UPDES	UT0022616-003	6/2/2008	17.8	7.7		4790	385.4		< 5.																					
UPDES	UT0022616-003	6/16/2008	19.7	7.3		4740	419.5		< 5.																					
UPDES	UT0022616-003	7/1/2008	20	6.8		4830	401.9		< 5.																					
UPDES	UT0022616-003	7/15/2008	19.3	7.7		4550	401.9		< 5.																					
UPDES	UT0022616-003	8/1/2008	19	7.9		4450	6.2		5																					
UPDES	UT0022616-003	8/15/2008	18.8	7.8		4400	33.3		< 5.																					
UPDES	UT0022616-003	9/2/2008	16.1	7.7		4410	26.4		< 5.																					
UPDES	UT0022616-003	9/15/2008	13.4	8.2		4490	20.1		< 5.																					
UPDES	UT0022616-003	10/1/2008	16.2	7.4		4450	428.9		< 5.																					
UPDES	UT0022616-003	10/15/2008	14.1	8.4		24.6	0		< 5.																					
UPDES	UT0022616-003	11/3/2008	10.9	8.4		4.66	0		< 5.																					
UPDES	UT0022616-003	11/18/2008		0			0		< 5.																					
UPDES	UT0022616-003	12/1/2008	10.5	9		4760	0		< 5.																					
UPDES	UT0022616-003	12/15/2008	5.7	7.6		4760	0		< 5.																					
UPDES	UT0022616-003	3/2/2009	11.6	7.5		4900	0.6		< 5.																					
UPDES	UT0022616-003	3/16/2009		8.8		4850	0.5		< 5.																					
UPDES	UT0022616-003	4/2/2009	8.8	7.6		4820	0.4		< 5.																					
UPDES	UT0022616-003	4/14/2009	13.9	7.9		4740	395.4		< 5.																					
UPDES	UT0022616-003	5/1/2009	15.4	7.9		4650	437.1		< 5.																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	4/1/2008								4315						0.29			
UPDES	UT0022616-003	4/15/2008								4319						0.25			
UPDES	UT0022616-003	5/2/2008								4243						0.21			
UPDES	UT0022616-003	5/16/2008								4082						0.2			
UPDES	UT0022616-003	6/2/2008								4084						0.16			
UPDES	UT0022616-003	6/16/2008								4146						0.23			
UPDES	UT0022616-003	7/1/2008								4233						0.11			
UPDES	UT0022616-003	7/15/2008								4131						0.1			
UPDES	UT0022616-003	8/1/2008								4098						0.3			
UPDES	UT0022616-003	8/15/2008								3967						0.1			
UPDES	UT0022616-003	9/2/2008								3976						0.18			
UPDES	UT0022616-003	9/15/2008								3995						0.08			
UPDES	UT0022616-003	10/1/2008								4132						0.09			
UPDES	UT0022616-003	10/15/2008								4190						0.18			
UPDES	UT0022616-003	11/3/2008								4513						0.12			
UPDES	UT0022616-003	11/18/2008								4320						0.24			
UPDES	UT0022616-003	12/1/2008								4299						0.12			
UPDES	UT0022616-003	12/15/2008								4382						0.19			
UPDES	UT0022616-003	1/2/2007							3180						0.8				
UPDES	UT0022616-003	1/15/2007							3283						1.03				
UPDES	UT0022616-003	2/1/2007							3253						0.79				
UPDES	UT0022616-003	2/15/2007							3374						0.32				
UPDES	UT0022616-003	3/1/2007							3509						0.28				
UPDES	UT0022616-003	3/13/2007							3581						0.25				
UPDES	UT0022616-003	4/3/2007							3560						0.26				
UPDES	UT0022616-003	4/16/2007							3531						0.24				
UPDES	UT0022616-003	5/1/2007							3532						0.31				
UPDES	UT0022616-003	5/15/2007							3456						0.18				
UPDES	UT0022616-003	6/1/2007							3430						0.14				
UPDES	UT0022616-003	6/15/2007							3442						0.16				
UPDES	UT0022616-003	7/2/2007							3455						0.15				
UPDES	UT0022616-003	7/16/2007							3461						< .05				
UPDES	UT0022616-003	8/6/2007							3372						< .05				
UPDES	UT0022616-003	8/16/2007							3414						< .05				
UPDES	UT0022616-003	8/31/2007							3344						< .05				
UPDES	UT0022616-003	9/18/2007							3327						0.35				
UPDES	UT0022616-003	10/1/2007							3334						0.21				
UPDES	UT0022616-003	10/15/2007							3176						0.44				
UPDES	UT0022616-003	11/1/2007							3078						0.35				
UPDES	UT0022616-003	11/16/2007							3112						0.47				
UPDES	UT0022616-003	12/3/2007							3163						0.39				
UPDES	UT0022616-003	12/18/2007							3409						0.45				
UPDES	UT0022616-003	1/2/2008							3720						0.61				
UPDES	UT0022616-003	1/15/2008							3868						0.5				
UPDES	UT0022616-003	2/1/2008							4080						0.59				
UPDES	UT0022616-003	2/15/2008							4161						0.66				
UPDES	UT0022616-003	3/3/2008							4374						0.49				
UPDES	UT0022616-003	3/17/2008							4416						0.29				
UPDES	UT0022616-003	4/1/2008							4315						0.29				
UPDES	UT0022616-003	4/15/2008							4319						0.25				
UPDES	UT0022616-003	5/2/2008							4243						0.21				
UPDES	UT0022616-003	5/16/2008							4082						0.2				
UPDES	UT0022616-003	6/2/2008							4084						0.16				
UPDES	UT0022616-003	6/16/2008							4146						0.23				
UPDES	UT0022616-003	7/1/2008							4233						0.11				
UPDES	UT0022616-003	7/15/2008							4131						0.1				
UPDES	UT0022616-003	8/1/2008							4098						0.3				
UPDES	UT0022616-003	8/15/2008							3967						0.1				
UPDES	UT0022616-003	9/2/2008							3976						0.18				
UPDES	UT0022616-003	9/15/2008							3995						0.08				
UPDES	UT0022616-003	10/1/2008							4132						0.09				
UPDES	UT0022616-003	10/15/2008							4190						0.18				
UPDES	UT0022616-003	11/3/2008							4513						0.12				
UPDES	UT0022616-003	11/18/2008							4320						0.24				
UPDES	UT0022616-003	12/1/2008							4299						0.12				
UPDES	UT0022616-003	12/15/2008							4382						0.19				
UPDES	UT0022616-003	3/2/2009							4667						0.47				
UPDES	UT0022616-003	3/16/2009							4639						0.23				
UPDES	UT0022616-003	4/2/2009							4516						0.19				
UPDES	UT0022616-003	4/14/2009							4491						0.2				
UPDES	UT0022616-003	5/1/2009							4475						0.12				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	5/15/2009	15.2	7.9		4740	417.8		< 5.																					
UPDES	UT0022616-003	6/1/2009	19.5	8.2		4650	1.0		< 5.																					
UPDES	UT0022616-003	6/15/2009	17.4			4500			< 5.																					
UPDES	UT0022616-003	7/1/2009	21	7.9		4490	0		< 5.																					
UPDES	UT0022616-003	7/15/2009	20.4	7.6		4400	0		< 5.																					
UPDES	UT0022616-003	8/3/2009	19.2	7.2		4230	0		< 5.																					
UPDES	UT0022616-003	8/17/2009	17.9	8.3		4180	0		< 5.																					
UPDES	UT0022616-003	9/2/2009	19.7	7		4110	0		< 5.																					
UPDES	UT0022616-003	9/15/2009	17	7.6		4130	0		< 5.																					
UPDES	UT0022616-003	10/2/2009	14.7	7.5		4090	448.8		< 5.																					
UPDES	UT0022616-003	10/16/2009	13.3	7.7		4090	448.8		< 5.																					
UPDES	UT0022616-003	11/2/2009	13.3	7.9		4080	438.9		< 5.																					
UPDES	UT0022616-003	11/18/2009	11	8		4030	448.8		< 5.																					
UPDES	UT0022616-003	12/2/2009	9.3	8		4040	403.0		< 5.																					
UPDES	UT0022616-003	12/16/2009	8.4	8.4		4010	417.4		< 5.																					
UPDES	UT0022616-003	1/4/2010	9	8.2		4140	0		< 5.																					
UPDES	UT0022616-003	1/18/2010	9.9	8.5		4160	0		5																					
UPDES	UT0022616-003	2/3/2010	9.3	6.5		4880	0		< 5.																					
UPDES	UT0022616-003	2/15/2010		6.6		4510	0		< 5.																					
UPDES	UT0022616-003	3/2/2010	10.5	7.1		4160	0		< 5.																					
UPDES	UT0022616-003	3/15/2010	8.2	7.1		4090	0		12																					
UPDES	UT0022616-003	4/19/2010	18.5	6.7		3950	803.4		> 5.																					
UPDES	UT0022616-003	5/3/2010	13.5	7.1		4060	965.0		< 5.																					
UPDES	UT0022616-003	5/17/2010	18.5	7		4170	879.7		< 5.																					
UPDES	UT0022616-003	6/2/2010	18	7.3		4020	1095.1		< 5.																					
UPDES	UT0022616-003	6/16/2010	18.8	7.3		3990	785.5		7																					
UPDES	UT0022616-003	7/2/2010	17.4	7.4		3950	1095.1		< 5.																					
UPDES	UT0022616-003	7/19/2010		6.8			839.3		< 5.																					
UPDES	UT0022616-003	8/3/2010		7.1			821.3		< 5.																					
UPDES	UT0022616-003	8/16/2010		6.5			821.3		< 5.																					
UPDES	UT0022616-003	9/3/2010		6.6			834.8		< 5.																					
UPDES	UT0022616-003	9/16/2010		6.7			848.2		< 5.																					
UPDES	UT0022616-003	10/11/2010	16.1	7.1		3780	834.8		< 5.																					
UPDES	UT0022616-003	10/22/2010	13	7.4		3730	951.5		< 5.																					
UPDES	UT0022616-003	11/2/2010	16	7.7		3650	834.8		< 5.																					
UPDES	UT0022616-003	11/17/2010	9.8	7.6		3650	215.4		< 5.																					
UPDES	UT0022616-003	12/1/2010	9.5	7.1		3600	763.0		< 5.																					
UPDES	UT0022616-003	12/15/2010	10	7.6		3490	852.7		< 5.																					
UPDES	UT0022616-003	1/5/2011	8.9	7.7		3580	1243.2		8																					
UPDES	UT0022616-003	1/18/2011	10.3	8		3780	1189.3		5																					
UPDES	UT0022616-003	2/1/2011	4.8	7.8		3480	816.8		< 5.																					
UPDES	UT0022616-003	2/15/2011	11.2	7.7		3510	830.3		< 5.																					
UPDES	UT0022616-003	3/1/2011	11.1	7.7		3540	816.8		< 5.																					
UPDES	UT0022616-003	3/18/2011	13	7.8		3640	731.5		< 5.																					
UPDES	UT0022616-003	4/4/2011	11.3	7.7		3610	745.0		< 5.																					
UPDES	UT0022616-003	4/15/2011	12	7.8		3570	798.9		< 5.																					
UPDES	UT0022616-003	5/2/2011	14.2	7.7		3560	852.7		10																					
UPDES	UT0022616-003	5/16/2011	14	7.7		3560	861.7		< 5.																					
UPDES	UT0022616-003	6/1/2011	15	7.8		3500	825.8		< 5.																					
UPDES	UT0022616-003	6/17/2011	15.2	7.6		3470	839.3		< 5.																					
UPDES	UT0022616-003	7/5/2011	17.6	7.5		3440	794.4		7																					
UPDES	UT0022616-003	7/19/2011	17.5	7.5		3530	825.8		< 5.																					
UPDES	UT0022616-003	8/1/2011	18.7	7.4		3530	776.4		< 5.																					
UPDES	UT0022616-003	8/15/2011	16.8	7.5		3560	763.0		< 5.																					
UPDES	UT0022616-003	9/1/2011	17.2	7.4		3620	771.9		< 5.																					
UPDES	UT0022616-003	9/22/2011	15	7.5		3620	1377.8		< 5.																					
UPDES	UT0022616-003	10/1/2011	14.9	7		3780	1404.7		7																					
UPDES	UT0022616-003	10/17/2011	14.6	7.2		3950	1310.5		< 5.																					
UPDES	UT0022616-003	11/1/2011	11.4	6.8		3990	1485.5		< 5.																					
UPDES	UT0022616-003	11/15/2011	12.7	7		4050	1341.9		< 5.																					
UPDES	UT0022616-003	12/1/2011	9.9	7		4110	1355.4		< 5.																					
UPDES	UT0022616-003	12/15/2011	11.8	7		3910	1063.7		6																					
UPDES	UT0022616-003	1/3/2012	10.5	7.1		4040	1009.8		6																					
UPDES	UT0022616-003	1/16/2012	7.2	7.1		4010	1005.3		< 5.																					
UPDES	UT0022616-003	2/1/2012	11.2	7.1		3870	1054.7		< 5.																					
UPDES	UT0022616-003	2/16/2012	13.4	7.1		3930	1027.8		6																					
UPDES	UT0022616-003	3/1/2012	12.9	7.1		3870	1027.8		< 5.																					
UPDES	UT0022616-003	3/15/2012	14.2	7.2		3880	973.9		6																					
UPDES	UT0022616-003	4/3/2012	11.5	7.2		3800	982.9		< 5.																					
UPDES	UT0022616-003	4/16/2012	13	7.2		3850	677.7		6																					
UPDES	UT0022616-003	5/1/2012	14.9	7.2		3820	596.9		< 5.																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	5/15/2009							4431						0.15				
UPDES	UT0022616-003	6/1/2009							4397						0.14				
UPDES	UT0022616-003	6/15/2009							4248						0.14				
UPDES	UT0022616-003	7/1/2009							4272						0.15				
UPDES	UT0022616-003	7/15/2009							4171						0.16				
UPDES	UT0022616-003	8/3/2009							3920						0.14				
UPDES	UT0022616-003	8/17/2009							3875						0.17				
UPDES	UT0022616-003	9/2/2009							3827						0.12				
UPDES	UT0022616-003	9/15/2009							3786						0.21				
UPDES	UT0022616-003	10/2/2009							3760						0.28				
UPDES	UT0022616-003	10/16/2009							3759						0.17				
UPDES	UT0022616-003	11/2/2009							3727						0.37				
UPDES	UT0022616-003	11/18/2009			> 2134.				3687						0.32				
UPDES	UT0022616-003	12/2/2009			> 2131.				3657						0.28				
UPDES	UT0022616-003	12/16/2009			> 2043.				3598						0.31				
UPDES	UT0022616-003	1/4/2010			2056				3705						0.25				
UPDES	UT0022616-003	1/18/2010			2111				3760						0.26				
UPDES	UT0022616-003	2/3/2010			2273				4122						0.23				
UPDES	UT0022616-003	2/15/2010			2119				3741						0.21				
UPDES	UT0022616-003	3/2/2010			2114				3681						0.27				
UPDES	UT0022616-003	3/15/2010			1993				3575						0.13				
UPDES	UT0022616-003	4/19/2010			1908				3475						0.65				
UPDES	UT0022616-003	5/3/2010			2027				3461						0.11				
UPDES	UT0022616-003	5/17/2010			1906				3453						0.92				
UPDES	UT0022616-003	6/2/2010			1924				3425						0.81				
UPDES	UT0022616-003	6/16/2010			1898				3365						0.86				
UPDES	UT0022616-003	7/2/2010			1867				3389						1.01				
UPDES	UT0022616-003	7/19/2010							3347						1.11				
UPDES	UT0022616-003	8/3/2010							3288						0.81				
UPDES	UT0022616-003	8/16/2010							3309						0.75				
UPDES	UT0022616-003	9/3/2010							3330						0.63				
UPDES	UT0022616-003	9/16/2010							3303						0.56				
UPDES	UT0022616-003	10/11/2010			1869				3298						0.83				
UPDES	UT0022616-003	10/22/2010			1844				3235						0.75				
UPDES	UT0022616-003	11/2/2010			1823				3233						0.8				
UPDES	UT0022616-003	11/17/2010			1827				3177						0.6				
UPDES	UT0022616-003	12/1/2010			1754				3104						0.95				
UPDES	UT0022616-003	12/15/2010			1712				2981						0.75				
UPDES	UT0022616-003	1/5/2011			1543				2794						0.57				
UPDES	UT0022616-003	1/18/2011			1521				2723						0.74				
UPDES	UT0022616-003	2/1/2011			1476				2730						0.49				
UPDES	UT0022616-003	2/15/2011			1419				2682						0.52				
UPDES	UT0022616-003	3/1/2011			1411				2670						0.52				
UPDES	UT0022616-003	3/18/2011			1442				2705						0.57				
UPDES	UT0022616-003	4/4/2011			1475				2720						0.54				
UPDES	UT0022616-003	4/15/2011			1409				2664						0.54				
UPDES	UT0022616-003	5/2/2011			1424				2672						0.51				
UPDES	UT0022616-003	5/16/2011			1477				2645						0.45				
UPDES	UT0022616-003	6/1/2011			1449				2714						0.29				
UPDES	UT0022616-003	6/17/2011			1425				2644						0.36				
UPDES	UT0022616-003	7/5/2011			1422				2641						0.22				
UPDES	UT0022616-003	7/19/2011			1482				2754						0.18				
UPDES	UT0022616-003	8/1/2011			1553				2767						0.18				
UPDES	UT0022616-003	8/15/2011			1592				2940						0.19				
UPDES	UT0022616-003	9/1/2011			1619				2972						0.18				
UPDES	UT0022616-003	9/22/2011			1679				2994						0.22				
UPDES	UT0022616-003	10/1/2011			1703				3064						0.39				
UPDES	UT0022616-003	10/17/2011			1676				3059						0.47				
UPDES	UT0022616-003	11/1/2011			1714				3020						0.66				
UPDES	UT0022616-003	11/15/2011			1700				3069						0.67				
UPDES	UT0022616-003	12/1/2011			1716				3106						0.64				
UPDES	UT0022616-003	12/15/2011			1694				3091						0.86				
UPDES	UT0022616-003	1/3/2012			1671				2988						0.74				
UPDES	UT0022616-003	1/16/2012			1602				2931						0.91				
UPDES	UT0022616-003	2/1/2012			1553				2971						0.69				
UPDES	UT0022616-003	2/16/2012			1600				2882						0.63				
UPDES	UT0022616-003	3/1/2012			1586				2871						0.65				
UPDES	UT0022616-003	3/15/2012			1576				2873						0.63				
UPDES	UT0022616-003	4/3/2012			1539				2836						0.62				
UPDES	UT0022616-003	4/16/2012			1519				2799						0.37				
UPDES	UT0022616-003	5/1/2012			1541				2832						0.51				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	5/15/2012	15.4	7.2		3840	592.4		< 5.																					
UPDES	UT0022616-003	6/1/2012	19.9	7.2		3850	529.6		5																					
UPDES	UT0022616-003	6/15/2012	17	7.2		3750	493.7		< 5.																					
UPDES	UT0022616-003	7/2/2012	20.2	7		3720	269.3		< 5.																					
UPDES	UT0022616-003	7/10/2012	19.7	7.1		3810	502.7		6																					
UPDES	UT0022616-003	7/19/2012		7		3800	327.6		< 5.																					
UPDES	UT0022616-003	7/24/2012	18.2	7.1		3760	435.3		< 5.																					
UPDES	UT0022616-003	8/1/2012	17.8	7.1		3470	552.0		6																					
UPDES	UT0022616-003	8/9/2012	18.2	7.1			475.7		< 5.																					
UPDES	UT0022616-003	8/16/2012	16.9	7.1		3790	417.4		< 5.																					
UPDES	UT0022616-003	8/21/2012	19.2	7.1		3840	403.9		7																					
UPDES	UT0022616-003	8/27/2012	22	7.1		3740	219.9		8																					
UPDES	UT0022616-003	9/4/2012	17.9	7.1		3540	157.1		6																					
UPDES	UT0022616-003	9/11/2012	16.8	7		3440	453.3		16																					
UPDES	UT0022616-003	9/19/2012	17.8	7.1		3310	435.3		7																					
UPDES	UT0022616-003	9/27/2012	17.5	7		3420	323.1		< 5.																					
UPDES	UT0022616-003	10/1/2012	17.5	7		3470	421.9		7																					
UPDES	UT0022616-003	10/9/2012	15.5	7.1		3650	430.8		< 5.																					
UPDES	UT0022616-003	10/17/2012	13.8	7.1		3510	475.7		< 5.																					
UPDES	UT0022616-003	10/24/2012	13	7		3440	511.6		< 5.																					
UPDES	UT0022616-003	11/1/2012	14.6	7		3290	377.0		< 5.																					
UPDES	UT0022616-003	11/7/2012	14.4	7.1		3270	511.6		< 5.																					
UPDES	UT0022616-003	11/14/2012	13.1	7		3410	408.4		18																					
UPDES	UT0022616-003	11/19/2012	10.9	7.1		3410	421.9		< 5.																					
UPDES	UT0022616-003	11/29/2012	13.4	7.1		3540	143.6		< 5.																					
UPDES	UT0022616-003	12/3/2012	8.9	7		3480	179.5		< 5.																					
UPDES	UT0022616-003	12/11/2012	8.3	7		3360	224.4		< 5.																					
UPDES	UT0022616-003	12/19/2012	9.2	7.1		3390	40.4		10																					
UPDES	UT0022616-003	12/26/2012	4.2	7.1		3720	161.6		12																					
UPDES	UT0022616-003	1/2/2013	1.9	7.2		3660	246.8		6																					
UPDES	UT0022616-003	1/8/2013	9.1	7.1		3350	296.2		< 5.																					
UPDES	UT0022616-003	1/16/2013	8.9	7		3320	31.4		< 5.																					
UPDES	UT0022616-003	1/23/2013	5.9	7.1		3480	0.2		6																					
UPDES	UT0022616-003	2/1/2013	8.3	7.6		3360	175.0		< 5.																					
UPDES	UT0022616-003	2/7/2013	10.5	7.1		3490	152.6		< 5.																					
UPDES	UT0022616-003	2/14/2013	7.8	7		3410	170.5		7																					
UPDES	UT0022616-003	2/19/2013	10.9	7.1		3540	76.3		< 5.																					
UPDES	UT0022616-003	3/1/2013	10.7	7		3550	224.4		< 5.																					
UPDES	UT0022616-003	3/7/2013	10.9	7.1		3450	71.8		< 5.																					
UPDES	UT0022616-003	3/12/2013	12.1	7		3570	197.5		< 5.																					
UPDES	UT0022616-003	3/19/2013	13.6	7		3610	103.2		< 5.																					
UPDES	UT0022616-003	3/27/2013	11.8	7		3750	206.4		< 5.																					
UPDES	UT0022616-003	4/2/2013	13.9	7		3790	215.4		< 5.																					
UPDES	UT0022616-003	4/9/2013	12.1	7		3800	228.9		6																					
UPDES	UT0022616-003	4/16/2013	13.5	7		3820	161.6		< 5.																					
UPDES	UT0022616-003	4/23/2013	15.1	7		3890	264.8		< 5.								< .03													
UPDES	UT0022616-003	5/1/2013	14.9	7		3780	291.7		> 42.																					
UPDES	UT0022616-003	5/9/2013	15.9	6.9		3640	278.3		< 5.																					
UPDES	UT0022616-003	5/16/2013	19.2	7		3730	170.5		< 5.								< .03													
UPDES	UT0022616-003	5/21/2013	15.1	7		3780	219.9		< 5.																					
UPDES	UT0022616-003	5/28/2013	18	7		3770	264.8		< 5.																					
UPDES	UT0022616-003	6/3/2013	17.2	7		3790	359.0		< 5.																					
UPDES	UT0022616-003	7/1/2013					0																							
UPDES	UT0022616-003	8/1/2013	18.4	7		3940			6																					
UPDES	UT0022616-003	8/1/2013					40.4																							
UPDES	UT0022616-003	8/7/2013	20.2	7.1		3860			< 5.																					
UPDES	UT0022616-003	8/13/2013					44.9																							
UPDES	UT0022616-003	8/13/2013	18.7	7		3840			< 5.																					
UPDES	UT0022616-003	8/20/2013	21.2	7		3880			10																					
UPDES	UT0022616-003	8/27/2013	19.1	7		3750			22																					
UPDES	UT0022616-003	9/3/2013	20.6	7.1		3760			12																					
UPDES	UT0022616-003	9/10/2013	18.6	7		3740			< 5.																					
UPDES	UT0022616-003	9/17/2013	19.5	7.1		3750			18																					
UPDES	UT0022616-003	9/24/2013	19.2	7.1		3860			6																					
UPDES	UT0022616-003	10/1/2013	13.8	7		3870	125.7		< 5.																					
UPDES	UT0022616-003	10/9/2013	11.5	7		3850	148.1		< 5.																					
UPDES	UT0022616-003	10/16/2013	10.2	7		3890	143.6		< 5.																					
UPDES	UT0022616-003	10/23/2013	9.9	7		3910	112.2		< 5.																					
UPDES	UT0022616-003	11/1/2013	8.7	7		3920	9.0		< 5.																					
UPDES	UT0022616-003	11/6/2013	9.4	7.1		3990	4.5		< 5.																					
UPDES	UT0022616-003	12/1/2013					0																							

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	5/15/2012			1508				2809						0.52				
UPDES	UT0022616-003	6/1/2012			1473				2771						0.3				
UPDES	UT0022616-003	6/15/2012			1489				2759						0.24				
UPDES	UT0022616-003	7/2/2012			1545				2793						0.13				
UPDES	UT0022616-003	7/10/2012			1468				2816						0.22				
UPDES	UT0022616-003	7/19/2012			1470				2826						0.3				
UPDES	UT0022616-003	7/24/2012			1477				2801						0.07				
UPDES	UT0022616-003	8/1/2012			1492				2774						0.73				
UPDES	UT0022616-003	8/9/2012			1498				2778						0.71				
UPDES	UT0022616-003	8/16/2012			1468				2849						0.72				
UPDES	UT0022616-003	8/21/2012			1552				2891						1.02				
UPDES	UT0022616-003	8/27/2012			1423				2683						0.23				
UPDES	UT0022616-003	9/4/2012			1374				2574						1.06				
UPDES	UT0022616-003	9/11/2012			1227				2393						1.25				
UPDES	UT0022616-003	9/19/2012			1210				2340						1.55				
UPDES	UT0022616-003	9/27/2012			1178				2381						1.27				
UPDES	UT0022616-003	10/1/2012			1231				2462						0.87				
UPDES	UT0022616-003	10/9/2012			980				2542						1.27				
UPDES	UT0022616-003	10/17/2012			1234				2475						1.12				
UPDES	UT0022616-003	10/24/2012			1209				2430						1.07				
UPDES	UT0022616-003	11/1/2012			1194				2392						1.01				
UPDES	UT0022616-003	11/7/2012			1133				2364						1.04				
UPDES	UT0022616-003	11/14/2012			1142				1370						0.99				
UPDES	UT0022616-003	11/19/2012			1131				2278						0.68				
UPDES	UT0022616-003	11/29/2012			1163				2339						1.01				
UPDES	UT0022616-003	12/3/2012			1177				2354						0.77				
UPDES	UT0022616-003	12/11/2012			1212				2367						1.01				
UPDES	UT0022616-003	12/19/2012			1204				2341						1.08				
UPDES	UT0022616-003	12/26/2012			1232				2431						1.02				
UPDES	UT0022616-003	1/2/2013			1191				2420						0.97				
UPDES	UT0022616-003	1/8/2013			1140				2304						1.25				
UPDES	UT0022616-003	1/16/2013			1174				2399						1.07				
UPDES	UT0022616-003	1/23/2013			1203				2435						0.91				
UPDES	UT0022616-003	2/1/2013			1198				2437						1.09				
UPDES	UT0022616-003	2/7/2013			1222				2427						0.96				
UPDES	UT0022616-003	2/14/2013			1210				2471						1.04				
UPDES	UT0022616-003	2/19/2013			1248				2464						1.1				
UPDES	UT0022616-003	3/1/2013			1233				2463						0.94				
UPDES	UT0022616-003	3/7/2013			1249				2530						0.78				
UPDES	UT0022616-003	3/12/2013			1230				2505						0.95				
UPDES	UT0022616-003	3/19/2013			1349				2656						1.08				
UPDES	UT0022616-003	3/27/2013			1389				2705						1.51				
UPDES	UT0022616-003	4/2/2013			1448				2769						1.19				
UPDES	UT0022616-003	4/9/2013			1468				2790						1.37				
UPDES	UT0022616-003	4/16/2013			1463				2818						> 1.51				
UPDES	UT0022616-003	4/23/2013			1480				2806						1.42				
UPDES	UT0022616-003	5/1/2013			1460				2781						1.48				
UPDES	UT0022616-003	5/9/2013			1440				2721						> 1.62				
UPDES	UT0022616-003	5/16/2013			1429				2716						> 1.61				
UPDES	UT0022616-003	5/21/2013			1423				2775						1.33				
UPDES	UT0022616-003	5/28/2013			1462				2757						1.18				
UPDES	UT0022616-003	6/3/2013			1450				2695						1.35				
UPDES	UT0022616-003	7/1/2013																	
UPDES	UT0022616-003	8/1/2013			1504				2767						2.29				
UPDES	UT0022616-003	8/1/2013																	
UPDES	UT0022616-003	8/7/2013			1509				2818						0.42				
UPDES	UT0022616-003	8/13/2013																	
UPDES	UT0022616-003	8/13/2013			1493				2809						0.39				
UPDES	UT0022616-003	8/20/2013			1484				2821						0.81				
UPDES	UT0022616-003	8/27/2013			1442				2735						1.27				
UPDES	UT0022616-003	9/3/2013			1467				2727						1.34				
UPDES	UT0022616-003	9/10/2013			1503				2671						0.58				
UPDES	UT0022616-003	9/17/2013			1389				2661						0.61				
UPDES	UT0022616-003	9/24/2013			1468				2765						1.03				
UPDES	UT0022616-003	10/1/2013			1472				2793						0.37				
UPDES	UT0022616-003	10/9/2013			1473				2779						0.5				
UPDES	UT0022616-003	10/16/2013			1458				2788						0.65				
UPDES	UT0022616-003	10/23/2013			1493				2749						0.8				
UPDES	UT0022616-003	11/1/2013			1456				2771						0.37				
UPDES	UT0022616-003	11/6/2013			1472				2781						1.02				
UPDES	UT0022616-003	12/1/2013																	

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	1/27/2014	6.4	7		3260	85.3		< 5.																					
UPDES	UT0022616-003	2/3/2014	2.1	7		3980	89.8		9																					
UPDES	UT0022616-003	2/10/2014	5.5	7		3870	80.8		7																					
UPDES	UT0022616-003	2/17/2014	6.4	7		3940	76.3		< 5.																					
UPDES	UT0022616-003	2/24/2014	7.2	7		3830	44.9		< 5.																					
UPDES	UT0022616-003	3/3/2014	10.8	7.1		3870	76.3		< 5.																					
UPDES	UT0022616-003	3/10/2014	5.6	7		3730	85.3		8																					
UPDES	UT0022616-003	3/17/2014	7.1	7		3850	152.6		20																					
UPDES	UT0022616-003	3/24/2014	11.2	7		3910	143.6		13																					
UPDES	UT0022616-003	4/1/2014	8.6	7		4030	130.2		< 5.																					
UPDES	UT0022616-003	4/8/2014	9.1	7.1		3890	139.1		< 5.																					
UPDES	UT0022616-003	4/14/2014	13.1	7		3900	170.5		< 5.																					
UPDES	UT0022616-003	4/24/2014	8.9	7		3910	148.1		6																					
UPDES	UT0022616-003	5/1/2014	10.8	7.1		3880	143.6		< 5.																					
UPDES	UT0022616-003	5/8/2014	11.2	7		4020	148.1		< 5.																					
UPDES	UT0022616-003	5/16/2014	15.2	7		3850	188.5		< 5.																					
UPDES	UT0022616-003	5/22/2014	17.4	7		4120	116.7		< 5.																					
UPDES	UT0022616-003	5/27/2014	17.6	7.1		3910	107.7		< 5.																					
UPDES	UT0022616-003	6/2/2014	18.4	7		3910	107.7		< 5.																					
UPDES	UT0022616-003	6/9/2014	18.3	7		3950	116.7		15																					
UPDES	UT0022616-003	6/16/2014	17.4	7		3880	112.2		31																					
UPDES	UT0022616-003	6/23/2014	23.6	7.1		3960	152.6		< 5.																					
UPDES	UT0022616-003	7/1/2014	17.8	7		4110	134.6		< 5.																					
UPDES	UT0022616-003	7/8/2014	20.2	7		3990	121.2		< 5.																					
UPDES	UT0022616-003	7/15/2014	19.8	7		3980	116.7		< 5.																					
UPDES	UT0022616-003	7/23/2014	20.2	7		4020	157.1		< 5.																					
UPDES	UT0022616-003	8/1/2014	19.9	7		3910	130.2		< 5.																					
UPDES	UT0022616-003	8/8/2014	20.1	7		3990	116.7		< 5.																					
UPDES	UT0022616-003	8/15/2014	20.1	7		3900	98.7		< 5.																					
UPDES	UT0022616-003	8/22/2014	15.3	7		3780	143.6		< 5.																					
UPDES	UT0022616-003	8/29/2014					0																							
UPDES	UT0022616-003	9/3/2014	20.1	7		3920	116.7		6																					
UPDES	UT0022616-003	9/10/2014	18.6	7		3900	152.6		< 5.																					
UPDES	UT0022616-003	9/16/2014	15.2	7		3970	121.2		< 5.																					
UPDES	UT0022616-003	9/23/2014	20.5	7.1		3840	98.7		7																					
UPDES	UT0022616-003	10/1/2014	13.2	7		3820	179.5		< 5.																					
UPDES	UT0022616-003	10/7/2014	15.3	7		3940	143.6		7																					
UPDES	UT0022616-003	10/15/2014	9.3	7		3880	166.1		< 5.																					
UPDES	UT0022616-003	10/21/2014	10.4	7		3860	170.5		< 5.																					
UPDES	UT0022616-003	10/28/2014	8.2	7		3840	152.6		< 5.																					
UPDES	UT0022616-003	11/3/2014	7.9	7		3970	148.1		< 5.																					
UPDES	UT0022616-003	11/10/2014	8.7	7		4110	157.1		< 5.																					
UPDES	UT0022616-003	11/17/2014	6.8	7		4120	152.6		10																					
UPDES	UT0022616-003	11/24/2014	5.2	7		4040	166.1		7																					
UPDES	UT0022616-003	12/1/2014	6.4	7		3990	179.5		6																					
UPDES	UT0022616-003	12/9/2014	5.6	7		4080	89.8		< 5.																					
UPDES	UT0022616-003	12/17/2014	6.2	7		4120	121.2		< 5.																					
UPDES	UT0022616-003	12/24/2014	5.4	7		4040	116.7		13																					
UPDES	UT0022616-003	1/5/2015	4.2	7		4090			< 5.																					
UPDES	UT0022616-003	1/13/2015	6.6	7.1		4010			9																					
UPDES	UT0022616-003	1/19/2015	6.7	7.1		4170			7																					
UPDES	UT0022616-003	1/26/2015	4.8	7		4060			5																					
UPDES	UT0022616-003	2/2/2015	6.3	7.1		3940			< 5.																					
UPDES	UT0022616-003	2/9/2015	8.8	7.1		3940			< 5.																					
UPDES	UT0022616-003	2/16/2015	8.2	7		4060			< 5.																					
UPDES	UT0022616-003	2/23/2015	4.6	7.1		4140			8																					
UPDES	UT0022616-003	3/2/2015	5.7	7		4060			< 5.																					
UPDES	UT0022616-003	3/9/2015	8.2	7		4050			< 5.																					
UPDES	UT0022616-003	3/16/2015	10.8	7.1		4020			< 5.																					
UPDES	UT0022616-003	3/23/2015	12	7.1		3940			< 5.																					
UPDES	UT0022616-003	4/1/2015	12.1	7.1		3990	94.2		< 5.																					
UPDES	UT0022616-003	4/8/2015	11.4	7.1		4100	98.7		< 5.																					
UPDES	UT0022616-003	4/14/2015	12.2	7.1		3930	112.2		6																					
UPDES	UT0022616-003	4/20/2015	14	7.1		3930	80.8		< 5.																					
UPDES	UT0022616-003	4/27/2015	9.4	7		3960	94.2		7																					
UPDES	UT0022616-003	5/4/2015	13.2	7		3910	107.7		7																					
UPDES	UT0022616-003	5/11/2015	11.4	7.1		3860	130.2		7																					
UPDES	UT0022616-003	5/18/2015	16.5	6.8		3950	94.2		20																					
UPDES	UT0022616-003	5/26/2015	15.2	7		3910	121.2		< 5.																					
UPDES	UT0022616-003	6/1/2015	15	7.1		3880	89.8		9																					
UPDES	UT0022616-003	6/9/2015	20.2	6.9		3900	94.2		10																					

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	1/27/2014			1073				1930						1.02				
UPDES	UT0022616-003	2/3/2014			1395				2674						2.56				
UPDES	UT0022616-003	2/10/2014			1373				2613						1.73				
UPDES	UT0022616-003	2/17/2014			1394				2643						1				
UPDES	UT0022616-003	2/24/2014			1381				2680						0.97				
UPDES	UT0022616-003	3/3/2014			1406				2613						1.09				
UPDES	UT0022616-003	3/10/2014			1330				2676						1.37				
UPDES	UT0022616-003	3/17/2014			1479				2699						0.3				
UPDES	UT0022616-003	3/24/2014			1518				2766						0.3				
UPDES	UT0022616-003	4/1/2014			1454				2795						0.63				
UPDES	UT0022616-003	4/8/2014			1443				2830						0.6				
UPDES	UT0022616-003	4/14/2014			1447				2806						0.78				
UPDES	UT0022616-003	4/24/2014			1421				2774						0.64				
UPDES	UT0022616-003	5/1/2014			1187				2732						0.35				
UPDES	UT0022616-003	5/8/2014			1463				2837						0.92				
UPDES	UT0022616-003	5/16/2014			1467				2802						0.7				
UPDES	UT0022616-003	5/22/2014			1450				2971						2.38				
UPDES	UT0022616-003	5/27/2014			1403				2838						0.5				
UPDES	UT0022616-003	6/2/2014			1383				2857						0.98				
UPDES	UT0022616-003	6/9/2014			1445				2853						0.85				
UPDES	UT0022616-003	6/16/2014			1464				2840						0.57				
UPDES	UT0022616-003	6/23/2014			1493				2843						0.8				
UPDES	UT0022616-003	7/1/2014			1528				2819						0.48				
UPDES	UT0022616-003	7/8/2014			1516				2847						0.78				
UPDES	UT0022616-003	7/15/2014			1479				2791						0.82				
UPDES	UT0022616-003	7/23/2014			1306				2824						0.53				
UPDES	UT0022616-003	8/1/2014			1465				2737						0.81				
UPDES	UT0022616-003	8/8/2014			1426				2789						1.52				
UPDES	UT0022616-003	8/15/2014			1340				2750						0.75				
UPDES	UT0022616-003	8/22/2014			1425				2923						0.86				
UPDES	UT0022616-003	8/29/2014																	
UPDES	UT0022616-003	9/3/2014			1486				2912						0.35				
UPDES	UT0022616-003	9/10/2014			1438				2789						0.72				
UPDES	UT0022616-003	9/16/2014			1910				2765						0.62				
UPDES	UT0022616-003	9/23/2014			1411				2729						0.76				
UPDES	UT0022616-003	10/1/2014			1413				2736						0.78				
UPDES	UT0022616-003	10/7/2014			1922				2761						0.69				
UPDES	UT0022616-003	10/15/2014			1252				2804						0.58				
UPDES	UT0022616-003	10/21/2014			1384				2832						0.94				
UPDES	UT0022616-003	10/28/2014			1433				2785						0.94				
UPDES	UT0022616-003	11/3/2014			1407				2837						0.89				
UPDES	UT0022616-003	11/10/2014			1474				2813						0.97				
UPDES	UT0022616-003	11/17/2014			1435				2832						1.28				
UPDES	UT0022616-003	11/24/2014			1404				2801						0.94				
UPDES	UT0022616-003	12/1/2014			1368				2861						0.89				
UPDES	UT0022616-003	12/9/2014			1424				2822						0.89				
UPDES	UT0022616-003	12/17/2014			1332				2849						0.89				
UPDES	UT0022616-003	12/24/2014			1410				2772						1.06				
UPDES	UT0022616-003	1/5/2015			1399				2864						1.46				
UPDES	UT0022616-003	1/13/2015			1274				2815						0.88				
UPDES	UT0022616-003	1/19/2015			1353				2884						1.14				
UPDES	UT0022616-003	1/26/2015			1348				2902						0.93				
UPDES	UT0022616-003	2/2/2015			1430				2880						1.12				
UPDES	UT0022616-003	2/9/2015			1229				2813						1.08				
UPDES	UT0022616-003	2/16/2015			1469				2908						0.9				
UPDES	UT0022616-003	2/23/2015			1454				2880						0.49				
UPDES	UT0022616-003	3/2/2015			1485				2928						1.04				
UPDES	UT0022616-003	3/9/2015			1397				2716						1.21				
UPDES	UT0022616-003	3/16/2015			1424				2896						1.09				
UPDES	UT0022616-003	3/23/2015			1448				2846						1.06				
UPDES	UT0022616-003	4/1/2015			1484				2812						0.66				
UPDES	UT0022616-003	4/8/2015			1520				2920						0.48				
UPDES	UT0022616-003	4/14/2015			1406				2906						1.22				
UPDES	UT0022616-003	4/20/2015			1526				2860						1.1				
UPDES	UT0022616-003	4/27/2015			1449				2837						1.23				
UPDES	UT0022616-003	5/4/2015			1375				2911						1.12				
UPDES	UT0022616-003	5/11/2015			1450				2880						1.03				
UPDES	UT0022616-003	5/18/2015			1432				2762						0.55				
UPDES	UT0022616-003	5/26/2015			1489				2781						0.32				
UPDES	UT0022616-003	6/1/2015			1495				2746						0.36				
UPDES	UT0022616-003	6/9/2015			1472				2782						0.41				

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-003	6/17/2015	19.8	7		3860	94.2		31																					
UPDES	UT0022616-003	6/23/2015	20.4	6.9		3910	116.7		7																					
UPDES	UT0022616-003	7/1/2015	22.9	7		4040	116.7		19																					
UPDES	UT0022616-003	7/7/2015	18.4	6.9		3970	85.3		< 5.																					
UPDES	UT0022616-003	7/14/2015	20.1	6.9		3960	121.2		< 5.																					
UPDES	UT0022616-003	7/21/2015	20.4	6.9		3940	148.1		< 5.																					
UPDES	UT0022616-003	7/28/2015	19.8	7		3990	76.3		< 5.																					
UPDES	UT0022616-003	8/3/2015	21.2	6.9		3840	112.2		< 5.																					
UPDES	UT0022616-003	8/10/2015	20.1	7		3960	107.7		< 5.																					
UPDES	UT0022616-003	8/17/2015	21.1	6.9		4030	94.2		< 5.																					
UPDES	UT0022616-003	8/25/2015	21.2	7		4020	98.7		6																					
UPDES	UT0022616-003	9/1/2015	20.4	7		3910	103.2		< 5.																					
UPDES	UT0022616-003	9/9/2015	16.8	7		3940	107.7		< 5.																					
UPDES	UT0022616-003	9/16/2015	16.8	6.9		3900	116.7		20																					
UPDES	UT0022616-003	9/23/2015	16.9	7		3870	71.8		< 5.																					
UPDES	UT0022616-003	10/1/2015	19.2	6.9		4100	0		< 5.																					
UPDES	UT0022616-003	10/7/2015	12.6	6.9		4010	0		< 5.																					
UPDES	UT0022616-003	10/14/2015	13	7		4010	89.8		< 5.																					
UPDES	UT0022616-003	10/20/2015	11.7	6.9		3990	0		< 5.																					
UPDES	UT0022616-003	10/27/2015	12.5	6.9		3990	0		< 5.																					
UPDES	UT0022616-003	11/2/2015	11.5	7		4000	0		< 5.																					
UPDES	UT0022616-003	11/10/2015	6.8	7		4060	0		7																					
UPDES	UT0022616-003	11/18/2015	4.6	7		4120	0		< 5.																					
UPDES	UT0022616-003	11/25/2015	4.2	6.9		4050	0		6																					
UPDES	UT0022616-003	12/1/2015	4.8	6.9		4120	0		< 5.																					
UPDES	UT0022616-003	12/8/2015	2.2	6.9		3840	0		8																					
UPDES	UT0022616-003	12/15/2015	2	6.9		4080	0		9																					
		No. of Obs.:	540	551	0	540	590	107	196	44	2	1	2	0	2	0	1	0	2	0	2	0	2	0	2	0	2	8	0	0
		Maximum:	26	9.5	0	5680	1485.53	9	43	33	0.2	0.001	0.56	0	51	0	0.1	0	43	0	4	0	471	0	352	0	32	126	0	0
		Minimum:	1.9	0	0	3.55	0	7.6	0	0	0.08	0.001	0.55	0	26	0	0.1	0	20	0	3	0	455	0	296	0	32	10	0	0
		Mean:	13.8	7.5		3761.7	363.8	8.2	9.3	2.1	0.1	0.0	0.6		38.5		0.1		31.5		3.5		463.0		324.0		32.0	60.4		
		Std. Dev.:	4.9	0.7		663.9	284.5	0.3	6.4	5.5	0.1		0.0		17.7				16.3		0.7		11.3		39.6		0.0	38.0		
		Equivalent weights of means:													1.92				2.59		0.09		20.14		5.31		1.07	1.70		

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-004			No discharge from 1/1/1991 through 7/1/2001																										
UPDES	UT0022616-004	7/10/2001	17.7	7.3		3420	365		<5.																					
UPDES	UT0022616-004	10/3/2001	16.1	7.6		3440	103.224		<5.																					
UPDES	UT0022616-004			No discharge from 10/4/2001 through 6/1/2002																										
UPDES	UT0022616-004	6/19/2002	16.3	7.3		3400	310		<5.																					
UPDES	UT0022616-004	7/15/2002	16.6	7		3450	275		26																					
UPDES	UT0022616-004	8/8/2002	15.9	7.1		3360	305		5																					
UPDES	UT0022616-004	9/16/2002	18.5	7.5		5700	632.808		<5.																					
UPDES	UT0022616-004			No discharge from 9/30/2002 through 9/15/2003																										
UPDES	UT0022616-004	9/16/2003	18.2	7.6		3.61	300		< 5.																					
UPDES	UT0022616-004			No discharge from 9/30/2003 through 7/1/2004																										
UPDES	UT0022616-004	7/8/2004	19.6	7.5		3420	256		< 5.																					
UPDES	UT0022616-004			No discharge from 7/15/2004 through12/31/2015																										
		No. of Obs.:	8	8	0	8	8	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Maximum:	19.6	7.6	0	5700	632.8	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Minimum:	15.9	7	0	3.61	103.2	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mean:	17.4	7.4	--	3274.2	318.4	--	15.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
		Std. Dev.:	1.3	0.2	--	1544.8	148.2	--	14.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

UPDES UT0022616-005 No discharge for period of record (9/1/1994 through 12/31/2015)

UPDES UT0022616-006 No discharge for period of record (9/1/1994 through 12/31/2015)

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-003	6/17/2015			1435				2915						0.51				
UPDES	UT0022616-003	6/23/2015			1539				3049						0.57				
UPDES	UT0022616-003	7/1/2015			1510				2963						0.6				
UPDES	UT0022616-003	7/7/2015			1446				2772						0.79				
UPDES	UT0022616-003	7/14/2015			1488				2842						0.55				
UPDES	UT0022616-003	7/21/2015			1443				2839						0.57				
UPDES	UT0022616-003	7/28/2015			1515				2879						0.89				
UPDES	UT0022616-003	8/3/2015			1402				2774						0.69				
UPDES	UT0022616-003	8/10/2015			1454				2843						1.11				
UPDES	UT0022616-003	8/17/2015			1499				2872						1.08				
UPDES	UT0022616-003	8/25/2015			1491				2884						0.71				
UPDES	UT0022616-003	9/1/2015			1487				2859						0.72				
UPDES	UT0022616-003	9/9/2015			1496				2882						0.55				
UPDES	UT0022616-003	9/16/2015			1475				2882						0.54				
UPDES	UT0022616-003	9/23/2015			1490				2911						0.68				
UPDES	UT0022616-003	10/1/2015			1310				2913						0.49				
UPDES	UT0022616-003	10/7/2015			1464				2849						0.63				
UPDES	UT0022616-003	10/14/2015			1501				2906						0.65				
UPDES	UT0022616-003	10/20/2015			1439				2849						0.79				
UPDES	UT0022616-003	10/27/2015			1501				2879						0.84				
UPDES	UT0022616-003	11/2/2015			1503				2898						0.9				
UPDES	UT0022616-003	11/10/2015			1521				2929						0.84				
UPDES	UT0022616-003	11/18/2015			1470				2908						0.82				
UPDES	UT0022616-003	11/25/2015			1513				2908						1.07				
UPDES	UT0022616-003	12/1/2015			1520				2968						1.5				
UPDES	UT0022616-003	12/8/2015			1521				2931						1.72				
UPDES	UT0022616-003	12/15/2015			1250				2977						1.29				
		No. of Obs.:	0	0	241	0	8	2	371	316	0	1	0	2	283	264	43	7	
		Maximum:	0	0	2273	0	423	304	5220	4513	0	0.46	0	26.2	27.11	2.4	0.1	110	
		Minimum:	0	0	582	0	318	147	1370	996	0	0.46	0	23.74	0.07	0.02	0.01	22	
		Mean:			1432.2		377.8	225.5	3057.3	2616.5		0.5		25.0	0.9	0.3	0.0	65.7	
		Std. Dev.:			245.1		40.4	111.0	534.9	658.2				1.7	2.1	0.3	0.0	25.5	
		Equivalent we			29.82														

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-004																		
UPDES	UT0022616-004	7/10/2001								2451						<0.1			
UPDES	UT0022616-004	10/3/2001								2517						<0.1			
UPDES	UT0022616-004																		
UPDES	UT0022616-004	6/19/2002								2414						<0.1			
UPDES	UT0022616-004	7/15/2002								2391						<0.1			
UPDES	UT0022616-004	8/8/2002								2369						0.1			
UPDES	UT0022616-004	9/16/2002								5936						<0.1			
UPDES	UT0022616-004																		No Discharge
UPDES	UT0022616-004	9/16/2003								2475						1.44			
UPDES	UT0022616-004																		
UPDES	UT0022616-004	7/8/2004								2413						0.63			
UPDES	UT0022616-004																		
		No. of Obs.:	0	0	0	0	0	0	0	8	0	0	0	0	0	3	0	0	
		Maximum:	0	0	0	0	0	0	0	5936	0	0	0	0	0	1.44	0	0	
		Minimum:	0	0	0	0	0	0	0	2369	0	0	0	0	0	0.1	0	0	
		Mean:	--	--	--	--	--	--	--	2871	--	--	--	--	--	0.7	--	--	
		Std. Dev.:	--	--	--	--	--	--	--	1239	--	--	--	--	--	0.7	--	--	

UPDES UT0022616-005

UPDES UT0022616-006

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
SITE TYPE	SITE NAME	DATE	Wat. Temp Deg. C	F-pH pH units	F-D.O. mg/l	Cond(FLD) umhos/cm	Flow GPM	L-pH pH units	TSS mg/l	O/G mg/l	NH3 mg/l	D-As mg/l	D-B mg/l	D-Cd mg/l	D-Ca mg/l	D-Cu mg/l	D-Fe mg/l	D-Pb mg/l	D-Mg mg/l	D-Mn mg/l	D-K mg/l	D-Se mg/l	D-Na mg/l	D-Zn mg/l	Bicarb mg/l	Acidity mg/l	Carb mg/l	Cl mg/l	Hydroxide mg/l	NO3 mg/l
UPDES	UT0022616-007	7/29/1997	18.1	8.1		990	112		49																					
UPDES	UT0022616-007	10/17/2006	5.4	9.1		263	20		387	0																				
UPDES	UT0022616-007		No discharge for remaining period of record (6/1/1994 through 12/31/2015)																											
		No. of Obs.:	2	2	0	2	2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Maximum:	18.1	9.1	0	990	112.2	0	387	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Minimum:	5.4	8.1	0	263	20	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mean:	11.8	8.6		626.5	66.1		218.0	0.0																				
		Std. Dev.:	9.0	0.7		514.1	65.2		239.0																					
UPDES	UT0022616-008		Slurry pond not constructed (discharge point not in use)																											
UPDES	UT0022616-009		No discharge for period of record (4/1/2007 through 12/31/2015)																											

Emery Mine UPDES Data

SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
SITE TYPE	SITE NAME	DATE	NO2 mg/l	O-PO4 mg/l	SO4 mg/l	T-P mg/l	T-Alk mg/l	T-Hardns mg/l	L-Sp. Cond umhos/cm	TDS mg/l	Set Solids ml/l	D-Al mg/l	D-Mb mg/l	T-Cats meq/l	T-Anis meq/l	T-Fe mg/l	T-Mn mg/l	T-Mg mg/l	COMMENTS
UPDES	UT0022616-007	7/29/1997								720	<0.5					0.4			
UPDES	UT0022616-007	10/17/2006								186	0.1					6.04			
UPDES	UT0022616-007																		
		No. of Obs.:	0	0	0	0	0	0	0	2	1	0	0	0	0	2	0	0	
		Maximum:	0	0	0	0	0	0	0	720	0.1	0	0	0	0	6.04	0	0	
		Minimum:	0	0	0	0	0	0	0	186	0.1	0	0	0	0	0.4	0	0	
		Mean:								453.0	0.1					3.2			
		Std. Dev.:								377.6						4.0			
UPDES	UT0022616-008																		
UPDES	UT0022616-009																		

APPENDIX VI-14

Mass-Balance Estimates of
Future Mine-Water Discharges

Information added December 2016

Predicted future mine-water discharge from the Emery Mine (first 5 years), as accessed by the Emery 2 portal, based on the Hantush equation
(see Singh and Atkins, 1985)

Assume:

(1) Estimated depth of groundwater (ft) over bottom of I-SEAM coal is as depicted on Plate VI-6

(2) Average dip of the coal bed (ft/ft) = 0.067

(3) Hydraulic conductivity of Ferron Sandstone = 0.022 ft/day (Calibrated value)
Assumed transmissivity = 8.8 ft^2/day (Based on avg thicknss of 400 ft; see Chap. VI of MRP)
Aquifer storage coefficient = 1.59E-03 (see Chapter VI of MRP)
Hydraulic conductivity of Bluegate Shale = 4.40E-04 ft/day (see 2005 slug test data)

(4) Average Ferron Sandstone thickness = 400 ft (see Chapter VI of MRP)

(5) Average thickness of the IJ coal seam = 20 ft
Average thickness of the Upper Ferron sandstone above the IJ coal seam = 80 ft

(6) Mine equipment water usage = 0.009 cfs/acre
Based on: Average mine discharge from 1991-2001 = 1.03 cfs
Average mine discharge from 2002-2005 = 0.63 cfs
Difference (i.e., in-mine wate use) = 0.40 cfs
Average mined area from 2002-2005 (w/o pillaring) = 42.5 acres

(7) Horizontal inflow: Originates from the Joes Valley-Paradise fault zone
Mine length exposed to inflow from the fault zone: 2.17 mile
Assumes all inflow from 1991-2001 resulted from horizontal flow to the mine
Horizontal inflow per unit length of mine = 0.47 cfs/mile

(8) Future mine workings to be oriented as indicated on Plate VI-6

(9) All coal is instantaneously mined at the beginning of each year

Analytical Model: Hantush Equation: $Q=2\pi TDG(\lambda,r/B)$
$\lambda=Tt/r^2S$
$r/B=r(K'/KLL')^{1/2}$

VERTICAL INFLOW ESTIMATE (FROM HANTUSH EQUATION):

Year	**Year 1 (Area 1)**		(using estimated data from Plate VI-6)								
Parameters		r (ft)	D (ft)	L' (ft)	L (ft)	t(day)					
		606	150		60	400	365				
Calculation	λ	5.50E+00	r/B		5.53E-01	G value	1.38	Q	0.13	cfs	
Year	**Year 1 (Area 2)**		(using estimated data from Plate VI-6)								
Parameters		r (ft)	D (ft)	L' (ft)	L (ft)	t(day)					
		519	150		60	400	365				
Calculation	λ	7.50E+00	r/B		4.74E-01	G value	1.18	Q	0.11	cfs	
Year	**Year 1 (Area 3)**		(using estimated data from Plate VI-6)								
Parameters		r (ft)	D (ft)	L' (ft)	L (ft)	t(day)					
		257	150		60	400	365				
Calculation	λ	3.06E+01	r/B		2.35E-01	G value	0.569	Q	0.05	cfs	
Year	**Year 1 (Area 4)**		(using estimated data from Plate VI-6)								
Parameters		r (ft)	D (ft)	L' (ft)	L (ft)	t(day)					
		426	250		160	400	365				
Calculation	λ	1.11E+01	r/B		2.38E-01	G value	0.611	Q	0.10	cfs	
Year	**Year 1 (Area 5)**		(using estimated data from Plate VI-6)								
Parameters		r (ft)	D (ft)	L' (ft)	L (ft)	t(day)					
		486	350		260	400	365				
Calculation	λ	8.55E+00	r/B		2.13E-01	G value	0.62	Q	0.14	cfs	

Total Vertical Inflow to Mine = 0.54 cfs

LATERAL INFLOW ESTIMATE:

Western edge mine length (i.e., parallel to Joes Valley Fault) = 1,800 feet = 0.34 miles

Total Lateral Inflow to Mine = 0.16 cfs

MINE WATER BUDGET:

Total Groundwater Inflow:		0.70 cfs
Mine Water Requirement:		1.18 cfs
Total Mine Water Discharge (Year 1):	(Negative value represents net water requirement; no discharge)	-0.48 cfs

VERTICAL INFLOW ESTIMATE (FROM HANTUSH EQUATION):

Year	**Year 2 (Area 1)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	339	400		310	400	365					
Calculation	λ	1.76E+01	r/B		1.36E-01	G value	0.5	Q		0.13	cfs
Year	**Year 2 (Area 2)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	836	400		310	400	365					
Calculation	λ	2.89E+00	r/B		3.36E-01	G value	0.834	Q		0.21	cfs
Year	**Year 2 (Area 3)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	719	350		260	400	365					
Calculation	λ	3.91E+00	r/B		3.15E-01	G value	0.75	Q		0.17	cfs
Year	**Year 2 (Area 4)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	575	300		210	400	365					
Calculation	λ	6.11E+00	r/B		2.81E-01	G value	0.75	Q		0.14	cfs
Year	**Year 2 (Area 5)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	636	250		160	400	365					
Calculation	λ	4.99E+00	r/B		3.56E-01	G value	0.7	Q		0.11	cfs
Year	**Year 2 (Area 6)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	299	200		110	400	365					
Calculation	λ	2.26E+01	r/B		2.02E-01	G value	0.569	Q		0.07	cfs
									Total Vertical Inflow to Mine =	0.84	cfs

LATERAL INFLOW ESTIMATE:

Western edge mine length (i.e., parallel to Joes Valley Fault) = 4,700 feet = 0.89 miles

Total Lateral Inflow to Mine = 0.42 cfs

MINE WATER BUDGET:

Total Groundwater Inflow:		1.26 cfs
Mine Water Requirement:		1.32 cfs
Total Mine Water Discharge (Year 2):	(Negative value represents net water requirement; no discharge)	-0.05 cfs

VERTICAL INFLOW ESTIMATE (FROM HANTUSH EQUATION):

Year	**Year 3 (Area 1)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	558	350		260	400	365					
Calculation	λ	6.49E+00	r/B		2.45E-01	G value	0.682	Q		0.15	cfs
Year	**Year 3 (Area 2)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	301	350		260	400	365					
Calculation	λ	2.23E+01	r/B		1.32E-01	G value	0.491	Q		0.11	cfs
Year	**Year 3 (Area 3)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)		L (ft)	t(day)					
	301	350		260	400	365					
Calculation	λ	2.23E+01	r/B		1.32E-01	G value	0.491	Q		0.11	cfs

Year	**Year 3 (Area 4)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	246	300		210	400	365					
Calculation	λ	3.34E+01	r/B	1.20E-01	G value	0.491	Q	0.09	cfs		
Year	**Year 3 (Area 5)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	250	300		210	400	365					
Calculation	λ	3.23E+01	r/B	1.22E-01	G value	0.491	Q	0.09	cfs		
Year	**Year 3 (Area 6)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	646	350		260	400	365					
Calculation	λ	4.84E+00	r/B	2.83E-01	G value	0.75	Q	0.17	cfs		
Year	**Year 3 (Area 7)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	547	350		260	400	365					
Calculation	λ	6.75E+00	r/B	2.40E-01	G value	0.682	Q	0.15	cfs		
Year	**Year 3 (Area 8)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	908	450		360	400	365					
Calculation	λ	2.45E+00	r/B	3.38E-01	G value	0.9	Q	0.26	cfs		
Year	**Year 3 (Area 9)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	396	500		410	400	365					
Calculation	λ	1.29E+01	r/B	1.38E-01	G value	0.554	Q	0.18	cfs		
							Total Vertical Inflow to Mine =	1.32	cfs		

LATERAL INFLOW ESTIMATE:

Western edge mine length (i.e., parallel to Joes Valley Fault) = 9,300 feet = 1.76 miles

Total Lateral Inflow to Mine = 0.83 cfs

MINE WATER BUDGET:

Total Groundwater Inflow:	2.15	cfs
Mine Water Requirement:	0.92	cfs
Total Mine Water Discharge (Year 3):	1.24	cfs

VERTICAL INFLOW ESTIMATE (FROM HANTUSH EQUATION):

Year	**Year 4 (Area 1)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	870	600		510	400	365					
Calculation	λ	2.67E+00	r/B	2.72E-01	G value	0.9	Q	0.35	cfs		
Year	**Year 4 (Area 2)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	695	500		410	400	365					
Calculation	λ	4.18E+00	r/B	2.43E-01	G value	0.7	Q	0.22	cfs		
Year	**Year 4 (Area 3)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	871	500		410	400	365					
Calculation	λ	2.66E+00	r/B	3.04E-01	G value	0.9	Q	0.29	cfs		
Year	**Year 4 (Area 4)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	254	350		260	400	365					
Calculation	λ	3.13E+01	r/B	1.11E-01	G value	0.491	Q	0.11	cfs		
Year	**Year 4 (Area 5)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	256	350		260	400	365					
Calculation	λ	3.08E+01	r/B	1.12E-01	G value	0.491	Q	0.11	cfs		
							Total Vertical Inflow to Mine =	1.08	cfs		

LATERAL INFLOW ESTIMATE:

Western edge mine length (i.e., parallel to Joes Valley Fault) = 11,300 feet = 2.14 miles

Total Lateral Inflow to Mine = 1.01 cfs

MINE WATER BUDGET:

Total Groundwater Inflow:		2.09 cfs
Mine Water Requirement:		1.45 cfs
Total Mine Water Discharge (Year 4):	(Negative value represents net water requirement; no discharge)	0.64 cfs

VERTICAL INFLOW ESTIMATE (FROM HANTUSH EQUATION):

Year	**Year 5 (Area 1)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	534	500	410	400	365						
Calculation	λ	7.08E+00	r/B	1.86E-01	G value	0.642	Q	0.21	cfs		
Year	**Year 5 (Area 2)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	566	600	510	400	365						
Calculation	λ	6.31E+00	r/B	1.77E-01	G value	0.66	Q	0.25	cfs		
Year	**Year 5 (Area 3)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	351	575	485	400	365						
Calculation	λ	1.64E+01	r/B	1.13E-01	G value	0.5	Q	0.18	cfs		
Year	**Year 5 (Area 4)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	748	550	460	400	365						
Calculation	λ	3.61E+00	r/B	2.47E-01	G value	0.834	Q	0.29	cfs		
Year	**Year 5 (Area 5)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	272	510	420	400	365						
Calculation	λ	2.73E+01	r/B	9.38E-02	G value	0.491	Q	0.16	cfs		
Year	**Year 5 (Area 6)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	551	525	435	400	365						
Calculation	λ	6.65E+00	r/B	1.87E-01	G value	0.642	Q	0.22	cfs		
Year	**Year 5 (Area 7)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	570	450	360	400	365						
Calculation	λ	6.22E+00	r/B	2.12E-01	G value	0.682	Q	0.20	cfs		
Year	**Year 5 (Area 8)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	437	380	290	400	365						
Calculation	λ	1.06E+01	r/B	1.81E-01	G value	0.611	Q	0.15	cfs		
Year	**Year 5 (Area 9)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	528	500	410	400	365						
Calculation	λ	7.25E+00	r/B	1.84E-01	G value	0.642	Q	0.21	cfs		
Year	**Year 5 (Area 10)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	192	500	410	400	365						
Calculation	λ	5.48E+01	r/B	6.70E-02	G value	0.407	Q	0.13	cfs		
Year	**Year 5 (Area 11)**	(using estimated data from Plate VI-6)									
Parameters	r (ft)	D (ft)	L' (ft)	L (ft)	t(day)						
	193	500	410	400	365						
Calculation	λ	5.42E+01	r/B	6.74E-02	G value	0.407	Q	0.13	cfs		

Total Vertical Inflow to Mine = 2.12 cfs

LATERAL INFLOW ESTIMATE:

Western edge mine length (i.e., parallel to Joes Valley Fault) = 11,300 feet = 2.14 miles

Total Lateral Inflow to Mine = 1.01 cfs

MINE WATER BUDGET:

Total Groundwater Inflow:	3.14 cfs
Mine Water Requirement:	1.47 cfs
Total Mine Water Discharge (Year 5):	1.67 cfs

Emery Mine Discharge Prediction Summary:

Year	Discharge (cfs)
1	-0.48
2	-0.05
3	1.24
4	0.64
5	1.67
Average	0.60

APPENDIX VI-20

Stream Alteration Permit for the
Emery 2 Surface Facility

Programmatic General Permit 10

U.S. ARMY CORPS OF ENGINEERS **BUILDING STRONG®**

MINIMAL IMPACT ACTIVITIES AUTHORIZED IN CONJUNCTION WITH THE STATE OF UTAH'S STREAM ALTERATION PROGRAM

EFFECTIVE: February 22, 2016
EXPIRES: February 22, 2021

The U.S. Army Corps of Engineers, Sacramento District (District), is issuing Programmatic General Permit 10 (PGP 10) for certain activities in waters of the United States (waters) that have been authorized under the State of Utah's Stream Alteration Program. An activity is verified under PGP 10 when the Utah State Engineer issues a Stream Alteration Permit in compliance with state law and the Corps has determined it meets the terms and conditions of this general permit.

ISSUING OFFICE: U.S. Army Corps of Engineers, Sacramento District

ACTION ID: SPK-2002-50464

AUTHORITIES: This permit covers activities under Section 404 of the Clean Water Act (Section 404) and Section 10 of the Rivers and Harbors Act of 1899 (Section 10). Under Section 404, the Corps authorizes the discharge of dredged or fill material into waters of the U.S. Work or structures in or affecting navigable waters are permitted by the Corps under Section 10.

Purpose: This permit is designed to eliminate duplication and expedite authorization of the activities that fall under the Corps' Regulatory Program that have been authorized through a Stream Alteration Permit.

The Stream Alteration Program was implemented by the State of Utah in 1972 to protect the natural resource value of the State's streams and protect the water rights and recreational opportunities associated with them. Section 73-3-29 of the Utah Code requires any person, governmental agency, or other organizations proposing to alter the bed or banks of a natural stream to obtain written authorization from the State Engineer prior to beginning work.

This permit applies to perennial, intermittent and ephemeral streams that are considered to be part of the surface tributary system over which the Utah State Engineer has regulatory authority under the Stream Alteration Program. Limits of the State of Utah's jurisdiction are defined in Administrative Rule R655-13.

Activities: The types of activities covered under this permit are those that have a minimal impact, individually and cumulatively, on the aquatic environment and those that have been authorized by the Utah State Engineer through a Stream Alteration Permit. These activities include, but are not limited to, culvert installation and extension, bridges, low water crossings, utility crossings, bank stabilization, linear transportation projects, diversion structures, outfall structures, boat ramps, docks, commercial and residential construction, flood control facilities and maintenance of previously permitted activities that are located in waters subject to jurisdiction under Section 10 or are not exempt under Section 404. Stream restoration activities located in riffle/pool complexes are authorized under this general permit.

Exclusions: This permit does not authorize discharges of dredged or fill material into special aquatic sites such as wetlands, springs, fens and riffle/pool complexes. Activities involving discharges of dredged or fill material in special aquatic sites would require an alternate form of Department of Army (DA) authorization. Exceptions to this prohibition are identified above under Activities. Applicants should contact the Corps for additional information.

This permit does not authorize the relocation of streams, including channelization and realignment of natural channels.

This permit does not authorize any activities in waters of the U.S. undertaken on tribal lands or activities conducted under emergency situations. These activities require an alternate form of Department of Army (DA) authorization, such as a Nationwide or other General Permit.

Terms: This permit authorizes minimal impact activities that have been authorized by the Utah State Engineer through a Stream Alteration Permit with the following provisions:

a) For activities in perennial and intermittent waters, no more than 300 linear feet may be impacted. If the activity involves the use of a bioengineering method, no more than 500 linear feet may be impacted. The Corps will determine what constitutes bioengineering methods on a case-by-case basis.

b) For activities in ephemeral waters that are under the purview of the State of Utah, no more than 500 linear feet may be impacted. If the activity involves the use of bioengineering methods, no more than 750 feet may be impacted. The Corps will determine what constitutes bioengineering methods on a case-by-case basis.

c) For stream restoration and enhancement activities, there is no limitation on linear footage of impact. The applicant must demonstrate that the proposed work will result in an increase to the functions and services provided by the stream channel.

The activity being permitted shall be a "single and complete" project. The term "single and complete project" is defined as that portion of the total linear project proposed or accomplished by one owner/developer or partnership or other association of owners/developers that includes all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single or multiple waterbodies several times at separate and distant locations, each crossing is considered a single and complete project for purposes

of NWP authorization. However, individual channels in a braided stream or river are not separate waterbodies, and crossings of such features cannot be considered separately.

Activities not meeting the terms and conditions of this permit may be authorized through an alternate form of Department of Army (DA) authorization, such as a Nationwide Permit. The Corps will determine, on a case-by-case basis, whether an activity has a more than minimal impact, individually or cumulatively, on the aquatic environment or may be contrary to the public interest.

Notification Procedures: Applicants must submit a joint application form developed by the State Engineer and the Corps when applying for a Stream Alteration Permit and verification under this general permit. Although not required, the Corps highly recommends a pre-application meeting with both agencies and the applicant. The joint application form and instructions may be obtained from either agency. To be determined completed for processing, the application must include the following:

a. Completed Joint Permit Application Form;

b. A vicinity map that clearly identifies the location of the proposed project site on a USGS topographic map (7.5 minute quadrangle map is recommended) with enough detail to easily locate the site and a recent aerial/satellite image of the site;

c. Plan and cross-sectional view drawings showing all work requiring a permit, including fills, structures, borrow sites, staging areas and storage areas. The drawings must clearly demarcate the ordinary high water mark of the waters of the U.S. to be impacted and clearly illustrate where fill will be placed below the ordinary high water mark. Professional drawings are not required; however, drawings must be scaled or indicate dimensions of the work to be completed;

d. A restoration plan for any areas temporarily disturbed during work, including re-contouring, re-vegetation with appropriate native plants;

e. Ground photos which clearly show the area of the stream to be impacted as well as photos of the borrow sites, staging areas and storage areas along the bank of the river which show the vegetation in those areas. Photos of the bank are used to help determine the presence/absence of wetlands and other special aquatic sites adjacent to the river, as such, photos showing snow covered ground will not be accepted.

f. If the activity involves bank stabilization or protection:

- A description of the need for the work, including the cause of the erosion and the threat posed to structures, infrastructure, and/or public safety;

- A narrative demonstrating the proposed activity incorporates the least damaging bank protection methods. These methods include, but are not limited to, the use of bioengineering, biotechnical design, root wads, large

woody debris and native plantings. If rock must be used due to site erosion conditions, explain how the bank stabilization structure incorporates elements beneficial to aquatic organisms;

- A planting plan which involves the use of native riparian plants, unless the applicant demonstrates it is not appropriate or not practicable.

Note: Activities which would harden and/or narrow the channel beyond what would be required for bank stabilization in natural channels are not authorized if the activity would have the potential to result in more than minimal impacts.

g. An assessment of the likely impact the work would have on upstream, downstream and cross-stream properties. Specifically, discuss the following:

- Will the activity accelerate deposition or erosion?
- Will the activity involve relocation, channelization or realignment of a natural stream channel?
- Will the activity result in a shift in the main flow patterns?

The completed joint application form and the information above must be submitted to Utah State Engineer's Office.

Once a complete application has been received, the State Engineer will circulate copies to federal and states agencies as a public notice of the proposed work. Copies will be sent to the Corps, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Utah Division of Wildlife Resources, Utah Division of Water Quality and local agencies. The State Engineer will allow at least 20 days for review and comment. The State Engineer will notify the Corps of any application that generates considerable public interest or opposition.
The Corps will review each application to determine whether the activity complies with the terms and conditions of this permit. The Corps must also ensure compliance with related laws including Section 7 of the federal Endangered Species Act and Section 106 of the National Historic Preservation Act.

For an activity to be authorized under this permit, the Corps must find the activity has no effect or, with the concurrence of the U.S. Fish and Wildlife Service (USFWS), the activity is not likely to adversely affect listed species or modify critical habitat. If USFWS requires additional conservation measures to concur that a project is not likely to adversely affect listed species or habitat, the activity may need to be authorized under another type of Corps permit. If the activity is likely to adversely affect listed species or modify critical habitat then the activity will require an alternate form of Department of Army (DA) authorization, such as a Nationwide Permit.

The Corps must ensure compliance with Section 106 of the National Historic Preservation Act

for each activity to be authorized under this permit. Activities that may result in adverse effects to sites listed, or sites eligible for listing, on the National Register of Historic Places will not be authorized under this permit. Should any such impacts be identified, the Corps will request, after any necessary coordination with the State Historic Preservation Office, to suspend processing of the application while the applicant considers ways of modifying the proposal to address the identified concerns.

Should a specific activity be found to not meet the terms and conditions of this permit or have impacts that are more than minimal, the Corps will notify the State and the applicant of one of the following:

a. The activity does not qualify for authorization under PGP 10, with instruction on the procedures to seek authorization under a different type of permit; or

b. The activity might be authorized under PGP 10 with certain modifications.

Permit Duration: This General Permit expires 5 years from the date of issuance. The Corps may re-evaluate the terms and conditions of this permit at any time deemed necessary to protect the public interest. Activities verified by the Corps under this permit are valid until the date this General Permit expires. In the event that this General Permit expires when the project is under construction or under contract to begin construction, the applicant will have up to one year after the permit expiration to complete the work. In such case, the applicant must notify the Corps and submit sufficient evidence such as photos of work or proof of contract.

General Conditions:

1. Activities may not adversely affect species listed under the federal Endangered Species Act or adversely modify their critical habitat.

2. Activities may not cause a take of any migratory birds, their parts, nests, eggs, and nestlings. Destruction of riparian vegetation shall be avoided to the maximum extent practicable. Unavoidable vegetation clearing and surface disturbance shall be conducted outside critical breeding, nesting, and fledging seasons. For raptor species, locations of existing raptor nests should be identified prior to the initiation of activities. Appropriate spatial buffer zones of inactivity should be established during crucial breeding and nesting periods relative to raptor nest sites or territories. Arrival at nesting sites can occur as early as December for certain raptor species. Nesting and fledging can continue through August.

3. Activities may not result in the take, possession, sale, purchase, barter or transport of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof. Destruction of riparian vegetation, especially mature cottonwoods, shall be avoided to the maximum extent practicable. Unavoidable vegetation clearing and surface disturbance shall be conducted outside critical breeding, nesting, and fledging seasons. Locations of existing bald and golden eagle nests should be identified prior to the initiation of activities. Appropriate spatial buffer zones of inactivity should be established during crucial breeding and nesting periods relative to eagle nest sites or territories. Arrival at nesting sites can occur as early as December.

Nesting and fledging can continue through August.

4. No activity may substantially disrupt the movements of those species of aquatic life indigenous to the water body, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water.

5. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that would result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

6. Destruction of riparian or riverine vegetation, especially mature cottonwoods, shall be avoided to the maximum extent practicable and all disturbed areas must be restored to pre-disturbance levels. When work authorized by this permit causes damage to riparian vegetation that is not directly covered by a permanent feature, these scarred areas shall be replanted with a mixture of native trees, shrubs, forbs and grasses, as appropriate. At a minimum, replanting an area at a 1:1 ratio will be required. The permittee is ultimately responsible for re-vegetation success.

7. Activities may not adversely affect sites listed on, or determined eligible for listing on, the National Register of Historic Places.

8. Work must stop if any previously unknown historic properties, archaeological artifacts, or remains are identified during the completion of authorized work, and the permittee must immediately notify the Corps. The Corps will initiate the Federal and State coordination procedures required to determine if the remains or cultural resources warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places. Work may not resume until the Corps has completed the process to comply with the appropriate laws and regulations.

9. Activities must satisfy all conditions of the Section 401 water quality certification issued for this permit by the Utah Division of Water Quality.

10. Fill material must be clean and free of contaminants and noxious plants. Fresh cement or concrete is not allowed in waters unless it is placed in sealed forms. Unsuitable fill material includes vehicle bodies, farm machinery, appliances and other metal objects, asphalt, biodegradable construction debris and tires.

11. Construction equipment shall be cleaned to remove noxious weeds/seeds and petroleum products prior to moving on site. Machinery shall be fueled outside of the channel to prevent spillage into waterways. Best management practices shall be used to ensure construction related byproducts do not enter the riverine ecosystem and have negative effects on aquatic organisms.

12. No activity may occur in the proximity of a public water supply intake, except where the

activity is for the maintenance, repair or replacement of the intake structure or for adjacent bank stabilization.

13. No heavy equipment shall be used within the stream channel, except where it is demonstrated this type of action is necessary.

14. Material may not be placed in any location or manner which will impair surface water flows into or out of any adjacent wetlands.

15. Construction Best Management Practices shall be implemented to minimize sedimentation inputs to river systems resulting from stream bed disturbance by storing excavated material outside of the stream channel. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark, must be permanently stabilized at the earliest practicable date.

16. Work in waters of the U.S. shall only be conducted during periods of low or no flow, unless the applicant demonstrates the proposed work during higher flows is necessary and would not result in more than minimal impacts, or that this condition is otherwise not appropriate or practicable.

17. Culverts placed in streams must be installed in a manner that maintains flows during low flow periods, and in a manner that maintains fish passage in locations where periodic flows provide stream connectivity and allow fish movement above and below the installed structure.

18. If permittee responsible compensatory mitigation to offset impacts to waters of the U.S. is required, the activity will need to be authorized under an alternate form of Department of Army (DA) authorization. When determining whether appropriate and practicable mitigation is necessary, the Corps will consider whether impacts to waters of the U.S. were avoided and minimized to the maximum extent practicable.

19. All temporary fills must be removed in their entirety within 30 days after completion of the permitted action and the affected areas returned to their pre-existing elevations.

20. Within 30 days of completion of the permitted work, the permittee must submit the following information to the Corps and State Engineer:

a. The permittee's name, address, telephone number and email address;

b. The Stream Alteration Permit number and Corps Action ID;

c. A statement that the authorized work was done in accordance with the Stream Alteration Permit and PGP 10 including special conditions added to the verification; and

d. The signature of the permittee certifying the completion of the work and mitigation.

21. Work authorized under this permit may be inspected by the Corps at any reasonable time to assure that it is being or has been completed in compliance with the terms and conditions of this permit.

22. Any activity authorized by this permit must be maintained in good condition and in conformance with the terms and conditions of this permit.

23. For activities authorized through this permit under Section 10 of the Rivers and Harbors Act of 1899, the permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

Further Information:

1. This permit does not obviate the need to obtain any other required federal, state or local authorizations.

2. This permit does not grant any property rights or exclusive privileges nor do they authorize injury to the property or the rights of others.

3. This permit does not convey the right to interfere with any existing or future federal project.

4. In issuing authorizations under this permit, the Federal Government does not assume any liability for the following: damages to authorized projects, or uses thereof, as a result of other permitted or un-permitted activities or natural events; damages to persons or property caused by authorized activity; damages to authorized projects, or uses thereof, as a result of current or future activities undertaken by or on behalf of the United States in the public interest; design or construction deficiencies associated with the authorized work; damage claims associated with any modification, suspension or revocation of individual authorizations.

5. In issuing authorizations under this permit, the Corps must rely on information supplied by the applicant. Should it be determined that any authorization was based on false, incomplete or inaccurate data, the Corps reserves the right to re-evaluate the case and to suspend, modify or revoke the authorization. Failure to comply with the terms and conditions of an authorization is also grounds for suspension, modification or revocation, as is the discovery of relevant information not considered in the initial application review.

CONTACTS AND ADDITIONAL INFORMATION:

The joint application form and instructions for completing the form can be found at http://www.waterrights.utah.gov/strmalt/

For additional information or questions about PGP 10, please contact one of the offices below.

Utah Division of Water Rights-State Engineer
1594 West North Temple, Suite 220
P.O. Box 146300
Salt Lake City, Utah 84114-6300
(801) 538-7240

U.S. Army Corps of Engineers, Sacramento District
Utah Regulatory Office
533 West 2600 South, Suite 150
Bountiful, Utah 84010-7744
(801) 295-8380

This permit becomes effective when the federal official, designated to act for the Secretary of the Army has signed below.

Michael S. Jewell
Chief, Regulatory Division

19 February 2016
Date

Daren Rasmussen <darenrasmussen@utah.gov>

RE: [EXTERNAL] 16-94-0002 Utah Stream Alteration Application

Pectol, Michael A SPK <Michael.A.Pectol@usace.army.mil> Mon, Sep 26, 2016 at 4:01 PM

To: Daren Rasmussen <darenrasmussen@utah.gov>
Cc: "tiffanygonzales@utah.gov" <tiffanygonzales@utah.gov>

Hi Daren,

This project is good to go under PGP 10. Thanks,

Mike Pectol
U.S. Army Corps of Engineers
(801) 295-8380, ext. 15 Michael.A.Pectol@usace.army.mil
Customer Service Hours: 9am - 3pm. I will be available to answer/return phone calls and respond to emails during these hours.
For more information regarding our program or to submit a customer service survey, please visit our website: http://www.spk.usace.army.mil/Missions/Regulatory.aspx

-----Original Message-----
From: tiffanygonzales@utah.gov [mailto:tiffanygonzales@utah.gov]
Sent: Wednesday, September 21, 2016 4:59 PM
To: Pectol, Michael A SPK <Michael.A.Pectol@usace.army.mil>
Subject: [EXTERNAL] 16-94-0002 Utah Stream Alteration Application

Application to Alter a Natural Stream No. 16-94-0002 (UNNAMED EPHEMERAL TRIBUTARY) has been filed in the office of the Utah Division of Water Rights. Your comments are requested so we can evaluate any impacts caused by the project. Information regarding the application can be accessed on the INTERNET by pointing a WWW browser to Blockedhttp://waterrights.utah.gov/cgi-bin/strmview.exe?Permit_Number=16940002&Modinfo=Viewapp .
We are requesting that all comments be returned to our office by Oct 11, 2016. If we do not receive comments by that date, we will assume you have no input on the proposal outlined in the application.
If you have any questions or comments, feel free to contact me by email at: tiffanygonzales@utah.gov or phone me at (801) 538-7414.

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Division of Water Rights
KENT L. JONES
State Engineer/Division Director

ORDER OF THE STATE ENGINEER

FOR STREAM ALTERATION APPLICATION NUMBER **16-94-02SA**
IN THE NAME OF BRONCO UTAH OPERATIONS, LLC FOR ALTERATION
TO QUITCHUPAH TRIBUTARY IN EMERY COUNTY, UTAH

This **ORDER** is issued pursuant to statute and in accord with the statutory criteria for approval of a stream alteration application that are described at UTAH CODE ANN. § 73-3-29. The State Engineer has determined that this application does meet the necessary legal criteria to **ORDER** the approval of the application based upon the following information and reasoning set forth in the Findings of Fact and Discussion.

FINDINGS OF FACT

1. The application was received by the Division of Water Rights ("Division") on September 21, 2016, and made available for comment on the Division's webpage, provided to pertinent governmental agencies, and to other entities as warranted, for a period of 20 calendar days, said period concluding prior to October 11, 2016.

2. The application contains the following information:
   - The stated description of the proposed project is: Removal of rock fall debris and installation of road crossing to access site associated with Quitchupah tributary in Emery County.
   - The stated purpose of the proposed project is: To access site.

3. The Division received comments or objections on the proposed project from:
   - State Floodplain Manager - Kathy Holder
   - USACE – U.S. Army Corps of Engineers (Corps) - Michael Pectol

   The comments or objections received by the Division are summarized as follows:
   - Kathy Holder has asked that the applicant must be compliant with all rules and regulations of the Federal Floodplain Insurance Program as administrated by the local city or county floodplain administrator.
   - The Corps has indicated that this project qualifies under PGP10.

DISCUSSION

1. Based on a review of the Division's water rights records and/or a review of the application by personnel of the Division's regional office, it is the opinion of the State Engineer that the project will not impair vested water rights.

2. It is the opinion of the State Engineer that the project will not unreasonably or unnecessarily affect recreational use or the natural stream environment.

3. It is the opinion of the State Engineer that the project will not unreasonably or unnecessarily endanger aquatic wildlife.

4. It is the opinion of the State Engineer that the project will not unreasonably or unnecessarily diminish the natural channel's ability to conduct high flows.

5. Other comments or concerns submitted by interested persons or parties are not believed to be within the purview of the State Engineer in evaluating an Application to Alter a Natural Stream.

ORDER

Stream Alteration Application No. **16-94-02SA**, submitted in the name of Bronco Utah Operations, LLC, applicant, in order to complete removal of rock fall debris and installation of road crossing to access site associated with Quitchupah tributary, a natural stream located in Emery County, Utah, is hereby APPROVED, contingent upon the conditions outlined in this **ORDER**. This approval also constitutes compliance with Section 404 (e) of the Clean Water Act (33 USC 1344) pursuant to Programmatic General Permit 10 issued to the State of Utah by the U.S. Army Corps of Engineers on February 22, 2016, and is subject to all conditions therein. Full text of Programmatic General Permit 10 can be found at the following: http://www.waterrights.utah.gov/strmalt/whitepapers/20160222_PGP10.pdf. The applicant is hereby authorized to conduct the work detailed in the application and supporting documentation, as described in this **ORDER**. Any modification or addition to the work may require additional authorization and/or application resubmittal.

1. The expiration date of this order is **October 11, 2018**. Work affecting the bed and/or banks of the stream may not be conducted after the expiration date. A request for extension must be submitted in writing to the Division and include an explanation for project delay. The request must be submitted at least 30 days prior to expiration of the order.

2. A copy of this order must be kept onsite at any time the work authorized under this order is in progress.

3. We suggest that you coordinate with potentially impacted landowners.

4. Photos must be taken before and after project construction and submitted to this office.

5. Best Management Practices should be implemented and maintained during any streamside or instream work to minimize sedimentation, temporary erosion of stream banks, and needless damage or alteration to the streambed.

6. Disturbed areas must be planted with a variety of appropriate vegetation (especially woody vegetation where feasible) to help hold the soil around riprap, prevent excessive erosion, and to help maintain other riverine functions. Successful revegetation efforts must be monitored and reported to this office.

7. Approval of this application does not authorize trespass, easements, rights-of-way, or any other access and land use permits. It is the responsibility of the applicant to obtain any such authorizations as may be necessary for this proposal.

8. Excavated material and construction debris may not be wasted in any stream channel or placed in flowing waters, this will include material such as grease, oil, joint coating, or any other possible pollutant. Excess materials must be wasted at an upland site well away from any channel. Construction materials, bedding material, excavated material, etc. may not be stockpiled in riparian or channel areas.

9. Erosion control, revegetation, and noxious weed control must be implemented and monitored until revegetation becomes well established. Success of these measures must also be reported prior to the compliance inspection. This is especially important for all disturbed areas, including fill, in order to prevent sediments from entering flowing water. Particular attention is required to assure that silt fencing is properly installed and left in place until after revegetation becomes established at which time the silt fence can then be carefully removed.

10. Ingress and egress access should be kept to a minimum.

11. Work must be accomplished during a period of low flow. Sediment introduced into stream flows during construction must be controlled to prevent increases in turbidity downstream. Flows must be diverted away from the construction area using a non-erodible cofferdam or other means of bypass.

12. Machinery must be properly cleaned and fueled offsite.

13. Riprap must consist of only clean, properly sized angular rock, which must be keyed deeply into the streambed to prevent undercutting. A filter must be placed behind if necessary (i.e., if soils are fine grained, non-cohesive, and/or erodible). Demolition debris or refuse will not be allowed, nor material such as bricks, concrete, asphaltic material [either natural (tar sand, oil shale, etc.) or man-made].

14. Cement is toxic to aquatic organisms, and its introduction into waters of the United States would constitute a violation of the Clean Water Act. Cement or concrete may not be allowed to enter stream flows. Water must be excluded from areas where concrete or cement is used until it has set. Contaminated water pumped from the construction area may not be discharged in a manner that will allow it to enter flows. Equipment used during this type of work must be washed well away from the channel.

15. The applicant must maintain existing stream shade on all Class 3 A streams. Destruction of any stream shade vegetation within the project area must be replaced at a 1:1 shade ratio at mature life stage with native vegetation along a Class 3 A stream. If stream shade vegetation is to be removed, the applicant must submit an estimate in their restoration plan of the portion of the water surface area within the project area that is shaded by estimating areas with no shade, poor shade, and shade prior to the commencement of work. Time of the year, time of the day, and weather can affect your observation of shading. Therefore, the relative amount of shade is a professional best-guess estimate. Ideally the applicant would be measuring when the sun is at an angle that provides maximum stream shade and the vegetation is in full leaf-out. As noted in General Condition #6 of PGP 10 the destruction of mature trees is to be avoided to the maximum extent possible and the permittee is ultimately responsible for revegetation success.

16. Within 30 days after the completion of this project, a compliance certification form must be completed and returned to the U.S. Army Corps of Engineers. Failure to return this compliance certification form would invalidate U.S. Army Corps of Engineers General Permit 10, thereby placing the applicant in violation of Section 404 of the Clean Water Act. Form can be found at:
http://www.waterrights.utah.gov/strmalt/ComplianceCertification.pdf

Your contact with the Division is Daren Rasmussen, who can be reached at telephone number 801-538-7377.

This **ORDER** is subject to the provisions of UTAH ADMIN. CODE R. 655-6-17 of the Division of Water Rights and to UTAH CODE ANN. §§ 63G-4-302 and 73-3-14, which provide for persons or parties with legal standing to file either a Request for Reconsideration with the State Engineer or an appeal with the appropriate District Court. A Request for Reconsideration must be filed with the State Engineer within 20 days of the date of this **ORDER**. However, a Request for Reconsideration is not a prerequisite to filing a court appeal. A court appeal must be filed within 30 days after the date of this **ORDER**, or if a Request for Reconsideration has been filed, within 30 days after the date the Request for Reconsideration is denied. A Request for Reconsideration is considered denied when no action is taken within 20 days after the Request is filed.

Dated this 11th day of October, 2016.

David K. Marble, P.E.
Assistant State Engineer

Enclosure

Mailed a copy of the foregoing Order this 11th day of October, 2016, to:

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
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APPENDIX VI-21

Emery 2 Surface Facility
Hydrologic Design Calculations

Emery 2 Surface Facility Hydrology Design Report

Bronco Utah Operations
Emery Mine
Emery, Utah

January~~October~~ 2017~~6~~

EarthFax Engineering Group, LLC.

Engineers / Scientists
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EMERY 2 SURFACE FACILITY HYDROLOGY DESIGN REPORT

CHAPTER 1

INTRODUCTION

Bronco Utah Operations (Bronco) is planning to construct a new mine portal and support areas (the Site) to access the Emery Mine works south of Emery, Utah. The Site currently consists of an undisturbed ephemeral drainage along the bottom of a canyon and a disturbed laydown area. Development of the Site will include construction of an access road along the bottom of the canyon, the creation of a pad adjacent to the proposed portal within the canyon, and the creation of a ventilation fan pad above the canyon and proposed portal pad. To prevent adverse hydrologic impacts downstream of the Site and to prevent undisturbed runoff from entering the Site, Bronco will construct a storm water runoff conveyance system including berms, catch basins, culverts, ditches, swales, and sedimentation ponds.

The purpose of this document is to present design information for the planned runoff and sediment controls. A series of berms, catch basins, culverts, and ditches will direct undisturbed runoff around the Site. Additional berms, catch basins, a culvert, ditches, and a swale will direct disturbed runoff from the Site into a sedimentation pond. The runoff and sediment controls have been designed to conform to the applicable criteria outlined in the Utah Administrative Code R645-301. This document has been prepared for Bronco by EarthFax Engineering Group, LLC (EarthFax), and contains the following information:

- Location and background information;
- Hydrologic analyses to determine runoff discharge for design storm events;
- Sediment control design criteria;

Engineering calculations are included as an attachment to this document.

CHAPTER 2
LOCATION AND BACKGROUND INFORMATION

The general layout of the proposed surface facilities is shown on Plate VI-10E. The total undisturbed watershed area contributing to the diversion conveyance system is 185 acres. The total future watershed area contributing to Sedimentation Pond 3 is 27.53 acres, which includes 13.11 acres of disturbed area and 14.42 acres of undisturbed area that cannot be reasonably diverted.

Sedimentation Pond 3 is an existing pond that was originally designed to contain the runoff resulting from a 100-year, 6-hour storm event from a smaller drainage area than will contribute to that pond following construction of the Emery 2 surface facilities. Therefore, Sedimentation Pond 3 has been re-designed to contain runoff resulting from a 10-year, 24-hour storm event for the expanded area.

The runoff conveyance and sediment control system for the Site has been designed to meet the minimum standards specified in the Utah Administrative Code Titles R645-301-742 and 751 as well as safety considerations. Thus the conveyance system and sedimentation pond have been designed to comply with the following criteria:

- The disturbed area conveyance system will safely convey the peak flow resulting from a 10-year, 6-hour storm event.
- The undisturbed area conveyance system will safely convey the peak flow resulting from a 100-year, 6-hour storm event.
- Berms, catch basins, culverts, ditches, and swale will be installed according to standard engineering practices.
- Berms, ditches, and the swale will be constructed from native or imported materials and not from coal mine waste rock.
- Sedimentation Pond 3 will be modified to contain runoff resulting from a 10-year, 24-hour storm event and the contributing sediment.
- The spillway on the pond will safely pass the peak flow resulting from a 25-year, 6-hour storm event.

CHAPTER 3
OPERATIONAL HYDROLOGIC DESIGN

3.1 Drainage Area Characteristics

Storm water discharge for the area was calculated using HydroCAD version 10.0. Curve number values were determined based on local vegetation and soil conditions, obtained from vegetation surveys conducted by Mt. Nebo Scientific and from Long Resource Consultants, Inc., respectively. The results of these surveys were used in conjunction with the U.S. Department of Agriculture's National Resource Conservation Service National Engineering Handbook, Part 630 Hydrology.

Vegetation in undisturbed areas adjacent to the Site consists of a mixed desert shrub community. Native soils in the area are categorized as Hydrologic Soil Group C soils. Based on these factors, it was assumed that the curve number for undisturbed areas is 80. All disturbed areas were assumed to be free of vegetation. Disturbed-areas were assumed to be represented by a curve number of 87 (typical of a compacted, gravel road). Pond areas were assumed to be represented by a curve number of 98.

Design storm magnitudes were obtained from the National Oceanic and Atmospheric Administration (NOAA) ATLAS 14, Point Precipitation Frequency Estimates web page (http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html). These data are provided in Attachment A. Watershed areas and average slopes were calculated using AutoCAD 2016 software from a 5-foot contour interval topographic map of the area.

The drainage areas contributing to the Site during operations and after reclamation are delineated on Plates VI-10-E and III-11, respectively, of the Emery Mining and Reclamation Plan ("MRP"). As indicated previously, the total area contributing to Sedimentation Pond 3 is 27.53

acres, which includes 13.11 acres of disturbed area and 14.42 acres of undisturbed area. The total undisturbed area that will be diverted around the disturbed area is 182.18 acres. Table 1 provides a summary of the hydrologic characteristics of all disturbed and undisturbed watershed areas associated with the Emery 2 surface facilities.

3.2 Runoff Conveyance System Details

The results of peak flow calculations used to design the operational runoff conveyance system are presented in Attachment B and summarized in Table 2. The locations of these features and contributing watersheds for the operational conveyance system are indicated on Plate VI-10E of the MRP. Design details for the conveyance features are indicated on Plate VI-11B of the MRP.

The proposed runoff conveyance system will consist of berms, culverts, catch basins, ditches, and a swale. Rock armoring was designed in cases where the maximum flow velocity was estimated to exceed 5 ft/s and in areas above the portal box cut (to provide additional safety against flooding). Rock sizing for berms, ditches, and swales were ~~was~~ determined in accordance with the 1989 version of Hydraulic Engineering Circular No. 11 published by the U.S. Department of Transportation. Rock pad sizing for the culvert outfall pads were determined in accordance with the 2006 version of the Hydraulic Engineering Circular No. 14 published by the U.S. Department of Transportation. The results of those calculations are provided in Attachment B and summarized in Table 2.

All berms, ditches, and swales will be excavated into and formed out of native materials or compacted native backfill. No coal waste or deleterious material will be used in construction of runoff controls.

3.3 Sedimentation Pond Modification

Sedimentation Pond 3, a re-designed existing sedimentation pond, will collect runoff from the access road, portal pad, laydown area, ventilation fan pad, and undisturbed areas that cannot be reasonably diverted. The stage-capacity data for Sedimentation Pond 3 is shown in Table 3. Additional design details for Sedimentation Pond 3 are presented in Attachment B and indicated on Plate VI-15B of the MRP.

Modifications to Sedimentation Pond 3 have been designed to safely detain all runoff resulting from the 10-year, 24-hour storm event (44,780 cubic feet) plus 18,960 cubic feet of sediment, for a total of 63,740 cubic feet dead storage. Sediment will be removed when at least 60% of the design sediment capacity (11,380 cubic feet, approximate elevation 5902.15 feet) and less than 100% of the design sediment capacity (18,960 cubic feet, approximate elevation 5903.52 feet) has accumulated~~ (an elevation of approximately 5,905.15 5,902.15feet)~~. The existing outlet structure at Sedimentation Pond 3 will be modified by ~~raising~~lowering the elevation of the existing decant pipe invert to ~~5907.0~~5903.52 feet and the elevation of the existing primary outlet invert to ~~5913.0~~ 5,909.55 feet. This will allow the decant structure to safely discharge the peak flow resulting from the 25-year, 6-hour storm event from the pond into Quitchipah Creek. An additional culvert will be installed with an invert elevation of 5,910.0 feet along the east side of Sedimentation Pond 3 to act as a secondary spillway.

3.4 Drainage Narrative

Runoff from Undisturbed Watershed 1 (UW-1) and UW-2 is collected behind Undisturbed Berm 1 (UB-1) and directed into Undisturbed Culvert 1 (UC-1). From UC-1, runoff is directed northeast through Catch Basin 1 (CB-1) and CB-2 into CB-3. Runoff from UW-3 is directed into CB-3 via UB-2. Runoff from UW-4 flows through an existing channel into CB-3. Runoff from UW-5 and UW-6 is directed into CB-3 via UB-3. From CB-3, undisturbed area runoff continues

northeast through UC-2. The outfall for UC-2 is within an existing channel that contributes to Quitchipah Creek.

Runoff from Disturbed Watershed 1 (DW-1) surface flows into a sump located within the Emery 2 portal pad. Runoff from DW-2 is directed southwest into the sump located within the Emery 2 portal pad via Disturbed Ditch 1 (DD-1). This sump will be constructed by sloping the area in the southwest extent of the portal pad to the south and/or southwest at a minimum slope of 1%. Sediment will be removed from this sump when deemed necessary at the discretion of the operator to maintain safe working conditions. A pump, with a minimum capacity of 900 gpm, will be placed in the sump to allow ponded water to be pumped at operator discretion from the sump into DD-2.

Runoff from DW-6 is directed into DD-2 via Disturbed Berm 2 (DB-2). Runoff from DW-7 is collected by DD-2. All run off from DD-2 is directed northeast into Disturbed Culvert 1 (DC-1) and then into Sedimentation Pond 3.

DB-1 directs runoff from DW-3 northeast into DD-3. Runoff from DW-4 and within DD-3 is directed northeast into DD-4. Runoff from DW-5 and within DD-4 is directed northeast into DD-5. From DD-5 all runoff is directed east into Sedimentation Pond 3.

CHAPTER 4
RECLAMATION HYDROLOGIC DESIGN

The Mining and Reclamation Plan details the reclamation design and plan for the Emery 2 surface facility. Sedimentation Pond 3, along with will all berms, catch basins, culverts, ditches, and swales related to the operational runoff conveyance system of the Emery 2 surface facilities, will be removed during reclamation. Natural drainage patterns will be restored to their approximate original configuration during reclamation.

The results of peak flow calculations used to design reclamation channels are presented in Attachment C and summarized in Table 2. The locations of these features and additional design details for the reclamation channels are indicated on Plate III-11 of the MRP.

The reclaimed runoff conveyance system will consist of two open channels. Both channels will be constructed using native materials. No coal waste or deleterious material will be used in construction of reclamation runoff controls. Riprap sizing was determined in accordance with the 1989 version of Hydraulic Engineering Circular No. 11 published by the U.S. Department of Transportation. The results of those calculations are provided in Attachment C and summarized in Table 2.

Both reclamation channels are designed with a bottom width of 4 feet, a depth of 2 feet, and side slopes of 2H:1V. The median riprap diameter will be 6 inches in channel RD-1 and 12 inches in channel RD-2 (which will be constructed in the steeper portion of the canyon). An impermeable liner will be installed beneath the riprap in channel RD-1 to preclude seepage into the deep fill that will be placed during reclamation of the portal box cut. Riprap in channel RD-2 will be underlain by a non-woven geotextile.

CHAPTER 5

REFERENCES

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Thompson, P.L. and R.T. Kilgore. 2006. Hydraulic Design of Energy Dissipaters for Culverts and Channels. Hydraulic Engineering Circular No. 14. U.S. Department of Transportation, Federal Highway Administration. Arlington, Virginia.

U.S. Natural Resource Conservation Service. Revised September, 2000. National Engineering Handbook, Part 630 Hydrology. Washington, D.C.

TABLE 1

Watershed Area Characteristics

Watershed ID	Drainage Area (ac)			Average Curve Number	Time of Conc. (min)
	Undisturbed	Disturbed	Total		
DW-1	0.71	1.42	2.13	84.7	2.6
DW-2	1.92	1.59	3.51	83.2	1.6
DW-3	0.00	1.76	1.76	87.0	10.3
DW-4	2.11	0.38	2.49	81.1	3.5
DW-5	0.45	0.14	0.59	81.7	1.0
DW-6	0.89	0.19	1.08	81.2	1.3
DW-7	8.34	7.39	15.73	83.3	10.0
DW-8	0.00	0.24	0.24	87.0	10.2
SUBTOTAL	14.42	13.11	27.53	--	--
UW-1	116.38	0.00	116.38	80.0	38.0
UW-2	9.42	0.00	9.42	80.0	9.9
UW-3	13.18	0.00	13.18	80.0	24.5
UW-4	35.06	0.00	35.06	80.0	23.7
UW-5	0.48	0.00	0.48	80.0	8.2
UW-6	7.66	0.00	7.66	80.0	9.1
SUBTOTAL	182.18	0.00	182.18	--	--
RW-1	134.0	0.0	134.0	80.0	38.0
RW-2	14.0	0.0	14.0	80.0	4.1
RW-3	36.0	0.0	36.0	80.0	23.8
RW-4	6.5	0.0	6.5	80.0	3.4
RW-5	12.0	0.0	12.0	80.0	9.1
SUBTOTAL	202.5	0.0	202.5	--	--

Notes: 1. See Plate VI-10E of the Emery MRP for operational watershed boundaries.
2. See Plate III-11 of the Emery MRP for reclamation watershed boundaries.
2. See Attachment B for operational design calculations.
3. See Attachment C for reclamation design calculations.

TABLE 2

Conveyance System Information [a]

Diversion Structure	Description	Design Event	Peak Flow (cfs)	Max. Vel. (fps)	Riprap D_{50} (in)	Flow Depth (ft)	Freeboard (ft)
DB-1	0.5-ft high berm with adjacent 0.5-ft deep triangular ditch, with 1.5H:1V side slopes	10-yr, 6-hr	0.79	0.91	None	0.27	0.73
DB-2	0.5-ft high berm with adjacent 0.5-ft deep triangular ditch, with 1.5H:1V side slopes	10-yr, 6-hr	0.26	0.63	None	0.15	0.85
DB-3	0.5-ft high berm with adjacent 0.5-ft deep triangular ditch, with 1.5H:1V side slopes	10-yr, 6-hr	0.11	1.18	None	0.21	0.79
DC-1	18" Diameter CHDPE Pipe	10-yr, 6-hr	4.42	7.83	None	0.53	0.97
DD-1	1-ft deep triangular ditch with 2H:1V side slopes	10-yr, 6-hr	1.26	4.16	None	0.40	0.60
DD-2	1.5-ft deep trapezoidal ditch with 1-ft bottom width and 1.5H:1V side slopes	10-yr, 6-hr	7.02	4.38	None	0.55	0.4549
DD-3	1-ft deep triangular ditch with 1.5H:1V side slopes	10-yr, 6-hr	0.70	1.30	None	0.52	0.48
DD-4	1-ft deep triangular ditch with 1.5H:1V side slopes	10-yr, 6-hr	0.65	3.35	None	0.35	0.65
DD-5	1-ft deep triangular ditch with 1.5H:1V side slopes	10-yr, 6-hr	0.64	3.74	None	0.34	0.66
DS-1	Broad swale, 0.5-ft deep and 15 ft wide	10-yr, 6-hr	0.08	0.58	None	0.09	0.41
SP3-SS	12-inch diameter CHDPE	25-yr, 24-hr	1.62	18.01	3[d]	0.47	0.53
UB-1	2-ft high berm with adjacent 2-ft deep triangular ditch, both with 1.5H:1V side slopes	100-yr, 6-hr	6.96	3.68	3	0.97	2.03
UB-2	0.5-ft high berm with adjacent 1.5-ft deep triangular ditch, both with 1.5H:1V side slopes	100-yr, 6-hr	5.59	4.02	3	0.95	0.87
UB-3	0.5-ft high berm with adjacent 0.5-ft deep triangular ditch, both with 1.5H:1V side slopes	100-yr, 6-hr	6.21	5.66	8	0.77	0.73
UC-1	30-inch diameter CHDPE	100-yr, 6-hr	37.92	12.27	None[c]	1.50	1.00
UC-2	30-inch diameter CHDPE	100-yr, 6-hr	54.34	13.68	9[d]	1.89	0.61
RD-1	2-ft deep trapezoidal ditch with 4-ft bottom width and 2H:1V side slopes	100-yr, 6-hr	43.24	6.34	6	1.10	0.90
RD-2	2-ft deep trapezoidal ditch with 4-ft bottom width and 2H:1V side slopes	100-yr, 6-hr	53.98	8.07	12	1.08	0.92

[a] See Plates VI-10E and VI-11B of the Emery MRP for additional design information
[b] Discharges into Sedimentation Pond 3
[c] Will transition to YC-2 via a catch basin
[d] Sizing for riprap apron at culvert outlet

TABLE 3

Sedimentation Pond 3 Stage Capacity Data[(a)]

Elevation (ft)	Surface Area (ft^2)	Incremental (ft^3)	Cumulative Volume (ft^3)
~~5,899.9~~ 5,898.5	0	0	0
~~5,900.0~~ 5,899.0	~~1,083~~ 597	~~54~~ 149	~~54~~ 149
~~5,902.0~~ 5,900.0	~~1,808~~ 2,820	~~2,891~~ 1,709	~~2,945~~ 1,858
~~5,904.0~~ 5,901.0	~~2,715~~ 4,692	~~4,523~~ 3,756	~~7,468~~ 5,614
~~5,906.0~~ 5,902.0	~~3,822~~ 5,143	~~6,537~~ 4,918	~~14,005~~ 10,531
~~5,908.0~~ 5,903.0	~~5,275~~ 5,611	~~8,602~~ 5,377	~~23,102~~ 15,908
~~5,910.0~~ 5,904.0	~~7,167~~ 6,097	~~11,423~~ 5,854	~~35,544~~ 21,762
~~5,912.0~~ 5,905.0	~~10,148~~ 6,601	~~17,315~~ 6,349	~~52,859~~ 28,111
~~5,913.0~~ 5,906.0	~~11,221~~ 7,122	~~11,157~~ 6,862	~~64,016~~ 34,973
~~5,914.0~~ 5,907.0	~~12,294~~ 7,659	~~11,285~~ 7,391	~~75,301~~ 42,363
~~5,915.0~~ 5,908.0	~~13,633~~ 8,213	~~9,528~~ 7,936	~~88,265~~ 50,299
~~5,915.5~~ 5,909.0	~~14,567~~ 8,783	~~7,050~~ 8,498	~~95,315~~ 58,797
5,910.0	9,372	9,078	67,875
5,911.0	9,940	9,656	77,531
5,912.0	11,068	10,504	88,035
Total			**~~95,315~~ 88,035**

[(a)] Based on AutoCAD 2016 LT Proposed Topography.

ATTACHMENT A

Depth-Duration-Frequency
Precipitation Data

NOAA Atlas 14, Volume 1, Version 5
Location name: Emery, Utah, US*
Latitude: 38.8540°, Longitude: -111.2606°
Elevation: 6066 ft*
* source: Google Maps

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	0.101 (0.088-0.118)	0.130 (0.114-0.153)	0.182 (0.157-0.212)	0.228 (0.196-0.268)	0.302 (0.252-0.355)	0.370 (0.302-0.435)	0.447 (0.357-0.529)	0.538 (0.417-0.642)	0.681 (0.504-0.829)	0.809 (0.578-0.999)
10-min	0.154 (0.134-0.179)	0.198 (0.173-0.232)	0.277 (0.239-0.323)	0.348 (0.298-0.408)	0.460 (0.384-0.540)	0.562 (0.459-0.662)	0.681 (0.544-0.805)	0.818 (0.635-0.977)	1.04 (0.766-1.26)	1.23 (0.879-1.52)
15-min	0.191 (0.166-0.222)	0.245 (0.214-0.288)	0.343 (0.296-0.400)	0.431 (0.369-0.505)	0.570 (0.476-0.669)	0.697 (0.569-0.820)	0.843 (0.674-0.998)	1.01 (0.787-1.21)	1.28 (0.950-1.56)	1.52 (1.09-1.89)
30-min	0.257 (0.223-0.299)	0.330 (0.288-0.388)	0.462 (0.399-0.538)	0.580 (0.497-0.680)	0.768 (0.642-0.900)	0.939 (0.766-1.10)	1.14 (0.907-1.34)	1.37 (1.06-1.63)	1.73 (1.28-2.11)	2.05 (1.47-2.54)
60-min	0.318 (0.276-0.370)	0.409 (0.357-0.480)	0.572 (0.494-0.666)	0.717 (0.615-0.841)	0.951 (0.794-1.11)	1.16 (0.948-1.37)	1.41 (1.12-1.66)	1.69 (1.31-2.02)	2.14 (1.58-2.61)	2.54 (1.82-3.14)
2-hr	0.384 (0.338-0.440)	0.484 (0.425-0.556)	0.655 (0.573-0.751)	0.811 (0.703-0.928)	1.06 (0.897-1.22)	1.28 (1.06-1.48)	1.54 (1.25-1.80)	1.85 (1.45-2.18)	2.34 (1.76-2.82)	2.79 (2.02-3.41)
3-hr	0.426 (0.384-0.486)	0.539 (0.484-0.614)	0.706 (0.632-0.802)	0.857 (0.760-0.973)	1.09 (0.956-1.24)	1.30 (1.11-1.49)	1.56 (1.31-1.82)	1.86 (1.52-2.20)	2.35 (1.85-2.84)	2.79 (2.12-3.44)
6-hr	0.538 (0.490-0.596)	0.672 (0.614-0.745)	0.849 (0.774-0.940)	1.00 (0.906-1.11)	1.22 (1.09-1.36)	1.41 (1.25-1.58)	1.65 (1.43-1.86)	1.93 (1.64-2.23)	2.42 (2.00-2.87)	2.87 (2.31-3.48)
12-hr	0.650 (0.596-0.709)	0.804 (0.741-0.880)	0.997 (0.911-1.09)	1.16 (1.05-1.26)	1.37 (1.24-1.51)	1.55 (1.38-1.71)	1.73 (1.53-1.92)	1.97 (1.71-2.25)	2.45 (2.06-2.90)	2.90 (2.38-3.51)
24-hr	0.860 (0.790-0.943)	1.07 (0.987-1.18)	1.35 (1.24-1.47)	1.57 (1.44-1.71)	1.87 (1.71-2.04)	2.11 (1.91-2.31)	2.35 (2.12-2.59)	2.61 (2.33-2.88)	2.96 (2.61-3.29)	3.24 (2.82-3.63)
2-day	0.942 (0.872-1.03)	1.17 (1.09-1.27)	1.45 (1.34-1.57)	1.68 (1.55-1.82)	1.99 (1.83-2.17)	2.25 (2.04-2.45)	2.51 (2.27-2.75)	2.78 (2.48-3.07)	3.16 (2.77-3.53)	3.46 (3.00-3.90)
3-day	0.997 (0.925-1.08)	1.24 (1.15-1.34)	1.52 (1.41-1.65)	1.75 (1.63-1.90)	2.08 (1.91-2.25)	2.33 (2.13-2.53)	2.60 (2.36-2.84)	2.88 (2.58-3.16)	3.27 (2.88-3.62)	3.57 (3.10-4.00)
4-day	1.05 (0.978-1.14)	1.30 (1.21-1.41)	1.59 (1.48-1.72)	1.83 (1.70-1.97)	2.16 (2.00-2.33)	2.42 (2.22-2.62)	2.70 (2.45-2.93)	2.98 (2.67-3.25)	3.37 (2.98-3.72)	3.68 (3.21-4.10)
7-day	1.22 (1.13-1.32)	1.51 (1.40-1.64)	1.84 (1.71-1.99)	2.11 (1.96-2.26)	2.46 (2.27-2.65)	2.73 (2.51-2.94)	3.01 (2.75-3.25)	3.28 (2.97-3.57)	3.64 (3.25-4.00)	3.90 (3.46-4.34)
10-day	1.38 (1.27-1.50)	1.71 (1.57-1.86)	2.10 (1.93-2.28)	2.40 (2.21-2.60)	2.80 (2.57-3.04)	3.11 (2.83-3.38)	3.41 (3.09-3.73)	3.71 (3.33-4.08)	4.09 (3.64-4.55)	4.38 (3.86-4.91)
20-day	1.69 (1.54-1.85)	2.10 (1.92-2.30)	2.60 (2.37-2.82)	2.97 (2.72-3.23)	3.46 (3.16-3.76)	3.83 (3.47-4.17)	4.18 (3.78-4.57)	4.53 (4.07-4.97)	4.98 (4.43-5.50)	5.29 (4.67-5.89)
30-day	1.99 (1.83-2.17)	2.46 (2.27-2.68)	3.00 (2.77-3.26)	3.40 (3.13-3.68)	3.92 (3.60-4.24)	4.29 (3.92-4.64)	4.64 (4.23-5.04)	4.98 (4.50-5.43)	5.39 (4.84-5.94)	5.68 (5.05-6.31)
45-day	2.31 (2.12-2.52)	2.86 (2.63-3.12)	3.47 (3.20-3.76)	3.92 (3.61-4.23)	4.47 (4.12-4.81)	4.85 (4.47-5.21)	5.20 (4.78-5.59)	5.49 (5.05-5.92)	5.81 (5.34-6.29)	5.98 (5.50-6.49)
60-day	2.63 (2.43-2.85)	3.25 (3.01-3.52)	3.94 (3.66-4.25)	4.45 (4.13-4.78)	5.10 (4.72-5.46)	5.54 (5.13-5.93)	5.96 (5.50-6.38)	6.32 (5.82-6.80)	6.73 (6.15-7.29)	6.97 (6.36-7.58)

[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.

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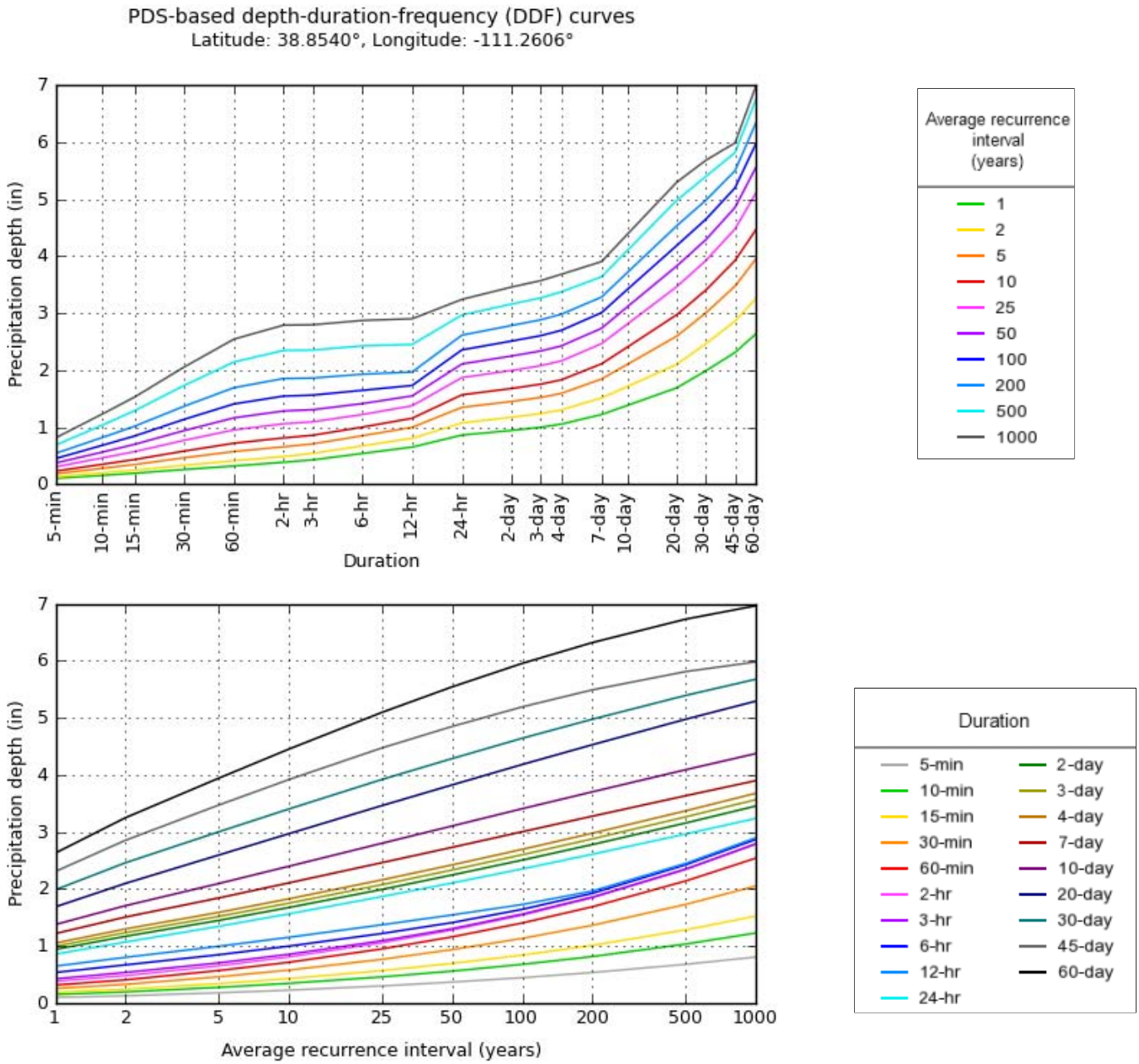
PF graphical



NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Thu Jul 7 12:14:50 2016

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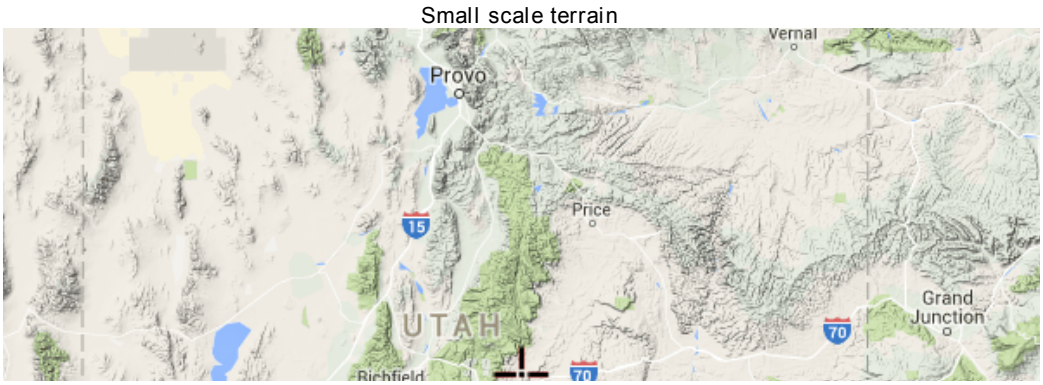
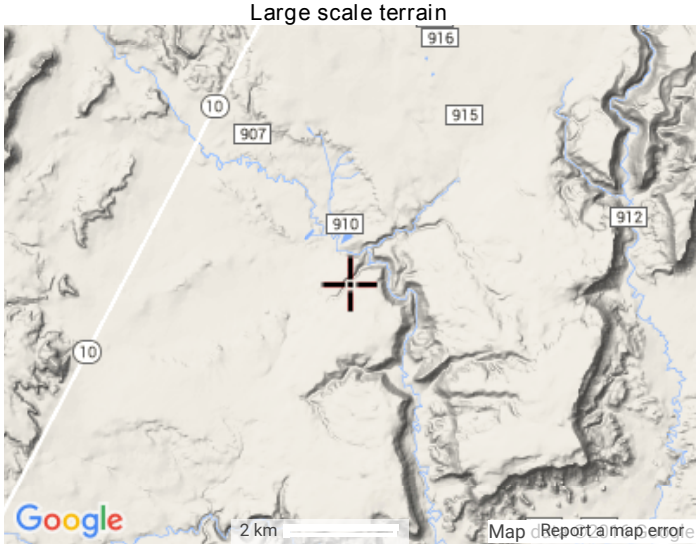
Maps & aerials

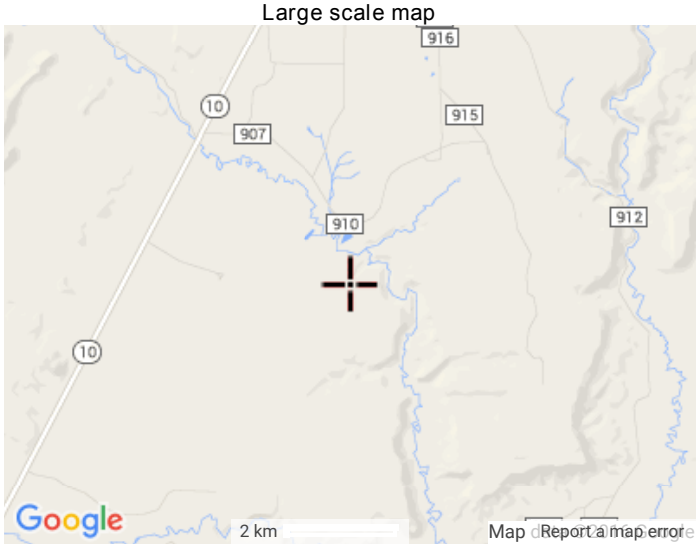
Small scale terrain



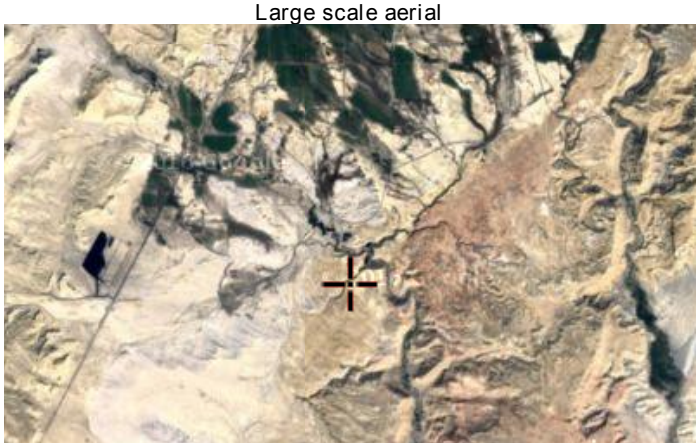
Large scale terrain



Large scale map



Large scale aerial



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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

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ATTACHMENT B

Operational Hydrology Design Information

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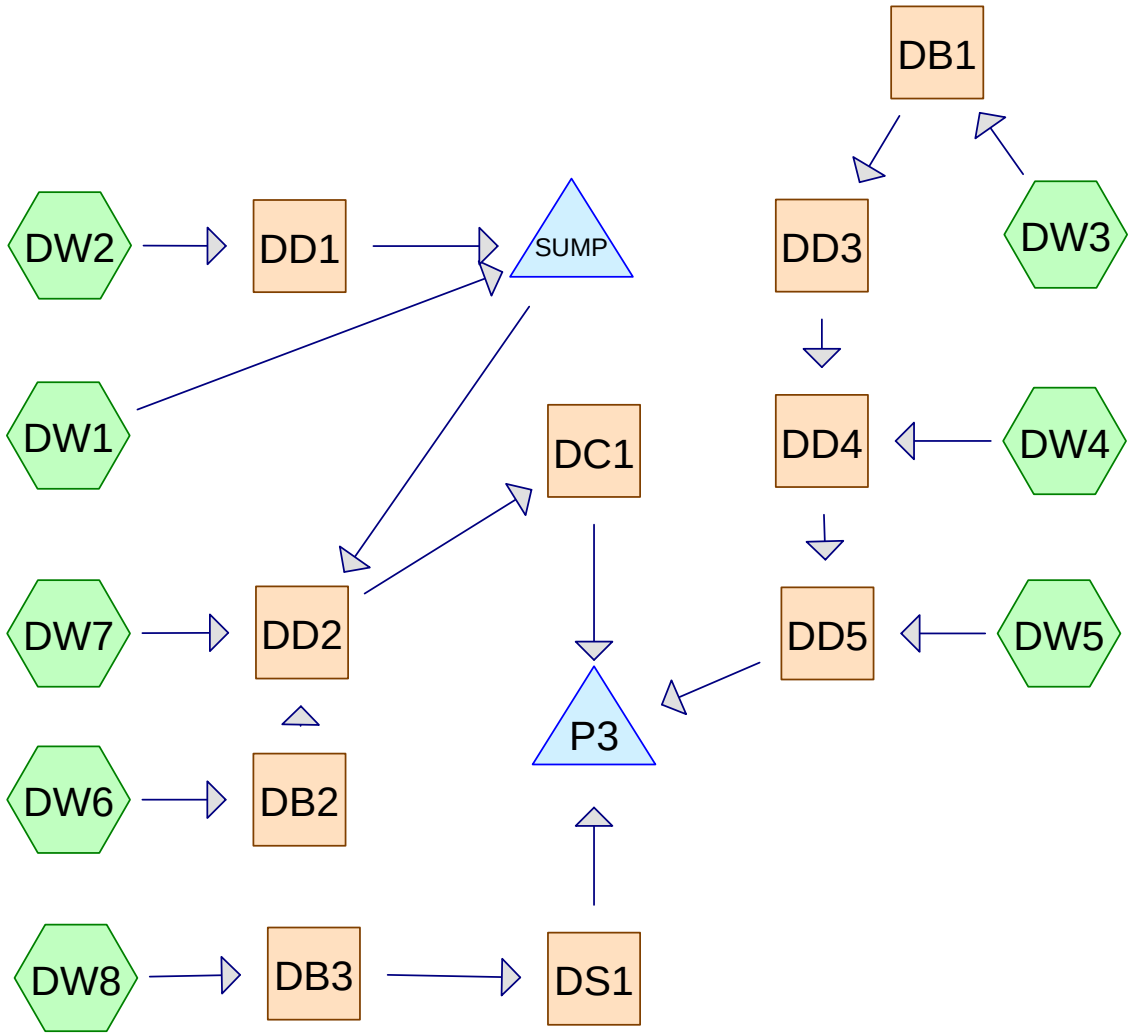

Subcat Reach Pond Link

Routing Diagram for Operations - Disturbed Drainage
Prepared by EarthFax Engineering Group, LLC, Printed 10/12/2016
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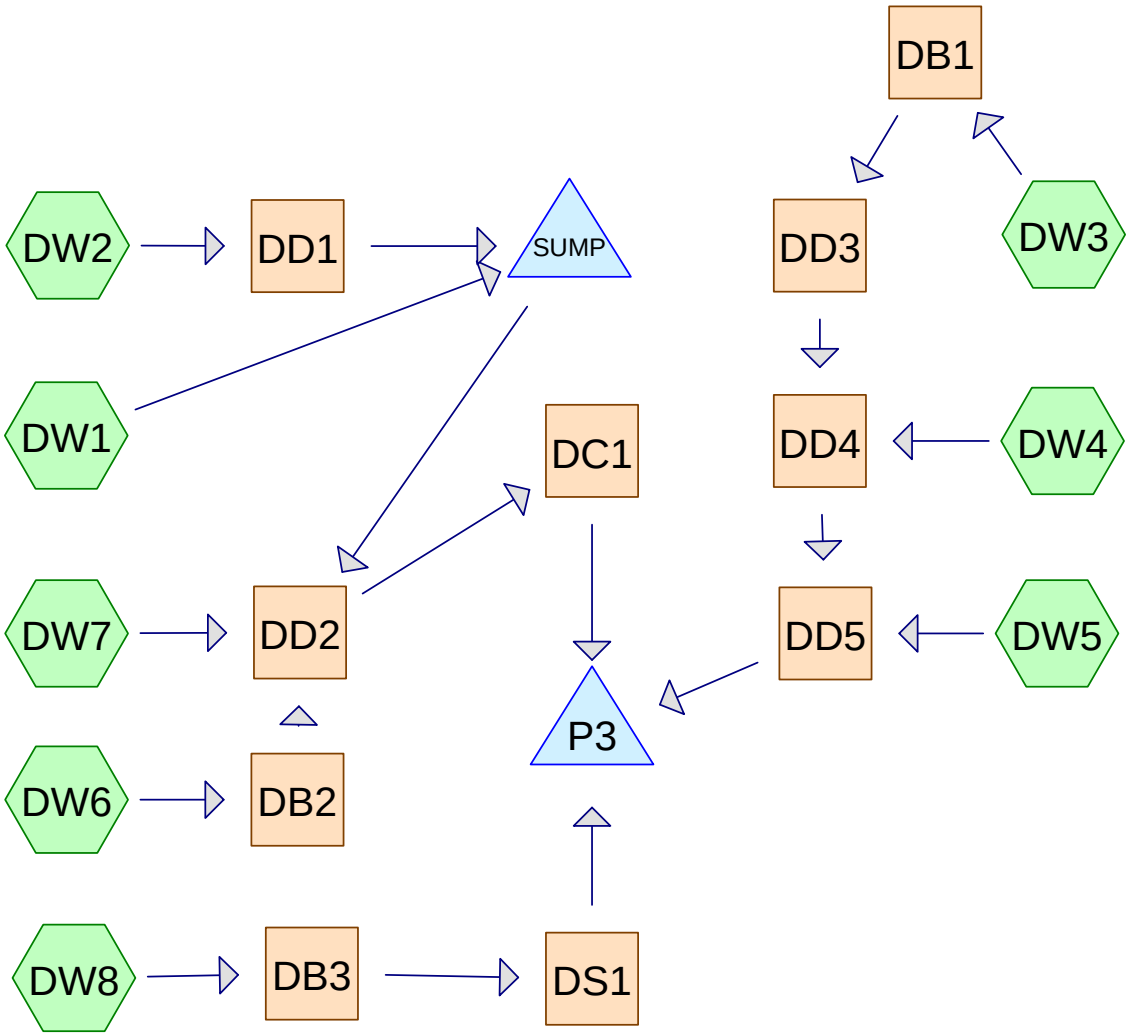
Page added 12/08/2016



Subcat Reach Pond Link

Routing Diagram for Operations - Disturbed Drainage
Prepared by EarthFax Engineering Group, LLC, Printed 12/7/2016
HydroCAD® 10.00-13 s/n 03900 © 2014 HydroCAD Software Solutions LLC

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment DW1: Runoff Area=2.130 ac 0.00% Impervious Runoff Depth=0.17"
Flow Length=440' Slope=0.3000 '/' Tc=2.6 min CN=85 Runoff=1.03 cfs 0.031 af

Subcatchment DW2: Runoff Area=3.510 ac 0.00% Impervious Runoff Depth=0.13"
Flow Length=310' Slope=0.5000 '/' Tc=1.6 min CN=83 Runoff=1.26 cfs 0.039 af

Subcatchment DW3: Runoff Area=1.760 ac 0.00% Impervious Runoff Depth=0.22"
Flow Length=330' Slope=0.0100 '/' Tc=10.3 min CN=87 Runoff=0.79 cfs 0.033 af

Subcatchment DW4: Runoff Area=2.490 ac 0.00% Impervious Runoff Depth=0.10"
Flow Length=290' Slope=0.1070 '/' Tc=3.5 min CN=81 Runoff=0.53 cfs 0.020 af

Subcatchment DW5: Runoff Area=0.590 ac 0.00% Impervious Runoff Depth=0.11"
Flow Length=130' Slope=0.3500 '/' Tc=1.0 min CN=82 Runoff=0.17 cfs 0.006 af

Subcatchment DW6: Runoff Area=1.080 ac 0.00% Impervious Runoff Depth=0.10"
Flow Length=180' Slope=0.3900 '/' Tc=1.3 min CN=81 Runoff=0.26 cfs 0.009 af

Subcatchment DW7: Runoff Area=15.730 ac 1.59% Impervious Runoff Depth=0.13"
Flow Length=750' Slope=0.0530 '/' Tc=10.0 min CN=83 Runoff=3.65 cfs 0.173 af

Subcatchment DW8: Runoff Area=0.240 ac 0.00% Impervious Runoff Depth=0.22"
Flow Length=500' Slope=0.0200 '/' Tc=10.2 min CN=87 Runoff=0.11 cfs 0.004 af

Reach DB1: Avg. Flow Depth=0.27' Max Vel=0.91 fps Inflow=0.79 cfs 0.033 af
n=0.030 L=200.0' S=0.0050 '/' Capacity=23.48 cfs Outflow=0.70 cfs 0.033 af

Reach DB2: Avg. Flow Depth=0.15' Max Vel=0.63 fps Inflow=0.26 cfs 0.009 af
n=0.030 L=200.0' S=0.0050 '/' Capacity=23.48 cfs Outflow=0.16 cfs 0.009 af

Reach DB3: Avg. Flow Depth=0.21' Max Vel=1.18 fps Inflow=0.11 cfs 0.004 af
n=0.035 L=500.0' S=0.0200 '/' Capacity=5.02 cfs Outflow=0.08 cfs 0.004 af

Reach DC1: Avg. Flow Depth=0.53' Max Vel=7.83 fps Inflow=4.42 cfs 0.268 af
18.0" Round Pipe n=0.013 L=400.0' S=0.0250 '/' Capacity=16.61 cfs Outflow=4.41 cfs 0.268 af

Reach DD1: Avg. Flow Depth=0.40' Max Vel=4.16 fps Inflow=1.26 cfs 0.039 af
n=0.030 L=670.0' S=0.0791 '/' Capacity=11.65 cfs Outflow=1.01 cfs 0.039 af

Reach DD2: Avg. Flow Depth=0.55' Max Vel=4.38 fps Inflow=7.02 cfs 0.268 af
n=0.035 L=1,200.0' S=0.0458 '/' Capacity=36.93 cfs Outflow=4.42 cfs 0.268 af

Reach DD3: Avg. Flow Depth=0.52' Max Vel=1.30 fps Inflow=0.70 cfs 0.033 af
n=0.030 L=560.0' S=0.0054 '/' Capacity=3.03 cfs Outflow=0.52 cfs 0.033 af

Reach DD4: Avg. Flow Depth=0.35' Max Vel=3.35 fps Inflow=0.65 cfs 0.053 af
n=0.030 L=1,080.0' S=0.0602 '/' Capacity=18.42 cfs Outflow=0.61 cfs 0.053 af

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Reach DD5: Avg. Flow Depth=0.34' Max Vel=3.74 fps Inflow=0.64 cfs 0.059 af
n=0.040 L=500.0' S=0.1400 '/' Capacity=34.26 cfs Outflow=0.63 cfs 0.059 af

Reach DS1: Avg. Flow Depth=0.09' Max Vel=0.58 fps Inflow=0.08 cfs 0.004 af
n=0.040 L=70.0' S=0.0143 '/' Capacity=6.60 cfs Outflow=0.08 cfs 0.004 af

Pond P3: Peak Elev=5,910.27' Storage=14,410 cf Inflow=4.92 cfs 0.331 af
Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Pond SUMP: Peak Elev=5,934.01' Storage=284 cf Inflow=2.01 cfs 0.069 af
Outflow=4.09 cfs 0.086 af

Total Runoff Area = 27.530 ac Runoff Volume = 0.315 af Average Runoff Depth = 0.14"
99.09% Pervious = 27.280 ac 0.91% Impervious = 0.250 ac

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Summary for Subcatchment DW1:

Runoff = 1.03 cfs @ 2.95 hrs, Volume= 0.031 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	0.710	80	30% Cover w/HSG C
	1.420	87	Dirt roads, HSG C
	2.130	85	Weighted Average
	2.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	440	0.3000	2.88		**Lag/CN Method,**

Summary for Subcatchment DW2:

Runoff = 1.26 cfs @ 2.94 hrs, Volume= 0.039 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	1.920	80	30% Cover w/HSG C
	1.590	87	Dirt roads, HSG C
	3.510	83	Weighted Average
	3.510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	310	0.5000	3.23		**Lag/CN Method,**

Summary for Subcatchment DW3:

Runoff = 0.79 cfs @ 3.04 hrs, Volume= 0.033 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

Area (ac)	CN	Description
1.760	87	Dirt roads, HSG C
1.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	330	0.0100	0.53		**Lag/CN Method,**

Summary for Subcatchment DW1:

Runoff = 1.03 cfs @ 2.95 hrs, Volume= 0.031 af, Depth= 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	0.710	80	30% Cover w/HSG C
	1.420	87	Dirt roads, HSG C
	2.130	85	Weighted Average
	2.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.6	440	0.3000	2.88		**Lag/CN Method,**

Summary for Subcatchment DW2:

Runoff = 1.26 cfs @ 2.94 hrs, Volume= 0.039 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	1.920	80	30% Cover w/HSG C
	1.590	87	Dirt roads, HSG C
	3.510	83	Weighted Average
	3.510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	310	0.5000	3.23		**Lag/CN Method,**

Summary for Subcatchment DW3:

Runoff = 0.79 cfs @ 3.04 hrs, Volume= 0.033 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

Area (ac)	CN	Description
1.760	87	Dirt roads, HSG C
1.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	330	0.0100	0.53		**Lag/CN Method,**

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Summary for Subcatchment DW4:

Runoff = 0.53 cfs @ 2.98 hrs, Volume= 0.020 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
	0.380	87	Dirt roads, HSG C
*	2.110	80	30% Cover w/HSG C
	2.490	81	Weighted Average
	2.490		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	290	0.1070	1.38		**Lag/CN Method,**

Summary for Subcatchment DW5:

Runoff = 0.17 cfs @ 2.94 hrs, Volume= 0.006 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
	0.140	87	Dirt roads, HSG C
*	0.450	80	30% Cover w/HSG C
	0.590	82	Weighted Average
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	130	0.3500	2.20		**Lag/CN Method,**

Summary for Subcatchment DW6:

Runoff = 0.26 cfs @ 2.95 hrs, Volume= 0.009 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	0.890	80	30% Cover w/HSG C
	0.190	87	Dirt roads, HSG C
	1.080	81	Weighted Average
	1.080		100.00% Pervious Area

Summary for Subcatchment DW4:

Runoff = 0.53 cfs @ 2.98 hrs, Volume= 0.020 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
	0.380	87	Dirt roads, HSG C
*	2.110	80	30% Cover w/HSG C
	2.490	81	Weighted Average
	2.490		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	290	0.1070	1.38		**Lag/CN Method,**

Summary for Subcatchment DW5:

Runoff = 0.17 cfs @ 2.94 hrs, Volume= 0.006 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
	0.140	87	Dirt roads, HSG C
*	0.450	80	30% Cover w/HSG C
	0.590	82	Weighted Average
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	130	0.3500	2.20		**Lag/CN Method,**

Summary for Subcatchment DW6:

Runoff = 0.26 cfs @ 2.95 hrs, Volume= 0.009 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	0.890	80	30% Cover w/HSG C
	0.190	87	Dirt roads, HSG C
	1.080	81	Weighted Average
	1.080		100.00% Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	180	0.3900	2.40		**Lag/CN Method,**

Summary for Subcatchment DW7:

Runoff = 3.65 cfs @ 3.06 hrs, Volume= 0.173 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	8.340	80	30% Cover w/HSG C
	7.140	87	Dirt roads, HSG C
	0.250	98	Water Surface, HSG D
	15.730	83	Weighted Average
	15.480		98.41% Pervious Area
	0.250		1.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	750	0.0530	1.26		**Lag/CN Method,**

Summary for Subcatchment DW8:

Runoff = 0.11 cfs @ 3.04 hrs, Volume= 0.004 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

Area (ac)	CN	Description
0.240	87	Dirt roads, HSG C
0.240		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	500	0.0200	0.82		**Lag/CN Method,**

Summary for Reach DB1:

Inflow Area = 1.760 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-yr, 6-hr event
Inflow = 0.79 cfs @ 3.04 hrs, Volume= 0.033 af
Outflow = 0.70 cfs @ 3.09 hrs, Volume= 0.033 af, Atten= 12%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.91 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 9.1 min

Page added 12/08/2016

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	180	0.3900	2.40		**Lag/CN Method,**

Summary for Subcatchment DW7:

Runoff = 3.65 cfs @ 3.06 hrs, Volume= 0.173 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

	Area (ac)	CN	Description
*	8.340	80	30% Cover w/HSG C
	7.140	87	Dirt roads, HSG C
	0.250	98	Water Surface, HSG D
	15.730	83	Weighted Average
	15.480		98.41% Pervious Area
	0.250		1.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	750	0.0530	1.26		**Lag/CN Method,**

Summary for Subcatchment DW8:

Runoff = 0.11 cfs @ 3.04 hrs, Volume= 0.004 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.00"

Area (ac)	CN	Description
0.240	87	Dirt roads, HSG C
0.240		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	500	0.0200	0.82		**Lag/CN Method,**

Summary for Reach DB1:

Inflow Area = 1.760 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-yr, 6-hr event
Inflow = 0.79 cfs @ 3.04 hrs, Volume= 0.033 af
Outflow = 0.70 cfs @ 3.09 hrs, Volume= 0.033 af, Atten= 12%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.91 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 9.1 min

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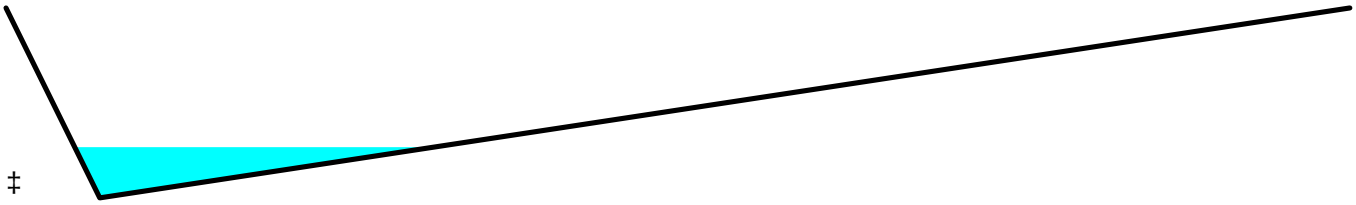
Peak Storage= 153 cf @ 3.09 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.48 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 200.0' Slope= 0.0050 '/'
Inlet Invert= 5,954.00', Outlet Invert= 5,953.00'



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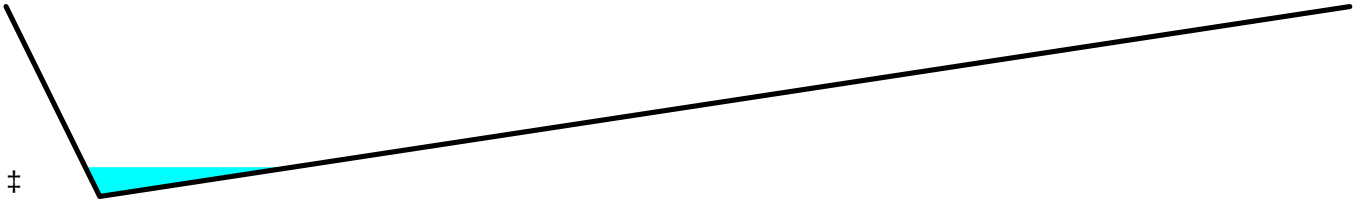
Summary for Reach DB2:

Inflow Area = 1.080 ac, 0.00% Impervious, Inflow Depth = 0.10" for 10-yr, 6-hr event
Inflow = 0.26 cfs @ 2.95 hrs, Volume= 0.009 af
Outflow = 0.16 cfs @ 3.00 hrs, Volume= 0.009 af, Atten= 39%, Lag= 3.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.63 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 11.5 min

Peak Storage= 51 cf @ 3.01 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.48 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 200.0' Slope= 0.0050 '/'
Inlet Invert= 5,954.00', Outlet Invert= 5,953.00'



‡

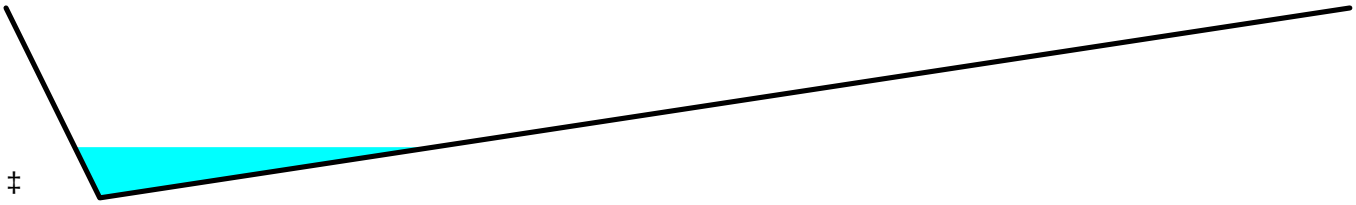
Summary for Reach DB3:

Inflow Area = 0.240 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-yr, 6-hr event
Inflow = 0.11 cfs @ 3.04 hrs, Volume= 0.004 af
Outflow = 0.08 cfs @ 3.12 hrs, Volume= 0.004 af, Atten= 27%, Lag= 4.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.18 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 15.2 min

Peak Storage= 153 cf @ 3.09 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.48 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 200.0' Slope= 0.0050 '/'
Inlet Invert= 5,954.00', Outlet Invert= 5,953.00'



‡

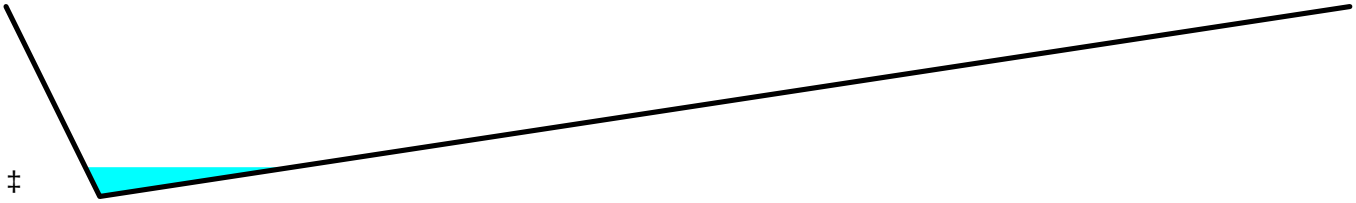
Summary for Reach DB2:

Inflow Area = 1.080 ac, 0.00% Impervious, Inflow Depth = 0.10" for 10-yr, 6-hr event
Inflow = 0.26 cfs @ 2.95 hrs, Volume= 0.009 af
Outflow = 0.16 cfs @ 3.00 hrs, Volume= 0.009 af, Atten= 39%, Lag= 3.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.63 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.29 fps, Avg. Travel Time= 11.5 min

Peak Storage= 51 cf @ 3.01 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.48 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 200.0' Slope= 0.0050 '/'
Inlet Invert= 5,954.00', Outlet Invert= 5,953.00'



‡

Summary for Reach DB3:

Inflow Area = 0.240 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-yr, 6-hr event
Inflow = 0.11 cfs @ 3.04 hrs, Volume= 0.004 af
Outflow = 0.08 cfs @ 3.12 hrs, Volume= 0.004 af, Atten= 27%, Lag= 4.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.18 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 0.55 fps, Avg. Travel Time= 15.2 min

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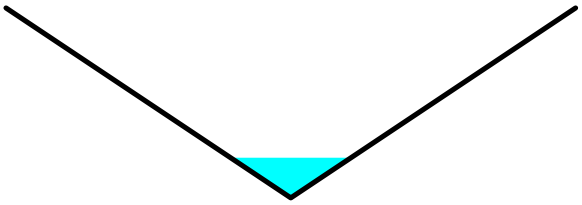
Peak Storage= 33 cf @ 3.12 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 5.02 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 5,925.00', Outlet Invert= 5,915.00'



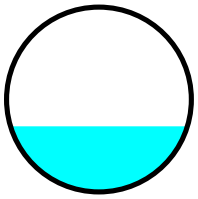
Summary for Reach DC1:

Inflow Area = 22.450 ac, 1.11% Impervious, Inflow Depth = 0.14" for 10-yr, 6-hr event
Inflow = 4.42 cfs @ 3.06 hrs, Volume= 0.268 af
Outflow = 4.41 cfs @ 3.07 hrs, Volume= 0.268 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.83 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.81 fps, Avg. Travel Time= 2.4 min

Peak Storage= 223 cf @ 3.07 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 16.61 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 400.0' Slope= 0.0250 '/'
Inlet Invert= 5,925.00', Outlet Invert= 5,915.00'



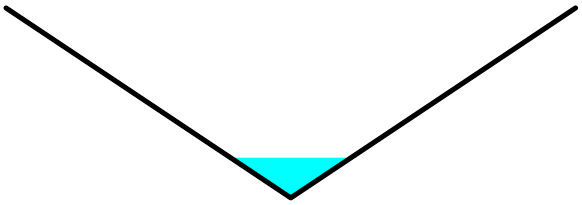
Summary for Reach DD1:

Inflow Area = 3.510 ac, 0.00% Impervious, Inflow Depth = 0.13" for 10-yr, 6-hr event
Inflow = 1.26 cfs @ 2.94 hrs, Volume= 0.039 af
Outflow = 1.01 cfs @ 2.98 hrs, Volume= 0.039 af, Atten= 20%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.16 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 5.9 min

Peak Storage= 33 cf @ 3.12 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 5.02 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 500.0' Slope= 0.0200 '/'
Inlet Invert= 5,925.00', Outlet Invert= 5,915.00'



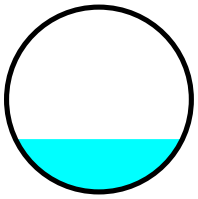
Summary for Reach DC1:

Inflow Area = 22.450 ac, 1.11% Impervious, Inflow Depth = 0.10" for 10-yr, 6-hr event
Inflow = 2.99 cfs @ 3.12 hrs, Volume= 0.182 af
Outflow = 2.93 cfs @ 3.13 hrs, Volume= 0.182 af, Atten= 2%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.06 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.58 fps, Avg. Travel Time= 2.6 min

Peak Storage= 166 cf @ 3.13 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 16.61 cfs

18.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 400.0' Slope= 0.0250 '/'
Inlet Invert= 5,925.00', Outlet Invert= 5,915.00'



Summary for Reach DD1:

Inflow Area = 3.510 ac, 0.00% Impervious, Inflow Depth = 0.13" for 10-yr, 6-hr event
Inflow = 1.26 cfs @ 2.94 hrs, Volume= 0.039 af
Outflow = 1.01 cfs @ 2.98 hrs, Volume= 0.039 af, Atten= 20%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.16 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.89 fps, Avg. Travel Time= 5.9 min

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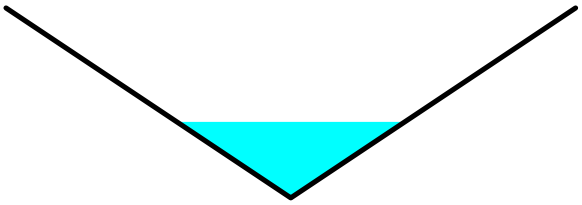
Peak Storage= 161 cf @ 2.98 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 11.65 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 670.0' Slope= 0.0791 '/'
Inlet Invert= 5,985.00', Outlet Invert= 5,932.00'



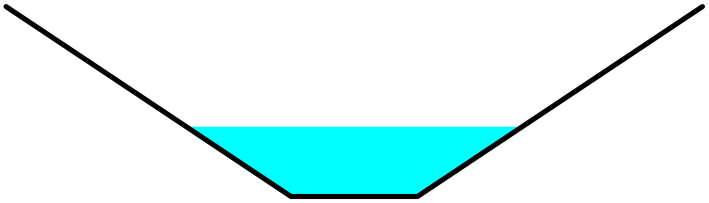
Summary for Reach DD2:

Inflow Area = 22.450 ac, 1.11% Impervious, Inflow Depth = 0.14" for 10-yr, 6-hr event
Inflow = 7.02 cfs @ 3.00 hrs, Volume= 0.268 af
Outflow = 4.42 cfs @ 3.06 hrs, Volume= 0.268 af, Atten= 37%, Lag= 3.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.38 fps, Min. Travel Time= 4.6 min
Avg. Velocity = 1.56 fps, Avg. Travel Time= 12.9 min

Peak Storage= 1,206 cf @ 3.06 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.50' Flow Area= 4.9 sf, Capacity= 36.93 cfs

1.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 5.50'
Length= 1,200.0' Slope= 0.0458 '/'
Inlet Invert= 5,980.00', Outlet Invert= 5,925.00'



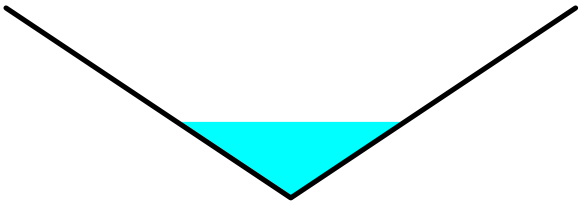
Summary for Reach DD3:

Inflow Area = 1.760 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-yr, 6-hr event
Inflow = 0.70 cfs @ 3.09 hrs, Volume= 0.033 af
Outflow = 0.52 cfs @ 3.18 hrs, Volume= 0.033 af, Atten= 25%, Lag= 5.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.30 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 20.6 min

Peak Storage= 161 cf @ 2.98 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 11.65 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 670.0' Slope= 0.0791 '/'
Inlet Invert= 5,985.00', Outlet Invert= 5,932.00'



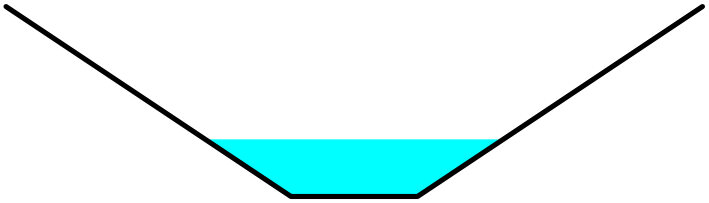
Summary for Reach DD2:

Inflow Area = 22.450 ac, 1.11% Impervious, Inflow Depth = 0.10" for 10-yr, 6-hr event
Inflow = 3.77 cfs @ 3.05 hrs, Volume= 0.182 af
Outflow = 2.99 cfs @ 3.12 hrs, Volume= 0.182 af, Atten= 21%, Lag= 3.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.94 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 14.0 min

Peak Storage= 907 cf @ 3.12 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 1.50' Flow Area= 4.9 sf, Capacity= 36.93 cfs

1.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 5.50'
Length= 1,200.0' Slope= 0.0458 '/'
Inlet Invert= 5,980.00', Outlet Invert= 5,925.00'



Summary for Reach DD3:

Inflow Area = 1.760 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-yr, 6-hr event
Inflow = 0.70 cfs @ 3.09 hrs, Volume= 0.033 af
Outflow = 0.52 cfs @ 3.18 hrs, Volume= 0.033 af, Atten= 25%, Lag= 5.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.30 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 0.45 fps, Avg. Travel Time= 20.6 min

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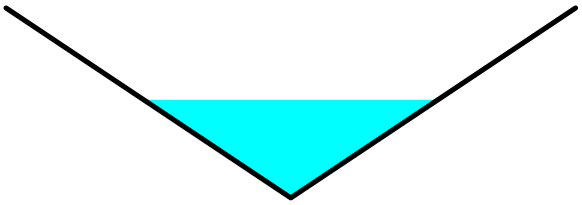
Peak Storage= 224 cf @ 3.18 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 3.03 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 560.0' Slope= 0.0054 '/'
Inlet Invert= 6,053.00', Outlet Invert= 6,050.00'



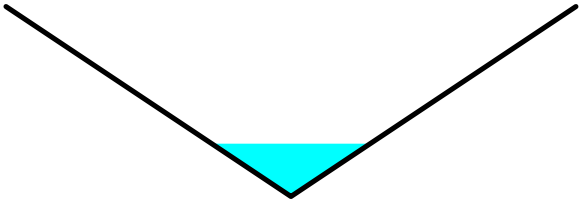
Summary for Reach DD4:

Inflow Area = 4.250 ac, 0.00% Impervious, Inflow Depth = 0.15" for 10-yr, 6-hr event
Inflow = 0.65 cfs @ 3.17 hrs, Volume= 0.053 af
Outflow = 0.61 cfs @ 3.24 hrs, Volume= 0.053 af, Atten= 7%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.35 fps, Min. Travel Time= 5.4 min
Avg. Velocity = 1.39 fps, Avg. Travel Time= 13.0 min

Peak Storage= 196 cf @ 3.24 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.25' Flow Area= 2.3 sf, Capacity= 18.42 cfs

0.00' x 1.25' deep channel, n= 0.030
Side Slope Z-value= 1.5 '/' Top Width= 3.75'
Length= 1,080.0' Slope= 0.0602 '/'
Inlet Invert= 6,050.00', Outlet Invert= 5,985.00'



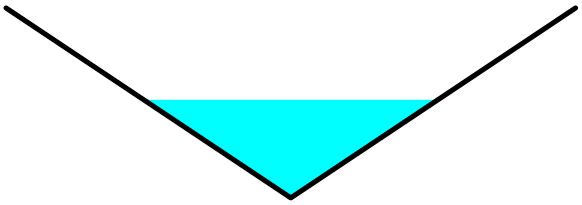
Summary for Reach DD5:

Inflow Area = 4.840 ac, 0.00% Impervious, Inflow Depth = 0.15" for 10-yr, 6-hr event
Inflow = 0.64 cfs @ 3.23 hrs, Volume= 0.059 af
Outflow = 0.63 cfs @ 3.26 hrs, Volume= 0.059 af, Atten= 1%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.74 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.60 fps, Avg. Travel Time= 5.2 min

Peak Storage= 224 cf @ 3.18 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 3.03 cfs

0.00' x 1.00' deep channel, n= 0.030
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 560.0' Slope= 0.0054 '/'
Inlet Invert= 6,053.00', Outlet Invert= 6,050.00'



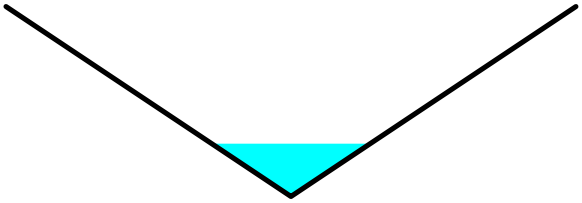
Summary for Reach DD4:

Inflow Area = 4.250 ac, 0.00% Impervious, Inflow Depth = 0.15" for 10-yr, 6-hr event
Inflow = 0.65 cfs @ 3.17 hrs, Volume= 0.053 af
Outflow = 0.61 cfs @ 3.24 hrs, Volume= 0.053 af, Atten= 7%, Lag= 3.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.35 fps, Min. Travel Time= 5.4 min
Avg. Velocity = 1.39 fps, Avg. Travel Time= 13.0 min

Peak Storage= 196 cf @ 3.24 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.25' Flow Area= 2.3 sf, Capacity= 18.42 cfs

0.00' x 1.25' deep channel, n= 0.030
Side Slope Z-value= 1.5 '/' Top Width= 3.75'
Length= 1,080.0' Slope= 0.0602 '/'
Inlet Invert= 6,050.00', Outlet Invert= 5,985.00'



Summary for Reach DD5:

Inflow Area = 4.840 ac, 0.00% Impervious, Inflow Depth = 0.15" for 10-yr, 6-hr event
Inflow = 0.64 cfs @ 3.23 hrs, Volume= 0.059 af
Outflow = 0.63 cfs @ 3.26 hrs, Volume= 0.059 af, Atten= 1%, Lag= 1.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.74 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.60 fps, Avg. Travel Time= 5.2 min

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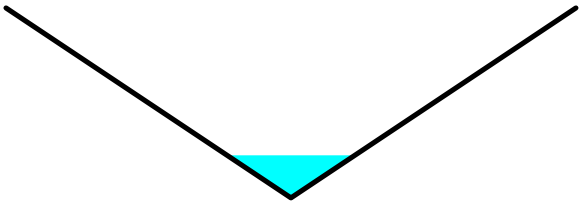
Peak Storage= 85 cf @ 3.26 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.50' Flow Area= 3.4 sf, Capacity= 34.26 cfs

0.00' x 1.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.5 '/' Top Width= 4.50'
Length= 500.0' Slope= 0.1400 '/'
Inlet Invert= 5,985.00', Outlet Invert= 5,915.00'



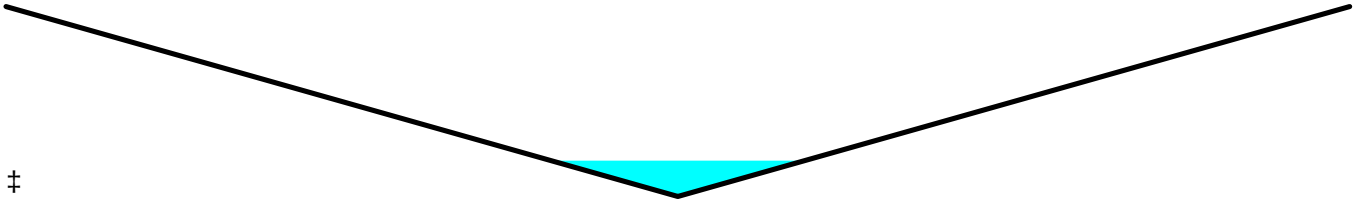
Summary for Reach DS1:

Inflow Area =	0.240 ac,	0.00% Impervious,	Inflow Depth =	0.22"	for 10-yr, 6-hr event
Inflow =	0.08 cfs @	3.12 hrs,	Volume=	0.004 af	
Outflow =	0.08 cfs @	3.15 hrs,	Volume=	0.004 af,	Atten= 3%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.58 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.25 fps, Avg. Travel Time= 4.7 min

Peak Storage= 9 cf @ 3.15 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 0.50' Flow Area= 3.8 sf, Capacity= 6.60 cfs

0.00' x 0.50' deep channel, n= 0.040
Side Slope Z-value= 15.0 '/' Top Width= 15.00'
Length= 70.0' Slope= 0.0143 '/'
Inlet Invert= 5,915.00', Outlet Invert= 5,914.00'



‡

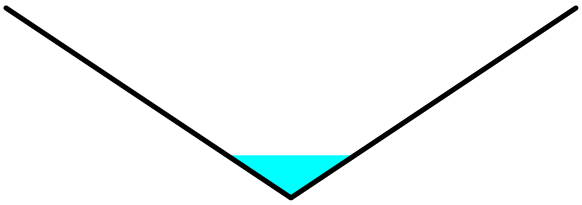
Summary for Pond P3:

Inflow Area =	27.530 ac,	0.91% Impervious,	Inflow Depth =	0.14"	for 10-yr, 6-hr event
Inflow =	4.92 cfs @	3.07 hrs,	Volume=	0.331 af	
Outflow =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Peak Storage= 85 cf @ 3.26 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.50' Flow Area= 3.4 sf, Capacity= 34.26 cfs

0.00' x 1.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 1.5 '/' Top Width= 4.50'
Length= 500.0' Slope= 0.1400 '/'
Inlet Invert= 5,985.00', Outlet Invert= 5,915.00'



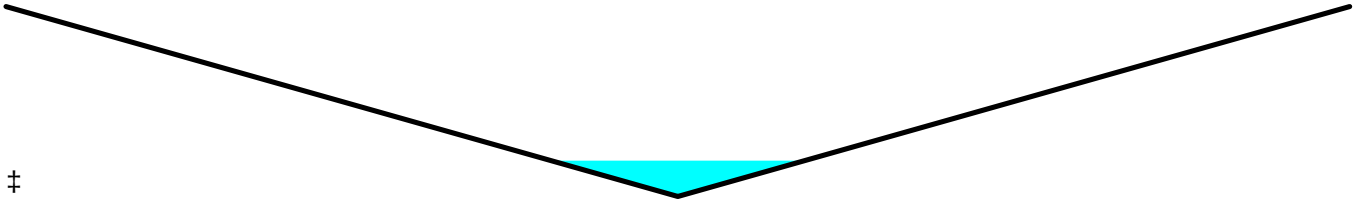
Summary for Reach DS1:

Inflow Area =	0.240 ac,	0.00% Impervious,	Inflow Depth =	0.22"	for 10-yr, 6-hr event
Inflow =	0.08 cfs @	3.12 hrs,	Volume=	0.004 af	
Outflow =	0.08 cfs @	3.15 hrs,	Volume=	0.004 af,	Atten= 3%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.58 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.25 fps, Avg. Travel Time= 4.7 min

Peak Storage= 9 cf @ 3.15 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 0.50' Flow Area= 3.8 sf, Capacity= 6.60 cfs

0.00' x 0.50' deep channel, n= 0.040
Side Slope Z-value= 15.0 '/' Top Width= 15.00'
Length= 70.0' Slope= 0.0143 '/'
Inlet Invert= 5,915.00', Outlet Invert= 5,914.00'



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Summary for Pond P3:

Inflow Area =	27.530 ac,	0.91% Impervious,	Inflow Depth =	0.11"	for 10-yr, 6-hr event
Inflow =	3.53 cfs @	3.14 hrs,	Volume=	0.245 af	
Outflow =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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Peak Elev= 5,910.27' @ 24.00 hrs Surf.Area= 7,566 sf Storage= 14,410 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,899.90'	72,210 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,899.90	0	0.0	0	0
5,900.00	1,083	0.0	0	0
5,902.00	1,808	0.0	0	0
5,904.00	2,715	0.0	0	0
5,906.00	3,822	0.0	0	0
5,908.00	5,275	0.0	0	0
5,908.16	5,424	100.0	856	856
5,910.00	7,167	100.0	11,584	12,440
5,912.00	10,148	100.0	17,315	29,755
5,913.00	11,221	100.0	10,685	40,439
5,914.00	12,294	100.0	11,758	52,197
5,914.27	12,656	100.0	3,368	55,565
5,915.00	13,633	100.0	9,595	65,160
5,915.50	14,567	100.0	7,050	72,210

Device	Routing	Invert	Outlet Devices
#1	Primary	5,913.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	5,914.27'	**42.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,899.90' (Free Discharge)
└**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,899.90' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond SUMP:

Inflow Area =	5.640 ac,	0.00% Impervious,	Inflow Depth =	0.15"	for 10-yr, 6-hr event
Inflow =	2.01 cfs @	2.96 hrs,	Volume=	0.069 af	
Outflow =	4.09 cfs @	2.99 hrs,	Volume=	0.086 af,	Atten= 0%, Lag= 1.9 min
Primary =	4.09 cfs @	2.99 hrs,	Volume=	0.086 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,934.01' @ 2.94 hrs Surf.Area= 265 sf Storage= 284 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 7.6 min (233.5 - 225.9)

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Peak Elev= 5,905.22' @ 24.00 hrs Surf.Area= 6,715 sf Storage= 10,682 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,898.50'	69,143 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,898.50	0	0.0	0	0
5,899.00	597	0.0	0	0
5,900.00	2,820	0.0	0	0
5,901.00	4,692	0.0	0	0
5,902.00	5,143	0.0	0	0
5,903.00	5,611	0.0	0	0
5,903.52	5,864	0.0	0	0
5,904.00	6,097	100.0	2,871	2,871
5,905.00	6,601	100.0	6,349	9,220
5,906.00	7,122	100.0	6,862	16,081
5,907.00	7,659	100.0	7,391	23,472
5,908.00	8,213	100.0	7,936	31,408
5,909.00	8,783	100.0	8,498	39,906
5,909.55	9,107	100.0	4,920	44,825
5,910.00	9,372	100.0	4,158	48,983
5,911.00	9,940	100.0	9,656	58,639
5,912.00	11,068	100.0	10,504	69,143

Device	Routing	Invert	Outlet Devices
#1	Primary	5,909.55'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	5,910.00'	**12.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,910.00' / 5,900.00' S= 0.1111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,898.50' (Free Discharge)
└**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,898.50' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Summary for Pond SUMP:

Inflow Area =	5.640 ac,	0.00% Impervious,	Inflow Depth =	0.15"	for 10-yr, 6-hr event
Inflow =	2.01 cfs @	2.96 hrs,	Volume=	0.069 af	
Outflow =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af,	Atten= 100%, Lag= 0.0 min
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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Volume	Invert	Avail.Storage	Storage Description
#1	5,932.50'	597 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,932.50	0	0	0
5,933.00	200	50	50
5,934.00	264	232	282
5,935.00	366	315	597

Device	Routing	Invert	Outlet Devices
#1	Primary	5,934.00'	**Pump** Discharges@5,980.00' Turns Off@5,933.00' 9.7" Diam. x 750.0' Long Discharge, Hazen-Williams C= 155 Flow (gpm)= 500.0 2,750.0 Head (feet)= 100.00 35.00 -Loss (feet)= 1.07 25.20 =Lift (feet)= 98.93 9.80

Primary OutFlow Max=4.03 cfs @ 2.99 hrs HW=5,933.33' TW=5,980.40' (Dynamic Tailwater)
└─**1=Pump** (Pump Controls 4.03 cfs)

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Peak Elev= 5,933.49' @ 16.65 hrs Surf.Area= 2,054 sf Storage= 3,025 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,932.00'	12,660 cf	**50.00'W x 40.00'L x 6.00'H Prismatoid Z=0.2**

Device	Routing	Invert	Outlet Devices
#1	Primary	5,934.00'	**Pump** Discharges@5,980.00' Turns Off@5,933.00' 9.7" Diam. x 750.0' Long Discharge, Hazen-Williams C= 155 Flow (gpm)= 500.0 2,750.0 Head (feet)= 100.00 35.00 -Loss (feet)= 1.07 25.20 =Lift (feet)= 98.93 9.80

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,932.00' TW=5,980.00' (Dynamic Tailwater)
└─**1=Pump** (Controls 0.00 cfs)

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POND 3 MODIFICATION STAGE-CAPACITY DATA

Elevation (ft)	Area (sq ft)	Incremental Volume (CF)	Cummulative Volume (CF)
5899.9	0		
5900.0	1,083	54	54
5902.0	1,808	2,891	2,945
5904.0	2,815	4,623	7,568
5906.0	3,822	6,637	14,205
5908.0	5,275	9,097	23,302
5910.0	7,167	12,442	35,744
5912.0	10,148	17,315	53,059
5913.0	11,221	10,685	63,744
5914.0	12,294	11,758	75,501
5915.0	13,633	12,964	88,465
5915.5	14,567	7,050	95,515

Inflow from 10-yr, 24-hr event =	1.028	AF
	44,780	CF
Primary spillway elevation =	5913.0	ft
Capacity at this elevation =	63,744	CF
Available sediment storage =	18,964	CF

<u>Linear interpolation for top of sediment storage elevation:</u>

Pond capacity at elev. 5906.0 =	14,205	CF
Pond capacity at elev. 5908.0 =	23,302	CF
Elev. at top of sed storage pool =	5907.0	ft
Pond area at elev. 5907.0 ft =	4,549	sq ft
60% sediment storage volume =	11,378	CF
Elev. at 60% cleanout level =	5905.15	ft

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POND 3 MODIFICATION STAGE-CAPACITY DATA

Elevation (ft)	Area (sq ft)	Incremental Volume (CF)	Cummulative Volume (CF)
5898.5	0		
5899.0	597	149	149
5900.0	2,820	1,709	1,858
5901.0	4,692	3,756	5,614
5902.0	5,143	4,918	10,531
5903.0	5,611	5,377	15,908
5904.0	6,097	5,854	21,762
5905.0	6,601	6,349	28,111
5906.0	7,122	6,862	34,973
5907.0	7,659	7,391	42,363
5908.0	8,213	7,936	50,299
5909.0	8,783	8,498	58,797
5910.0	9,372	9,078	67,875
5911.0	9,940	9,656	77,531
5912.0	11,068	10,504	88,035

Inflow from 10-yr, 24-hr event =	1.028	AF
	44,780	CF
Primary spillway elevation =	5909.55	ft
Capacity at this elevation =	63,740	CF
Available sediment storage =	18,960	CF

<u>Linear interpolation for top of sediment storage elevation:</u>

Pond capacity at elev. 5903.0 =	15,908	CF
Pond capacity at elev. 5904.0 =	21,762	CF
Elev. at top of sed storage pool =	5,903.52	ft
Pond area at elev. 5903.52 ft =	5,864	sq ft
60% sediment storage volume =	11,376	CF
Elev. at 60% cleanout level =	5902.17	ft

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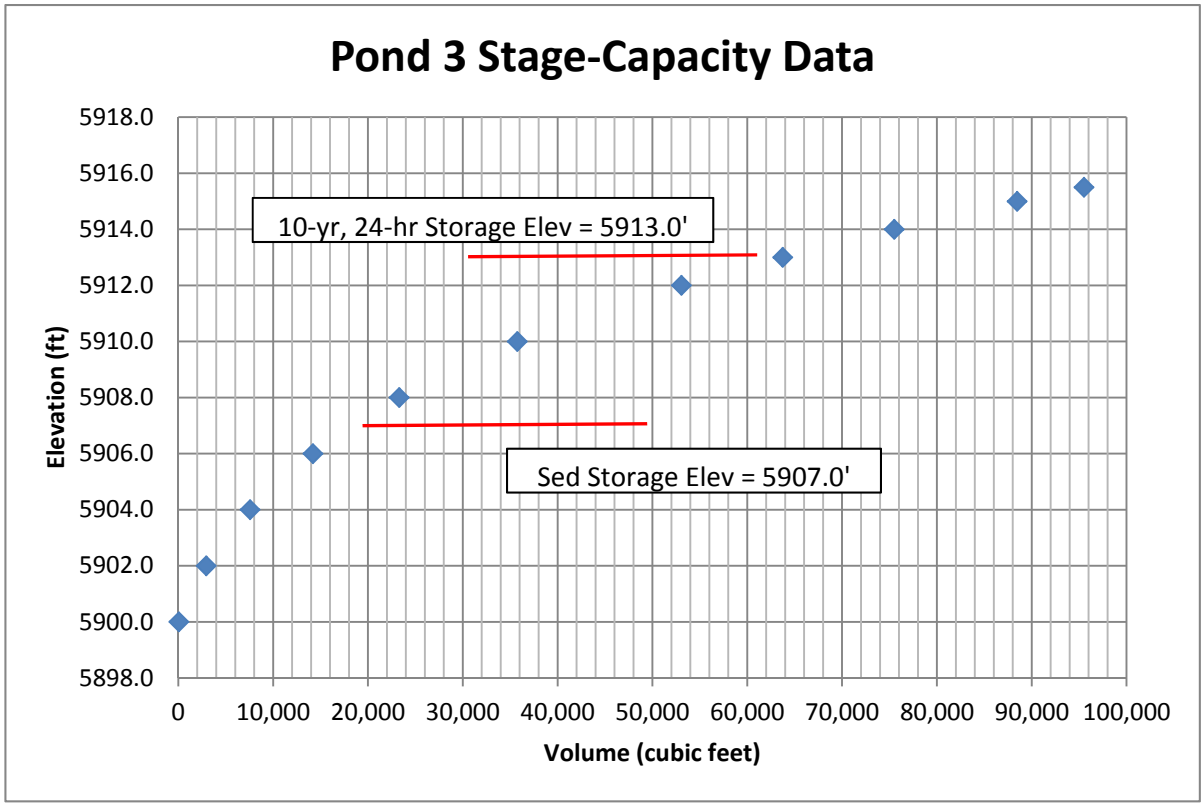

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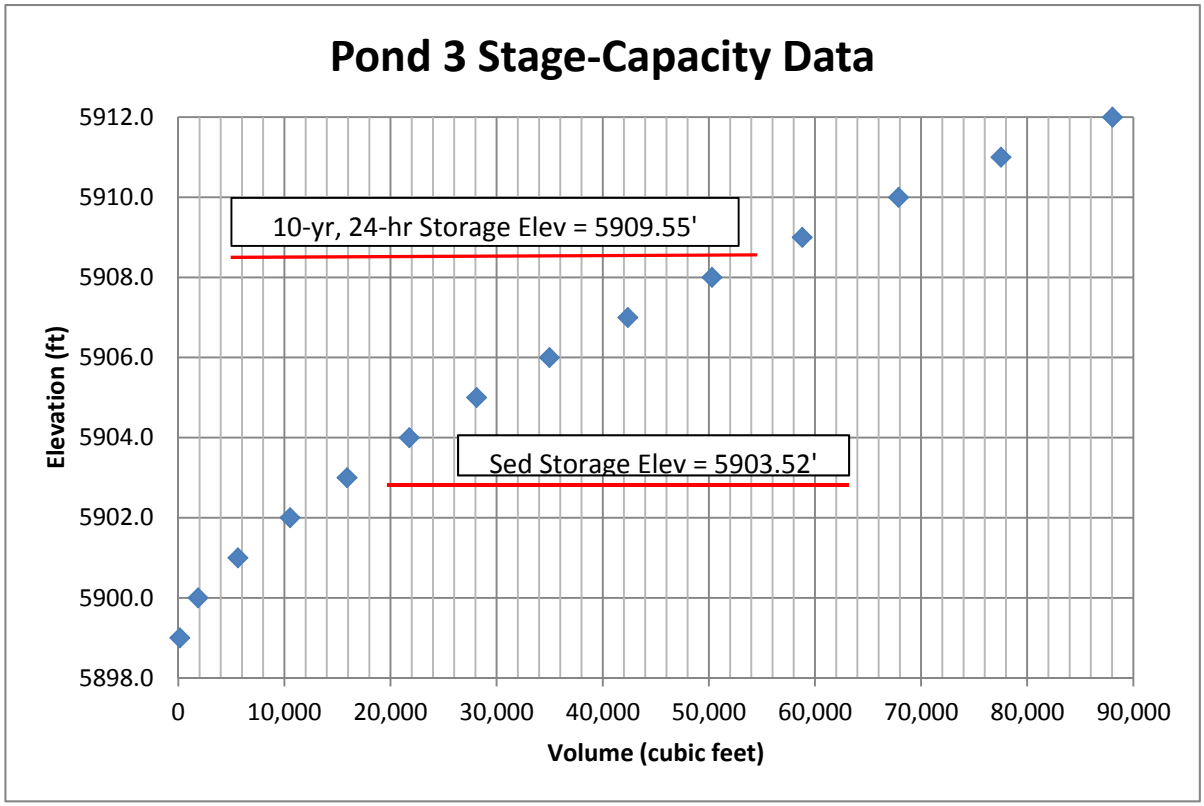

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Summary for Pond P3:

Inflow Area = 27.530 ac, 0.91% Impervious, Inflow Depth > 0.45" for 10-yr, 24-hr event
Inflow = 14.65 cfs @ 12.06 hrs, Volume= 1.028 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,912.95' @ 24.00 hrs Surf.Area= 11,165 sf Storage= 44,767 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,899.90'	77,125 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,899.90	0	0.0	0	0
5,900.00	1,083	0.0	0	0
5,902.00	1,808	0.0	0	0
5,904.00	2,715	0.0	0	0
5,906.00	3,822	0.0	0	0
5,907.00	4,549	0.0	0	0
5,908.00	5,275	100.0	4,912	4,912
5,910.00	7,167	100.0	12,442	17,354
5,912.00	10,148	100.0	17,315	34,669
5,913.00	11,221	100.0	10,685	45,354
5,914.00	12,294	100.0	11,758	57,111
5,914.27	12,656	100.0	3,368	60,479
5,915.00	13,633	100.0	9,595	70,075
5,915.50	14,567	100.0	7,050	77,125

Device	Routing	Invert	Outlet Devices
#1	Primary	5,913.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	5,914.27'	**42.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,899.90' (Free Discharge)
└─**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,899.90' (Free Discharge)
└─**2=Orifice/Grate** (Controls 0.00 cfs)

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Summary for Pond P3:

Inflow Area = 27.530 ac, 0.91% Impervious, Inflow Depth > 0.40" for 10-yr, 24-hr event
Inflow = 10.71 cfs @ 12.08 hrs, Volume= 0.925 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,909.04' @ 24.00 hrs Surf.Area= 8,807 sf Storage= 40,258 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,898.50'	69,143 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,898.50	0	0.0	0	0
5,899.00	597	0.0	0	0
5,900.00	2,820	0.0	0	0
5,901.00	4,692	0.0	0	0
5,902.00	5,143	0.0	0	0
5,903.00	5,611	0.0	0	0
5,903.52	5,864	0.0	0	0
5,904.00	6,097	100.0	2,871	2,871
5,905.00	6,601	100.0	6,349	9,220
5,906.00	7,122	100.0	6,862	16,081
5,907.00	7,659	100.0	7,391	23,472
5,908.00	8,213	100.0	7,936	31,408
5,909.00	8,783	100.0	8,498	39,906
5,909.55	9,107	100.0	4,920	44,825
5,910.00	9,372	100.0	4,158	48,983
5,911.00	9,940	100.0	9,656	58,639
5,912.00	11,068	100.0	10,504	69,143

Device	Routing	Invert	Outlet Devices
#1	Primary	5,909.55'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	5,910.00'	**12.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,910.00' / 5,900.00' S= 0.1111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,898.50' (Free Discharge)
└─**1=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,898.50' (Free Discharge)
└─**2=Culvert** (Controls 0.00 cfs)

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Summary for Pond P3:

Inflow Area = 24.700 ac, 1.01% Impervious, Inflow Depth = 0.25" for 25-yr, 6-hr event
Inflow = 9.06 cfs @ 3.06 hrs, Volume= 0.506 af
Outflow = 2.19 cfs @ 3.59 hrs, Volume= 0.506 af, Atten= 76%, Lag= 31.6 min
Primary = 1.20 cfs @ 3.59 hrs, Volume= 0.405 af
Secondary = 0.99 cfs @ 3.59 hrs, Volume= 0.102 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,914.62' @ 3.59 hrs Surf.Area= 13,120 sf Storage= 7,835 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 56.3 min (291.8 - 235.5)

Volume	Invert	Avail.Storage	Storage Description
#1	5,899.90'	20,014 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,899.90	0	0.0	0	0
5,900.00	1,083	0.0	0	0
5,902.00	1,808	0.0	0	0
5,904.00	2,715	0.0	0	0
5,906.00	3,822	0.0	0	0
5,908.00	5,275	0.0	0	0
5,908.16	5,424	0.0	0	0
5,910.00	7,167	0.0	0	0
5,912.00	10,148	0.0	0	0
5,913.00	11,221	0.0	0	0
5,914.00	12,294	0.0	0	0
5,914.27	12,656	100.0	3,368	3,368
5,915.00	13,633	100.0	9,595	12,964
5,915.50	14,567	100.0	7,050	20,014

Device	Routing	Invert	Outlet Devices
#1	Primary	5,913.00'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	5,914.27'	**42.0" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.20 cfs @ 3.59 hrs HW=5,914.62' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 1.20 cfs @ 6.12 fps)

Secondary OutFlow Max=0.99 cfs @ 3.59 hrs HW=5,914.62' (Free Discharge)
└─**2=Orifice/Grate** (Orifice Controls 0.99 cfs @ 2.00 fps)

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Summary for Pond P3:

Inflow Area = 27.530 ac, 0.91% Impervious, Inflow Depth = 0.21" for 25-yr, 6-hr event
Inflow = 7.56 cfs @ 3.11 hrs, Volume= 0.476 af
Outflow = 1.69 cfs @ 4.75 hrs, Volume= 0.475 af, Atten= 78%, Lag= 98.5 min
Primary = 0.93 cfs @ 4.75 hrs, Volume= 0.364 af
Secondary = 0.77 cfs @ 4.75 hrs, Volume= 0.111 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,910.51' @ 4.75 hrs Surf.Area= 9,661 sf Storage= 8,997 cf

Plug-Flow detention time= 100.1 min calculated for 0.475 af (100% of inflow)
Center-of-Mass det. time= 99.7 min (339.4 - 239.8)

Volume	Invert	Avail.Storage	Storage Description
#1	5,898.50'	24,318 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,898.50	0	0.0	0	0
5,899.00	597	0.0	0	0
5,900.00	2,820	0.0	0	0
5,901.00	4,692	0.0	0	0
5,902.00	5,143	0.0	0	0
5,903.00	5,611	0.0	0	0
5,903.52	5,864	0.0	0	0
5,904.00	6,097	0.0	0	0
5,905.00	6,601	0.0	0	0
5,906.00	7,122	0.0	0	0
5,907.00	7,659	0.0	0	0
5,908.00	8,213	0.0	0	0
5,909.00	8,783	0.0	0	0
5,909.55	9,107	0.0	0	0
5,910.00	9,372	100.0	4,158	4,158
5,911.00	9,940	100.0	9,656	13,814
5,912.00	11,068	100.0	10,504	24,318

Device	Routing	Invert	Outlet Devices
#1	Primary	5,909.55'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	5,910.00'	**12.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,910.00' / 5,900.00' S= 0.1111 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.93 cfs @ 4.75 hrs HW=5,910.51' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.93 cfs @ 4.71 fps)

Secondary OutFlow Max=0.77 cfs @ 4.75 hrs HW=5,910.51' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.77 cfs @ 1.92 fps)

Page added 12/08/2016

Sedimentation Pond 3 Outfall

Label	Diameter (in)	Discharge (cfs)	Depth (ft)	Slope (ft/ft)	Velocity (ft/s)	Mannings Coefficient
SP3-SS Max Depth	12	0.52	0.26	0.01	3.24	0.013
SP3-SS Max Velocity	12	0.52	0.10	0.50	12.82	0.013

Page Added 12/08/2016

RIPRAP APRON DESIGN

Method: Thompson, P.L. and R.T Kilgore. 2006. Hydraulic Design of Energy Dissipators for Culverts and Channels. Hydraulic Engineering Circular No. 14, Third Edition. Federal Highway Administration. Arlington, VA.

Equation:

$$D_{50} = 0.2D\left[\frac{Q}{SQRT(g)*D^{2.5}}\right]^{4/3}\left[\frac{Q}{TW}\right]$$

Where
D_{50} = median riprap diameter (ft)
D = culvert diameter (ft)
Q = design discharge (cfs)
g = acceleration due to gravity (ft/s^2)
TW = tailwater depth (ft)

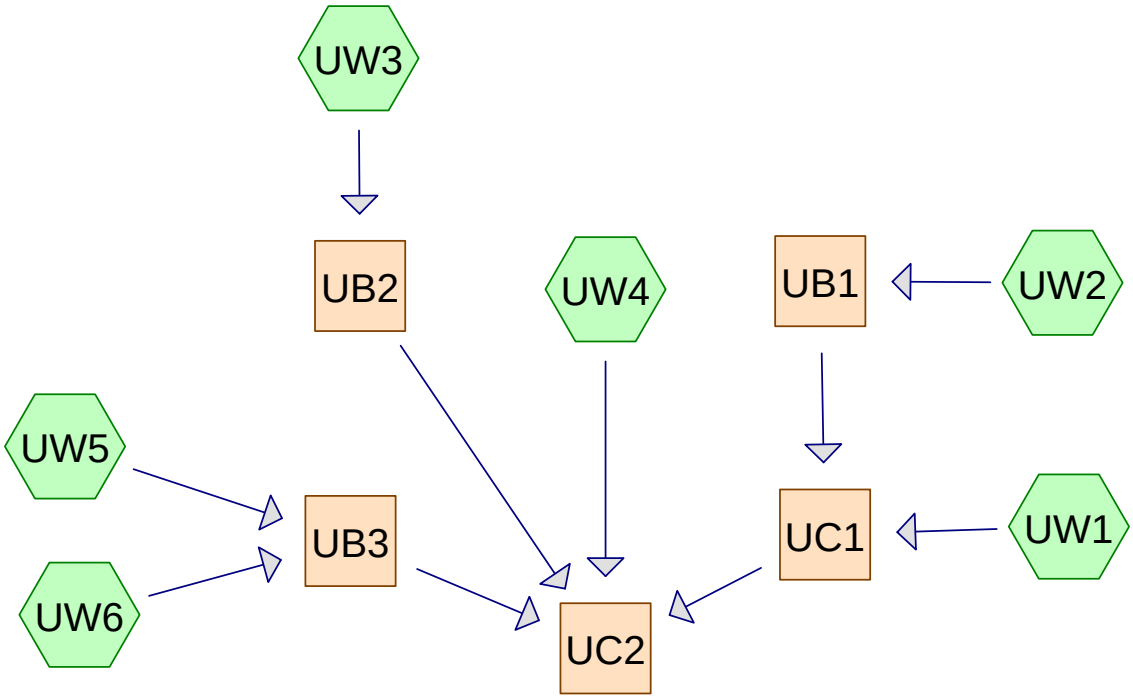
Client: Bronco Utah Operations, LLC
Site: Emery2 surface facility - Outlet of Secondary Spillway
Proj. No.: UC-1665-07
Designer: TA Jimenez

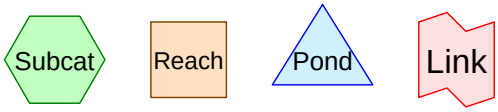
Calculations:

D =	1	ft
Q =	0.52	cfs
g =	32.2	ft/s^2
TW =	0.1	ft

D_{50} =	**0.08**	**ft**
=	**1.0**	**in**

Use a median diameter of 3 inches for added protection.





Routing Diagram for Operations - Undisturbed Drainage
Prepared by EarthFax Engineering Group, LLC, Printed 10/12/2016
HydroCAD® 10.00 s/n 03900 © 2011 HydroCAD Software Solutions LLC

Time span=0.00-6.00 hrs, dt=0.05 hrs, 121 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment UW1: Runoff Area=116.380 ac 0.00% Impervious Runoff Depth>0.34"
Flow Length=3,590' Slope=0.0540 '/' Tc=38.0 min CN=80 Runoff=36.05 cfs 3.297 af

Subcatchment UW2: Runoff Area=9.420 ac 0.00% Impervious Runoff Depth>0.36"
Flow Length=1,180' Slope=0.1350 '/' Tc=9.9 min CN=80 Runoff=6.96 cfs 0.281 af

Subcatchment UW3: Runoff Area=13.180 ac 0.00% Impervious Runoff Depth>0.35"
Flow Length=1,900' Slope=0.0470 '/' Tc=24.5 min CN=80 Runoff=5.59 cfs 0.383 af

Subcatchment UW4: Runoff Area=35.060 ac 0.00% Impervious Runoff Depth>0.35"
Flow Length=2,460' Slope=0.0760 '/' Tc=23.7 min CN=80 Runoff=15.27 cfs 1.020 af

Subcatchment UW5: Runoff Area=0.480 ac 0.00% Impervious Runoff Depth>0.36"
Flow Length=390' Slope=0.0330 '/' Tc=8.2 min CN=80 Runoff=0.38 cfs 0.014 af

Subcatchment UW6: Runoff Area=7.660 ac 0.00% Impervious Runoff Depth>0.36"
Flow Length=1,200' Slope=0.1650 '/' Tc=9.1 min CN=80 Runoff=5.83 cfs 0.228 af

Reach UB1: Avg. Flow Depth=0.97' Max Vel=3.68 fps Inflow=6.96 cfs 0.281 af
n=0.040 L=800.0' S=0.0313 '/' Capacity=125.80 cfs Outflow=5.97 cfs 0.275 af

Reach UB2: Avg. Flow Depth=0.95' Max Vel=4.02 fps Inflow=5.59 cfs 0.383 af
n=0.035 L=800.0' S=0.0313 '/' Capacity=38.67 cfs Outflow=5.39 cfs 0.376 af

Reach UB3: Avg. Flow Depth=0.77' Max Vel=5.66 fps Inflow=6.21 cfs 0.243 af
n=0.030 L=160.0' S=0.0813 '/' Capacity=15.68 cfs Outflow=6.09 cfs 0.242 af

Reach UC1: Avg. Flow Depth=1.50' Max Vel=12.27 fps Inflow=37.92 cfs 3.572 af
30.0" Round Pipe n=0.013 L=800.0' S=0.0187 '/' Capacity=56.17 cfs Outflow=37.73 cfs 3.551 af

Reach UC2: Avg. Flow Depth=1.89' Max Vel=13.68 fps Inflow=54.34 cfs 5.189 af
30.0" Round Pipe n=0.013 L=240.0' S=0.0208 '/' Capacity=59.20 cfs Outflow=54.28 cfs 5.181 af

Total Runoff Area = 182.180 ac Runoff Volume = 5.223 af Average Runoff Depth = 0.34"
100.00% Pervious = 182.180 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment UW1:

Runoff = 36.05 cfs @ 3.42 hrs, Volume= 3.297 af, Depth> 0.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	116.380	80	30% Cover w/HSG C
	116.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
38.0	3,590	0.0540	1.57		**Lag/CN Method,**

Summary for Subcatchment UW2:

Runoff = 6.96 cfs @ 3.04 hrs, Volume= 0.281 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	9.420	80	30% Cover w/HSG C
	9.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.9	1,180	0.1350	1.99		**Lag/CN Method,**

Summary for Subcatchment UW3:

Runoff = 5.59 cfs @ 3.23 hrs, Volume= 0.383 af, Depth> 0.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	13.180	80	30% Cover w/HSG C
	13.180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	1,900	0.0470	1.29		**Lag/CN Method,**

Summary for Subcatchment UW4:

Runoff = 15.27 cfs @ 3.22 hrs, Volume= 1.020 af, Depth> 0.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	35.060	80	30% Cover w/HSG C
	35.060		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.7	2,460	0.0760	1.73		**Lag/CN Method,**

Summary for Subcatchment UW5:

Runoff = 0.38 cfs @ 3.02 hrs, Volume= 0.014 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	0.480	80	30% Cover w/HSG C
	0.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	390	0.0330	0.79		**Lag/CN Method,**

Summary for Subcatchment UW6:

Runoff = 5.83 cfs @ 3.03 hrs, Volume= 0.228 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	7.660	80	30% Cover w/HSG C
	7.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	1,200	0.1650	2.21		**Lag/CN Method,**

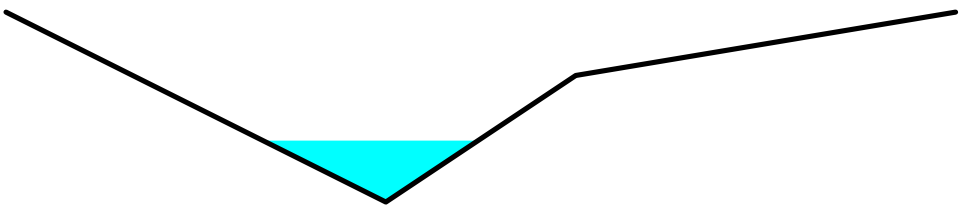
Summary for Reach UB1:

Inflow Area = 9.420 ac, 0.00% Impervious, Inflow Depth > 0.36" for 100-yr, 6-hr event
Inflow = 6.96 cfs @ 3.04 hrs, Volume= 0.281 af
Outflow = 5.97 cfs @ 3.15 hrs, Volume= 0.275 af, Atten= 14%, Lag= 6.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.68 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 6.2 min

Peak Storage= 1,320 cf @ 3.09 hrs
Average Depth at Peak Storage= 0.97'
Bank-Full Depth= 3.00' Flow Area= 18.0 sf, Capacity= 125.80 cfs

Custom cross-section, Length= 800.0' Slope= 0.0313 '/' (101 Elevation Intervals)
Constant n= 0.040
Inlet Invert= 6,075.00', Outlet Invert= 6,050.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	3.00	0.00
6.00	0.00	3.00
9.00	2.00	1.00
15.00	3.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
2.00	7.0	8.1	5,600	41.79
3.00	18.0	16.4	14,400	125.80

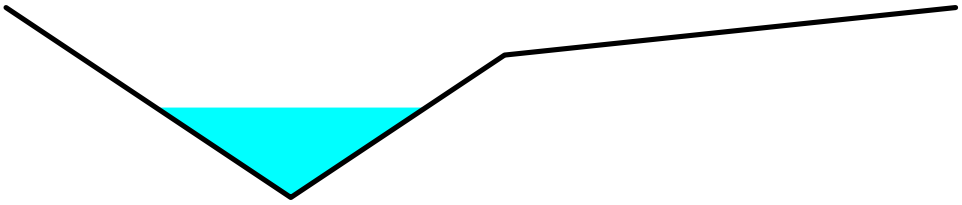
Summary for Reach UB2:

Inflow Area = 13.180 ac, 0.00% Impervious, Inflow Depth > 0.35" for 100-yr, 6-hr event
Inflow = 5.59 cfs @ 3.23 hrs, Volume= 0.383 af
Outflow = 5.39 cfs @ 3.33 hrs, Volume= 0.376 af, Atten= 4%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.02 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 2.66 fps, Avg. Travel Time= 5.0 min

Peak Storage= 1,077 cf @ 3.27 hrs
Average Depth at Peak Storage= 0.95'
Bank-Full Depth= 2.00' Flow Area= 7.0 sf, Capacity= 38.67 cfs

Custom cross-section, Length= 800.0' Slope= 0.0313 '/'
Constant n= 0.035
Inlet Invert= 6,075.00', Outlet Invert= 6,050.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	2.00	0.00
3.00	0.00	2.00
5.25	1.50	0.50
10.00	2.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
1.50	3.4	5.4	2,700	18.50
2.00	7.0	11.1	5,600	38.67

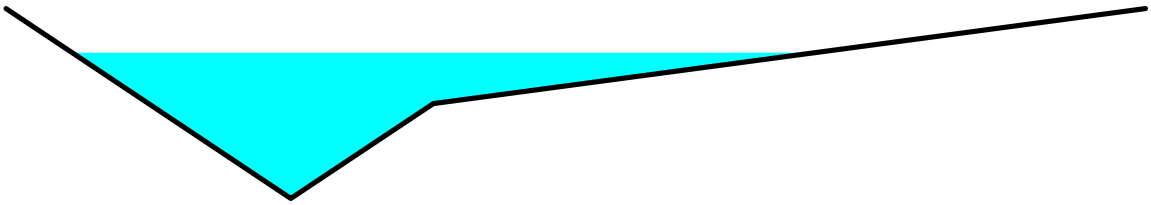
Summary for Reach UB3:

Inflow Area = 8.140 ac, 0.00% Impervious, Inflow Depth > 0.36" for 100-yr, 6-hr event
Inflow = 6.21 cfs @ 3.03 hrs, Volume= 0.243 af
Outflow = 6.09 cfs @ 3.04 hrs, Volume= 0.242 af, Atten= 2%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.66 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.70 fps, Avg. Travel Time= 0.7 min

Peak Storage= 175 cf @ 3.04 hrs
Average Depth at Peak Storage= 0.77'
Bank-Full Depth= 1.00' Flow Area= 2.3 sf, Capacity= 15.68 cfs

Custom cross-section, Length= 160.0' Slope= 0.0813 '/'
Constant n= 0.030
Inlet Invert= 6,053.00', Outlet Invert= 6,040.00'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	1.00	0.00
1.50	0.00	1.00
2.25	0.50	0.50
6.00	1.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0.0	0	0.00
0.50	0.4	1.8	60	1.86
1.00	2.3	6.5	360	15.68

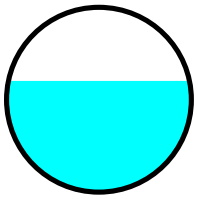
Summary for Reach UC1:

Inflow Area = 125.800 ac, 0.00% Impervious, Inflow Depth > 0.34" for 100-yr, 6-hr event
Inflow = 37.92 cfs @ 3.41 hrs, Volume= 3.572 af
Outflow = 37.73 cfs @ 3.44 hrs, Volume= 3.551 af, Atten= 0%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.27 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 8.62 fps, Avg. Travel Time= 1.5 min

Peak Storage= 2,468 cf @ 3.42 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 56.17 cfs

30.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 800.0' Slope= 0.0187 '/'
Inlet Invert= 5,995.00', Outlet Invert= 5,980.00'



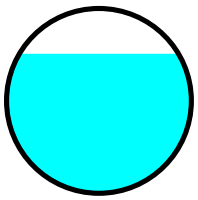
Summary for Reach UC2:

Inflow Area = 182.180 ac, 0.00% Impervious, Inflow Depth > 0.34" for 100-yr, 6-hr event
Inflow = 54.34 cfs @ 3.36 hrs, Volume= 5.189 af
Outflow = 54.28 cfs @ 3.37 hrs, Volume= 5.181 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.68 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 9.87 fps, Avg. Travel Time= 0.4 min

Peak Storage= 953 cf @ 3.36 hrs
Average Depth at Peak Storage= 1.89'
Bank-Full Depth= 2.50' Flow Area= 4.9 sf, Capacity= 59.20 cfs

30.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 240.0' Slope= 0.0208 '/'
Inlet Invert= 5,980.00', Outlet Invert= 5,975.00'



RIPRAP APRON DESIGN

Method: Thompson, P.L. and R.T Kilgore. 2006. Hydraulic Design of Energy Dissipators for Culverts and Channels. Hydraulic Engineering Circular No. 14, Third Edition. Federal Highway Administration. Arlington, VA.

Equation:

$$D_{50} = 0.2D\left[\frac{Q}{SQRT(g)*D^{2.5}}\right]^{4/3}\left[\frac{Q}{TW}\right]$$

Where
D_{50} = median riprap diameter (ft)
D = culvert diameter (ft)
Q = design discharge (cfs)
g = acceleration due to gravity (ft/s^2)
TW = tailwater depth (ft)

Client: Bronco Utah Operations, LLC
Site: Emery2 surface facility - Outlet of culvert UC-2
Proj. No.: UC-1665-07
Designer: RB White

Calculations:

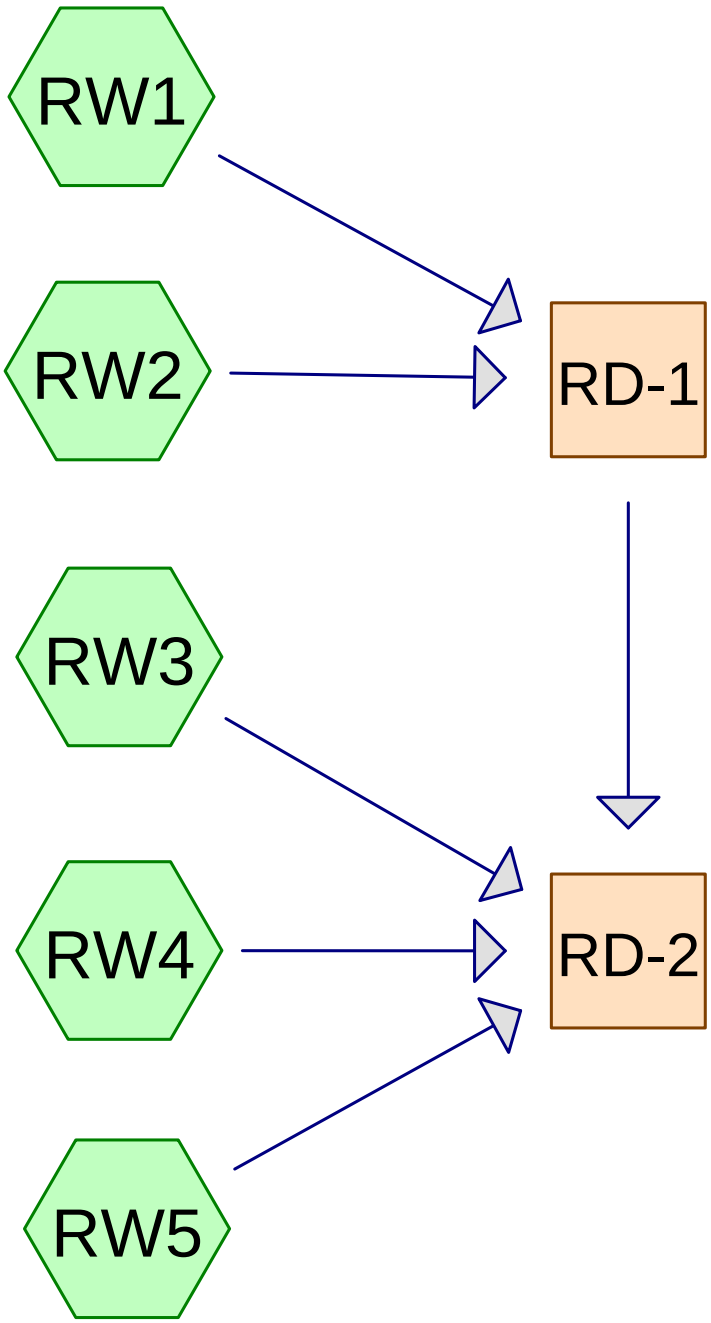
D =	2.5	ft
Q =	54.34	cfs
g =	32.2	ft/s^2
TW =	1.89	ft

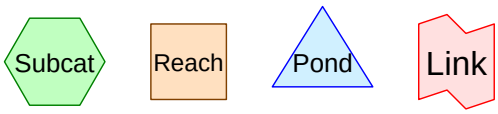
D_{50} =	**0.63**	**ft**
=	**7.6**	**in**

Use a median diameter of 9 inches for added protection.

ATTACHMENT C

Reclamation Hydrology Design Information





Routing Diagram for Reclamation Drainage
Prepared by EarthFax Engineering Group, LLC, Printed 10/12/2016
HydroCAD® 10.00 s/n 03900 © 2011 HydroCAD Software Solutions LLC

Time span=0.00-6.00 hrs, dt=0.05 hrs, 121 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment RW1: Runoff Area=134.000 ac 0.00% Impervious Runoff Depth>0.34"
Flow Length=3,590' Slope=0.0540 '/' Tc=38.0 min CN=80 Runoff=41.51 cfs 3.796 af

Subcatchment RW2: Runoff Area=14.000 ac 0.00% Impervious Runoff Depth>0.36"
Flow Length=440' Slope=0.1600 '/' Tc=4.1 min CN=80 Runoff=13.51 cfs 0.421 af

Subcatchment RW3: Runoff Area=36.000 ac 0.00% Impervious Runoff Depth>0.35"
Flow Length=2,560' Slope=0.0800 '/' Tc=23.8 min CN=80 Runoff=15.62 cfs 1.047 af

Subcatchment RW4: Runoff Area=6.500 ac 0.00% Impervious Runoff Depth>0.36"
Flow Length=460' Slope=0.2500 '/' Tc=3.4 min CN=80 Runoff=6.54 cfs 0.196 af

Subcatchment RW5: Runoff Area=12.000 ac 0.00% Impervious Runoff Depth>0.36"
Flow Length=1,210' Slope=0.1650 '/' Tc=9.1 min CN=80 Runoff=9.14 cfs 0.358 af

Reach RD-1: Avg. Flow Depth=1.10' Max Vel=6.34 fps Inflow=43.24 cfs 4.217 af
n=0.040 L=910.0' S=0.0418 '/' Capacity=139.90 cfs Outflow=42.87 cfs 4.160 af

Reach RD-2: Avg. Flow Depth=1.08' Max Vel=8.07 fps Inflow=53.98 cfs 5.760 af
n=0.040 L=960.0' S=0.0688 '/' Capacity=179.51 cfs Outflow=53.69 cfs 5.697 af

Total Runoff Area = 202.500 ac Runoff Volume = 5.818 af Average Runoff Depth = 0.34"
100.00% Pervious = 202.500 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment RW1:

Runoff = 41.51 cfs @ 3.42 hrs, Volume= 3.796 af, Depth> 0.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	134.000	80	30% Cover w/HSG C
	134.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
38.0	3,590	0.0540	1.57		**Lag/CN Method,**

Summary for Subcatchment RW2:

Runoff = 13.51 cfs @ 2.96 hrs, Volume= 0.421 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	14.000	80	30% Cover w/HSG C
	14.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	440	0.1600	1.78		**Lag/CN Method,**

Summary for Subcatchment RW3:

Runoff = 15.62 cfs @ 3.22 hrs, Volume= 1.047 af, Depth> 0.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	36.000	80	30% Cover w/HSG C
	36.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	2,560	0.0800	1.79		**Lag/CN Method,**

Summary for Subcatchment RW4:

Runoff = 6.54 cfs @ 2.96 hrs, Volume= 0.196 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	6.500	80	30% Cover w/HSG C
	6.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	460	0.2500	2.25		**Lag/CN Method,**

Summary for Subcatchment RW5:

Runoff = 9.14 cfs @ 3.03 hrs, Volume= 0.358 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.65"

	Area (ac)	CN	Description
*	12.000	80	30% Cover w/HSG C
	12.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	1,210	0.1650	2.21		**Lag/CN Method,**

Summary for Reach RD-1:

Inflow Area = 148.000 ac, 0.00% Impervious, Inflow Depth > 0.34" for 100-yr, 6-hr event
Inflow = 43.24 cfs @ 3.42 hrs, Volume= 4.217 af
Outflow = 42.87 cfs @ 3.49 hrs, Volume= 4.160 af, Atten= 1%, Lag= 4.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.34 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 4.35 fps, Avg. Travel Time= 3.5 min

Peak Storage= 6,175 cf @ 3.45 hrs
Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 139.90 cfs

4.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 910.0' Slope= 0.0418 '/'
Inlet Invert= 6,000.00', Outlet Invert= 5,962.00'

Summary for Reach RD-2:

Inflow Area = 202.500 ac, 0.00% Impervious, Inflow Depth > 0.34" for 100-yr, 6-hr event
Inflow = 53.98 cfs @ 3.44 hrs, Volume= 5.760 af
Outflow = 53.69 cfs @ 3.50 hrs, Volume= 5.697 af, Atten= 1%, Lag= 3.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-6.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.07 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 5.69 fps, Avg. Travel Time= 2.8 min

Peak Storage= 6,402 cf @ 3.46 hrs
Average Depth at Peak Storage= 1.08'
Bank-Full Depth= 2.00' Flow Area= 16.0 sf, Capacity= 179.51 cfs

4.00' x 2.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 960.0' Slope= 0.0688 '/'
Inlet Invert= 5,962.00', Outlet Invert= 5,896.00'

EARTHFAX ENGINEERING GROUP, LLC
RIPRAP SIZING BASED ON HEC-11

Project #: UC-1665-07
Site: Emery 2 Facility Reclamation Channel Riprap Design
Engineer: RB White

Bank angle = 2 :1 = 26.57 degrees = 0.464 radians
Riprap material angle of repose = 39 degrees = 0.681 radians

K1 = 0.704

Channel	Design Velocity (ft/s)	Flow Depth (ft)	Median Riprap Diameter		
			Calculated (ft)	Calculated (in)	Planned (in)
RD-1	6.34	1.10	0.412	4.9	6
RD-2	8.07	1.08	0.857	10.3	12

Reference:

Brown, S.A. and E,S, Clyde. 1989. Design of Riprap Revetment. Hydraulic Engineering Circular No. 11. U.S. Departmnt of Transportation, Federal Highway Administration. McLean, Virginia.

APPENDIX VI-22

Baseline Investigation of Unnamed Ephemeral Wash
Affected by Emery 2 Surface Facilities

EMERY NO. 2 PORTAL AREA UNNAMED DRAINAGE INVESTIGATION

Prepared for:

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January 7, 2009

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EMERY NO. 2 PORTAL AREA UNNAMED DRAINAGE INVESTIGATION

1.0 Introduction

Consolidation Coal Company (Consol) is planning to develop a new underground coal mine adjacent to its existing Emery Mine. The Emery Mine is located approximately 65 miles south of Price in Emery County, Utah. The new mine (designated as Emery No. 2) would be located south of the existing underground mine, and its surface facilities would be constructed about ¼ mile southwest of the Emery Mine's main surface facilities. Consol's ongoing planning efforts for Emery No. 2 include designing the mine, obtaining the required permits and approvals, and conducting relevant environmental baseline studies. This report presents results of one of the environmental studies. It will be used in support of the mine permit application package that will be submitted to the Utah Division of Oil, Gas and Mining (DOGM).

As conceptually designed and laid out, the surface facilities associated with Emery No. 2 would encroach on a small, unnamed ephemeral channel that conveys storm water runoff through a bedrock-incised canyon. Approximately 1,500 linear feet of the channel would be covered by a pad constructed in the canyon bottom. The pad would be used to house the mine portal, conveyors, and a coal stockpile. Runoff that would otherwise flow through the channel would instead be intercepted by -- and conveyed through the canyon via -- constructed ditches. Although watershed modeling will provide much of the basis for the engineering design of these ditches, it is still necessary to document the existing hydrologic resources associated with this channel before it is covered.

The focus of this report is on validating the unnamed channel's classification as ephemeral (as opposed to intermittent or perennial). As perhaps implied by the use of the term in the initial description above, at first glance the channel appears to be unquestionably ephemeral. However, it is important to substantiate this assertion by applying a methodical and evidence-based approach to establish its status. To that end, this report evaluates the hydrological, physical, and biological attributes that are indicative of the persistence of stream flow in natural channels. The assessment is primarily based upon a field survey of the watershed and the entire channel reach.

2.0 Background

By convention, streams are typically classified as perennial, intermittent, or ephemeral according to the amount of time that they convey flow, and the source of their flow. Though these characteristics occur along a continuum, most streams (or stream reaches) fairly easily fit into one of the defined flow classifications as they are typically defined in scientific and regulatory literature. However, some streams are more difficult to classify because of where they fit along the continuum.

The Utah Coal Program's regulatory definitions of these three stream types, as given at *R645-100-200,* are relevant to this study. The definitions are quoted as follows:

"'Perennial Stream' means a stream or part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff. The term does not include intermittent stream or ephemeral stream.

"'Intermittent Stream' means a stream, or reach of a stream, that is below the local water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge.

"'Ephemeral Stream' means a stream which flows only in direct response to precipitation in the immediate watershed, or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table."

Within the context of a coal mine permit application there are numerous reasons to correctly classify the streams in the vicinity of a proposed mine. One of the functions of a permit application is to accurately assess what types of resource impacts may occur; another is to determine how those impacts might be mitigated or minimized. For example, a water quality impact in a perennial stream would likely have a different potential to affect biota than would the same water quality impact in an ephemeral stream, because the former class of stream provides different ecological values than does the latter. Additionally, a typical intermittent stream would react differently to the type of channel fill that Consol is proposing than would a typical ephemeral stream, so different design standards may be needed. Key to assessing potential water-related impacts is accurately characterizing the baseline conditions of the potentially affected water resource. The coal regulations given at *R645-301-724.200* require an applicant for a mine permit to characterize baseline surface water quality and quantity, and describe seasonal surface water variations. The applicant must also prepare a Probable Hydrologic Consequences (PHC) document that relies upon these characterizations as a basis for determining what impacts the mine operations may have on surface water resources.

Further, some sections of the coal regulations have restrictions or design requirements that vary depending upon the classification of the stream channel that would be affected and its watershed size. These include the following: *R645-301-731.600 – Stream Buffer Zones; R645-301-742.320 – Diversion of Perennial and Intermittent Streams and Ephemeral Streams that Drain a Watershed of at Least One Square Mile; R645-301-742.330 – Diversion of Miscellaneous Flows; and R645-301-742.400 – Road Drainage.*

3.0 Methodology

Section 1.0 above noted that the unnamed channel appears as unquestionably ephemeral; however, validating its classification as ephemeral is in many ways proving a negative (i.e. not intermittent or perennial), which is often difficult. The lack of persistent flow is one of the main definitional characteristics of an ephemeral stream, but because both perennial and intermittent streams can be without flow for certain periods of time, a single observation – or even several – of zero flow in a channel is not a sufficient basis for stream classification. Further, these classifications are not based upon distinct and disconnected categories. Instead, they represent a progression of flow frequencies and sources, both of which can vary in a given stream within a fairly wide range depending upon cumulative effects of weather and climate such as prolonged drought.

The duration and pattern of stream flow in any given channel typically affects other channel characteristics, including channel morphology, bed substrate, aquatic resources, and riparian vegetation. As such, these characteristics can also be used to support a channel classification determination. The analysis of the unnamed channel at the proposed Emery No. 2 mine relies on this kind of multi-faceted approach. Hydrological, physical, and biological characteristics that are indicative of stream flow patterns were observed throughout the entire channel reach during a one-day field survey in November 2009.

Prior to the field survey, topographic mapping, geology and groundwater information various published sources, aerial photography from the National Agriculture Imagery Program (NAIP), and a published soil survey (NRCS 2009) were examined to provide the initial context for the field observations. Topographic mapping is helpful for delineating the contributing watershed area, which has a bearing on flow sources. Geology and groundwater information provide background on the potential for a groundwater/surface water connection, which is directly relevant to flow persistence. Aerial photography can provide vegetation information, in regard to both upland watershed vegetation and riparian corridors. Soil surveys provide supporting information on wetlands and hydric soils, both of which rely upon persistent water.

During the November field survey, the entire mainstem stream channel and numerous side channels were traversed on foot, initially in a downstream-to-upstream direction so that general channel characteristics (as well as their consistency and/or variability) could be observed. The majority of the upland watershed area was also observed. Next, the channel was traversed again, this time from upstream to downstream, with frequent stops to take notes, photograph cross sections and reaches, record GPS locations of various relevant features, and measure the size of the active channel. These stops were not made at set locations; instead they were chosen to reflect representative channel characteristics as well as their variation along the channel length. The features that were noted included presence of flow, channel bottom saturation, morphologic features such as depositional bars and meanders, extent of bed and bank material sorting, presence of biota including fish and macroinvertebrates, and type/extent of vegetation.

Interpretations of the noted characteristics were made in part following a method developed by the State of New Mexico's Environment Department (NMED). The NMED Surface Water Quality Bureau recently developed a protocol for determining whether individual streams in New Mexico are ephemeral, intermittent, or perennial (NMED 2009) because the state applies water quality standards based upon a stream's flow classification. The determination is made by completing a rating sheet in the field, which uses a numerical scale where individual values describing specific stream characteristics are summed, and the results determine the classification. This method was not applied rigorously in the study on the unnamed drainage; instead it provided an independent means of supporting the initial observational conclusions.

4.0 Environmental Setting

The unnamed channel drains a watershed area of approximately ⅓ of a square mile and is tributary to Quitchupah Creek. Quitchupah Creek drains a watershed area of approximately 30 square miles. As shown on Figure 1, the unnamed channel enters Quitchupah Creek about 1,500 feet downstream of the latter's confluence with Christiansen Wash. The original surface facilities associated with the existing Emery Mine are located near the confluence of Christiansen Wash and Quitchupah Creek, and the

newer surface facilities associated with the mine's 4th East Portal are located a short distance upstream within the Christiansen Wash watershed.

Both Quitchupah Creek and Christiansen Wash are classified as perennial streams. The natural flow regimes of both have been altered by irrigation withdrawals and return flows. In addition, Quitchupah Creek's flows (see Photo 1) are supplemented by groundwater pumped from the existing Emery Mine, as well as discharges from another coal mine (the SUFCO Mine operated by Canyon Fuel Company, LLC) located in the headwaters of the watershed.

Photo 1 (See Figure 1 for photo key)

Unlike those streams, the unnamed channel has no diversions, irrigation, or mining related flow contributions, or other channel modifications. Its watershed is essentially undeveloped. There are no water rights to either surface water or groundwater within the watershed (Consol 2008).

Elevations within the watershed range from about 5,900 feet at the mouth of the unnamed channel to about 6,200 feet at the southwestern corner of the top of the drainage area. As is common in the Colorado Plateau at these elevations, bedrock is commonly exposed as a series of cliffs and ledges, which are interspersed with talus slopes. The Ferron Sandstone Member of the Mancos Shale Formation makes up the surface geology over most of the watershed. It is comprised of marine-derived sediments laid down in lenticular beds of varying thicknesses. The bed thickness and composition drives the formation of cliffs, ledges, and intervening slopes, as well as the ability to retain and transmit groundwater. Much of the canyon through which the unnamed drainage flows is characterized by these exposed rock features, while the majority of the upland watershed is flatter (Photo 2) and covered with shallow soils derived from the sedimentary rock.

Photo 2

The Ferron Sandstone is known as a regionally significant aquifer. Consol and its consultants have thoroughly studied it, as well as other potential groundwater occurrences, as part of their permitting efforts for the existing Emery Mine. Because the existing permit area includes the majority of the watershed area that is drained by the unnamed channel being evaluated in this report, this previously collected and compiled groundwater information is also generally relevant to this study. According to Consol (2008), groundwater in the Ferron is confined within two to three zones, known as the upper, middle, and lower aquifers. While the natural potentiometric surface of each of these zones is (or was historically) above ground surface over much of the vicinity, aquicludes (primarily shale beds) prevent the groundwater from discharging naturally at the surface. Though there may be some upward seepage to Quitchupah Creek or discharge via surface springs, groundwater in the Ferron is confined to well below the ground surface unless the restricting beds are punctured (by boreholes, for example). In 1979 and 1980, prior to the Emery Mine's development, seep and spring surveys were conducted within one mile of that mine's permit area (Consol 2008), including within the unnamed channel's watershed area. The purpose of those surveys was to identify any and all surface occurrences of groundwater, including those associated with the Ferron Sandstone, small perched aquifers, stream alluvium, irrigation seepage, or other unknown sources. While numerous seeps and springs were identified during those surveys, none were found within the unnamed channel or its watershed (Consol 2008).

The Order III soil survey for the area that includes the subject watershed (NRCS 2009) indicates that the water table in and adjacent to unnamed channel is more than 200 centimeters below ground surface, and further concludes that there are no hydric soils present along the channel. However, a survey of this level is not of sufficient resolution to identify small areas of soil inclusions within the larger mapped soil units, and these inclusions could potentially be hydric or otherwise affected by a shallow water table. To provide a better resolution on the soil mapping within the area, a more detailed Order II soil

survey was done by Long Resource Consultants in the fall of 2009. This detailed soil survey confirmed that there were no hydric soils along the unnamed drainage (Robert Long, personal communication 2010). Near the mouth of the drainage at a location influence by Quitchupah Creek streamflows, an area of oxyaquic soils was mapped. These soils represent a drier regime than is associated with hydric soils, but indicate some connection with the water table at dept

The watershed of the unnamed drainage contains vegetation typical of the general area: pinyon-juniper and desert shrub communities are the dominant types represented, but density is sparse due to the soil type, exposed bedrock, and climate. The presence of the Wasatch Plateau to the west of the watershed affects precipitation patterns in the area, functioning as an orographic barrier that results in a rain shadow east of the Plateau. Thus, climate is semiarid or arid, with an average annual temperature of 46°F and an average annual precipitation rate of 7 to 8 inches (Western Regional Climate Center 2009). In any given year, precipitation can be much less or much more than the average. Drought years of less than one inch and wet years of almost 17 inches are on record for the Emery Co-op weather station (Western Regional Climate Center 2009).

Photo 3

5.0 Results and Discussion

Information gathered prior to the field survey, some of which was described in Section 4.0 above, provided a strong indication that the unnamed channel conveyed flows only in response to discrete and infrequent precipitation events. With such a small contributing watershed area (less than 250 acres), the semiarid to arid climate (less than 8 inches annually) cannot support sustained streamflow with direct precipitation alone. Instead, sustained flow would have to be supported by groundwater that is recharged from outside the watershed boundaries. However, there was nothing reported in the available groundwater information (Consol 2008) to suggest that the unnamed drainage has a

connection with groundwater. This was also corroborated by published and field-verified soils information, as reported in Section 4.0.

To provide a precipitation context to the stream classification, and as recommended in the New Mexico Hydrology Protocol (NMED 2009), the 12-month Standardized Precipitation Index (SPI) for the study vicinity was obtained from the National Climatic Data Center (2009). The SPI is based upon a statistical assessment of precipitation data, wherein the time period of analysis is categorized as having precipitation of near normal, or abnormally, moderately, severely, extremely, or exceptionally dry or wet. Abnormally dry or abnormally wet are the measures closest to near normal, grading towards the exceptional category, which represents the largest departure from normal. A prolonged or excessive drought can result in a perennial stream drying up for a short period of time or an intermittent stream that has a shorter season of flow than is typical. Conversely, a prolonged or excessive wet spell can result in an intermittent stream flowing for a greater-than-typical time period. Therefore, the SPI can provide contextual information when interpreting the field results in streams where borderline or conflicting evidence is observed. The New Mexico Hydrology Protocol (NMED 2009) highly recommends that field evaluations for classification determinations not be made when the 12-month SPI is greater than -1.0. According to the National Climatic Data Center (2009), , the period from December 2008 through November 2009 ranked as abnormally dry (SPI between -0.59 and -0.71) in the vicinity of the unnamed drainage, and thus was within the acceptable range for field evaluations as recommended by NDEM (2009).

NMED (2009) also recommends that surveys be conducted at least at least 48 hours after the last known major rainfall, because recent rainfall or snow accumulation/melting can affect observations of channel flow by obscuring the presence of baseflows. Weather was tracked for a several-day period prior to the field evaluation. No precipitation occurred in the vicinity of the unnamed channel within this time period; further, there was no snow accumulation present in the watershed at the time of the survey.

The November 2009 field survey of the unnamed channel and its watershed provided essentially unarguable evidence of the ephemeral nature of flow in the channel. None of the hydrological, physical, or biological attributes that are indicative of the persistence of stream flow in natural channels were present. All observations in all three categories were readily and easily made in support of the ephemeral classification. Based upon the results of the survey, the unnamed drainage can be placed at the far end of the continuum between perennial and ephemeral. The following subsections discuss all the hydrological, physical, and biological components that were observed, and their significance and interpretation.

5.1 Hydrologic Indicators of Ephemeral Flow

There was no water flowing or pooling within any portion of the unnamed channel during the November 30, 2009 field survey. Further, there were no areas where channel bottom or bed substrates were saturated or moist. Specific observations were made in areas where these conditions would be likely to persist, such as in the channel bottom behind large rocks that provide prolonged shade, or in topographic depressions within the channel profile (Photo 4). Even in those locations, bed and banks were dry.

Photo 4

In addition to looking for the presence of water in the channel or visible in the channel substrate, the survey also attempted to identify the presence of interflow or groundwater discharge into the hyporheic zone of the channel. This zone, in streams where it is present, indicates flow through the bed sediments at times when stream flow does not have a surface component. Along the unnamed channel, exposed bedrock is present in the channel bottom in numerous locations (see Photo 5), precluding the potential for hyporheic flow in those reaches. In other locations along the channel, shallow (up to 1 foot deep) holes were dug to look for evidence of water or saturated conditions that could indicate hyporheic flow. No such evidence was observed: dry conditions persisted at all locations where the loose substrate was examined.

Only near the mouth of the unnamed drainage were surface conditions such that there seemed to be even the potential for hyporheic flow or shallow groundwater. What appeared to be a thicker layer of fine bed sediments than were present further upstream covered the channel bottom. These sediments had recent desiccation cracks (see Photo 6). They were dry down to at least one foot at the time of the field survey and appeared to be associated with recent flood flows in Quitchupah Creek. Quitchupah Creek had experienced an extreme flood about 2 ½ months prior to the field valuation and backflowed a short distance up the mouth of the unnamed drainage.

Photo 5

Photo 6

In addition to the observations that were made to identify sustained baseflows or shallow groundwater contributions to hyporheic flow, observations were also made to look for evidence of recent storm flows. High water marks (scour lines or deposits), floatable organic debris deposition, fine sediments deposited on bank vegetation, etc. can all indicate recent runoff. In addition to the previously noted backwater flow from the Quitchupah Creek flood, the ephemeral channel showed signs of a fairly recent, but very low volume, flow (Photo 7). The presence of lighter colored fine sediments deposited in the channel bottom was the primary indication of this flow. Measurements made at several locations along the drainage indicated a flow width of one to two feet and a flow depth of a couple of inches at most.

Photo 7

Individually and cumulatively, the observations of hydrologic indicators consistently and clearly point to the classification of the unnamed drainage as ephemeral. Further, these observations supported the conclusions derived from the assessment of watershed size, previous groundwater studies, and soil surveys.

5.2 Physical Indicators of Ephemeral Flow

Physical indicators of stream classification are a result of a geomorphic processes and related stream flow characteristics. These indicators may be less conclusive on their own than either the hydrologic indicators described in 5.1 or the biologic indicators described in Section 5.3, but they can provide supporting information that is particularly useful in streams that are borderline between types.

Regular and persistent stream flows often create channels that are sinuous, because a regular meander pattern is a function of a stream's attempt to balance its velocity (energy) and the valley gradient. While

bedrock and other characteristics can affect meander development, in general, perennial streams are more sinuous and have a more stable meander pattern than other streams. Hand in hand with meander development is the development of point bars, and well-sorted bed materials that form features such as riffles. Perennial streams have a more constant and stable source of energy via their stream flow to create these features. Ephemeral streams are at the other end of the spectrum in this regard: while they may experience occasional very high energy flows than can move sediments, scouring and depositing material throughout the channel cross section, this energy is irregular and inconsistent so fluvial features such as point bars or riffles are not well defined, beds and banks are not continuous, and substrate does not generally have a sorted appearance.

Throughout the unnamed channel, and as reflected in photos 8 and 9 below, the flow path does not show any sign of regular or persistent meandering, fully developed point bars, sustained material sorting, or other geomorphic indications of perennial flows. Instead, the channel exhibits indications of readily moving flow paths within a wider channel bottom and lateral bars comprised of poorly sorted materials. These indicators support the unnamed channel's classification as ephemeral, rather than intermittent or perennial.

Photo 8

Photo 9

5.3 Biological Indicators of Ephemeral Flow

During the November 2009 field survey, observations were made on the presence or absence, and type, of fauna and flora encountered in and near the unnamed channel.

Given the fact that there was no water in any portion of the unnamed drainage, it is not surprising that there were no fish observed. Nor were amphibians of any sort found during the November survey. Further, due to the noted complete absence of water, either flowing at the surface or through the hyporheic zone, benthic macroinvertebrates would not be expected to be encountered. However, at locations along the channel, cobbles and larger gravel particles were occasionally overturned to look for dried caddisfly casings or bivalve shells that might indicate a former presence of sustained flows. No such evidence was observed.

Another sign that there had been no sustained flows in recent times was the lack of algal materials. Commonly, streams with even small baseflows support some form of filamentous algae or periphytons that cling to substrate. Ephemeral channels do not flow consistently or in sufficient duration to allow either of those to colonize.

Notes on the presence of vegetation were also made during the survey. Review of the Aerial photos of the proposed surface facilities indicate that the unnamed channel lacked either an extensive corridor of riparian vegetation or a narrower corridor that contained large woody riparian species. Based upon the photo, there appeared to be little difference in type or extent of vegetation within, adjacent, or outside of the channel, including the upland watershed area. However, the aerial photo did not have a sufficient resolution to signify a smaller riparian corridor or the presence of phreatophytes or aquatic

vegetation. The field survey was relied upon to provide those observations, as well as to verify the conclusions based upon the aerial photo review.

With the exception of the previously mentioned Quitchupah Creek backwater reach near the mouth of the unnamed drainage, there were no vegetative indicators of frequent or sustained stream flows (Photos 10 and 11). The upland vegetation community appeared to span the channel with little identifiable change in either density or composition. Vegetation that was observed to be growing within and along the channel bottom included mature individuals of the following perennial species: pinyon, juniper, galleta grass, and Indian rice grass. Not only are all of these upland species not dependent upon a frequent water source, they would not tolerate sustained contact with it. Their presence at locations along the channel bottom provides a strong indication that flow in the unnamed drainage occurs infrequently. Conversely, no riparian, phreatic, or aquatic vegetation was noted along the channel (with the exception of the phragmites found near the channel mouth, which is supported by flows in Quitchupah Creek). The absence of these vegetation types provides a strong indication of infrequent flow.

Photo 10

Photo 11

Individually and cumulatively, the observations of biological indicators consistently and clearly point to the classification of the unnamed drainage as ephemeral.

6.0 Summary and Conclusions

The November 2009 field survey, as well as other supporting evidence obtained prior to the field survey, substantiates the initial assertion that the unnamed drainage channel planned for encroachment by Emery No. 2's development is classed as ephemeral. There are no indications that the channel flows intermittently or perennially. All of the hydrological, physical, and biological attributes that were examined during the survey strongly suggest that the channel bottom is (1) always above the water table, and (2) conveys flow only infrequently and in direct response to either precipitation that is generated within its watershed or snow melt generated therein. With the knowledge that the unnamed channel is ephemeral, Consol's permitting efforts for Emery No. 2 can proceed with a clearer understanding of what is required for environmental baseline descriptions, facility design, and impact assessment.

7.0 References

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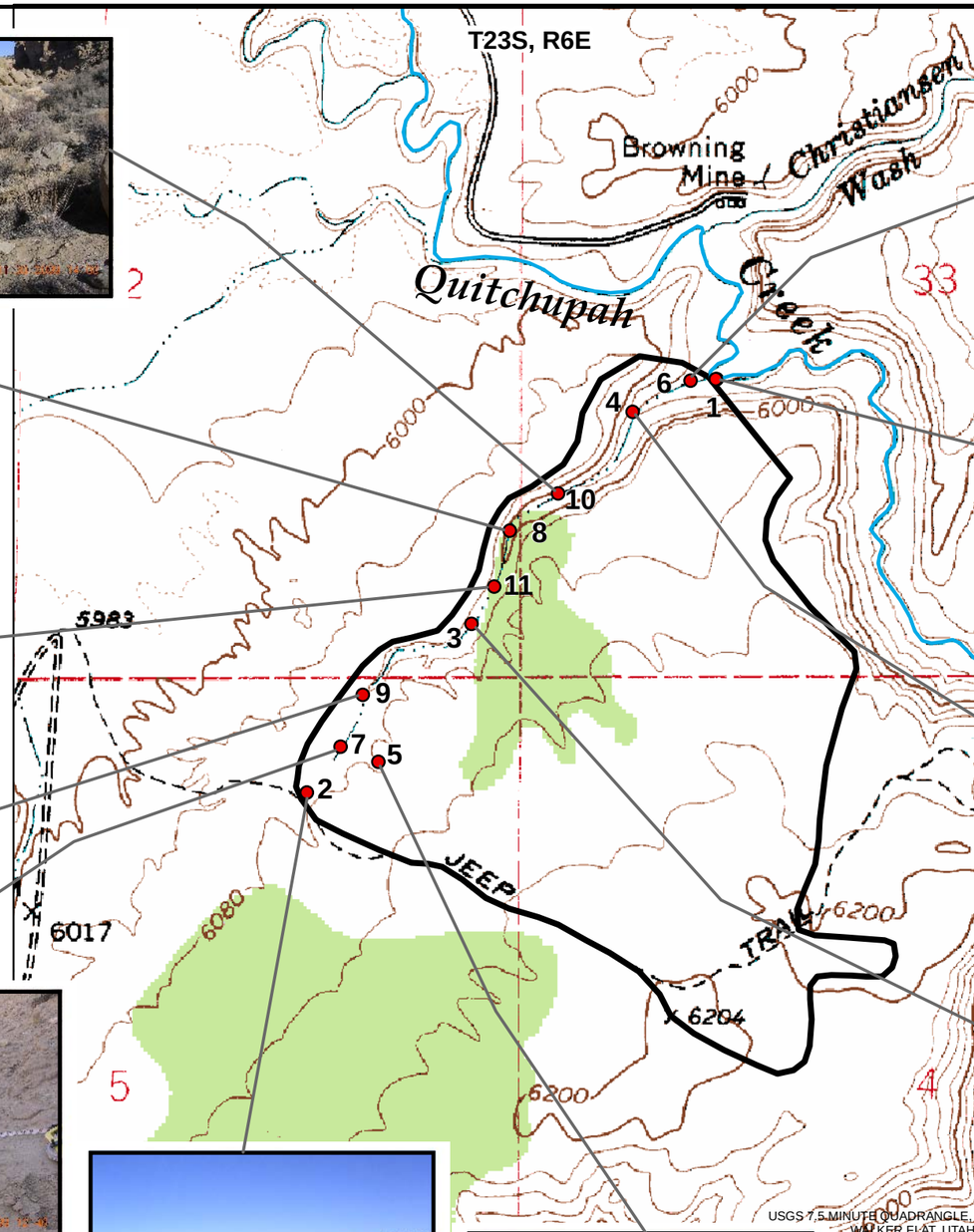
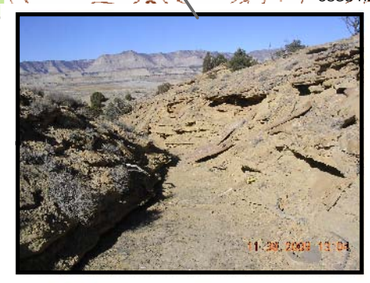




Legend

Unnamed Drainage Watershed Boundary

1 Photo Number

1,000 500 0 1,000 Feet

N

CONSOLIDATION COAL COMPANY
EMERY NO. 2 PORTAL AREA
UNNAMED DRAINAGE INVESTIGATION

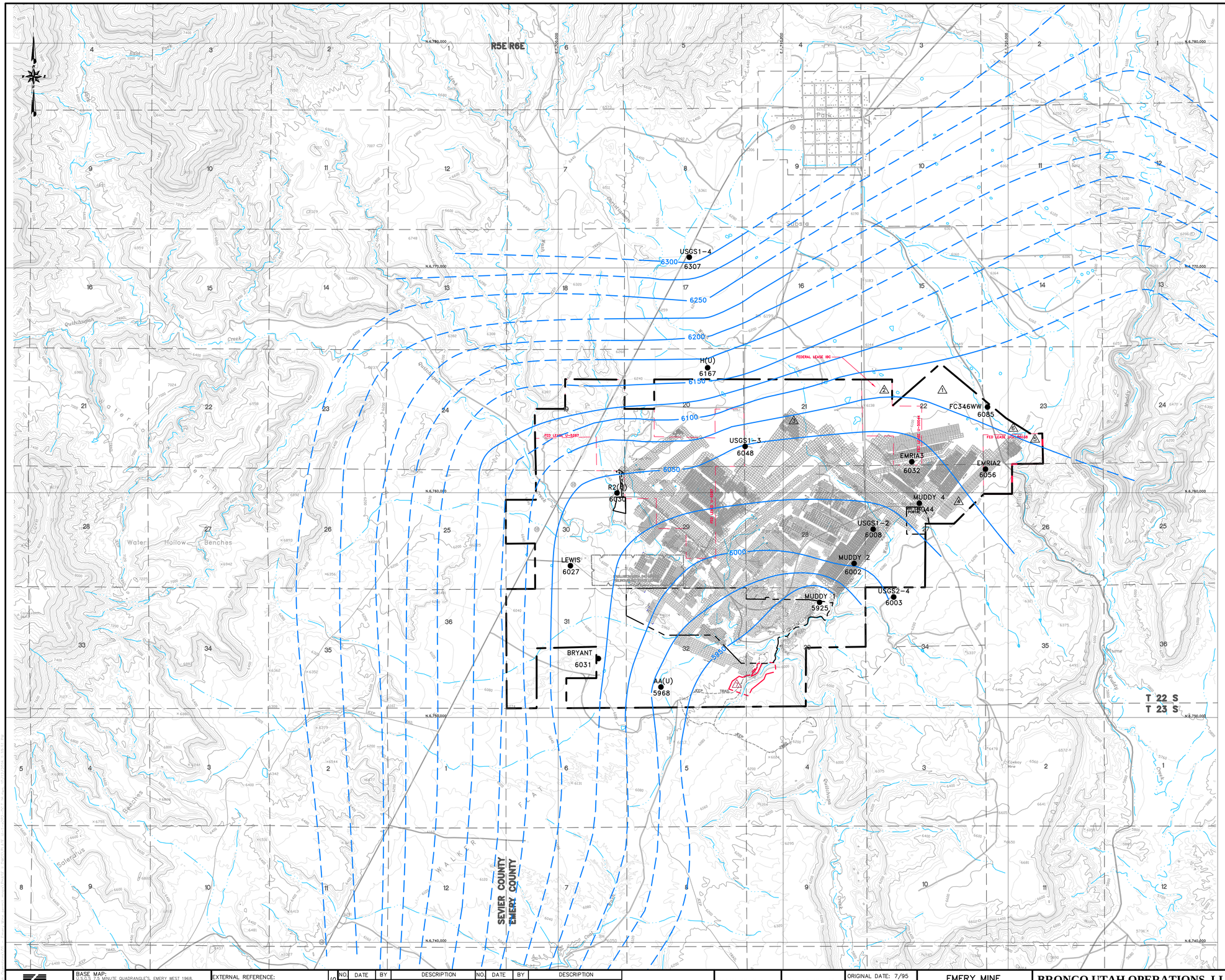
FIGURE 1
WATERSHED BOUNDARY & PHOTO KEY

JBR

DRAWN BY	DATE DRAWN
KK/cp	01/12/10

SCALE 1:12,000

File Path: drawings\Consol Emery Mine\Emery No2 B.A09332.00\Watersh Boundary & Photo Key.mxd



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- 5675 — POTENTIOMETRIC SURFACE ELEVATION (FT)-DASHED WHERE INFERRED
- LEWIS 6027 — WELL LOCATION WITH NAME AND WATER SURFACE ELEVATION (FT)

NOTE:

DASHED POTENTIOMETRIC SURFACE INFERRED FROM LINES AND MORRISSEY (1983)

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968. EMERY EAST 1968, PHOTO REVISED 1978. MESA BUTTE 1968, PHOTO REVISED 1978. WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES. NAD 83 CONUS. ZONE 4302-UTAH, CENTRAL - US FEET VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
G:\UC982\XREF-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREF-CURRENT\XREF-WORKS-ZZNLBA.DWG
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G:\UC982\XREF-CURRENT\XREF-FAULTLINE.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C. 1st NORTH FED LEASE IBC, FULL EXTRACTION	6	04/10	JAG	ZZN WEDGE
2	12/12/06	JAG	UPDATED POTENTIOMETRIC SURFACE (OLD VI-9)	7	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT
3	03/08	JAG	ZZ NORTH, ADJ. VS. PERMIT DEF. 3099				
4	05/09	JAG					

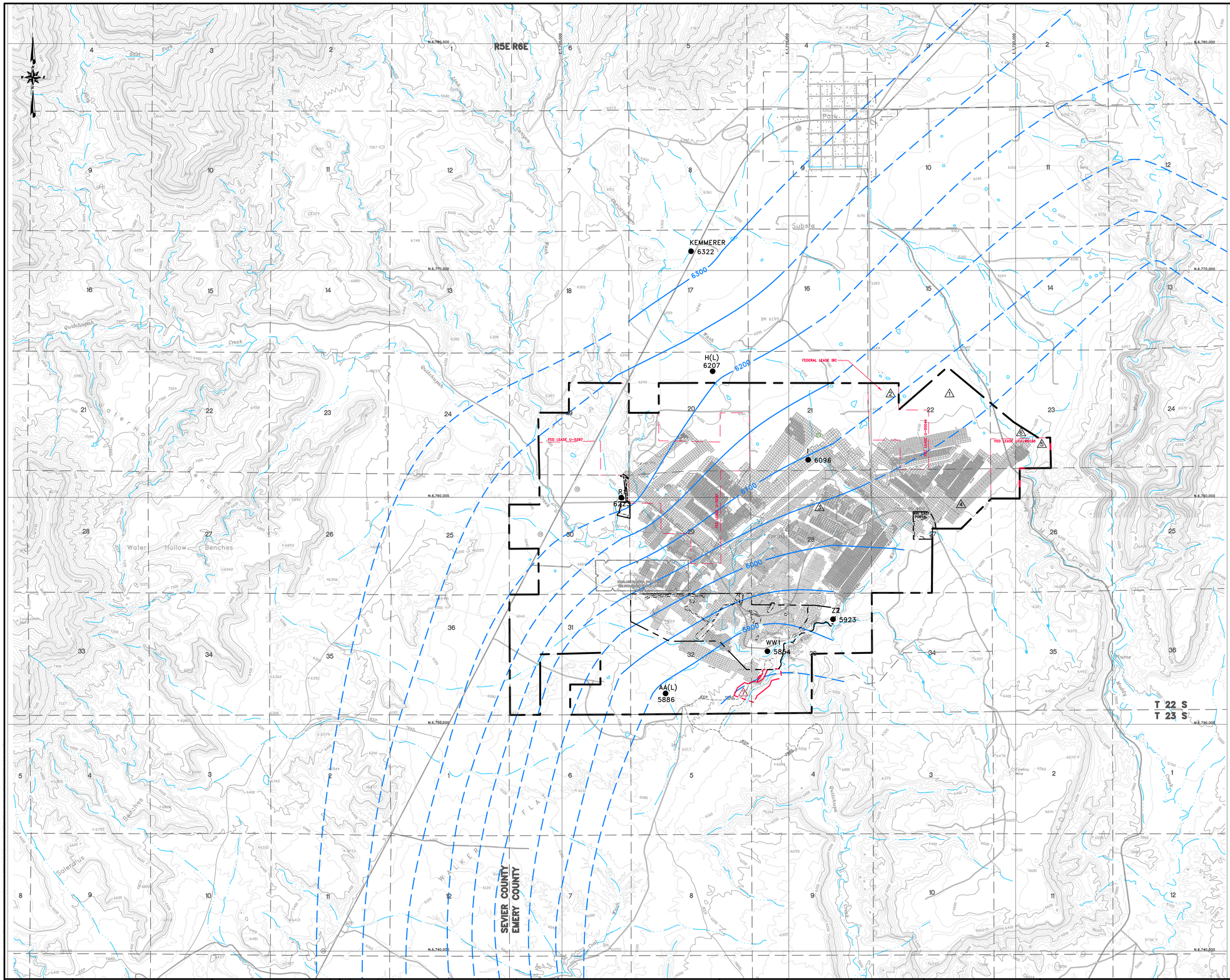
0' 2000'
SCALE: 1" = 2000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 7/95
RE-DRAWN DATE: 7/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWG

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-1
UPPER FERRON SANDSTONE POTENTIOMETRIC SURFACE (1979)



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- 6000 — POTENTIOMETRIC SURFACE ELEVATION (FT)-DASHED WHERE INFERRED
- AA ● 5886 — WELL LOCATION WITH NAME AND WATER SURFACE ELEVATION (FT)

NOTE:

DASHED POTENTIOMETRIC SURFACE INFERRED FROM LINES AND MORRISSEY (1983)

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH
NOT VALID WITHOUT A SIGNATURE

EarthFax

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE'S, EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88-US FEET

EXTERNAL REFERENCE:
G:\UC982\XREF-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREF-CURRENT\XREF-WORKS-ZZNLBA.DWG
G:\UC982\XREF-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREF-CURRENT\XREF-SECTION.DWG
G:\UC982\XREF-CURRENT\XREF-COORDS.DWG
G:\UC982\XREF-CURRENT\XREF-FAULTLINE.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.
2	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION
3	03/08	JAG	UPDATED POTENTIOMETRIC SURFACE
4	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT DEF. 3099
5	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
6	04/10	JAG	ZZN WEDGE
7	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT

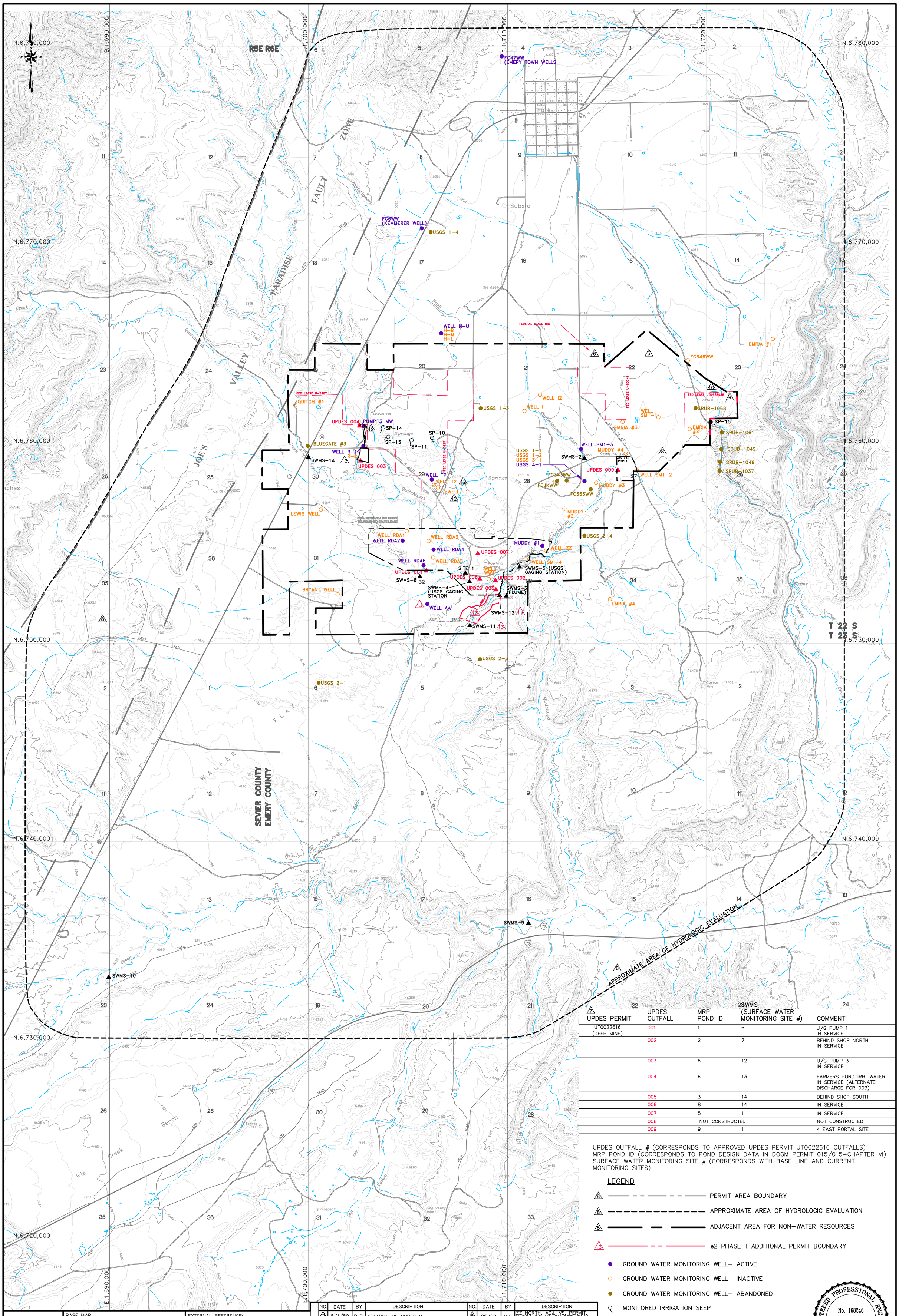
0' 2000'
SCALE: 1" = 2000'
CONTOUR INTERVAL = 40'

DRAWN BY: KHB
APPROVED BY: JAG
CHECKED BY: JAG
ORIGINAL DATE: 7/95
RE-DRAWN DATE: 7/07
DWG DATA: G:\UC1665\05\PHASEII DWG

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-2
LOWER FERRON SANDSTONE POTENTIOMETRIC SURFACE (1985)



UPDES PERMIT	UPDES OUTFALL	MRP POND ID	SWMS (SURFACE WATER MONITORING SITE #)	COMMENT
UT0022616 (DEEP MINE)	001	1	6	U/G PUMP 1 IN SERVICE
	002	2	7	BEHIND SHOP NORTH IN SERVICE
	003	6	12	U/G PUMP 3 IN SERVICE
	004	6	13	FARMERS POND IRR. WATER IN SERVICE (ALTERNATE DISCHARGE FOR 003)
	005	3	14	BEHIND SHOP SOUTH
	006	8	14	IN SERVICE
	007	5	11	IN SERVICE
	008	NOT CONSTRUCTED		NOT CONSTRUCTED
	009	9	11	4 EAST PORTAL SITE

UPDES OUTFALL # (CORRESPONDS TO APPROVED UPDES PERMIT UT0022616 OUTFALLS)
MRP POND ID (CORRESPONDS TO POND DESIGN DATA IN DOGM PERMIT 015/015-CHAPTER VI)
SURFACE WATER MONITORING SITE # (CORRESPONDS WITH BASE LINE AND CURRENT MONITORING SITES)

LEGEND

- PERMIT AREA BOUNDARY
- APPROXIMATE AREA OF HYDROLOGIC EVALUATION
- ADJACENT AREA FOR NON-WATER RESOURCES
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- GROUND WATER MONITORING WELL- ACTIVE
- GROUND WATER MONITORING WELL- INACTIVE
- GROUND WATER MONITORING WELL- ABANDONED
- MONITORED IRRIGATION SEEP
- MONITORED SPRING
- SURFACE WATER MONITORING SITE
- UPDES DISCHARGE POINT

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S, EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
G:\UC982\XREFS-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREFS-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREFS-CURRENT\XREF-SECTION.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
2	8/1/89	RJD	ADDITION OF NPDES 0	8	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT, HYDRO BOUNDARY DEF. 3099
3	8/7/90	RJD	ADDITION OF SW SITES 14 & 15	9	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
4	9/95		AMENDED PERMIT BOUNDARY TO EXCLUDE EXPIRED STATE LEASE	10	04/10	JAG	ZZN WEDGE
5	6/30/05	JAG	ADDED FIRST NORTH I.B.C.	11	09/11	JAG	REVISE GROUNDWATER MONITOR PLAN, ABATE NOV 10088
6	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION	12	07/16	JAG	REVISE GW MONITOR PLAN
7	03/08	JAG	UPDATE MAP (OLD VI-3)	13	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT REVISE GW MONITOR PLAN

0' 2000'
SCALE: 1" = 2000'
CONTOUR INTERVAL = 40'

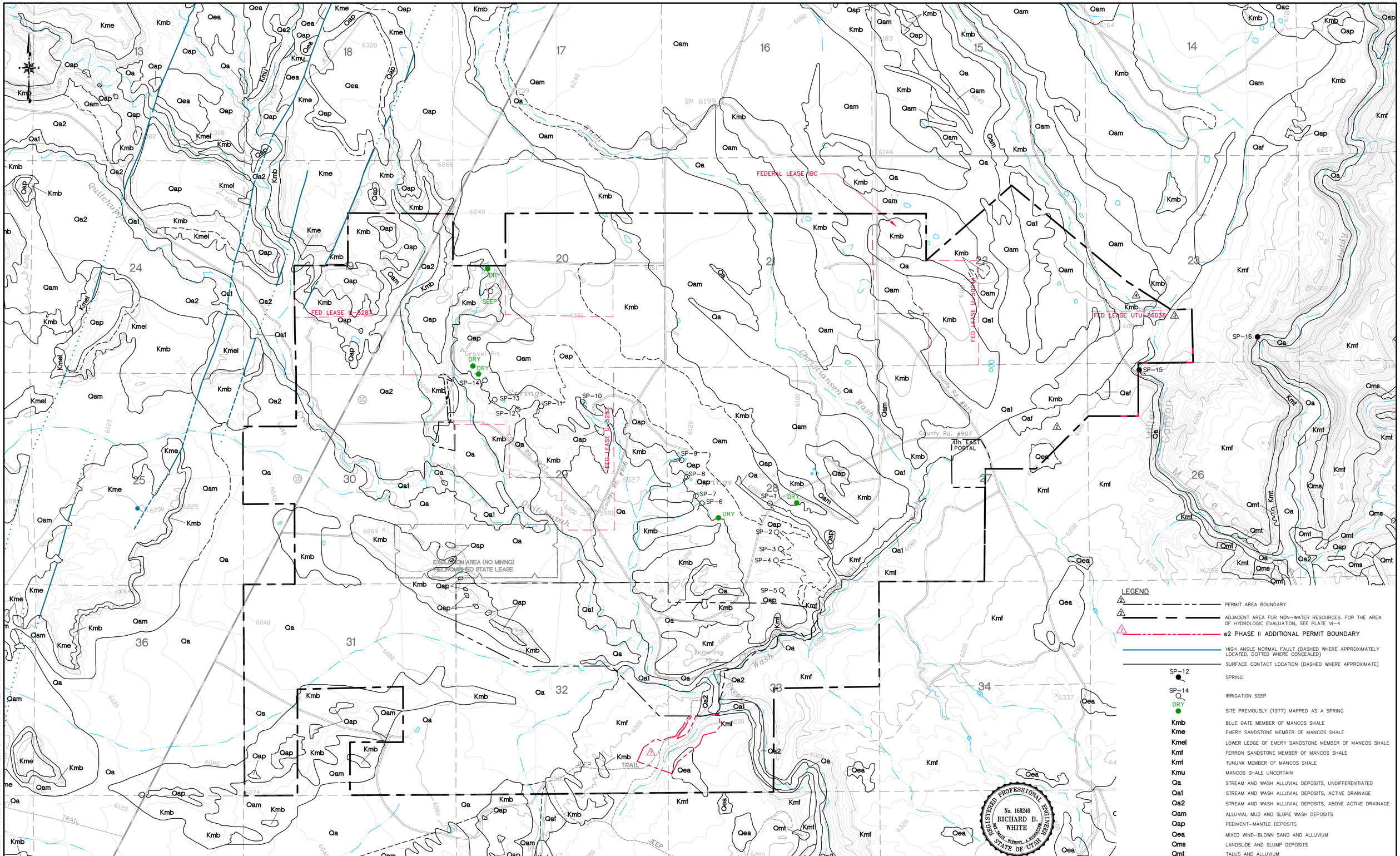
DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 1/81
RE-DRAWN DATE: 7/05
APPROVED BY: JAG
DWG DATA: G:\UC982\14-HYDROLOGY REWRITE\CHAPVI-PLATES\PLATE VI-4.DWG

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-4
GROUND WATER MONITORING WELL AND SURFACE WATER MONITORING SITE LOCATION MAP

G:\UC1665 - Bronco Utah Operations\05 - Emery Mine permit maps\PHASE II DWGS\PLATE VI-4-e2P2-OCT 16.dwg



EarthFax

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE"S. EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978, MESA BUTTE 1968, PHOTO REVISED 1978, WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES, NAD 83 CONUS
ZONE 4302–UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88–US FEET

GEOLOGIC MAP
EAST HALF OF THE SALINA 30'x60' QUADRANGLE, EMERY, SEVIER AND WAYNE COUNTIES UTAH
BY: HELMUT H. DOELLING 2004

EXTERNAL REFERENCE:
G:\UC982\XREFS-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREFS-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREFS-CURRENT\XREF-SECTION.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	03/08	JAG	UPDATE MAP (OLD VI-2/2A)	7	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT
2	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT OFF. 2099				
3	08/09	JAG	ZZ NORTH, MILLER CANYON LEA UTU-86038				
4	04/10	JAG	ZZN WEDGE				

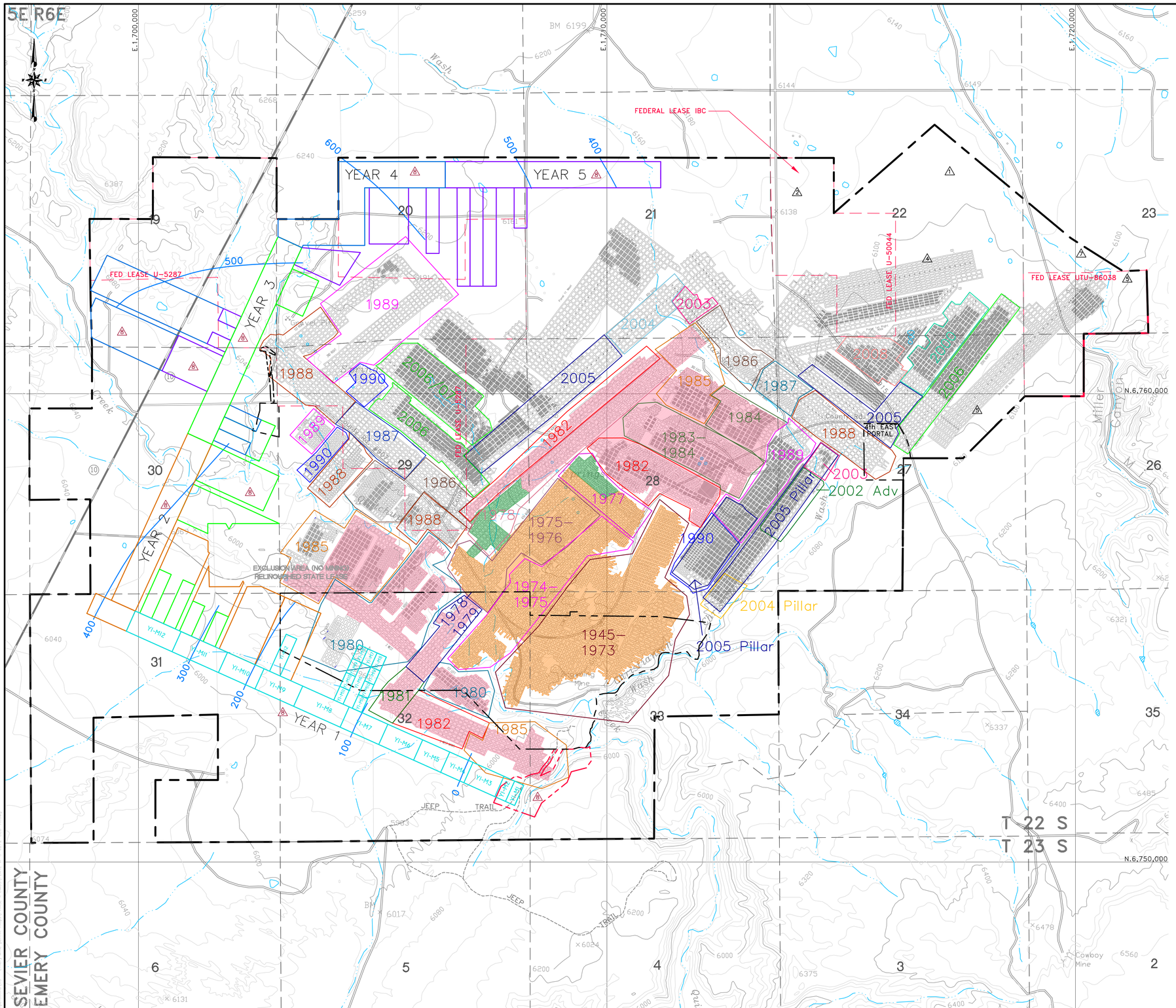
0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 8/07
RE-DRAWN DATE:12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665/05/PHASE II

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

CONSOLIDATION COAL COMPANY
P.O. BOX 566
SESSER, IL 62884–0566

PLATE VI–5
GENERAL GEOLOGY



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- PRIOR TO AUG. 3, 1977
- MAY. 3, 1977 TO AUG 3, 1977
- MAY 3, 1978 TO JAN. 5, 1986
- EXCLUSION AREA (NO MINING) RELINQUISHED STATE LEASE
- FORCASTED PANEL YEAR 1
- FORCASTED PANEL YEAR 2
- FORCASTED PANEL YEAR 3
- FORCASTED PANEL YEAR 4
- FORCASTED PANEL YEAR 5
- 500 — ESTIMATED DEPTH OF GROUNDWATER (FT) OVER BOTTOM OF I-SEAM COAL (COMPARE PLATE V-20 AND PLATE VI-7)

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88-US FEET

EXTERNAL REFERENCE:
G:\UC982\XREF-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREF-CURRENT\XREF-SECTION.DWG
G:\UC982\XREF-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREF-CURRENT\XREF-WORKS-ZZNLBA.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.	5	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT DFF 3099
2	12/12/06	JAG	1ST NORTH FED LEASE IBC. FULL EXTRACTION	6	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
3	04/7	JAG	UPDATE MINING PLAN	7	04/10	JAG	ZZN WEDGE
4	09/08	JAG	LIFE OF MINE FULL EXTRACTION	8	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT

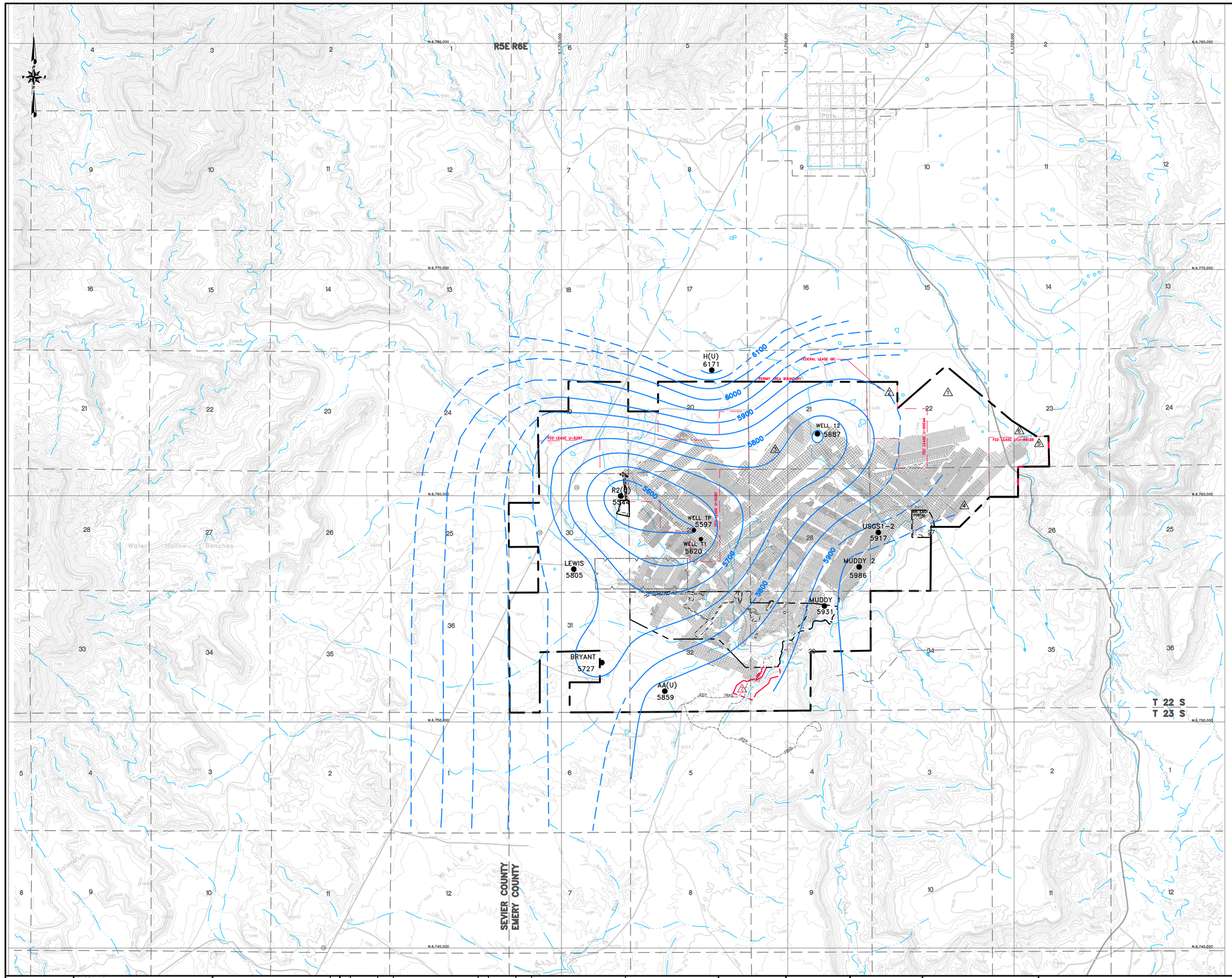
0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 1/03
RE-DRAWN DATE: 12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-6
ANTICIPATED INITIAL DEPTH OF GROUNDWATER OVER BOTTOM OF I-SEAM



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- 5675 — POTENTIOMETRIC SURFACE ELEVATION (FT)-DASHED WHERE INFERRED
- LEWIS 5805 — WELL LOCATION WITH NAME AND WATER SURFACE ELEVATION (FT)

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH
NOT VALID WITHOUT A SIGNATURE

EarthFax

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE'S: EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
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G:\UC982\XREFS-CURRENT\XREF-SECTION.DWG
G:\UC982\XREFS-CURRENT\XREF-COORDS.DWG
G:\UC982\XREFS-CURRENT\XREF-OLDWORKS.DWG
G:\UC982\XREFS-CURRENT\XREF-FAULTZONE.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.	5	08/09	JAG	ZZ NORTH MILLER CANYON LBA UTU-86038
2	12/12/06	JAG	1st NORTH FED. LEASE IBC, FULL EXTRACTION	6	04/10	JAG	ZZN WEDGE
3	03/08	JAG	UPDATED POTENTIOMETRIC SURFACE	7	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT
4	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT BF. 2099				

0' 2000'
SCALE: 1" = 2000'
CONTOUR INTERVAL = 40'

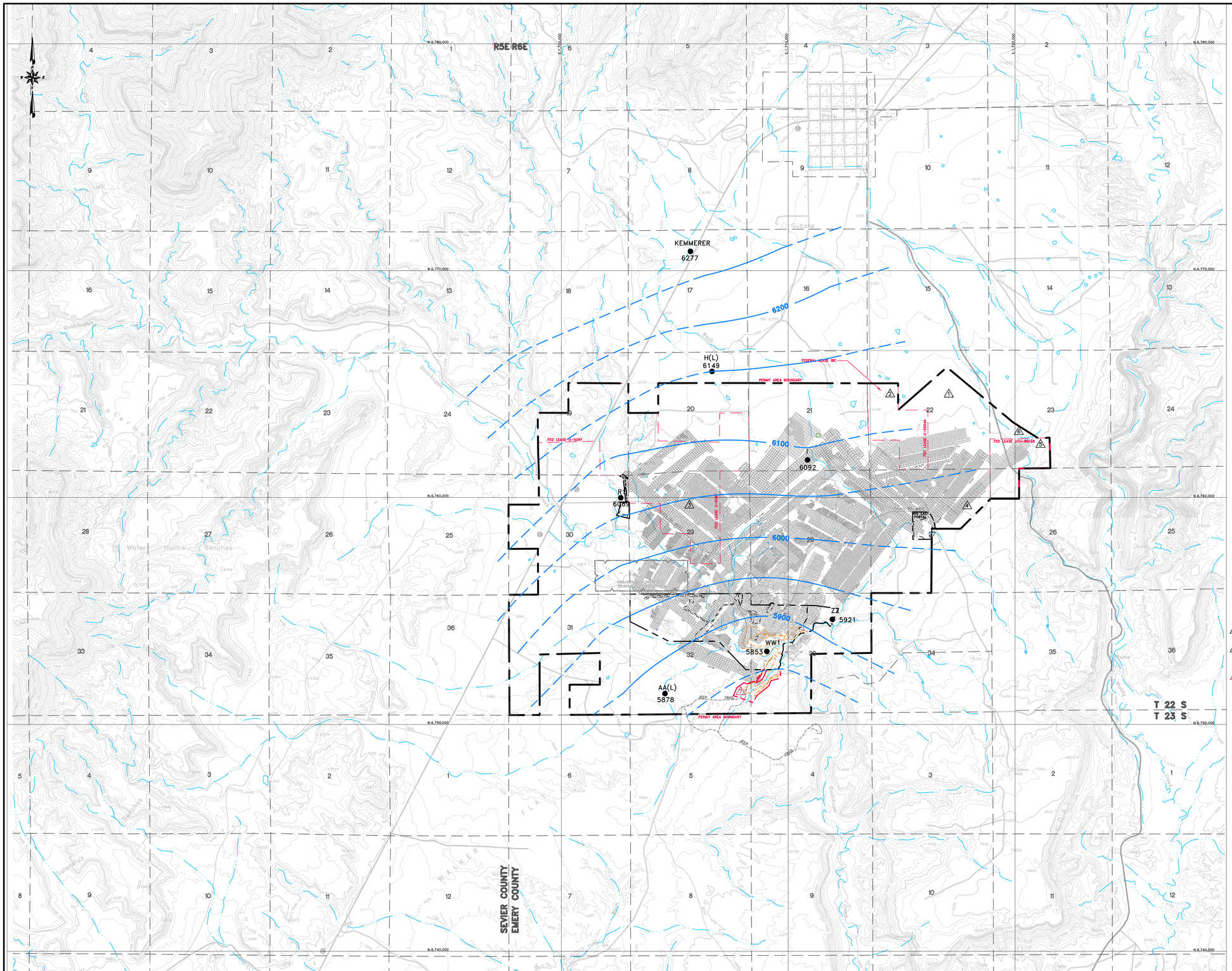
DRAWN BY: KHB
CHECKED BY: JAG
ORIGINAL DATE: 7/95
RE-DRAWN DATE: 7/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-7
UPPER FERRON SANDSTONE POTENTIOMETRIC SURFACE (2006)

G:\UC1665 - Bronco Utah Operations\05 - Emery Mine permit maps\PHASE II DWGS\PLATE VI-7-e2P2-OCT 16.dwg 10/14/2016 2:44:40 PM



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- 6000 — POTENTIOMETRIC SURFACE ELEVATION (FT)-DASHED WHERE INFERRED
- AA ● 5878 — WELL LOCATION WITH NAME AND WATER SURFACE ELEVATION (FT)

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
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G:\UC982\XREFS-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREFS-CURRENT\XREF-SECTION.DWG
G:\UC982\XREFS-CURRENT\XREF-COORDS.DWG
G:\UC982\XREFS-CURRENT\XREF-WORKS-ZZNLBA.DWG
G:\UC982\XREFS-CURRENT\XREF-FAULTZONE.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.
2	12/12/06	JAG	1ST NORTH FED LEASE IBC, FULL EXTRACTION
3	03/08	JAG	UPDATED POTENTIOMETRIC SURFACE
4	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT BRF. 5092
5	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
6	04/10	JAG	ZZN WEDGE
7	10/16	JAG	e2 PHASE II ADDITIONAL PERMIT

0' 2000'
SCALE: 1" = 2000'
CONTOUR INTERVAL = 40'

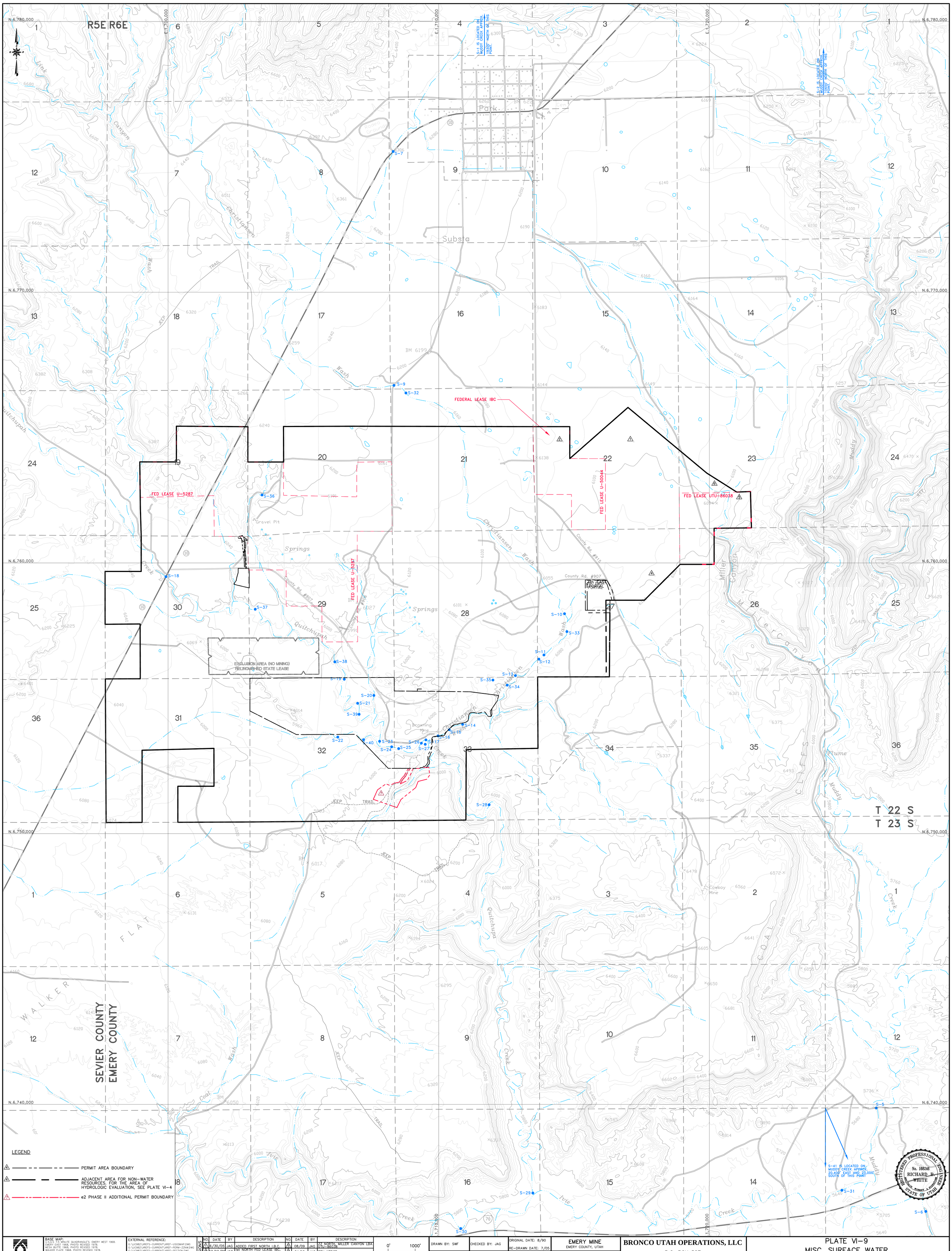
DRAWN BY: KHB
CHECKED BY: JAG
ORIGINAL DATE: 7/95
RE-DRAWN DATE: 7/07
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-8
LOWER FERRON SANDSTONE
POTENTIOMETRIC SURFACE (2006)

G:\UC1665 - Bronco Utah Operations\05 - Emery Mine permit maps\PHASE II DWGS\PLATE VI-8-APR2-OCT 16.dwg, 10/14/2016 9:55:23 AM



EarthFax

BASE MAP: U.S.G.S. 7.5 MINUTE QUADRANGLE'S, EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978, MESA BUTTE 1968, PHOTO REVISED 1978, WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM: STATE PLANE COORDINATES: NAD 83 CONUS, ZONE 4302=UTAH, CENTRAL – US FEET, VERTICAL DATUM – NAVD 88–US FEET

EXTERNAL REFERENCE:
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G:\UC982\XREFS–CURRENT\XREF–SECTION.DWG
G:\UC982\XREFS–CURRENT\XREF–COORDS.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.
2	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION
3	03/08	JAG	CHANGED MAP ID AND NAME (QID VI-1)
4	05/09	JAG	72 NORTH, ADJ. VS. PERMIT DEF. 3099
5	08/09	JAG	7% NORTH, MILLER CANYON LBA UTU-86038
6	04/10	JAG	ZZN WEDGE
7	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT

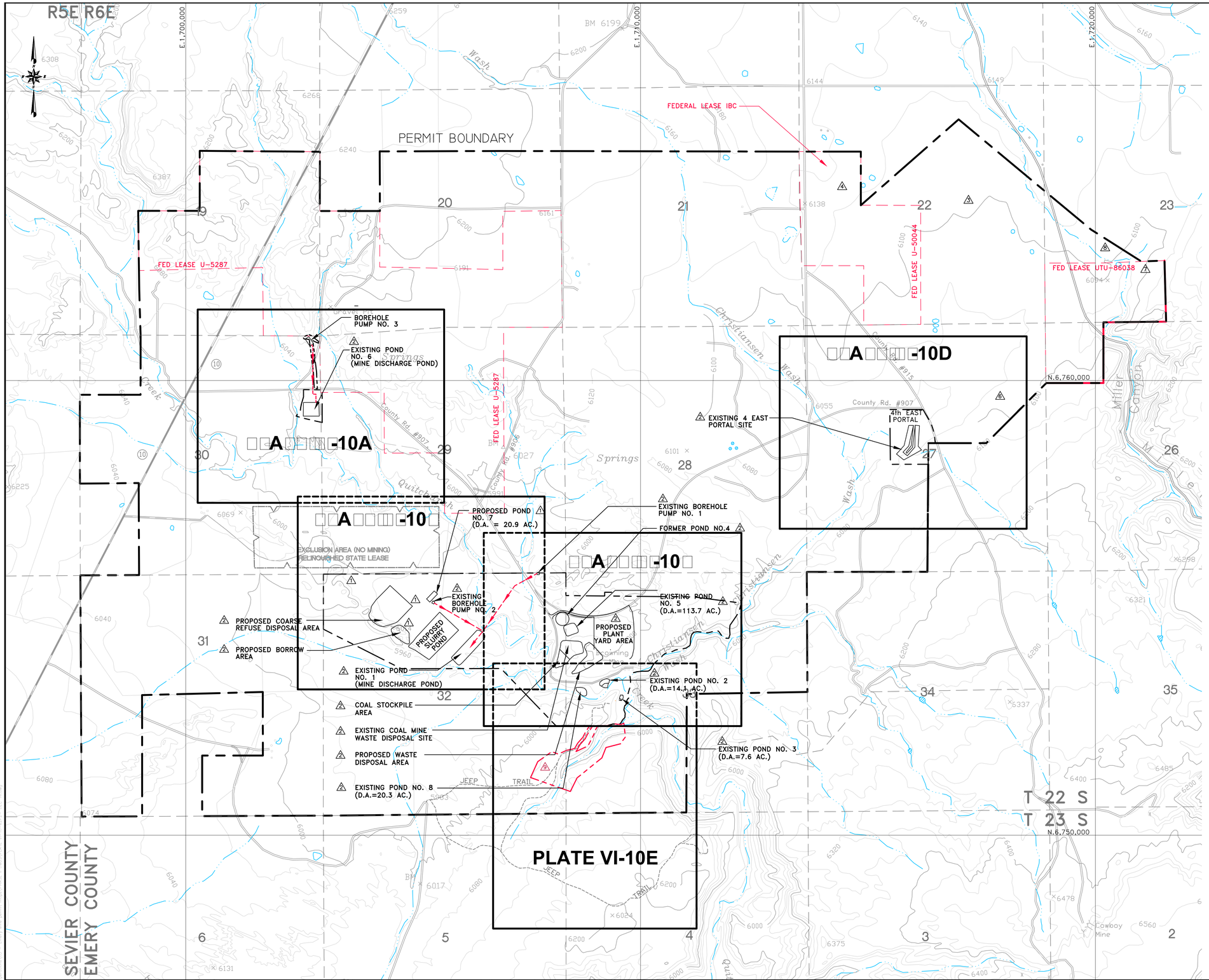
0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 8/90
RE-DRAWN DATE: 7/05
APPROVED BY: JAG
DWG DATA: G:\UC982\14–HYDROLOGY REWRITE \CHAP'VI–PLATES'\PLATE VI–9.DWG

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO. ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI–9
MISC. SURFACE WATER DATA COLLECTION SITES
(WATEC INC. 11/79)



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- BOREHOLE PUMP WATER LINE

D.A. = DRAINAGE AREA

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968. EMERY EAST 1968, PHOTO REVISED 1978. MESA BUTTE 1968, PHOTO REVISED 1978. WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES. NAD 83 CONUS ZONE 4302-UTAH, CENTRAL - US FEET VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
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G:\UC982\XREF-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREF-CURRENT\XREF-SECTION.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
2	5/95	TDK	LABELS, EXISTING AND PROPOSED ADDED	6	05/09	JAG	ZZ NORTH ADJ. VS. PERMIT DEF. 2009
3	6/30/05	JAG	ADDED FIRST NORTH I.B.C.	7	08/09	JAG	ZZ NORTH MILLER CANYON LBA UTU-86038
4	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION	8	04/10	JAG	ZZN WEDGE
5	3/08	JAG	INDEX MAP DESIGNATION	9	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT

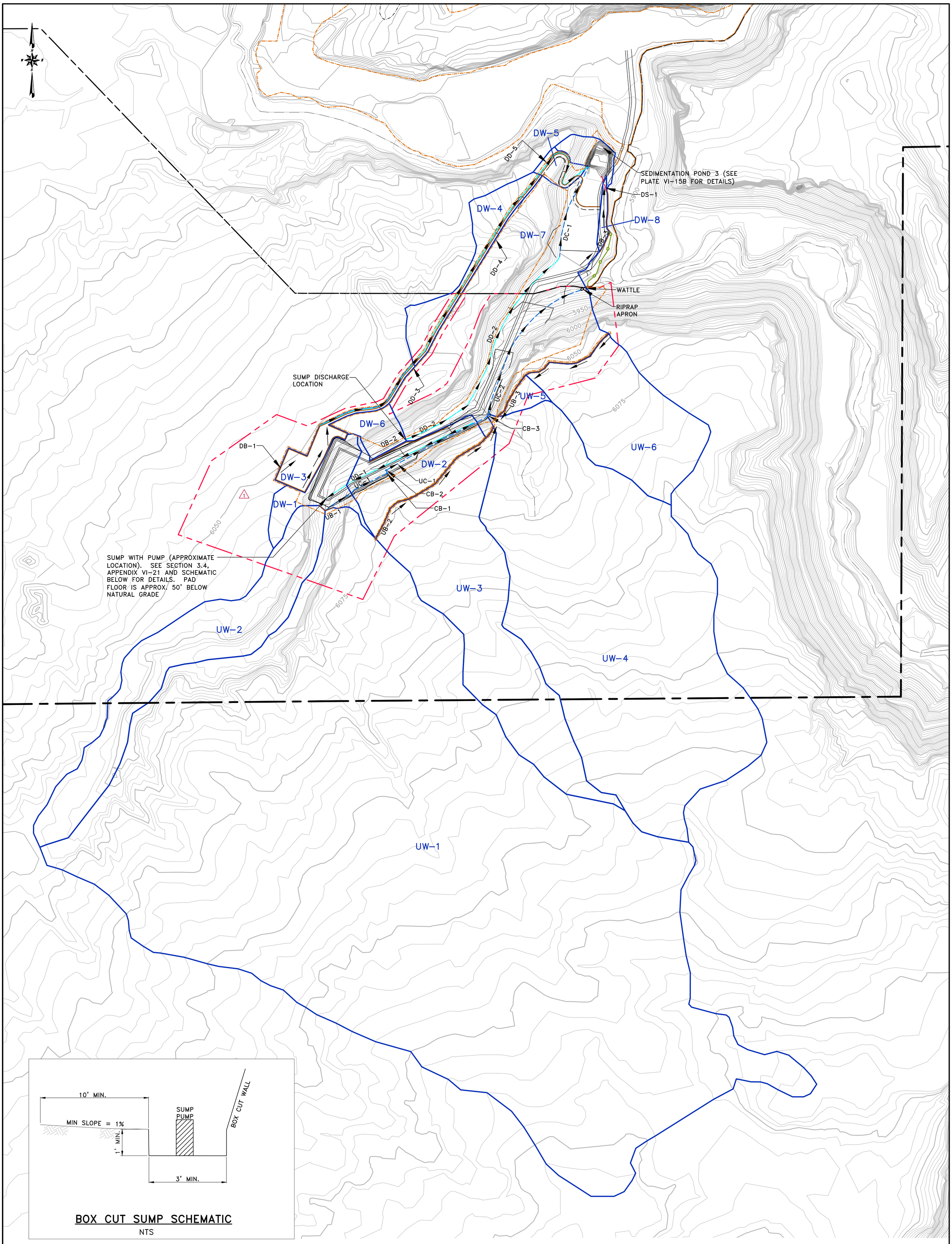
0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 7/90
RE-DRAWN DATE:12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-10
SURFACE DRAINAGE CONTROL INDEX MAP



Drainage Narrative:

Runoff from Undisturbed Watershed 1 (UW-1) and UW-2 is collected in Undisturbed Berm 1 (UB-1) and directed into Undisturbed Culvert 1 (UC-1). From UC-1 runoff is directed northeast through Catch Basin 1 (CB-1) and CB-2 into CB-3. Runoff from UW-3 is directed into CB-3 via UB-2. Runoff from UW-4 flows through an existing channel into CB-3. Runoff from UW-5 and UW-6 is directed into CB-3 via UB-3. From CB-3 undisturbed area runoff continues northeast through UC-2. The outfall for UC-2 is within an existing channel that contributes to Quitchipah Creek.

Runoff from Disturbed Watershed 1 (DW-1) surface flows into a sump located within the Emery 2 portal pad. Runoff from DW-2 is directed southwest into the Emery 2 portal pad via Disturbed Ditch 1 (DD-1). A pump directs runoff from the sump into DD-2. Runoff from DW-6 is directed into DD-2 via Disturbed Berm 2 (DB-2). Runoff from DW-7 is collected by DD-2. All run off from DD-2 is directed northeast into Disturbed Culvert 1 (DC-1) and then into Sedimentation Pond 3.

DB-1 directs runoff from DW-3 northeast into DD-3. Runoff from DW-4 and within DD-3 is directed northeast into DD-4. Runoff from DW-5 and within DD-4 is directed northeast into DD-5. From DD-5 all runoff is directed east into Sedimentation Pond 3.

LEGEND

- PERMIT AREA BOUNDARY
- APPROXIMATE AREA OF HYDROLOGIC EVALUATION
- ADJACENT AREA FOR NON-WATER RESOURCES
- 1 e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- DISTURBED AREA BOUNDARY
- PROPOSED MAJOR CONTOURS
- EXISTING CHANNEL
- PROPOSED DITCH
- PROPOSED CULVERT
- PROPOSED BERM
- WATERSHED BOUNDARY
- PROPOSED SWALE
- PROPOSED SILT FENCE (FOR CONSTRUCTION ONLY)

UC	UNDISTURBED AREA CULVERT
DC	DISTURBED AREA CULVERT
DS	DISTURBED AREA SWALE
CB	CATCH BASIN
→	DIRECTION OF FLOW
UB	UNDISTURBED AREA BERM
DB	DISTURBED AREA BERM
DD	DISTURBED AREA DITCH

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE STATE OF UTAH NOT VALID WITHOUT A SIGNATURE

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S, EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978, MESA BUTTE 1968, PHOTO REVISED 1978, WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES, NAD 83 CONUS, ZONE 4302-UTAH, CENTRAL - US FEET, VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	01/17	JAG	e2 PHASE II ADDITIONAL PERMIT				

0' 200'
SCALE: 1" = 200'
CONTOUR INTERVAL = 40'

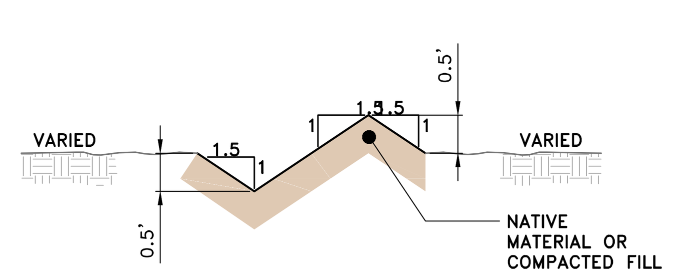
DRAWN BY: SWF | CHECKED BY: RBW | ORIGINAL DATE: 10/16 | RE-DRAWN DATE:
APPROVED BY: JAG | DWG DATA: UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO. ACT015/015

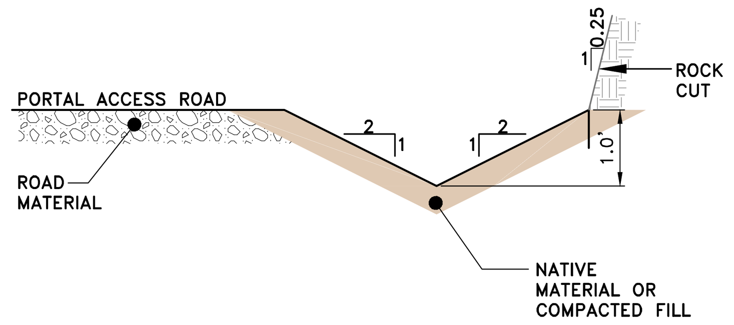
BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VI-10E
SURFACE DRAINAGE CONTROL MAP

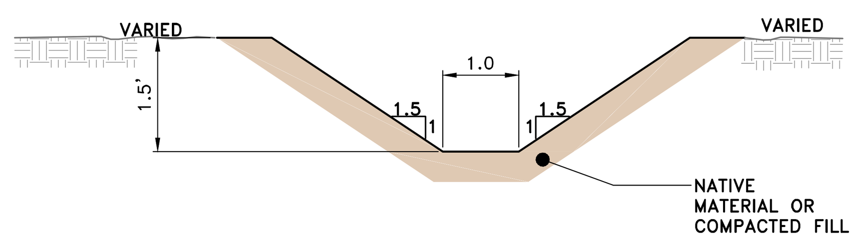
G:\UC1665 - Bronco Utah Operations\05 - Emery Mine permit maps\PHASE II DWGS\PLATE VI-10E-e2P2-JAN 17.dwg, PLATE VI-10E, 1/31/2017 10:59:13 AM



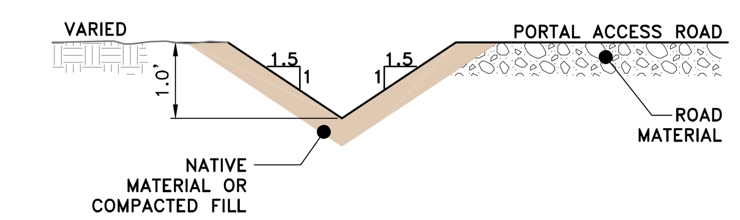
DB-1, 2, AND 3
NTS



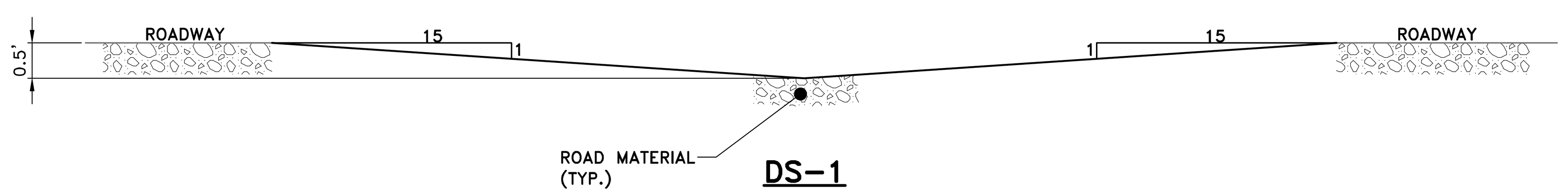
DD-1
NTS



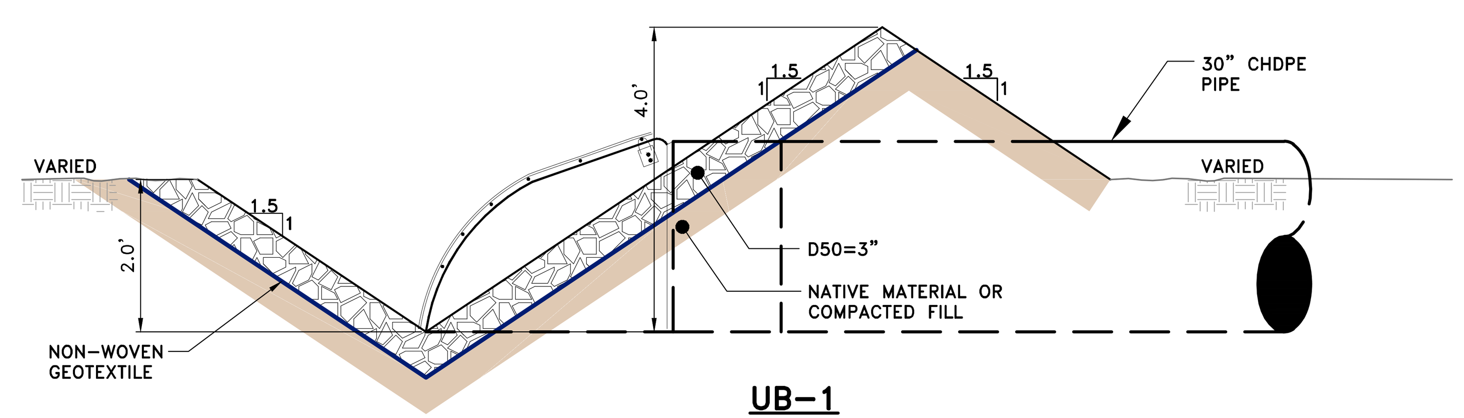
DD-2
NTS



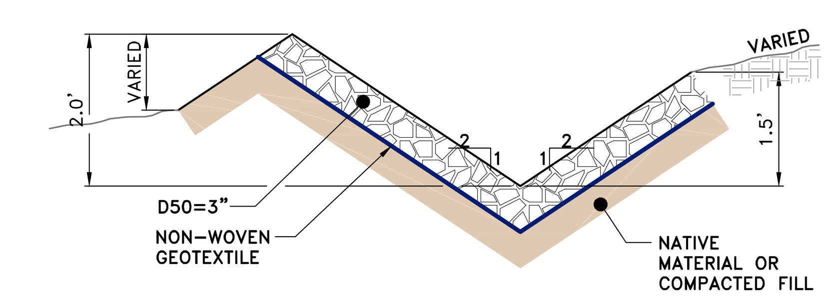
DD-3, 4, AND 5
NTS



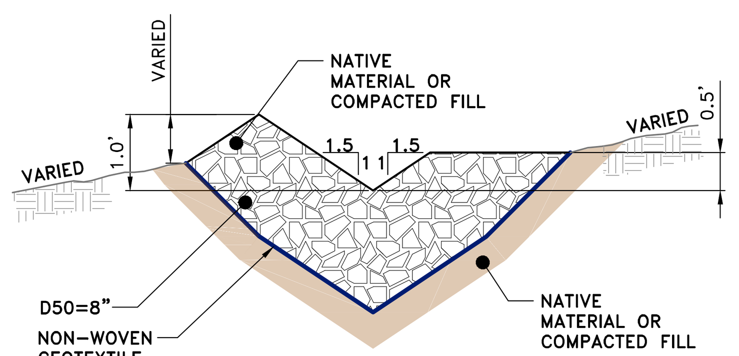
DS-1
NTS



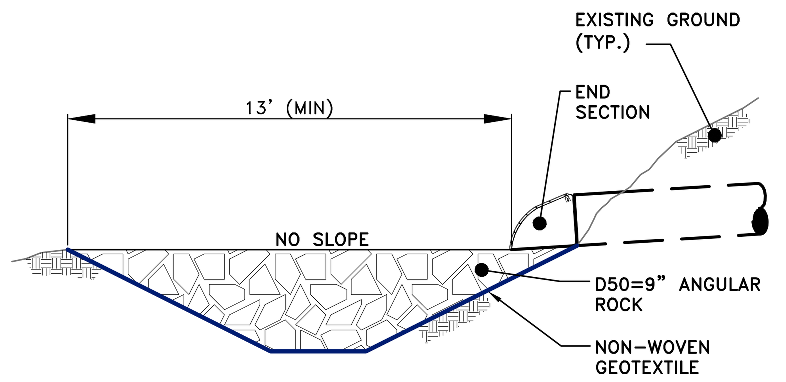
UB-1
NTS



UB-2
NTS



UB-3
NTS



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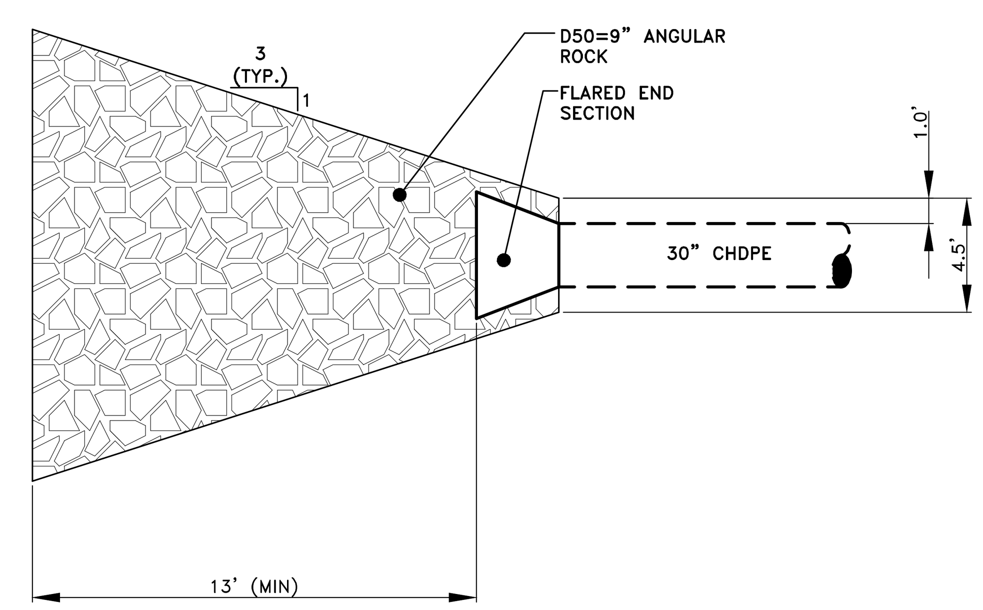
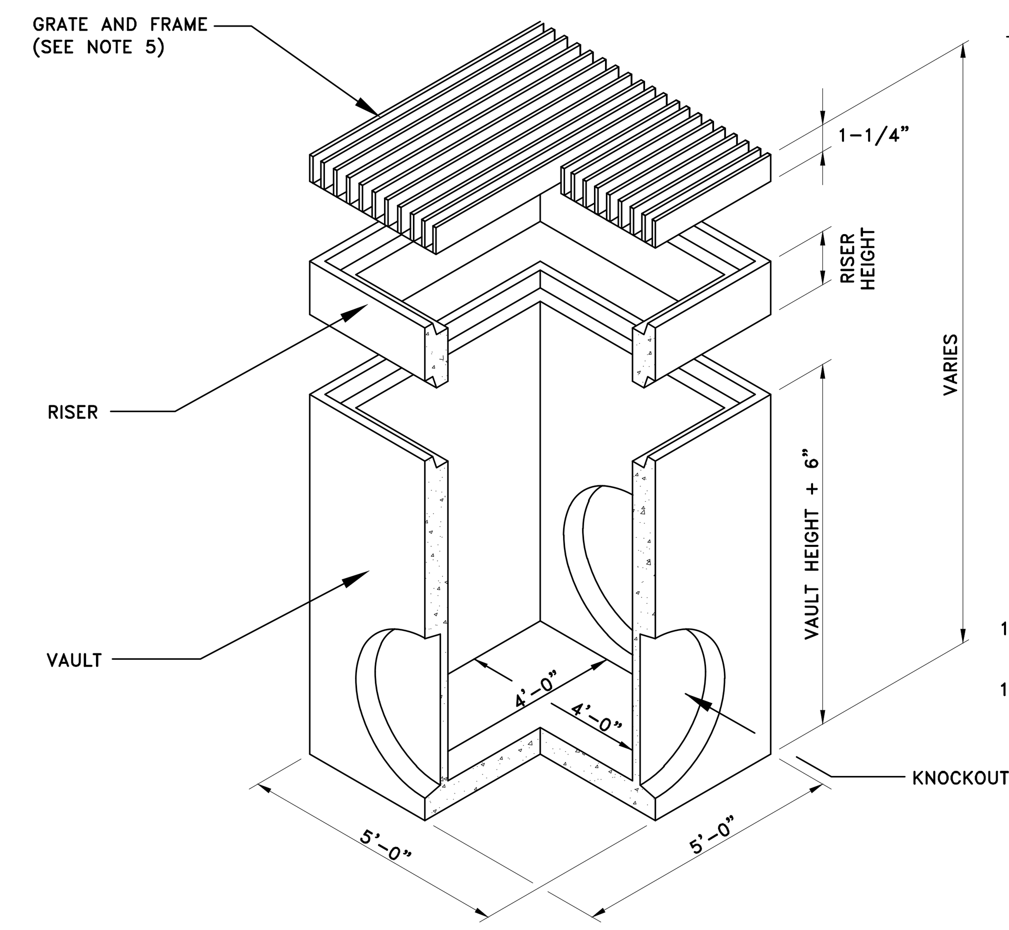


PLAN

RIPRAP APRON DETAIL
NO SCALE

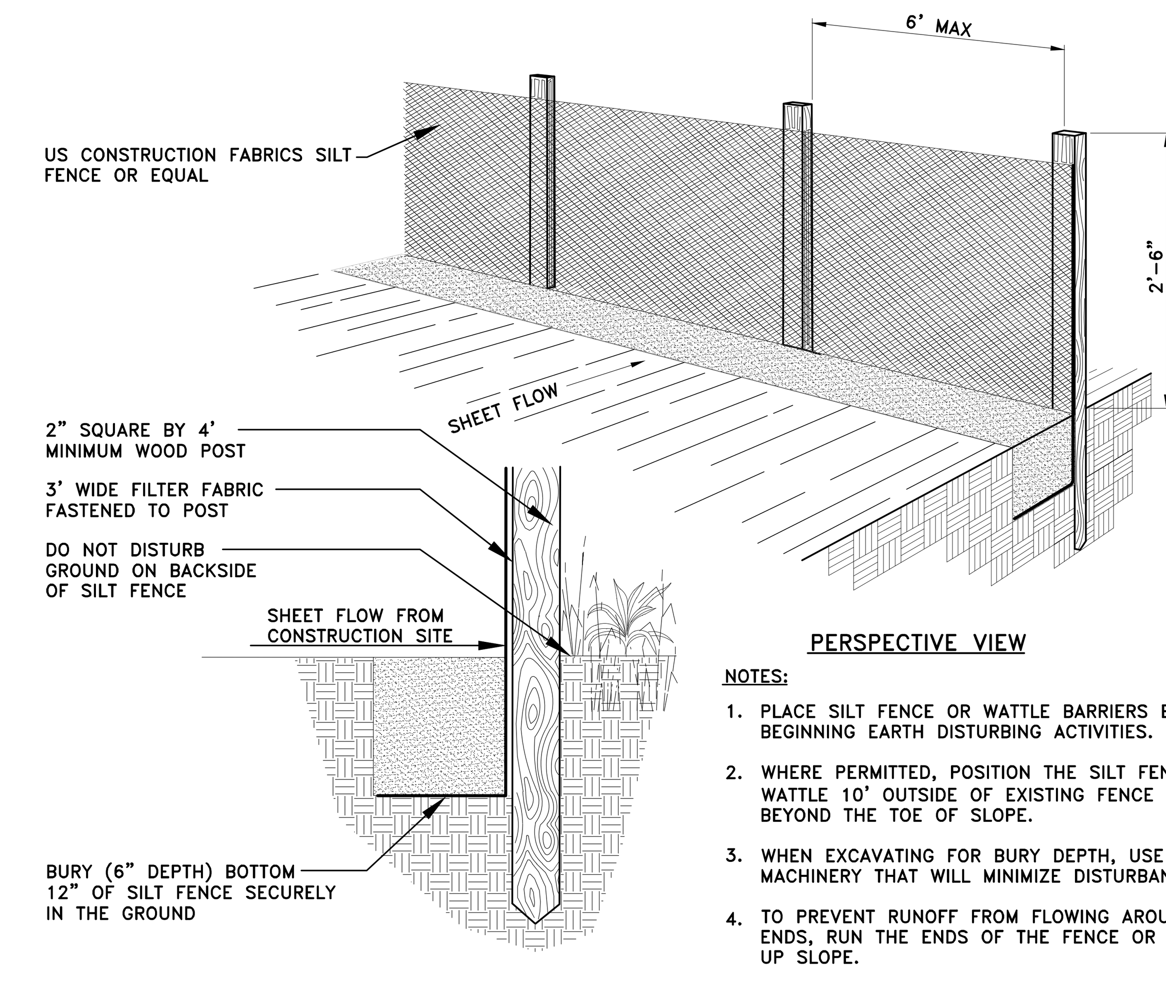


NOTES:

1. BOX MAY BE CAST-IN-PLACE OR PRECAST REINFORCED CONCRETE. IF CAST-IN-PLACE, CONTRACTOR SHALL SUBMITT STEEL REINFORCING DESIGN TO THE ENGINEER AT LEAST 7 BUSINESS DAYS PRIOR TO CASTING. CONTRACTOR SHALL NOT INSTALL CAST-IN-PLACE BOX WITHOUT PRIOR WRITTEN APPROVAL OF ENGINEER.
2. PRECAST SECTIONS SHALL CONFORM TO ASTM C-478, CONSISTING OF OLD CASTLE 4'x4' OR EQUAL.
3. CENTER PIPE IN BOX OPENING, USE APPROVED NON-SHRINK GROUT TO SEAL OPENING AROUND PIPE OR USE APPROVED PIPE MANUFACTURER'S PIPE BOOT.
4. CATCH BASIN, GRATE, AND FRAME TO BE DESIGNED TO SUPPORT ANTICIPATED LOAD.
5. PROVIDE AND INSTALL GRATE WITH MINIMUM SURFACE EXPOSURE OF 9 FT^2. PROVIDE AND INSTALL ASSOCIATED FRAME.
6. FORM OPENINGS DURING CONSTRUCTION OR CORE WALLS AS REQUIRED FOR PIPING.
7. TRIM CULVERTS FLUSH WITH INSIDE BOX WALL.
8. GRATING ELEVATION FOR CATCH BASIN 3 SHALL BE SET TO ALLOW FREE SURFACE DRAINAGE TO THE CATCH BASIN FROM SURROUNDING FINISH ELEVATIONS.
9. OVER-EXCAVATE UNSUITABLE FOUNDATION MATERIAL AS DIRECTED BY THE ENGINEER. REPLACE WITH UNTREATED BASE COURSE AND COMPACT.
10. BACKFILL ANNULAR SPACE BETWEEN CATCH BASIN WALL AND EXCAVATION WITH PEA GRAVEL OR OTHER FREE-FLOWING SOIL.
11. CATCH BASIN 1 AND 2 MAYBE BE INSTALLED WITH GRATE AND FRAME OR CLOSED TOP ABOVE GRADE.

TYPICAL PRE-CAST CATCH BASIN DETAIL
NTS

CATCH BASIN	INLET ELEV.	OUTLET ELEV.	TOP ELEV.	LID TYPE	INSTALLATION
1	5,991.0±	5,991.0±	5,995.0±	OPEN OR CLOSED	SECURED ON GRADE
2	5,990.0±	5,990.0±	5,994.0±	OPEN OR CLOSED	SECURED ON GRADE
3	5,980.0±	5,980.0±	5,984.0±	OPEN	BELOW GRADE

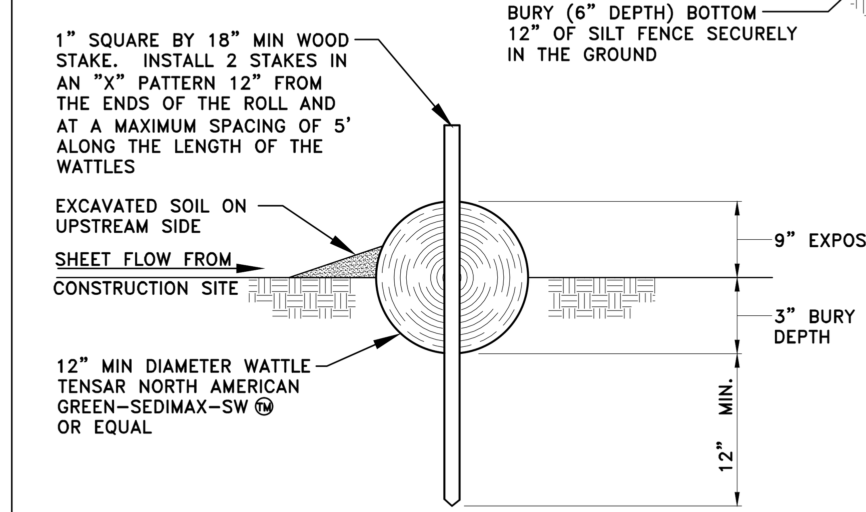


PERSPECTIVE VIEW

SECTION

NOTES:

1. PLACE SILT FENCE OR WATTLE BARRIERS BEFORE BEGINNING EARTH DISTURBING ACTIVITIES.
2. WHERE PERMITTED, POSITION THE SILT FENCE OR WATTLE 10' OUTSIDE OF EXISTING FENCE LINE BEYOND THE TOE OF SLOPE.
3. WHEN EXCAVATING FOR BURY DEPTH, USE MACHINERY THAT WILL MINIMIZE DISTURBANCE.
4. TO PREVENT RUNOFF FROM FLOWING AROUND ENDS, RUN THE ENDS OF THE FENCE OR WATTLE UP SLOPE.
5. MAINTAIN A PROPERLY FUNCTIONING FENCE OR WATTLE BARRIER THROUGHOUT THE DURATION OF THE PROJECT OR UNTIL DISTURBED AREAS HAVE BEEN VEGETATED.
6. WHEN A STORM EVENT DEPOSITS SEDIMENT BEHIND THE FENCE/WATTLES, REMOVE THE SEDIMENT AND PLACE IT IN A STABLE AREA APPROVED BY THE ENGINEER.
7. IN AREAS THAT HAVE BEEN SEEDED AND MULCHED, REMOVE FENCE/WATTLE UNLESS THEY ARE PROTECTING A WETLAND OR WATER BODY.



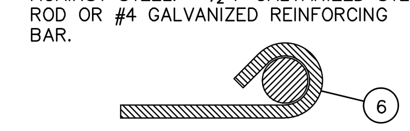
TYPICAL WATTLE SECTION

SWPPP SILT FENCE/WATTLE DETAIL
NTS

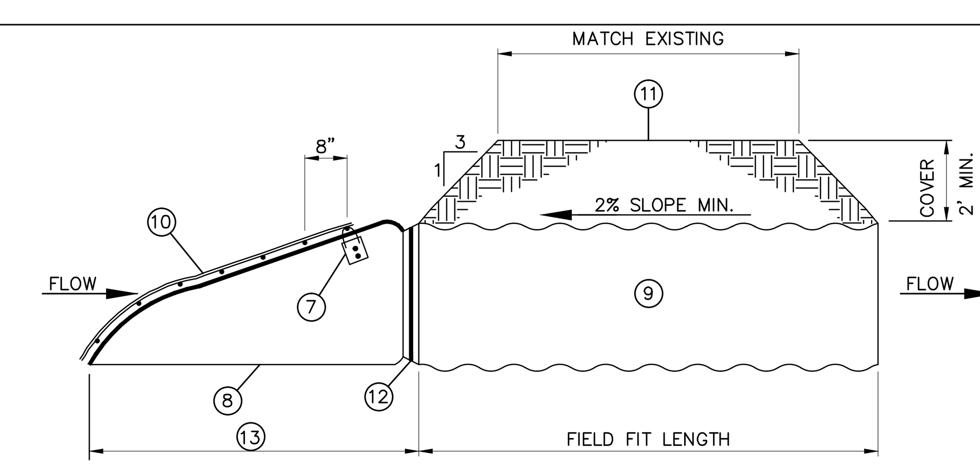
SWPP NOTES:

1. CONTRACTOR TO PROVIDE ALL MEASURES NECESSARY TO CONTROL EROSION AND PROTECT ALL WATER RESOURCES.
2. CONTRACTOR IS RESPONSIBLE FOR PROVIDING A STORM WATER POLLUTION PLAN (SWPPP) AND OBTAINING A U.P.D.E.S PERMIT FROM THE STATE OF UTAH.
3. CONTRACTOR IS RESPONSIBLE FOR OBTAINING A NOTICE OF INTENT (NOI) FROM THE STATE OF UTAH, DIVISION OF WATER QUALITY.
4. CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE SUBMITTAL OF THE NOTICE OF TERMINATION (NOT) TO THE STATE DIVISION OF WATER QUALITY.
5. CONTRACTOR SHALL REMOVE ALL SWPPP ITEMS (AS APPROPRIATE) UPON THE OWNERS REQUEST.
6. INSTALL WATTLE CHECK DAM IN EXISTING STREAM AS NECESSARY TO PREVENT SEDEMENT TRANSPORT. WATTLES SHALL REMAIN IN PLACE UNTIL RE-SEEDING IS COMPLETE.
7. INSTALL SILT FENCE AT DISTURBED AREA BOUNDARY (10 FT. OUTSIDE OF THE TOE OF THE SLOPE) AS SHOWN. SILT FENCE SHALL REMAIN IN PLACE UNTIL RE-SEEDING IS COMPLETE.

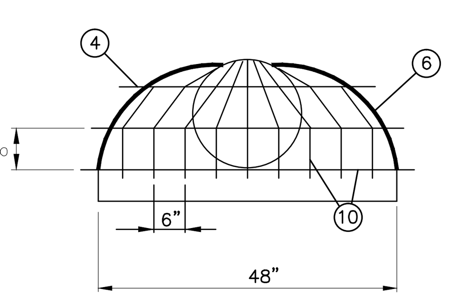
NOTE:
ROLL EDGE OF SIDEWALL SNUGLY AGAINST STEEL. ½"ø GALVANIZED STEEL ROD OR #4 GALVANIZED REINFORCING BAR.



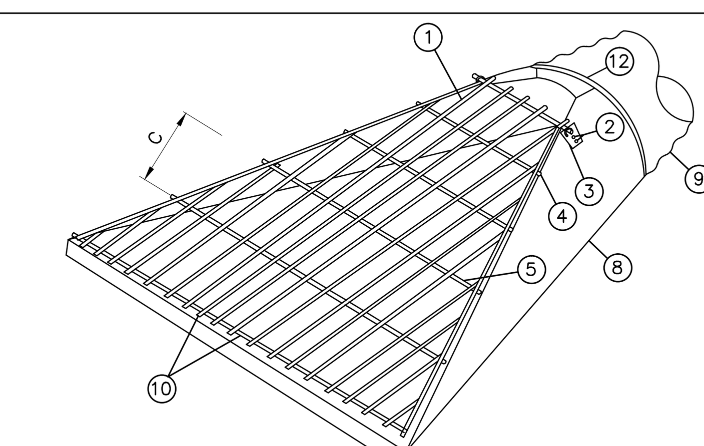
SECTION VIEW OF EDGE OF FLARED CMP ASSEMBLY



FRONT ELEVATION



SIDE ELEVATION



ISOMETRIC ELEVATION

MATERIALS LIST FOR CULVERT/END SECTION

1. #4 REBAR
2. 1/2"ø STAINLESS STEEL BOLT/NUT. (TYP).
3. 10 GAGE STEEL STRAPS (TYP).
4. OVERLAP BARS 4" PAST EDGE OF END SECTION (TYP).
5. WELD EACH CROSS JOINT (TYP).
6. REINFORCED EDGE ON END SECTION (TYP)
7. TRASH RACK HINGE.
8. FLARED STEEL CMP END SECTION, MINIMUM WALL THICKNESS 0.064" OR 16 GAGE
9. CMP, MINIMUM WALL THICKNESS PER TABLE.
10. HINGED TRASH RACK (TYP).
11. ACCESS ROAD OR OTHER COVER.
12. 1/2"ø, PLACE THREADED ROD OVER TOP OF END SECTION.
13. FOR SLOPES STEEPER THAN 4:1 THE LENGTH IS 32"
FOR SLOPES SHALLOWER THAN 6:1 THE LENGTH IS 48"

NOTES:

1. PROVIDE HINGED SAFETY BARS (TRASH RACK) ON INFLOW SIDE OF CULVERT.
2. PROVIDE FLARED END SECTIONS ON BOTH ENDS OF CULVERT.
3. INSTALL CULVERT ASSEMBLY INTO EXISTING FLOW CHANNEL. REPAIR CHANNEL AS REQUIRED TO INSTALL CULVERT ASSEMBLY AS DIRECTED BY OWNER OR ENGINEER.
4. ALL SAFETY BARS (TRASH RACK) AND COMPONENTS SHALL HAVE A CORROSION PROTECTIVE FINISH.

FLARED END SECTION INSTALLATION ON:

- INLET OF UC-1
- OUTLET OF UC-2
- INLET AND OUTLET OF DC-1
- INLET AND OUTLET OF SEDIMENTATION POND 3 SECONDARY SPILLWAY
- TRASH RACKS INSTALLED ON CULVERT INLETS ONLY

CULVERT INLET/OUTLET TRASH RACK DETAIL
NO SCALE

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE NOT VALID WITHOUT A SIGNATURE STATE OF UTAH

EarthFax

BASE MAP:

COORDINATE SYSTEM:

EXTERNAL REFERENCE:

REVISIONS

NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	01/17	JAG	e2 PHASE II ADDITIONAL PERMIT				

AS SHOWN

DRAWN BY: SWF | CHECKED BY: RBW | ORIGINAL DATE: 10/16 | RE-DRAWN DATE:

APPROVED BY: TAJ | DWG DATA: G:\UC1665-BRONCO UTAH OPERATIONS/05-EMERY MINE PERMIT MAPS/PHASE II DWGS/PLATE VI-11B-e2P2.DWG

EMERY MINE
EMERY COUNTY, UTAH

PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
EMERY, UTAH 84522

PLATE VI-11B
EMERY 2 DRAINAGE DETAILS

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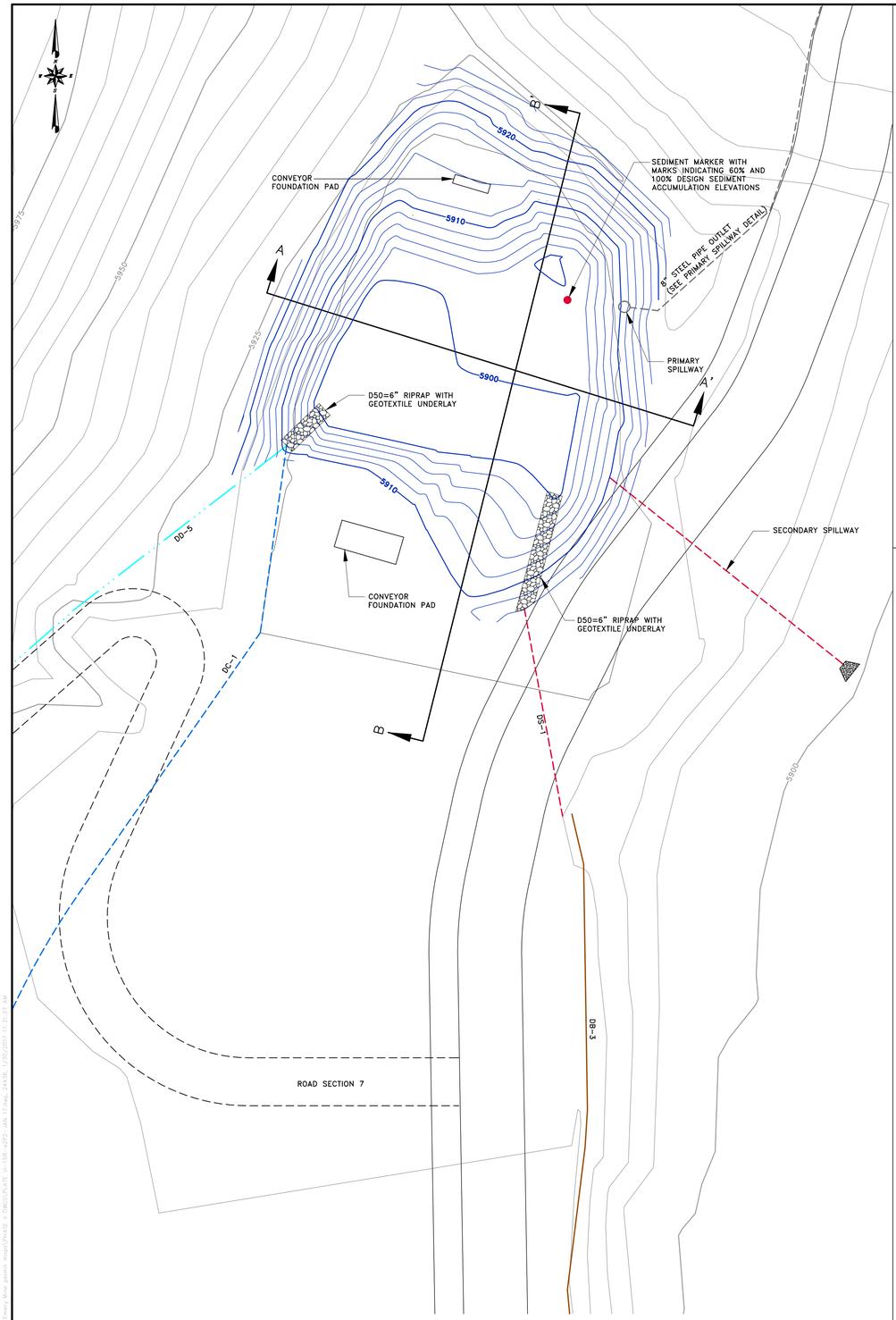
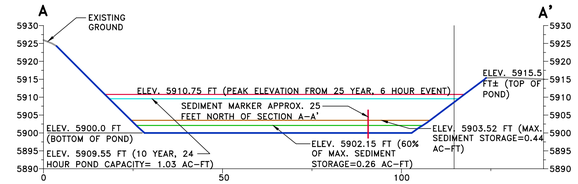


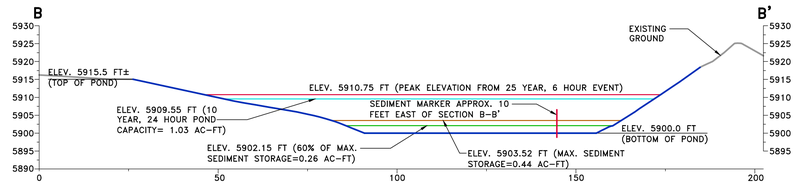
PLAN

SCALE: 1'=20'



CROSS SECTION A-A'

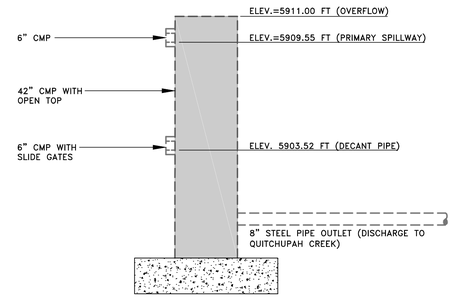
1"=20'-0"



NOTE: INSTALL A T-POST WITH 60% AND 100% DESIGN SEDIMENT ACCUMULATION ELEVATIONS IN POND.

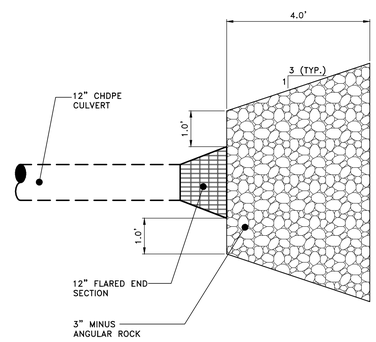
CROSS SECTION B-B'

1"=20'-0"

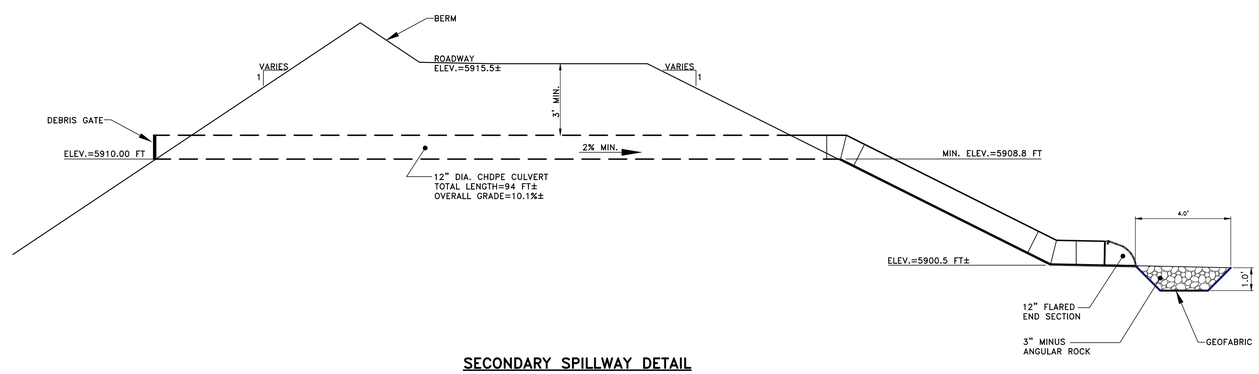


PRIMARY SPILLWAY DETAIL

NTS



ROCK PAD



SECONDARY SPILLWAY DETAIL

NTS

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE NOT VALID WITHOUT A SIGNATURE STATE OF UTAH

EarthFax	BASE MAP:		REVISIONS	NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION	AS SHOWN	DRAWN BY: SWF
	COORDINATE SYSTEM:	EXTERNAL REFERENCE:		1	01/17	JAG	02 PHASE II ADDITIONAL PERMIT						APPROVED BY: TAJ

CHECKED BY: RBW	ORIGINAL DATE: 10/16	EMERY MINE	BRONCO UTAH OPERATIONS, LLC
	RE-DRAWN DATE:	EMERY COUNTY, UTAH	P.O. BOX 527
DWG DATA: G:\UC1665\05\PHASE II DWGS		PERMIT NO. ACT015/015	EMERY, UTAH 84522

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POND 3 MODIFICATIONS

CHAPTER VII

SOILS

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VII-2 TOPSOIL SUBSTITUTION PLAN, PERMANENT UNDERGROUND DEVELOPMENT WASTE DISPOSAL SITE

VII-3 BIOLOGICAL & SOIL RESOURCES AT THE 4TH EAST PORTAL AREA

VII-4 LETTER FROM MT. NEBO CONSULTANTS – APPEND 1.5 AC. AREA TO 4TH EAST PORTAL AREA

VII-5 ORDER 2 SOIL SURVEY OF EMERY 2 MINE PERMIT AREA (LONG RESOURCE CONSULTANTS DEC. 2016)

Inserted 12/2016

CHAPTER VII, APPENDIX VII-5
Order 2 Soil Survey of Emery 2 Mine Permit

Inserted 10/2016

Order 2 Soil Survey

of

Emery 2 Mine Permit Area

Located near Emery, Utah

Prepared for

Bronco Utah Operations, LLC

By

Long Resource Consultants, Inc.

Morgan, Utah

December 9, 2016

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Introduction

Purpose of Soil Survey

The purpose of this report is to summarize the results of an order 2 soils inventory conducted for Bronco Utah Operations LLC (BUOLLC) in an area south and west of the existing Emery Mine in Emery County, Utah. The *Emery 2 Soil Survey* area is adjacent to the existing Emery Mine surface facilities.

BUOLLC is proposing to expand the underground operations of the Emery Mine to the southwest, which will require construction of new roads and surface facilities. This soil survey was prepared so that BUOLLC could: 1) identify suitable sources of topsoil and subsoil; 2) determine topsoil and subsoil salvage depths and quantities; and, 3) develop a post mining reclamation plan using salvaged soil materials. This soil survey covers approximately 189.7 acres.

The proposed Emery 2 permit area is approximately 28.9 with proposed disturbance of 10.3 acres. These areas are shown on Figure 3, *Emery 2 Mine Order 2 Soil Survey Map*.

Project Area

The Emery 2 Soil Survey area is on Walker Flat, approximately 4.7 miles south of the town of Emery, Utah, Figure 1. It is bounded on the west by the Old Woman Plateau, on south by the San Rafael Swell, and on the north and east by Quitchapah Creek. The area is located in portions of the east half of section 32 and the west half of section 33, Township 27 South, Range 6 East, Salt Lake Base Meridian.

The Emery 2 Soil Survey area drains north to Quitchapah Creek which crosses the north portion of the survey area and forms part of the boundary along the northeast part of the area. Quitchapah Creek flows into Ivie Creek about 4 miles south of the soil survey area. Ivie Creek flows into Muddy Creek about 4.5 miles southeast of the soil survey area. Then Muddy Creek flows southeast approximately 50 miles to its confluence with the Fremont River which forms the Dirty Devil River that flows into the Colorado River near Hite Crossing, Utah.

The soil survey area is accessed from the north by following State Route (SR) 10 south 5.5 miles from Emery, Utah to a dirt surface road. It is accessed from the south by following SR 10 Fremont Junction on Interstate 70 (exit 89) north 6.75 miles to the dirt surface road. The distance along the dirt surface road to the southwest corner of the *Emery 2 Soil Survey Area* is approximately 2.4 miles. The survey area can be accessed on foot through the canyon from a parking area south of the Emery mine office.

Native vegetation in the Emery 2 Soil Survey Area consists of shadscale, black greasewood, black sage in the northwest portion; and Utah juniper, pinyon pine, big sagebrush, and black greasewood in the southeast portion.

Climate

An official U.S. Weather Bureau station is located in Emery, Utah. The period of available records for this station is January 1, 1901 through April 30, 2006 (Western Regional Climate Center, May 2016). Average annual precipitation at Emery is 7.33 inches and is evenly distributed throughout the year. The average annual air temperature is 46.0 ^{o}F.

The precipitation pattern is aridic and the soil temperature regime is mesic (USDA-NRCS 2009). Table 1 contains a summary of weather data for Emery, Utah. Summers are warm with cool nights.

Table 1. Summary of weather data for Emery, Utah (1901-1970). Summary of Emery, Utah weather records for 1971 to 2000 have similar values.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Ave Max Temp ^{o}F	37.1	42.0	50.0	59.3	68.8	77.6	83.4	81.3	74.4	63.4	50.1	39.6	60.6
Ave Min Temp ^{o}F	10.9	16.1	22.8	30.0	37.8	45.5	52.2	50.7	42.0	32.3	21.7	13.5	31.3
Ave Total Precip. Inches	0.47	0.50	0.43	0.39	0.60	0.51	0.83	1.12	0.90	0.81	0.33	0.44	7.33
Average Total Snowfall (Inches)	5.3	5.0	2.8	0.6	0.4	0.0	0.1	0.0	0.0	0.6	1.7	4.4	20.9
Average Total Snow Depth (Inches)	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Western Regional Climate Center, May 2016.

The Emery Area soil survey identified the area as transitioning from Typic aridic (Desert 5 to 9 inches) to Ustic aridic (Semi-Desert 10 to 16 inches) precipitation patterns (USDA-NRCS 2016). The NRCS precipitation break is along the southeast rim of the canyon that cuts through the soil survey area. This transition is identified in the field with dominantly shadscale vegetation northwest of the canyon and Utah juniper, pinyon pine, and big sagebrush on the plateau southeast of the canyon. Tamarisk and black greasewood are present in the alluvial areas along Quitchapah Creek.

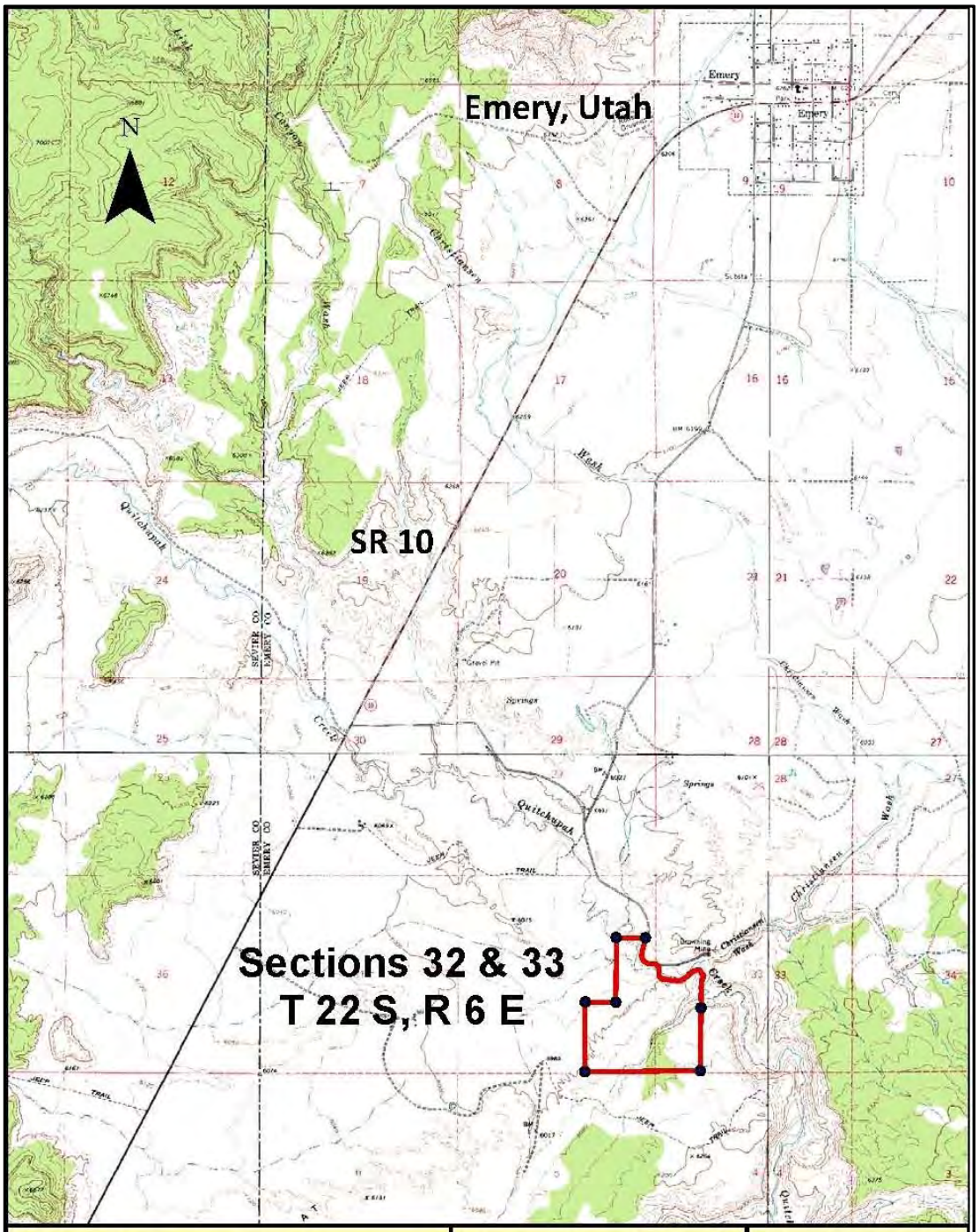


Fig. 1. Location of Emery 2 Soil Survey Area	USGS Quads: Emery East, Utah Emery West, Utah Walker Flat, Utah Messa Butte , Utah	1:48,000

Figure 1. General location of Emery 2 soil survey area.

How This Soil Survey was Conducted

This soil survey was made in accordance with the guidelines for an order 2 soil survey as detailed in the Soil Survey Manual (USDA 1993). Soils were classified using the *Keys to Soil Taxonomy*, Twelfth Edition (USDA 2014). The dominant soil sub-groups identified in the Emery 2 Soil Survey area are Lithic Ustic Torriorthents, shallow Ustic Torriorthents, Lithic Torriorthents, and Typic Torriorthents. Tables of the taxonomic classification and field descriptions of the soil profiles are contained in appendix B.

Field Evaluation of Soils

Soil pedon descriptions were completed for representative hand pits dug in September, October, and November 2009. Two soil profiles were examined and described in June 2016. Pits in very deep soils were dug or augured to a minimum 150 cm (60 inches), unless bedrock was encountered. Sandstone or shale bedrock was encountered in most of the pits between 25 to 100 cm (10 and 40 inches). Shallow and moderately deep pits were hand dug. A hand soil auger was used to examine soils deeper than 100 cm (60 inches) Soil pedon log sheets were completed for each soil pit using the methods detailed in the *Field Book for Describing and Sampling Soils*, version 3.0 (Schoeneberger et. al., 2012). Soil colors were determined using Munsell Soil Color Charts (Munsell 2000 and 2013). Soil pits were described by Robert Long, Certified Professional Soil Scientist. Field description sheets are in Appendix B. Taxonomic classification of soil profiles was completed by using *Keys to Soil Taxonomy*, Twelfth Edition (USDA 2014). Soils were correlated to established soil series used in Emery County, Utah (USDA 2016a).

Aerial photographs (NAIP 2006 and 2014, 1 meter) and U.S.G.S. topographic maps were used to delineate soil map unit boundaries based on slope gradient, geomorphic features, and vegetation. The aerial photography was taken in 2014 (Utah AGRC 2016). Samples of soil horizons were collected in gallon size plastic bags and in micromonolith boxes. The box samples were used for further determination of soil profile characteristics. Soil lines and sample locations were delineated on the aerial photography using ARC-Map software, version 10.2, in NAD 1983.

Analysis of Soil Samples

Soil samples (32) collected during September 29-30, 2009 from eight soil profiles were shipped to Intermountain Labs in Sheridan, Wyoming for analysis on September 24, 2009. Each of the soil samples were analyzed for the topsoil suitability parameters outlined by the Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM, 2008), Table 2.

Soil samples (19) collected on October 8, 2009 from five soil profiles were shipped to Intermountain Labs in Sheridan, Wyoming for analysis on 20, 2009. Each of the soil samples were analyzed for the topsoil suitability parameters outlined by the Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM 2008), Table 2.

Soil samples (6) collected November12, 2009 from one soil profile were shipped to Intermountain Labs in Sheridan, Wyoming for analysis on December 3, 2006. Each of the soil samples were analyzed for the topsoil suitability parameters outlined by the Utah Division of Oil Gas and Mining's (DOGM) *Guidelines for Management of Topsoil and Overburden* (DOGM 2008), Table 2.

Laboratory data reports of the soil sample analyses are in Appendix C.

Table 2. Soil analysis parameters for topsoil and overburden (Utah DOGM, 2008).

Topsoil Suitability Parameters	
Paste pH	Available Phosphorus
Saturation percent	Particle Size Analysis (% very fine sand, sand, silt, and clay)
Electrical Conductivity (ECe)	Organic Matter Percent
Soluble Na, K, Mg, and Ca	CaCo3 Percent
Sodium Adsorption Ratio	Extractable Potassium
Additional Analyses for Topsoil and Overburden	
Soluble Selenium	Soluble Boron
Alkalinity	

Geology and Setting

Ferron sandstone (Kmf), Blue Gate shale (Kmb), Quaternary stream and wash alluvium (Qa), and Quaternary mixed wind-blown sand and alluvium are the primary sources of parent material in the soil survey area. Ferron sandstone and Blue Gate shale are members of the Upper Cretaceous Mancos formation (Utah Geological Survey 2004).

Ferron sandstone (Kmf) is a member of the Upper Cretaceous Mancos formation. It is alternating yellow-gray, light-brown, and white sandstone, sandy gray shale, gray and carbonaceous shale, and coal; mostly fine to medium grained sandstone, commonly calcareous (Utah Geological Survey 2004). Shallow and moderately deep soils have developed in the Ferron sandstone area.

Blue Gate (Kmb) shale is a member of the Upper Cretaceous Mancos formation that occurs above the Ferron sandstone. It is a "pale blue-gray marine shale, nodular and irregularly bedded mudstone and siltstone…" that "weathers into low rolling hills and badlands (Utah Geological Survey, 2004). Shallow sodic saline soils have developed in Blue Gate shale in the southwest portion of the soil survey area. Blue Gate shale is also present on the upper slopes in the canyon area.

Quaternary alluvium (Qa) consists of unconsolidated clay, silt, sand, and gravel deposits along more active streams and washes of Holocene age (Utah Geological Survey, 2004). Very deep soils have developed in the Quaternary alluvium along Quitchapah Creek.

Quaternary mixed wind-blown sand and alluvium (shown as Qed on geology map, but Qea is closest symbol in geology report) "consists of sand and silt of eolian origin interspersed with silt, sand, and gravel of fluvial origin; generally dominated by eolian deposits (Utah Geological Survey, 2004)". Moderately deep coarse-loamy soils have developed in these wind-blown deposits.

NRCS Soil Survey

The Emery 2 soil survey is within the Emery Area, Utah, Parts of Emery, Carbon, and Sevier Counties soil survey published by the Natural Resource Conservation (USDA – NRCS June 2016b), Figure 2. Table 3 lists the NRCS soil map units that occur within the Emery 2 soil survey area.

The only significant differences between soils mapped by the NRCS and those identified by the Emery 2 soil survey were:

- Soils on the plateau east of the canyon are dominated by coarse-loamy textures, while NRCS map unit 103 is dominated by fine-loamy soils. The other soil characteristics in the survey area are similar.
- The very deep soils in the bottom of the canyon and along Quitchapah Creek are coarse-loamy and have horizons with SAR values ranging from less than 1.0 to 48.7.

Table 3. NRCS soil map units occurring within the Emery 2 soil survey area.

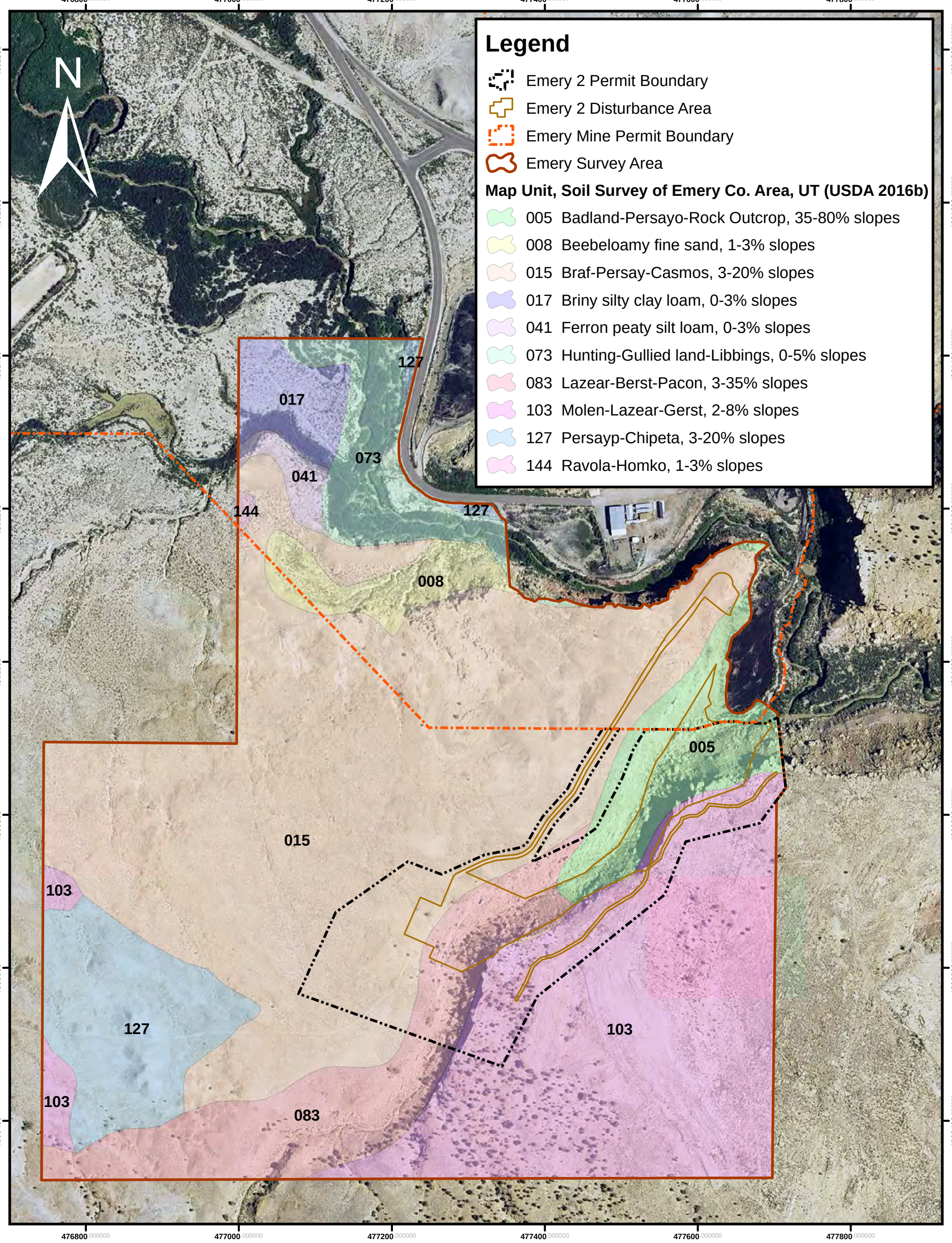
NRCS Map Unit	Map Unit Name	Acres Within Emery 2 Soil Survey Area
005	Badland-Persayo-Rock Outcrop Complex, 35 to 80 percent slopes	10.3
008	Beebe loamy fine sand, 1 to 3 percent slopes	4.9
015	Braf -Persayo-Casmos complex, 3 to 20 percent slopes	82.8
017	Briny silty clay loam, 0 to 3 percent slopes	4.3
041	Ferron peaty silt loam, 0 to 3 percent slopes	1.6
073	Hunting-Gullied land-Libbings complex, 0 to 5 percent slopes	8.3
083	Lazear-Gerst-Pacon complex, 3 to 35 percent slopes	18.0
103	Molen-Lazear-Gerst complex, 2 to 8 percent slopes	45.4
127	Persayo-Chipeta association, 3 to 20 percent	13.9
144	Ravola-Homko complex, 1 to 3 percent slopes	0.2
	Total	189.7

Source: Soil Survey of the Emery Area, Parts of Emery, Carbon, and Sevier Counties (USDA 2016b).

Prime Farmland

The Natural Resource Conservation Service (NRCS) conducted an evaluation of potential Prime Farmlands within the Emery 2 soil survey area and determined that the it “contains no Prime or Unique farmlands of farmlands of Statewide importance (Sasser 2010)." The NRCS letter detailing this assessment is in Appendix A.

NRCS soil map unit 144 is designated as *Prime Farmland if Irrigated*. This soil map unit is of very limited extent in the Emery 2 soil survey area and no evidence of irrigation is present in the survey area. The surface area of 144 soil map unit is 0.2 acres within the Emery 2 soil survey area and it is not located within the proposed permit area.



Bronco UTAH OPERATIONS, LLC

Figure 2.
NRCS - Emery County Area Soil Survey

Rev. Dec 9, 2016
June 30, 2016 Base map NAIP 2014 UTM NAD 83 1 inch = 400 feet

Prepared By:
Long Resource Consultants, Inc.
Morgan, Utah

0 200 400 600 800 Feet

Soil Survey Map Units

Soil Survey Legend

Native soils in the Emery 2 Soil Survey area were identified with nine map units based on the taxonomic classification (USDA – NRCS, 2010) of the soils and slope. One additional soil map units is included to identify a previously disturbed area. The composition of these map units is described in Table 4. Detailed descriptions of each soil map unit are included in this section. Topsoil and subsoil suitability classifications of *Good*, *Fair*, *Poor*, and *Unacceptable* are based on *Guidelines for Management of Topsoil and Overburden* (Utah DOGM 2008).

Soil map unit delineations are shown in Figure 3. Map unit boundaries are based on:

- Field traverses and transects within the soil survey area;
- Interpretation of GIS slope maps, and;
- Interpretation of vegetation patterns on aerial photography using GIS software.

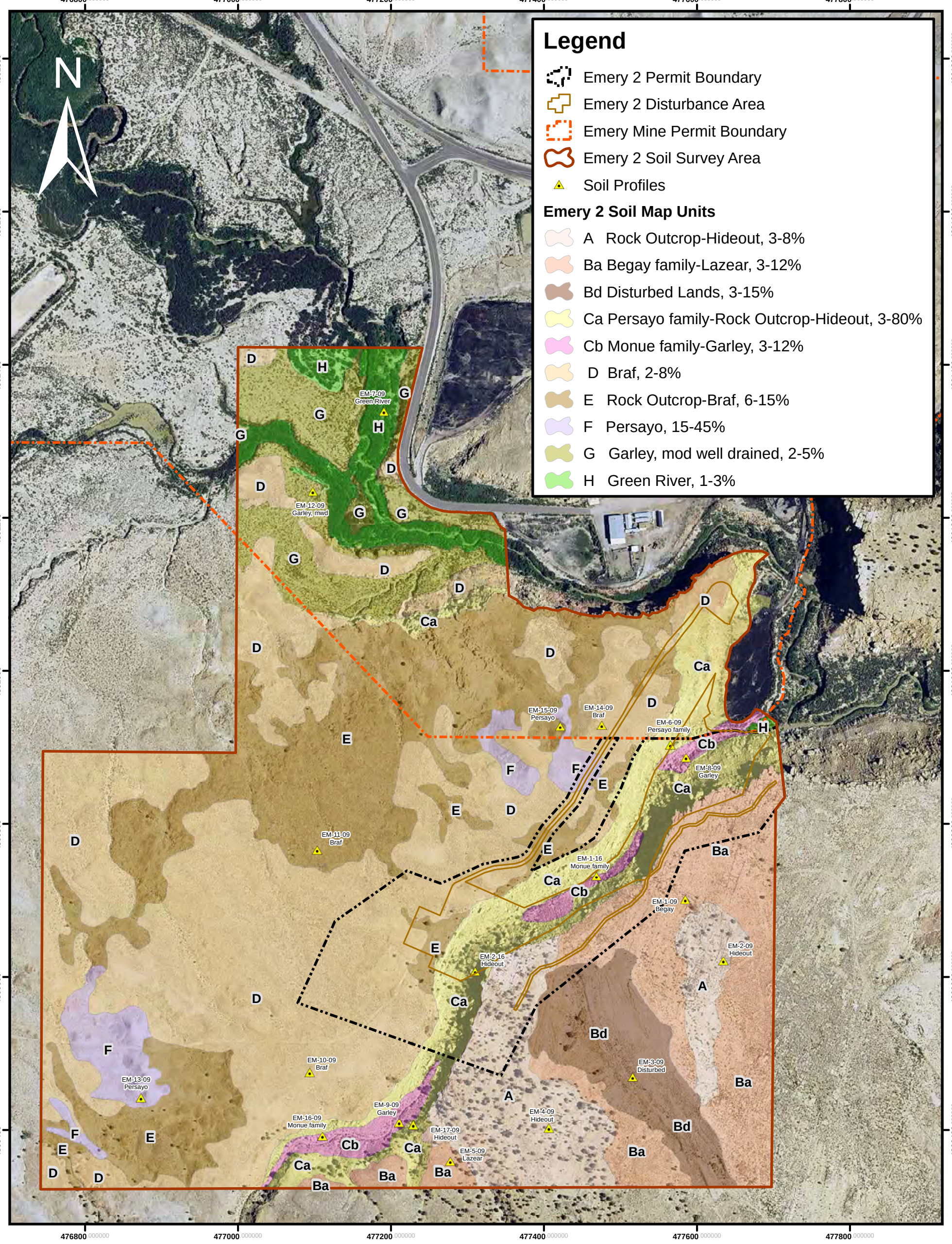
In some cases, site specific evaluation of the soils and vegetation will be necessary for delineation of map unit boundaries in the field.

Table 4. Soil map unit composition for the Emery 2 Soil Survey area.

Map Unit	Percent	Soil Series or Taxonomic Family	Modal Pedon
A	**Rock Outcrop – Hideout complex, 3 to 8 percent slopes**		
	50	Sandstone Outcrop	
	40	Hideout	EM-4-09
	10	Begay family	
Ba	**Begay family – Lazear complex, 3 to 12 percent slopes**		
	50	Begay family	EM-1-09
	35	Lazear	EM-5-09
	10	Hideout	
	5	Sandstone Outcrop	
Bd	**Disturbed Lands, 3 to 15 percent slopes**		
	85	Previously disturbed soils	EM-3-09
	10	Begay family	
	5	Hideout	

Table 4. Soil map unit composition for the Emery 2 Soil Survey area.

Map Unit	Percent	Soil Series or Taxonomic Family	Modal Pedon
Ca	**Persayo family – Rock Outcrop - Hideout complex, 3 to 80 percent slopes**		
	50	Persayo family	EM-6-09
	20	Sandstone Outcrop	
	15	Hideout	EM-17-09
	8	Garley	EM-8-09
	7	Monue family	
Cb	**Monue Family – Garley complex, 3 to 12 percent slopes**		
	60	Monue Family	EM-16-09
	30	Garley	EM-9-09
	10	Begay family	
D	**Braf sandy loam, 2 to 8 percent slopes**		
	85	Braf	EM-10-09
	10	Sandstone Outcrop	
	5	Persayo family	
E	**Rock Outcrop –Braf complex, 6 to 15 percent slopes**		
	50	Sandstone Outcrop	
	45	Braf	EM-11-09
	5	Persayo family	
F	**Persayo very gravelly clay loam, 15 to 45 percent slopes**		
	85	Persayo	EM-13-09
	10	Braf	
	5	Sandstone Outcrop	
G	**Garley loam, moderately well drained, 2 to 5 percent slopes**		
	85	Garley, moderately well drained	EM-12-09
	10	Green river	
	5	Braf	
H	**Green River sandy clay loam, 1 to 3 percent slopes**		
	90	Green River	EM-7-09
	10	Garley, moderately well drained	



Bronco UTAH OPERATIONS, LLC

Figure 3. Emery 2 Mine Order 2 Soil Survey Map

Rev. Dec 8, 2016
June 30, 2016 Base map NAIP 2014 UTM NAD 83 1 inch = 400 feet

Prepared By:
Long Resource Consultants, Inc.
Morgan, Utah

0 200 400 600 800 Feet

A Rock Outcrop — Hideout complex, 3 to 8 percent slopes

General

Map unit A is characterized by Ferron sandstone outcrops and shallow soils on a plateau in the southeast portion of the soil survey area. Inclusions of moderately deep Begay family soils also occur in this soil map unit. Component distribution is based on a 10 point transect (Appendix B). Hideout soils are dominated by Utah juniper and pinyon pine. Big sagebrush and black greasewood are on the Begay family soils. Grasses are of very limited extent in this map unit. Table 5 lists the taxonomic classification of the soil components in map unit A.

Table 5. Taxonomic classification of soil components in map unit A.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50		Sandstone outcrop
40	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Hideout soils in map unit A is EM-4-09, The surface 4 cm (2 inches) is very pale brown loamy sand. The lower surface is pale brown sandy loam to 20 cm (8 inches). Ferron sandstone is at 20 cm (8 inches).

Limiting Features

The large amount of Ferron sandstone outcrop and shallow depth to sandstone will be limiting to excavation and topsoil salvage in this map unit.

Available water capacity is *Fair* (DOGM 2008) in these coarse textured soils.

Reclamation of this map unit will be limited by the amount of topsoil salvage from shallow soils.

Ba Begay family — Lazear complex, 3 to 12 percent slopes

General

Map unit Ba is dominated by moderately deep, Begay family, and shallow, Lazear, soils over Ferron sandstone. Minor inclusions of shallow Hideout soils also occur in this map unit. Wyoming big sagebrush, black greasewood, and shadscale dominate the Begay family soils. Shadscale is the dominant vegetation on Lazear soils. Grasses are of very limited extent in this map unit. Table 6 lists the taxonomic classification of the soil components in map unit Ba.

Table 6. Taxonomic classification of soil components in map unit Ba.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic
35	Lazear	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
5		Sandstone outcrop

Typifying Soil Pedon Descriptions

The typifying pedon for Begay family soils in map unit Ba is EM-1-09. The surface is pale yellow sandy loam to 8 cm (3 inches). The sub-surface is light yellowish brown sandy loam to 50 cm (20 inches). The subsoil is pale yellow channery sandy loam to 80 cm (32 inches). Ferron sandstone is at 80 cm (32 inches).

The typifying pedon for Lazear soils in map unit Ba is EM-5-09. The surface is pale brown channery sandy loam to 7 cm (3 inches). The sub-surface is light yellowish brown channery sandy clay loam to 20 cm (8 inches). Ferron sandstone is at 20 cm (8 inches).

Hideout soils are similar to Lazear soils, but textures are coarse-loamy (5 to 18 percent clay).

Limiting Features

The moderately deep (50 to 100 cm) and shallow (less than 50 cm) depths to Ferron sandstone will be limiting to excavations.

Available water capacity is *Fair* (DOGM 2008) in these coarse textured soils.

Calcium carbonates in the Lazear subsoil will be limiting (*Fair*) to reclamation success. Topsoil salvage will be limited by the depth to Ferron sandstone.

Reclamation potential in this map unit ranges from fair to good depending on depth to sandstone.

Bd Disturbed Lands, 3 to 15 percent slopes

General

Map unit Bd is characterized by soils which have been previously disturbed for construction of roads and drill locations. The specific date and origin of this disturbance could not be determined. This disturbance did not appear to be recent when field work was conducted in the fall of 2009. Shadscale and black greasewood had become well established in the area by the time the soil survey field work was conducted in 2009.

Disturbed soils are shallow to hard shale and sandstone with characteristics similar to Lazear soils. Minor inclusions of Begay family and Hideout soils are present in non- disturbed areas. Black greasewood and shadscale are the dominant vegetation on the disturbed soils. Big sagebrush and black greasewood characterize the Begay family soils, while the small areas of Hideout soils are dominated by pinyon pine and Utah juniper. Table 7 lists the taxonomic classification of the soil components in map unit Bd.

Table 7. Taxonomic classification of soil components in map unit Bd.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85		Previously disturbed Lands
10	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic
5	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for disturbed soils in map unit Bd is EM-3-09. The surface is very pale brown channery loam to 18 cm (7 inches). The subsoil is pale brown channery sandy clay loam to 46 cm (18 inches). Hard shale is at 46 cm (18 inches).

Limiting Features

The shallow depth to hard shale and sandstone will be limiting to excavations in this map unit.

Topsoil salvage in this map unit will be limited by the previous soil disturbance.

Available water capacity is *Fair* (DOGM 2008) in these coarse textured soils.

Reclamation potential in this map unit is fair due to the previous disturbance.

Ca Persayo family - Rock Outcrop - Hideout complex, 3 to 80 percent slopes

General

Map unit Ca is located in the narrow canyon that separates the soil survey area from south to northeast. Soils are shallow to either Mancos shale (Persayo family) or Ferron sandstone (Hideout). There is a significant amount of sandstone outcrop with large car to house sized boulders on the steep canyon sideslopes and bottom. Alluvium in the bottom of the canyon is coarse-loamy with *Unacceptable* saline and sodic conditions in localized areas. Shadscale and Gardner's saltbush dominate the Persayo family soils. Utah juniper and pinyon pine occur on Hideout soils. Black greasewood and shadscale are the dominant vegetation on the Garley and Monue Family soils. Table 8 lists the taxonomic classification of the soil components in map unit Ca.

Table 8. Taxonomic classification of soil components in map unit Ca.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50	Persayo family	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow
20		Sandstone Outcrop
15	Hideout	Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic
8	Garley	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic
7	Monue Family	Typic Haplocambids, coarse-loamy, mixed, superactive, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Persayo family soils in map unit Ca is EM-6-09. The surface is very pale brown channery loamy sand to 7 cm (3 inches). The subsoil is very pale brown channery sandy loam to 18 cm (7 inches). Decomposing shale with a few fine and very fine roots is from 18 to 34 cm (7 to 13 inches). Soft shale that restricts plant root development is at 38 cm (13

inches). Persayo family soils have less than 18 percent clay in the control section (Persayo soil series has 18 to 35 percent clay). These soils are on very steep slopes ranging from 45 to 80 percent.

The typifying soil pedon for Hideout soils in map unit Ca is EM-17-09. The surface is pale brown very channery loamy sand to 4 cm (2 inches). The subsoil is brown channery sandy loam to 19 cm (8 inches). These soils are on structural benches on the canyon sideslopes.

Limiting Features

Persayo family and Hideout soils in this map unit are limited by the shallow depth to shale and sandstone, respectively.

Available water capacity is *Fair* to *Poor* (DOGM 2008) in these coarse textured soils.

The large (car to house size) sandstone boulders will make topsoil salvage difficult in some areas.

The very steep canyon sideslopes will make topsoil salvage difficult.

Garley soils have *Poor* to *Unacceptable* (DOGM 2008) saline and sodic conditions.

Monue family soils have *Poor* (DOGM 2008) saline and sodic conditions in the bottom of the soil profile.

Reclamation potential in this map unit ranges from fair to poor depending on slope, depth, soil chemistry, and other localized conditions.

Cb Monue Family — Garley complex, 3 to 12 percent slopes

General

Map unit Cb is characterized by very deep coarse-loamy soils in the upper portion of the canyon bottom. Minor inclusions of moderately deep Begay family soils occur on the footslopes of the adjacent canyon sideslopes. Black greasewood is the dominant vegetation on the Monue Family and Garley soils. Small clumps of Indian ricegrass occur on the Monue Family soils. Shadscale is found on the Garley soils. Utah juniper and pinyon pine grow on the Hideout soils. Table 9 lists the taxonomic classification of the soil components in map unit Cb.

Table 9. Taxonomic classification of soil components in map unit Cb.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
60	Monue Family	Typic Haplocambids, coarse-loamy, mixed, superactive, mesic
30	Garley	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic
10	Begay family	Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

Map unit Cb is the best source of topsoil and subsoil in the Emery 2 soil survey area. However, this map unit comprises less than 5 percent of the Emery 2 permit area.

Soil profiles in map unit Cb were evaluated from 43 to 67 inches. Monue family soils are a good to fair source of topsoil, but limited by *Poor* conductivity and SAR in the lower subsoil. Garley soils are limited by *Poor* salinity (conductivity) levels and *Unacceptable* sodium (SAR) levels. *Unacceptable* and *Poor* materials will need to be salvaged and stockpiled separately from the *Good* and *Fair* materials. This segregation of materials will require monitoring by a Certified Professional Soil Scientist. Additional laboratory analysis of soil samples may be required for site specific determination of material quality.

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Monue Family soils in map unit Cb is EM-16-09. The surface is light yellowish brown gravelly sandy loam to 8 cm (3 inches). The subsurface is pale yellow sandy loam to 46 cm (18 inches). The upper subsoil is light yellowish brown sandy loam to 80 cm (32 inches). The lower subsoil is light yellowish brown sandy loam with *Fair* to *Poor* salinity and SAR levels (DOGM 2008) to 170 cm (67 inches).

The typifying soil pedon for Garley soils in map unit Cb is EM-8-09. The surface is pale brown loamy sand to 9 cm (3 inches). The lower surface is light yellowish brown loamy sand to 46 cm (18 inches). The upper subsoil is light yellowish brown sandy loam to 60 cm (24 inches). The lower subsoil consists of layers light yellowish brown very gravelly sandy loam and very bouldery sandy loam to 150 cm (59 inches), SAR levels are *Unacceptable* in all soil below 9 cm (3 inches). Salinity is *Poor* (DOGM 2008) in all 46 to 88 cm (18 to 35 inches).

Limiting Features

Poor to *Unacceptable* salinity and SAR levels (DOGM 2008) will be limiting to topsoil and subsoil salvage. Soil salinity and pH should be monitored during topsoil and subsoil salvage in order to minimize the amount of soils with *Poor* salinity and *Unacceptable* SAR that are salvaged. Soil samples should be collected from disturbance areas and analyzed for pH, salinity and SAR.

Available water capacity is *Fair* to *Poor* in these coarse textured soils (DOGM 2008).

Reclamation potential ranges from fair to good depending on the amount of non-saline and non-sodic topsoil that is salvaged.

D Braf sandy loam, 2 to 8 percent slopes

General

Map unit D is characterized by shallow coarse-loamy soils. Ferron sandstone outcrop inclusions occur on convex summits and shoulders. Minor inclusions of shallow Persayo family soils occur on hillslopes. Shadscale and black sage with Indian ricegrass are the dominant vegetation on Braf soils. Table 10 lists the taxonomic classification of the soil components in map unit D.

Table 10. Taxonomic classification of soil components in map unit D.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic
10		Sandstone outcrop
5	Persayo family	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Braf soils in map unit D is EM-10-09. The surface is pale brown loamy sand to 7 cm (3 inches). The upper subsoil is light yellowish brown sandy loam to 27 cm (11 inches). The lower subsoil is pale yellow flaggy sandy loam to 45 cm (18 inches). Ferron sandstone is at 45 cm (18 inches). Calcium carbonate levels are *Fair* in the subsoil (DOGM 2008).

Limiting Features

The shallow depth to Ferron sandstone will be limiting to excavations and topsoil salvage.

Calcium carbonate levels (DOGM 2008) are *Fair* in the subsoil.

Available water capacity is *Fair* (DOGM 2008).

Reclamation potential is fair based on the shallow depth to sandstone.

E Rock Outcrop — Braf complex, 6 to 15 percent slopes

General

Map unit E is characterized by Ferron sandstone outcrops and shallow soils. The sandstone outcrops are on convex ridges and hillslopes. The shallow Braf soils are in swales on the hillslopes and on leeward hillslopes. Persayo family soils occur on the steeper shale outcrop areas. Shadscale, black sage, Indian ricegrass, and prickly pear are the dominate vegetation on the Braf soils. Widely scattered Utah juniper and pinyon pine are growing in the swales. Table 11 lists the taxonomic classification of the soil components in map unit E.

Table 11. Taxonomic classification of soil components in map unit E.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
50		Sandstone outcrop
45	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic
5	Persayo family	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Braf soils in map unit E is EM-11-09. The surface is pale brown channery sandy loam to 3 cm (1 inch), The subsoil is pale brown sandy loam to 8 cm (3 inches). Ferron sandstone is at 8 cm (3 inches). The surface and subsoil horizons were sampled and analyzed together due to the limited thickness of each.

Limiting Features

Sandstone outcrops and shallow soils will be limiting to topsoil salvage.

Available water capacity is *Fair* (DOGM 2008).

Reclamation potential is fair to poor due to the very limited potential for topsoil salvage.

F Persayo very gravelly clay loam, 15 to 45 percent slopes

General

Map unit F is characterized by soils which are shallow to Mancos shale on steep to very steep slopes. There are minor inclusions of shallow coarse-loamy Braf soils over sandstone and sandstone outcrops. Shadscale is the dominant vegetation on the Persayo soils. Table 12 lists the taxonomic classification of the soil components in map unit F.

Table 12. Taxonomic classification of soil components in map unit F.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85	Persayo	Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow
10	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic
5		Sandstone Outcrop

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Persayo soils in map unit F is EM-13-09. The surface is light yellowish brown very gravelly clay loam to 10 cm (4 inches). The subsoil is light brownish gray silty clay loam to 40 cm (16 inches). Soft shale is at 40 cm (16 inches). Salinity levels are *Poor* and SAR levels are *Unacceptable* in the subsoil. Calcium carbonate levels are *Fair* to *Poor* (DOGM 2008).

Limiting Features

The shallow depth to shale and steep slopes will be limiting to topsoil salvage.

Poor salinity and *Unacceptable* SAR levels in the subsoil will limit topsoil salvage (DOGM 2008).

Reclamation potential will be limited by the shallow depths to shale and sandstone.

G Garley loam, moderately well drained, 2 to 5 percent slopes

General

Map unit G is characterized by very deep coarse-loamy saline and sodic soils. This map unit occurs on the stream terrace along Quitchapah Creek. Minor inclusions of Green River soils with aquic soil conditions occur on the floodplain. Also included are small areas of shallow Braf soils on the footslopes adjacent to the stream terrace. Black greasewood is the dominant vegetation on the Garley soils. Grasses are very limited in this map unit. Table 13 lists the taxonomic classification of the soil components in map unit G.

This map unit does not occur within the Emery 2 Mine Permit area.

Table 13. Taxonomic classification of soil components in map unit G.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
85	Garley, moderately well drained	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic
10	Green River	Oxyaquic Torrifluvents, coarse-loamy, mixed, calcareous, superactive, mesic
5	Braf	Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Garley, moderately well drained, soils in map unit G is EM-12-09. The surface is light gray loam to 15 cm (3 inches). The upper subsoil is light yellowish brown sandy loam and loam to 72 cm (28 inches). A buried surface of light yellowish brown sandy loam is from 72 to 102 cm. The lower subsoil is light yellowish brown sandy loam to 164 cm (65 inches). SAR levels are *Unacceptable*. Salinity levels are *Fair* in the surface and *Poor* below 15 cm (3 inches). Calcium carbonate and available water capacity range from *Good* to *Fair* in the soil profile. Soil pH is *Fair* below the surface horizon (DOGM 2008).

Limiting Features

The *Unacceptable* SAR levels will limit the amount of topsoil that can be salvaged (DOGM 2008). The topsoil salvaged from Garley soils should be stockpiled separately from the better quality topsoil salvaged from other map units.

Reclamation potential is poor due to the *Poor* salinity and *Unacceptable* SAR levels.

H Green River sandy clay loam, 1 to 3 percent slopes

General

Map unit H soils are coarse-loamy and very deep (greater than 150 cm or 60 inches) on the floodplain along Quitchapah Creek (perennial stream). These soils are subject to flooding and high groundwater during periods of high stream flows in Quitchapah Creek. Minor inclusions of Garley soils occur on the stream terraces. Tamarisk is the dominant vegetation on Green River soils with small clumps of coyote willow along the stream channel. Black greasewood dominates the Garley soils. Table 14 lists the taxonomic classification of the soil components in map unit H.

This map unit is of very limited extent within the Emery 2 permit area. It occurs at the confluence of the canyon drainage and Quitchapah Creek in the permit area.

Table 14. Taxonomic classification of soil components in map unit H.

Percent of Map Unit	Soil Series or Family	Taxonomic Classification
90	Green River	Oxyaquic Torrifluvents, coarse-loamy, mixed, calcareous, superactive, mesic
10	Garley, moderately well drained	Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic

Typifying Soil Pedon Descriptions

Soils colors are for dry soil unless specified otherwise.

The typifying soil pedon for Green River soils in map unit H is EM-7-09. The surface is light yellowish brown sandy clay loam to 15 cm (6 inches). A buried surface is pale yellow silty loam and barns to 28 cm (11 inches). The underlying subsoil is light gray loam and silt loam to 56 cm (22 inches). The lower subsoil is light yellowish brown sandy loam and loam to 130 cm (51 inches). The lower subsoil is light gray sandy loam to 150 cm. Fine, medium and coarse soil mottles were observed between 28 and 56 cm (11 and 22 inches). The surface 15 cm (6 inches) appeared to have been deposited when the area was flooded on September 16, 2009. The stream channel was incised ten to fifteen feet within this soil map unit at the location of the representative pedon for Green River soils.

Limiting Features

Calcium carbonate levels are *Fair* (DOGM 2008) from 15 to 102 cm (6 to 40 inches).

Flooding could be limiting to reclamation, if the stream flows are too high.

This soil map unit is a good source of topsoil for reclamation.

Map Unit Areas

The cumulative surface area for each soil map unit was calculated with ARC-Map software on the horizontal plane. Cumulative surface areas are listed for each soil map unit in Table 15.

Table 15. Cumulative surface area for soil map units in the Emery 2 soil survey area.

	Soil Map Units										
	A	Ba	Bd	Ca	Cb	D	E	F	G	H	Total
Acres	13.8	20.3	8.4	18.3	3.2	64.5	37.4	5.4	12.0	6.4	189.7
Percent	7.3	10.7	4.4	9.6	1.7	34.0	19.7	2.9	6.3	3.4	

Major Soil Types

Representative soil profiles for each of the major soil types are described in this section. Major soil types are those which comprise at least 15 percent of a soil map unit. Field description sheets are in Appendix B. Laboratory analysis data for these profiles are in Appendix C.

Soil horizon depths were measured in centimeters in the field. Depths in inches have been rounded to the nearest inch.

Major soil types were correlated to established soil series (USDA 2016a). Soils that did meet specific soil series criteria were correlated to soil families with the name of a locally used soil series in the same family (USDA 2016a and 2016b).

Begay family

Begay family soils are moderately deep (50 to 100 cm, 20 to 40 inches) to Ferron sandstone. They have developed in stabilized eolian deposits on the plateau southeast of the canyon.

Soil profile EM-1-09 is representative of Begay family soil in the Emery 2 soil survey area. Dominant vegetation on the Begay family soils is big sage, black greasewood, and shadscale.

Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

A --- 0 to 8 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light yellowish brown (2.5Y 6/4) moist; 63 percent sand; 20 percent silt; 17 percent clay; weak medium platy parting to moderate fine granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 3 percent subangular calcareous sandstone gravels; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; neutral, pH 7.3; clear smooth boundary; CaCO3 9.1 percent.

Bw1 --- 8 to 23 cm (3 to 9 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; 57 percent sand; 29 percent silt; 14 percent clay; structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 5 percent calcareous sandstone gravels; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; clear smooth boundary; CaCO3 7.2 percent.

Bw2 --- 23 to 50 cm (9 to 20 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 73 percent sand; 14 percent silt; 13 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 3 percent (common) fine masses of carbonate on vertical faces of peds and 4 percent (common) fine irregular carbonate concretions around rock fragments; 8 percent subangular calcareous sandstone gravels; electrical conductivity of 3.94 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; $CaCO_3$ 7.2 percent.

Bk --- 50 to 80 cm (20 to 32 inches); very pale brown (10YR 7/4) dry, channery sandy loam; yellowish brown (10YR 5/4) moist; 65 percent sand; 23 percent silt; 12 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds and 7 percent (common) medium carbonate concretions around rock fragments; 6 percent subangular calcareous sandstone gravels and 12 percent subangular calcareous sandstone channers; electrical conductivity of 3.07 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.6 ; abrupt smooth boundary; $CaCO_3$ 7.8 percent.

R --- 80 cm (32 inches); Ferron sandstone.

Braf

Braf soils are shallow, less than 50 cm (20 inches) to sandstone bedrock. In some areas, especially map unit F, Braf soils are less than 25 cm (10 inches) deep. These soils are well drained. Braf soils have a typic aridic moisture regime and are drier than Hideout and Lazear soils which have aridic moisture regimes bordering on ustic. Braf soils have 5 to 18 percent clay in the control section. These soils are in Wind Erodibility Groups 2 and 3. Braf soils were delineated as the dominant soil (map unit 015) on the bench west of the canyon by the NRCS in the Emery Area soil survey (USDA 2016b).

Soil profile EM-10-09 is representative of Braf soils in the Emery 2 soil survey area. Shadscale, black sage, Indian ricegrass, and prickly pear cactus are the dominant vegetation on Braf soils.

Lithic Torriorthents, loamy, mixed superactive, calcareous, mesic

A --- 0 to 7 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 84 percent sand; 8 percent silt; 8 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; clear smooth boundary; CaCO3 13.5 percent.

C1 --- 7 to 27 cm (3 to 11 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 20 percent silt; 10 percent clay; structure; very friable, moderately hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent fine calcium carbonate coats on bottom of rock fragments; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.50 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; CaCO3 22.2 percent.

C2 --- 27 to 45 cm (11 to 18 inches); pale yellow (2.5Y 7/4) dry, flaggy sandy loam; light yellowish brown (2.5Y 6/4) moist; 76 percent sand; 16 percent silt; 8 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent fine calcium carbonate coats on bottom of rock fragments; 20 percent subangular calcareous sandstone flags and 10 percent subangular calcareous sandstone channers; electrical conductivity of 1.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; CaCO3 18.7 percent.

R --- 45 cm (18 inches); Ferron sandstone.

Disturbed Soils

The soil surfaces in map unit Bd were previously disturbed for the construction of drill holes and access roads. The area appeared to have been similar to map unit Ba prior to the disturbance. The specific date and origin of this disturbance could not be determined. This disturbance did not appear to be recent when field work was done in the fall of 2009. Shadscale and black greasewood had become well established in the area by the time the soil survey field work was conducted in 2009.

The dominant soil in the disturbed areas is shallow to sandstone or hard shale. These soils are similar to Lazear with the native A horizon removed or disturbed.

Soil profile EM-3-09 is representative of the disturbed soils in map unit Bd. Black greasewood and shadscale have partially re-vegetated these areas.

Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents

A --- 0 to 18 cm (0 to 7 inches); very pale brown (10YR 7/3) dry, channery loam; pale brown (10YR 6/3) moist; 47 percent sand; 33 percent silt; 20 percent clay; structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions around rock fragments; 15 percent subangular calcareous sandstone channers; electrical conductivity of 1.40 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary;: CaCO3 13.9 percent.

C --- 18 to 46 cm (7 to 18 inches); pale brown (10YR 6/3) dry, channery sandy clay loam; brown (10YR 5/3) moist; 53 percent sand; 25 percent silt; 22 percent clay; medium structure; friable, hard, nonsticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 2 percent (common) medium irregular moderately cemented carbonate concretions around rock fragments; 5 percent subangular calcareous sandstone flags and 15 percent subangular 2 calcareous sandstone channers; electrical conductivity of 4.39 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt smooth boundary; CaCO3 13.4 percent.

R --- 46 cm (18 inches); hard shale.

Garley

Garley soils are very deep, greater than 150 cm (60 inches) and are in the bottom of the canyon that crosses the Emery 2 soil survey from south to northeast. They are coarse-textured and are saline and have *Unacceptable* SAR levels (Utah DOGM 2008).

Soil profile EM-8-09 is representative of Garley soils in the Emery 2 soil survey area. Black greasewood, shadscale, and scattered clumps of Indian ricegrass are the dominant vegetation.

Typic Torrifluvents, coarse-loamy, mixed, active, calcareous, mesic

A --- 0 to 9 cm (0 to 4 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 79 percent sand; 13 percent silt; 8 percent clay; moderate medium platy structure; friable, hard, slightly sticky, slightly plastic; many very fine roots throughout, few fine roots throughout; common very fine tubular pores; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.7; clear smooth boundary; $CaCO_3$ 8.8 percent.

C1--- 9 to 32 cm (4 to 13 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 10 percent silt; 5 percent clay; moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, few fine roots throughout, and few medium roots throughout; common very fine tubular pores; electrical conductivity of 3.82 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; abrupt smooth boundary; $CaCO_3$ 8.9 percent.

C2 --- 32 to 46 cm (13 to 18 inches); pale yellow (10YR 7/4) dry, very gravelly loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 40 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 3.91 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.8; abrupt wavy boundary; $CaCO_3$ 8.9 percent.

Ab1 --- 46 to 60 cm (18 to 24 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 8.29 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; clear smooth boundary; $CaCO_3$ 5.3 percent.

C3 --- 60 to 70 cm (24 to 28 inches); light yellowish brown (10YR 6/4) dry, very gravelly loam; light olive brown (10YR 5/4) moist; 50 percent sand; 40 percent silt; 10 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout,

common fine roots throughout, few medium roots throughout and few coarse roots throughout; many very fine interstitial pores; 40 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 9.77 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; abrupt wavy boundary; $CaCO_3$ 8.4 percent.

C4 --- 70 to 88 cm (28 to 35 inches); pale yellow (10YR 7/4) dry, sandy loam; light yellowish brown (10YR 6/4) moist; 79 percent sand; 10 percent silt; 11 percent clay; massive; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, and few fine roots throughout,; common very fine tubular pores; 2 percent fine masses of carbonate on faces of peds; electrical conductivity of 9.38 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; abrupt wavy boundary; $CaCO_3$ 6.3 percent.

AB2 --- 88 to 98 cm (~~47~~ 35 to 66 inches); light yellowish brown (10YR 6/4) dry, very gravelly loam; light olive brown (10YR 5/4) moist; 80 percent sand; 8 percent silt; 12 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 50 percent calcareous sandstone boulders; electrical conductivity of 4.35 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt wavy boundary; $CaCO_3$ 5.5 percent.

C5 --- 98 to 108 cm (35 to 43 inches); light yellowish brown (10YR 6/4) dry, very bouldery sandy loam; light olive brown (10YR 5/4) moist; 77 percent sand; 14 percent silt; 9 percent clay; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; few very fine tubular pores; 50 percent calcareous sandstone boulders; electrical conductivity of 5.54 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline pH 7.7; abrupt smooth boundary; $CaCO_3$ 6.8 percent.

C6 --- 108 to 120 cm (43 to 47 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; light olive brown (10YR 5/4) moist; 75 percent sand; 13 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; many very fine and common fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 5.59 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 3.2 percent.

C7 --- 120 to 150 cm (59 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; olive brown (10YR 4/4) moist; 77 percent sand; 11 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 6.17 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 6.0 percent.

Garley, moderately well drained phase

Garley, moderately well drained, soils in map unit G are on low stream terraces along Quitchapah Creek. These soils have the same unacceptable SAR levels discussed previously in the Garley soils section.

Soil profile EM-12-09 is representative of Garley, moderately well drained soils in the Emery 2 soil survey area. Black greasewood is the dominant vegetation on Garley, moderately well drained soils. Black greasewood is the dominant vegetation.

Typic Torrifluvents, coarse-loamy, mixed, active, mesic

A --- 0 to 15 cm (0 to 6 inches); light gray (2.5Y 7/2) dry, loam; light olive brown (2.5Y 5/3) moist; 48 percent sand; 38 percent silt; 14 percent clay; moderate coarse platy structure; friable, very hard, slightly sticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 6.54 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; clear smooth boundary; CaCO3 17.5 percent.

C1 --- 15 to 35 cm (6 to 14 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 54 percent sand; 30 percent silt; 16 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; unable to dig with shovel; clear smooth boundary; CaCO3 18.7 percent.

C2 --- 35 to 46 cm (14to 18 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 64 percent sand; 25 percent silt; 11 percent clay; weak fine and medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.60 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.2; gradual smooth boundary; CaCO3 14.3 percent.

C3 --- 46 to 72 cm (18 to 28 inches); light yellowish brown (2.5Y 6/3) dry, loam; light olive brown (2.5Y 5/3) moist; 46 percent sand; 38 percent silt; 16 percent clay; weak medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 5 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 8.88 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; gradual smooth boundary; CaCO3 16.1 percent.

Ab --- 72 to 102 cm (28 to 40 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 12.1 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 14.6 percent.

C4 --- 102 to 130 cm (40 to 52 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 5.55 dS/m by EC meter, saturated paste; electrical conductivity of 12.6 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 15.2 percent.

C5 --- 130 to 164 cm (52 to 65 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 30 percent silt; 16 percent clay; 2 percent fine prominent brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine prominent spherical very weakly cemented masses of oxidized iron clear in matrix; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 9.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; CaCO3 14.8 percent.

Green River

Green River soils are very deep and are located in the floodplain along Quitchapah Creek. These soils are susceptible to flooding and a water table may be present in locations near the stream.

Soil profile EM-7-09 is representative of Green River soils in the Emery 2 soil survey area. Tamarisk is the dominant vegetation with coyote willows along streambanks.

Oxyaquic Torrifluvents, coarse-loamy, mixed, superactive, calcareous, mesic

A --- 0 to 15 cm (0 to 6 inches); light yellowish brown (2.5Y 6/3) dry, sandy clay loam; light olive brown (2.5Y 5/3) moist; 57 percent sand; 15 percent silt; 28 percent clay; medium platy structure; very friable, slightly hard, nonsticky, nonplastic; electrical conductivity of 2.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 14.4 percent.

2A --- 15 to 28 cm (6 to 11 inches); pale yellow (2.5Y 7/3) dry, silt loam; grayish brown (2.5Y 5/2) moist; 37 percent sand; 52 percent silt; 11 percent clay; moderate medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.55 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 18.3 percent.

2C --- 28 to 43 cm (11 to 17 inches); light gray (2.5Y 7/2) dry, loam; light yellowish brown (2.5Y 6/3) moist; 43 percent sand; 48 percent silt; 9 percent clay; 2 percent medium distinct olive yellow (2.5Y 6/6) and 2 percent fine distinct olive yellow (2.5Y 6/6) mottles; moderate medium subangular blocky structure; very friable, hard, slightly sticky, nonplastic; many very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.36 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 15.9 percent.

3A --- 43 to 56 cm (17 to 22 inches); light gray (2.5Y 7/2) dry, silt loam; light olive brown (2.5Y 5/3) moist; 23 percent sand; 56 percent silt; 21 percent clay; 6 percent coarse prominent strong brown (7.5YR 5/8) and 6 percent medium prominent strong brown (7.5YR 5/8) mottles; strong coarse platy structure; very friable, hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 3.46 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 19.2 percent.

3C1 --- 56 to 78 cm (22 to 31 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 61 percent sand; 26 percent silt; 13 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 3.67 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 15.2 percent.

3C2 --- 78 to 102 cm (31to 40 inches); light yellowish brown (2.5Y 6/3) dry, loam; dark grayish brown (2.5Y 4/2) moist; 46 percent sand; 37 percent silt; 17 percent clay; massive parting to single grain; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 3.93 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 16.5 percent.

3C3 --- 102 to 130 cm (40 to 51 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; single grain and medium structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 2.21 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 14.5 percent.

3C4 --- 130 to 150 cm (51 to 59 inches); light gray (2.5Y 7/2) dry, sandy loam; light yellowish brown (2.5Y 6/3) moist; 69 percent sand; 25 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 1.6 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; CaCO3 14.3 percent.

Hideout

Hideout soils are shallow and located on the plateau southeast of the canyon and on structural benches in the canyon. These soils have 5 to 18 percent clay in the control section while Lazear soils have 18 to 27 percent clay. Hideout soils have an aridic moisture regime that borders on ustic. Hideout soils are similar to Braf soils, but Braf soils are typic aridic (drier).

Soil profile EM-4-09 is representative of Hideout soils in the Emery 2 soil survey area. Utah juniper, pinyon pine, Birchleaf mahogany, Utah serviceberry, Wyoming big sage, black sage, broom snakeweed, and prickly pear cactus are the dominant vegetation.

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A --- 0 to 6 cm (0 to 2 inches); very pale brown (10YR 7/3) dry, loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 14 percent silt; 7 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.69 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; CaCO3 6.1 percent.

C --- 6 to 20 cm (2 to 8 inches); pale brown (10YR 6/3) dry, sandy loam; brown (10YR 5/3) moist; 69 percent sand; 21 percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 0.95 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 6.4 percent.

R --- 20 cm (8 inches); Ferron sandstone.

Lazear

Lazear soils are shallow and located on the plateau southeast of the canyon. These soils are similar to Hideout soils, but Lazear soils have 18 to 27 percent clay in the control section while Hideout soils have 5 to 18 percent clay.

Soil profile EM-5-09 is representative of Lazear soils in the Emery 2 soil survey area. Shadscale, black sage, broom snakeweed, and bluegrass are the dominant vegetation.

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A --- 0 to 7 cm (0 to 3 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; 65 percent sand; 22 percent silt; 13 percent clay; moderate medium platy structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone channers and 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.65 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; $CaCO_3$ 22.5 percent.

C --- 7 to 20 cm (23 to 8 inches); light yellowish brown (10YR 6/4) dry, channery sandy clay loam; pale brown (10YR 6/3) moist; 63 percent sand; 16 percent silt; 21 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels and 15 percent subangular calcareous sandstone channers; electrical conductivity of 0.57 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; $CaCO_3$ 25.4 percent.

R --- 20 cm (8 inches); Ferron sandstone.

Monue Family

Monue family soils are very deep and are located on alluvial fans in the upper third of the canyon. These soils are on the same landforms in the canyon as Garley soils. Monue family soils generally have slightly more grass cover than Garley soils. These soils have *Fair* conductivity and SAR levels below 80 cm (31 inches) and poor levels below 122 cm (48 inches). Monue family soils are a good source of topsoil and subsoil within the Emery 2 permit area.

Soil profile EM-16-09 is representative of Monue family soils in the Emery 2 soil survey area. Black greasewood and Indian rice grass are the dominant vegetation.

Typic Haplocambids, coarse-loamy, mixed, superactive, mesic

A1 --- 0 to 8 cm (0 to 3 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam gravel; light olive brown (2.5Y 5/3) moist; 64 percent sand; 28 percent silt; 8 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; 1 percent subangular calcareous sandstone gravels; electrical conductivity of 1.01 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 13.4 percent.

Bw1 --- 8 to 21 cm (3 to 8 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 68 percent sand; 24 percent silt; 8 percent clay; structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 (Exists in NASIS Horizon) 11.4 percent.

Bw2 --- 21 to 46 cm (8 to 18 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary; CaCO3 11.6 percent.

C2 --- 46 to 80 cm (18 to 31 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 60 percent sand; 28 percent silt; 12 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) carbonate concretions on bottom of rock fragments; 2 percent subangular calcareous sandstone gravels; electrical conductivity of 0.45 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 13 percent.

C3 --- 80 to 122 cm (31 to 48 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 22 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very coarse interstitial pores; electrical conductivity of 5.89 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; gradual smooth boundary; CaCO3 12.9 percent.

2C --- 122 to 170 cm (48 to 67 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 68 percent sand; 24 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) salt masses in matrix and 1 percent (few) carbonate concretions on bottom of rock fragments; 4 percent subangular calcareous sandstone channers; electrical conductivity of 9.6 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; moderately alkaline, pH 8; CaCO3 12.3 percent.

Persayo

Persayo soils are shallow to Blue Gate shale member of the Mancos formation on very steep to extremely steep hillslopes, referred to locally as the "Blue Hills". Persayo soils are medium textured and have 18 to 35 percent clay in the control section, while Persayo Family soils have less than 18 percent clay in the control section.

Soil profile EM-13-09 is representative of Persayo soils in the Emery 2 soil survey area. Widely scattered shadscale was the only vegetation observed.

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A --- 0 to 10 cm (0 to 4 inches); light yellowish brown (2.5Y 6/3) dry, very gravelly clay loam; dark grayish brown (2.5Y 4/2) moist; 32 percent sand; 41 percent silt; 27 percent clay; weak fine subangular blocky parting to moderate fine granular structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 20 percent angular strongly cemented calcareous shale channers and 40 percent angular strongly cemented calcareous shale gravels; electrical conductivity of 2.44 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; clear smooth boundary; CaCO3 33.6 percent.

C --- 10 to 40 cm (4 to 16 inches); light brownish gray (2.5Y 6/2) dry, silty clay loam; grayish brown (2.5Y 5/2) moist; 18 percent sand; 50 percent silt; 32 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 10 percent angular very weakly cemented calcareous shale parachanners; electrical conductivity of 8.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.2; clear smooth boundary; CaCO3 16.5 percent.

Cr --- 40 cm (16 inches); Blue Gate member of the Mancos shale.

Persayo Family

Persayo family soils are shallow to Blue Gate shale member of the Mancos formation and located on extremely steep sideslopes in the canyon. These soils have less than 18 percent clay in the control, while Persayo soils have 18 to 27 percent clay in the control section.

Soil profile EM-6-09 is representative of Persayo Family soils in the Emery 2 soil survey area. Gardners saltbush and shadscale are the dominant vegetation. Depth to the Blue Gate member of the Mancos shale is 18 cm (7 inches). Very fine and fine roots penetrate the shale to 34 cm (13 inches). Soil textures are influenced by slope wash from the Ferron sandstone cliffs.

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A --- 0 to 7 cm (0 to 3 inches); very pale brown (10YR 7/3) dry, channery loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 12 percent silt; 9 percent clay; weak medium platy structure parting to single grain; very friable, slightly hard, non-sticky, non-plastic; common very fine and few fine roots; common very fine and few fine tubular pores; 10 percent angular strongly cemented 2 to 76 millimeters (0.1 to 3 inches) sandstone channers, 5 percent angular strongly cemented sandstone gravels, 5 percent angular strongly cemented sandstone flags, and 1 percent angular strongly cemented sandstone boulders; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; $CaCO_3$ 6.4 percent.

2C --- 7 to 18 cm (3 to 7 inches); very pale brown (10YR 7/4) dry, para-channery sandy loam; light yellowish brown (10YR 6/4) moist; 71 percent sand; 15 percent silt; 14 percent clay; weak fine and medium subangular blocky structure; very friable, slightly hard, slightly sticky, non-plastic; many very fine, few fine, few medium roots; common very fine tubular pores; 20 percent angular weakly cemented shale parachanners; electrical conductivity of 2.71 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; $CaCO_3$ 7.5 percent.

2Cr1 --- 18 to 34 cm (7 to 13 inches); decomposing Blue Gate member of the Mancos shale; common very fine and few fine roots; clear smooth boundary.

2Cr2 --- 34 to 38 cm (13 to 15 inches); Blue Gate member of the Mancos shale.

Topsoil Salvage

Soil Limiting Features

Topsoil and subsoil salvage depths were determined by the depth to carbonates, soil pH (greater than 8.5), salinity (EC), sodicity (SAR), texture and depth to parent material (based on DOGM 2008). Clayey soils, carbonate accumulations and corresponding poor pH are the primary limiting soil features in the Emery 2 soil survey area. The depth to each of these limiting soil features varies by soil type and map unit.

The determination of *Good*, *Fair*, *Poor*, or *Unacceptable* qualities of the topsoil and subsoil is based on the soil suitability criteria established by the Utah Division of Oil Gas and Mining in *Guidelines for Management of Topsoil and Overburden* (Utah DOGM 2008). The Utah DOGM suitability guidelines are summarized in Table 16.

Table 16. Soil suitability and unsuitability criteria (Utah DOGM, 2005).

Criteria	Good	Fair	Poor	Unacceptable
Saturation %	25 to 55	≥56 to 80	<25 or >80	
pH	6.5 to 8.2	6.0 to 6.4 8.2 to 8.5	5.5 to 6.0 8.6 to 9.0	< 5.5 > 9.0
EC (mS/cm 25°C)	0 to 4	4 to 8	8 to 15	> 15
SAR [1]	0 to 4	5 to 10	10 to 14	> 14 [1]
$CaCO_3$ %	<15	15 to 30	>30	
Texture	sl, l, sil, scl, vfsl, fsl	cl, c, sicl, sc, ls, lfs	sic, s, sc, c, cos, fs, vfs	g, vcos

Criteria	Good	Fair	Poor	Unacceptable
Total Organic Carbon	< 10%			≥ 10%
Available Water Capacity	> 0.10 moderate	0.05 to 0.10 low	< 0.05 very low	
K factor	< 0.37	0.37	> 0.37	
<u>Overburden</u>				
Selenium, soluble, mg/kg				≥ 0.15 [2] ≥ 0.10 [3, 4]
Boron, available, mg/kg				≥ 5.0
Acid/Base Potential, tons $CaCO_3$/1000 tons				≤ 0

1. For clay textured soils *Unacceptable* is SAR > 14. For sandy textured soils *Unacceptable* is > 20.
2. Unacceptable level for the rooting zone (top four feet of fill) and/or ephemeral drainages with 100 year flood plains, top 4 feet fill.
3. Unacceptable level for the top 4 feet of fill in surface-water impoundments.
4. Unacceptable level for intermittent/perennial drainages including 100 year flood plains.

Topsoil Salvage by Major Soil Types

Estimated Topsoil and subsoil salvage depths are based on field examination of soil profiles and laboratory analysis of representative soil samples. Actual salvage depths will vary within soil types and map units. These estimates are provided as a guideline for determining potential salvage volumes and to determine post-mining reclamation soil profile composition. Topsoil and subsoil salvage operations should be monitored in consultation with a Certified Professional Soil Scientist. A summary of estimated average topsoil and subsoil salvage depths for each major soil type are listed in Table 17Salvage depth estimates listed in TablPage 54545e 17 for topsoil and subsoil are based on the representative soil profile previously listed in the *Major Soil Types* section.

Estimations of *Good*, *Fair*, *Poor*, and *Unacceptable* sources of topsoil and subsoil are based on the *Guidelines for Management of Topsoil and Overburden* (DOGM 2008).

Begay family

Begay family soils are a fair source of topsoil. These soils have low available water capacities due to the sandy loam textures. These soils are in Wind Erodibility Group 3. Begay family soils are limited by the moderate depth to sandstone (less than 40 inches) and low water holding capacity.

The estimated topsoil salvage depth for Begay family soils is 23 cm (9 inches) and 57 cm (22 inches) of subsoil. Salvage depths are limited by the depth to Ferron sandstone, which is 80 cm (32 inches) in the representative soil profile (EM-1-09). The separation between topsoil and subsoil is based on decreased organic matter and increased salinity.

Braf

Limiting features of Braf soils are: 1) the low available water capacity (AWC), due to the loamy sand textures; and 2) the calcium carbonate equivalents (CCE) range from 18 to 22 in the C horizon; and 3) shallow depth to Ferron sandstone. Both the AWC and CCE for Braf soils are in the *Fair* range (Utah DOGM 2008). Braf soils are a fair source of topsoil, but are limited by the shallow depth to Ferron sandstone. These soils are in Wind Erodibility Groups 2 and 3.

The estimated topsoil salvage depth is 27 cm (11 inches) and 18 cm (7 inches) of subsoil in the representative soil profile (EM-10-09). Limiting soil features are increased salinity at 27 cm and Ferron sandstone at 45 cm.

Total salvage depths in the Braf soils evaluated in this survey range from as little as 8 cm (1.2 inches) in EM-11-09 to as much as 48 cm (18.9 inches) in EM-14-09.

Disturbed Soils

Overburden analysis (Utah DOGM 2008) was conducted on the representative soil profile in addition to standard topsoil analyses, because of the previous disturbance. The overburden analysis suite consists of acid-base potential, soluble selenium, soluble boron, and total organic carbon. None of the results for the overburden parameters exceeded the Utah DOGM suitability guidelines (Table 8 in Utah DOGM 2008).

The only limiting feature identified in these soils was an electrical conductivity of 4.39 in the C horizon, 18 to 46 cm (7-18 inches). This conductivity level is in the *Fair* range (Utah DOGM 2008). These soils are in Wind Erodibility Group 3. These previously disturbed lands are a fair source of topsoil due to the shallow depth to sandstone and shale, and potential for horizons with fair salinity levels. Salvage of previously disturbed materials should be monitored. The estimated salvage depths for disturbed soils in map unit Bd are 18 cm (7 inches) of topsoil and 28 cm (18 inches) of subsoil, based on the representative soil profile (EM-3-09). Separation between topsoil and subsoil is based on increased salinity at 18 cm.

Garley

Garley soils are well drained. The main limiting features of Garley soils, based on *Utah DOGM Topsoil and Overburden Guidelines* (Utah DOGM 2008), are: 1) *Unacceptable* SAR values that range from 15 to 49 (ESP 25 to 52 percent); 2) *Poor* electrical conductivity values ranging from 8.29 to 15.9 dS/m; 3) *Poor* pH values that correspond directly with the *Unacceptable* SAR levels; 4) loamy sand textures (*Poor*); and 5) *Poor* available water capacity due to the loamy sand textures. These soils are in Wind Erodibility Group 3.

Garley soils are a *Poor* source of topsoil and *Unacceptable* source of subsoil due to the SAR levels. The representative soil profile (EM-08-09) has 9 cm (~~3~~ 4 inches) of topsoil with *Poor* SAR value in map unit Cb based on the loamy sand texture. The *Unacceptable* SAR level for sandy textured soils is 20 (DOGM 2008). These soils have developed from numerous fluventic depositions, so the chemical and physical characteristics may vary between locations.

SAR levels in the subsoil range from 32.2 to 48.7 in the 9 to 88 cm zone of the representative soil profile. These SAR levels are in excess of the *Unacceptable* level. Garley subsoil should not be stockpiled with other salvaged subsoil materials.

It will be difficult to salvage 9 cm of topsoil and not have some mixing with *Unacceptable* SAR soils. Salvage from areas with Garley soils should be closely monitored in the field by a Certified Professional Soil Scientist. Salvaged Garley soils should be stockpiled separately from other topsoil sources. Placement of Garley topsoil and subsoil in reclamation areas should be limited to depths below four feet, whenever possible.

Garley, moderately well drained

The moderately well drained Garley soils have *Unacceptable* SAR levels (greater than 20) throughout the representative soil profile EM-12-09 (Utah DOGM 2008). These soils have *Poor* electrical conductivities, and *Poor* available water capacity due to the coarse soil texture. In addition, they are only moderately well drained due to the close proximity to Quitchapah Creek. Garley soils are described as well drained in the official series description (USDA – NRCS 2016). These soils are in Wind Erodibility Groups 3 and 4L. The Garley, moderately well drained soils are an *Unacceptable* source of topsoil and subsoil due to the SAR levels, based on the representative soil profile (EM-12-09).

The estimated topsoil and subsoil salvage depths are both 0 cm (0 inches).

Disturbance of Garley, moderately well drained, soils should be avoided or minimized. If disturbance of these soils is not avoidable, then the topsoil and subsoil from this soil type should be stockpiled separately from other sources. Placement of Garley, moderately well drained, topsoil and subsoil in reclamation areas should be limited to depths below four feet, whenever possible.

Green River

These soils are limited by *Fair* calcium carbonate levels (15.2 to 19.2 tons $CaCO_3$ per 1,000 tons) in soil horizons between 15 and 102 cm (6 and 40 inches). Occasional flooding and aquic soil conditions from 28 to 56 cm (11 to 22 inches) are also limiting features. SAR is *Fair* in the 56 to 78 cm (22 to 31 inches) horizon of the representative soil profile (EM-7-09). The calculated K factor is *Poor* (greater than 0.37) between 28 and 56 cm in the representative soil profile. These soils are in Wind Erodibility Groups 3 and 4L. Green River soils are a poor source of topsoil due to the flooding potential and *Poor* K Factor.

The estimated topsoil salvage depth for Green River soils is 15 cm (6 inches), based on an increase of carbonates below this depth. An estimated 135 cm (53 inches) of subsoil can be salvaged from Green River soils to a depth of 150 cm (60 inches), if deep disturbance of the soil is required. Green River soils are geographically associated with Garley, moderately well drained soils and their locations should be monitored (*Unacceptable* SAR levels).

Disturbance of Green River soils should be avoided due to their close proximity to Quitchapah Creek. Additional permitting may be required, if these soils are impacted.

Hideout

These soils are in Wind Erodibility Groups 2 and 3. Hideout soils are a fair source of topsoil due to the shallow depth to sandstone and low available water capacities. These soils are geographically associated with large areas of Ferron sandstone outcrops. The estimated topsoil salvage depth is limited to approximately 20 cm (8 inches) based on the representative soil profile (EM-4-09).

Physical and chemical characteristics of Hideout topsoil and subsoil are similar. They should be salvaged and stockpiled together as topsoil due to the thinness of each.

Lazear

Lazear soils are a fair source of topsoil due to the calcium carbonate levels and the shallow depth. Calcium carbonate concentrations in the representative profile range from 22.5 to 25.4 percent, which are in the *Fair* range (Utah DOGM 2008). These soils are in Wind Erodibility Groups 3 and 4L.

The estimated topsoil salvage depth for Lazear soils is limited by the shallow depth to Ferron sandstone, which is 20 cm (8 inches) in the representative soil profile (EM-5-09).

Physical and chemical characteristics of Lazear topsoil and subsoil are similar. They should be salvaged and stockpiled together as topsoil due to the thinness of each.

Monue Family

Monue family soils are a good source of topsoil and good to fair source of subsoil. SAR and salinity levels are *Fair* from 80 cm 122 cm and *Poor* below 122 cm in the representative soil profile (EM-16-09). These soils have low available water capacities due to the sandy loam textures. Monue family soils are in Wind Erodibility Group 3.

The estimated topsoil salvage depth for Monue Family soils is 46 cm (18 inches) in the representative soil profile (EM-16-09). Subsoil salvage of 76 cm (48 inches) may occur in the Monue Family soils based on the representative soil profile, if deep disturbance is required. Monue Family soils are subject to wind erosion, so the actual topsoil salvage depth should be limited to the amount required to successfully revegetate the disturbance. The separation between topsoil and subsoil is based on the transition from the B to the C horizons in the representative soil profile.

Monue family soils are a good source of topsoil and subsoil within the Emery 2 permit area. The lower subsoil that is poor quality due to increased conductivity and SAR should not be stockpiled with the better quality topsoil and upper subsoil. Salvage of these soils should be monitored by a Certified Professional Soil Scientist.

Persayo

Persayo soils are a fair source of topsoil and an *Unacceptable* source of subsoil. These soils are limited by low water holding capacity in the upper 10 cm (4 inches) and *Unacceptable* SAR (15.9) below 10 cm (4 inches). Persayo soils are in Wind Erodibility Group 4L. These soils are limited by the shallow depth to shale.

The estimated topsoil salvage depth for Persayo soils is 10 cm (4 inches) in the representative soil profile (EM-13-09). The *Unacceptable* subsoil (SAR) below 10 cm to depth of 30 cm (28

inches) should only be disturbed, if deeper excavation is required. Persayo subsoil should be stockpiled separately from other subsoil materials. Disturbance of Persayo soils should be minimized.

Persayo Family

Persayo family soils are a good source of topsoil and subsoil, but limited by the shallow depth to shale in the representative soil profile (EM-6-09). These soils are limited by low available water capacities. Persayo family soils are in Wind Erodibility Groups 2 and 3. SAR levels were *Good* in the representative soil profile, but *Poor* to *Unacceptable* values are possible due to the shallow depth to Mancos shale. These soils are on very steep to extremely steep (45 to 80 percent) slopes which will be limiting to topsoil salvage operations.

The estimated topsoil salvage depth for Persayo family soils is limited by the depth to Mancos shale, which is 18 cm (7 inches) in the representative soil profile.

Physical and chemical characteristics of Persayo family topsoil and subsoil are similar. They should be salvaged and stockpiled together as topsoil due to the thinness of each.

Table 17. Estimated topsoil and subsoil salvage depths for each major soil type in the Emery 2 soil survey area based on the typifying or representative soil profiles. Salvage depth estimates are based on the representative soil profile listed in the *Major Soil Types* section.

Soil Series/Family	Typifying Profile	Topsoil Salvage	Subsoil Salvage	Topsoil Salvage	Subsoil Salvage	Total Salvage	Limitations
		cm	cm	inches	inches	inches	
Begay family	EM-1-09	23	57	9	22	31	Increased carbonate concentrations, increased salinity, and sandstone at 80 cm. Topsoil subsoil split based on decreased organic matter and increased soil pH and salinity.
Braf	EM-10-09	27	18	11	7	18	Increased salinity at 27 cm and sandstone at 45 cm.
Disturbed Soils	EM-3-09	18	28	7	11	18	Increased salinity at 18 cm and hard shale at 46 cm.
Garley	EM-8-09	9	0	4	0	4	Increase of SAR from 20.4 to 32.2 at 9 cm (SAR of 20 used for *Unacceptable* limit based on loamy sand texture).
Garley, mod well drained	EM-12-09	0	0	0	0	0	*Unacceptable* SAR levels to the surface. Topsoil and subsoil should be salvaged and stockpiled separately from other soil due to the *Unacceptable* qualities, if disturbance is necessary. Topsoil salvage depth (15 cm) based on depth of A horizon.

Table 17. Estimated topsoil and subsoil salvage depths for each major soil type in the Emery 2 soil survey area based on the typifying or representative soil profiles. Salvage depth estimates are based on the representative soil profile listed in the *Major Soil Types* section.

Soil Series/Family	Typifying Profile	Topsoil Salvage	Subsoil Salvage	Topsoil Salvage	Subsoil Salvage	Total Salvage	Limitations
		cm	cm	inches	inches	inches	
Green River	EM-7-09	15	135	6	53	59	Carbonates increase below 15 cm; redox mottles observed from 28 to 56 cm.
Hideout	EM-4-09	20	0	8	0	8	Sandstone at 20 cm; topsoil and subsoil should be salvaged as topsoil due to thin topsoil.
Lazear	EM-5-09	20	0	8	0	8	Sandstone at 20 cm; topsoil and subsoil should be salvaged as topsoil due to thin topsoil.
Monue Family	EM-16-09	46	76	18	30	48	A and B horizons comprise topsoil depth. Single grain alluvial parent material (C horizons) below 46 cm. Poor salinity below 122 cm.
Persayo	EM-13-09	10	30	4	12	16	*Poor* salinity and *Unacceptable* SAR below 10 cm. Thin topsoil layer should be salvaged and stockpiled separately from subsoil.
Persayo family	EM-6-09	18	0	7	0	7	Shale at 18 cm; topsoil and subsoil should be salvaged as topsoil. Large stones and boulders should be separated from salvaged topsoil.

Map Unit Salvage Depths

Table 18 identifies the weighted average depth of topsoil and subsoil that may be available for salvage based on field evaluations of soil pits and laboratory analysis of soil samples. Salvage depths may include some *Poor* quality materials. Field data sheets are in appendix B. Results of the laboratory analysis of soil samples are contained in appendix C.

Salvage depths will be limited by the depth to Ferron sandstone and presence of sandstone outcrops in portions of the Emery 2 permit area.

Table 18. Summary of weighted average topsoil and subsoil salvage depths for soil map units in the Emery 2 soil survey area. Actual salvage depths will vary from these estimates. Salvage operations should be monitored by a Certified Professional Soil Scientist.

Map Unit	Weighted Average Topsoil Salvage Depth[1]	Weighted Average Subsoil Salvage Depth[2]	Total Weighted Average Salvage Depth[3]
	feet	feet	feet
A	0.3	0.2	0.5
Ba	0.7	0.9	1.6
Bd	0.6	1.0	1.6
Ca	0.6	0.2	0.8
Cb	1.1	1.6	2.7
D	0.8	0.5	1.3
E	0.4	0.3	0.7
F	0.3	0.9	1.2
G	0.1	0.5	0.6
H	0.4	4.0	4.4

1. Weighted topsoil salvage depth for map unit is sum of products of map unit component percents and representative salvage depths from Table 17 (see Table F-1 for details).
2. Weighted subsoil salvage depth for map unit is sum of products of map unit component percents and representative salvage depth from Table 17 (see Table F-1 for details).
3. Sum of weighted topsoil and subsoil depths.

The estimated topsoil and subsoil salvage depths listed in Table 18 are for planning purposes. Actual depths will vary and should be monitored by a Certified Professional Soil Scientist. Salvage depth estimates are detailed in Appendix F.

Salvage of topsoil and subsoil from map unit Cb should be closely monitored due to presence of both *Good* and *Unacceptable* materials. Additional laboratory analysis may be necessary in order to identify specific topsoil and subsoil salvage depths within the Emery 2 permit area.

Potential salvage depths are listed for map unit H. However, soils in this map unit are on the floodplain of Quitchapah Creek and disturbance should be avoided. Additional studies and permitting may be necessary, if disturbance of soils in map unit H is necessary.

Disturbance Impacts

Soil map unit delineations within the proposed Emery 2 permit area are shown in Figure 3. The map unit areas within the Emery 2 permit area and disturbance areas are listed in Table 19. Map units Ca on the canyon sideslopes and D on the bench west of the canyon are the two most dominant within the Emery 2 permit area. Map units G and H do not occur within the Emery 2 permit area.

Estimated salvage volumes are detailed in Table 20. These estimated volumes are based on the weighted average topsoil and subsoil salvage depths listed in Table 18 and the map unit disturbance acres listed in Table 19. These volumes are the *potential* amounts of topsoil and subsoil that would need to be stockpiled, if all soils within the disturbance area are disturbed.

Ferron sandstone outcrops are the dominant feature in map units A and E and a major component in Ca. It is also a minor component in map units Ba, D, and F. Sandstone outcrops comprise approximately 1.70 acres of the planned disturbance area (Table 21).

Table 19. Map unit acres for Emery 2 permit and disturbance areas.

	Soil Map Units										
	A	Ba	Bd	Ca	Cb	D	E	F	G	H	Total
	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres	acres
Emery 2 Permit acres	2.9	4.5	0.3	10.4	1.3	8.0	1.3	0.2	0.0	0.0	28.9
Emery Mine Access Road[1]				0.2		0.4	0.1				0.7
Emery Mine Canyon Area				0.4	0.0[3]						0.4
Total Emery Mine Disturbance				0.6	0.0[3]	0.4	0.1				1.1
Emery 2 Road & Facilities[2]						0.9	0.6	0.1			1.6
Emery 2 Canyon Area	0.0[3]	0.0[3]		5.6	1.3						6.9
Emery 2 Rock Scaling Work Area		0.3									0.3
Emery 2 East Bench Berm[4]	0.1	0.3		0.0[3]							0.4
Emery 2 Disturbance Total[5]	0.1	0.6		5.6	1.3	0.9	0.6	0.1			9.2[5]
Total Disturbance[6]	0.1	0.6		6.2	1.3	1.3	0.7	0.1			10.3

1. Disturbance for west bench road to Emery 2 facilities above portal on existing Emery Mine permit area.
2. Disturbance for west bench road to Emery 2 facilities above portal on Emery 2 permit area.
3. Planned disturbance to be less than 0.01 acres.
4. Disturbance for berm on east bench to control surface runoff.
5. Total Emery 2 area is sum of Emery 2 road & facilities, canyon, rock scaling area, and east bench berm areas.
6. Total Disturbance is Total Emery Disturbance plus Emery 2 Disturbance.

Table 20. Estimated salvage volumes for map units by disturbance areas and by mine permit.

Map Unit	Disturbance Area[1]	Weighted Topsoil Salvage Depth[2]	Weighted Subsoil Salvage Depth[3]	Estimated Topsoil Salvage Volume	Estimated Subsoil Salvage Volume
	acres	feet	feet	cubic yards	cubic yards
Road & Facilities above Emery 2 Portal on Emery Mine Permit					
Road to Facilities on Emery Mine					
Ca	0.2	0.6	0.2	300	100
D	0.4	0.8	0.5	478	298
E	0.1	0.4	0.3	39	29
				816	428
Road & Facilities on Emery 2					
D	0.9	0.8	0.5	1,162	726
E	0.6	0.4	0.3	374	281
F	0.1	0.3	0.9	29	87
				1,565	1,094
Total Salvage from Road & Facilities				2,381	1,521
Canyon Area on Emery					
Ca	0.4	0.6	0.2	387	129
Canyon Area on Emery 2					
Ca	5.6	0.6	0.2	5,421	1,807
Cb	1.3	1.1	1.6	2,307	3,356
Total Salvage from Emery 2				7,728	5,163
Total Salvage from Canyon Area				8,115	5,292
East Bench Berm on Emery 2					
A	0.1	0.3	0.2	48	32
Ba	0.3	0.7	0.9	339	436
Total Salvage from East Bench				387	468
East Bench Scaling Area on Emery 2					
Ba	0.3	0.7	0.9	339	436
Total Salvage on Emery Permit[4]				1,162	565
Total Salvage from Emery 2 Permit[5]				10,438	7,357
Total Salvage from Disturbance Area[6]				**11,600**	**7,992**

1. Disturbance map unit area from Table 19.
2. Estimated weighted map unit topsoil salvage depths from Table 18.
3. Estimated weighted map unit subsoil salvage depths from Table 18.
4. Estimated salvage volumes are from all areas on the existing Emery Mine permit.
5. Estimated Emery 2 salvage volumes are the sum of volumes for the all Emery 2 disturbances.
6. Total Disturbance is Total Emery Disturbance plus Emery 2 Disturbance.

Table 21. Estimate of sandstone outcrop area within the Emery 2 disturbance area.

Area[1]	Map Unit Symbol	Map Unit Acres[2]	Percent Rock Outcrop[3]	Estimated Sandstone Outcrop in Map Unit Component[4]	Estimated Sandstone Outcrop Area in Map Unit[5]
		acres	%	acres	acres
East Bench Berm	A	0.1	50	0.0	
East Bench Berm	Ba	0.3	5	0.0	
East Bench Berm	Ca	0.0	20	0.0	
					0.0
East Bench Scaling	Ba	0.3	5	0.0	
					0.0
Emery 2 Canyon	A	0.0	50	0.00	
Emery 2 Canyon	Ca	5.6	20	1.1	
Emery 2 Canyon	Cb	1.3	0	0.0	
					1.1
Canyon on Emery	Ca	0.4	20	0.1	
Canyon on Emery	Cb	0.0	0	0.0	
					0.1
Emery 2 Road & Facilities	D	0.9	10	0.1	
Emery 2 Road & Facilities	E	0.6	50	0.3	
Emery 2 Road & Facilities	F	0.1	5	0.0	
					0.4
Emery Road	Ca	0.2	20	0.0	
Emery Road	D	0.4	10	0.0	
Emery Road	E	0.1	50	0.1	
					0.1
TOTAL		10.30			1.7

1. Geographic portion of Emery 2 disturbance area.
2. Map unit acres within geographic portions of Emery 2 disturbance area from Table 19.
3. Percent rock outcrop in map unit from Table 4.
4. Map unit area (acres) multiplied by percent rock outcrop in map unit.
5. Cumulative estimated in geographic portion of Emery 2 disturbance area.

Topsoil and Subsoil Salvage in Canyon Area

The topsoil and subsoil identified in this report will be salvaged by an experienced contractor that has worked on several projects of this type for the Utah mining industry. The salvage operation will be monitored by a *Certified Professional Soil Scientist* (CPSS) capable of making field decisions and changes in conjunction with DOGM.

Large chunks of sandstone on the canyon rim have been identified as unstable and present a safety issue. They will be brought down before any topsoil or subsoil is salvaged from the canyon. Bringing down these large chunks of sandstone from the canyon rim will result in some disturbance of topsoil and subsoil in the canyon. Topsoil and subsoil removal will begin after the canyon rim has been stabilized.

Safety will be the top priority when salvaging topsoil and subsoil in the Emery 2 disturbance area. Steepness of slope, large boulders on the canyon rim or on the sideslope, and other site specific factors may preclude salvage in some areas.

Appropriate equipment for salvaging topsoil and subsoil will be utilized to salvage topsoil and subsoil from the Emery 2 disturbance areas. The type of equipment selected to complete this task is dependent on slope, access, size of work space, soil horizon depths, and amount of rock in the soil.

This soil survey identified sodic and saline soils in the canyon within the Emery 2 disturbance area. Soil samples will be collected from the Emery 2 canyon area to further identify areas with *Unacceptable* sodium adsorption ratios (SAR), pH, and electrical conductivities (ECe) prior to the start of salvage operations. Samples will be analyzed for pH, conductivity, sodium adsorption ratio, and texture by the methods detailed in Table 3 of the *Guidelines for Management of Topsoil and Overburden* (Utah DOGM 2008). Samples will be collected in the Emery 2 canyon on the basis of approximately one sample location per 1 to 2 acres as determined appropriate by the *Certified Professional Soil Scientist* collecting the soil samples. The canyon area has an estimated 6.3 acres of salvageable soils. The following table lists how the soil sample locations in the canyon area may be selected.

Table 22. Estimated number and location of soil sample locations in Emery 2 canyon for use during construction phase.

Emery 2 Disturbance Area	Soil Families of Concerns	Estimated Number of Sample Locations Within Canyon[1]
Canyon bottom	Monue and Garley	3 to 5
Canyon Sideslopes	Persayo	1 to 2

1. The actual number soil sample locations will be determined in the field by the Certified Professional Soil Scientist collecting the samples.

Soil samples collected for construction salvage purposes will be collected by soil horizon as determined by the Certified Soil Scientist collecting the soil samples. The surface horizon sample will not exceed 12 inches in thickness and subsurface horizon samples will not exceed 18 inches in thickness.

The large rocks will be sorted out of the topsoil and subsoil as the salvage operation progresses. Sorting of rock may take place either in the canyon or at the storage location, depending on the amount of space available and the amount of sorting required. Rock will either be hauled from the canyon and stockpiled in designated storage areas or left in piles within the canyon to provide fill for building the road to the new portal site. Larger boulders will be broken down to a size that can be handled by the equipment and transported in trucks to designated storage areas.

Soil and rock will be removed in layers along the face of the work area. When all of the soil and rock have been removed from a layer, then removal of the next soil layer will begin. Layer thickness will depend on soil quality, thickness, and rock size.

Topsoil and subsoil pH and conductivity will be monitored in the field by a *Certified Professional Soil Scientist* (CPSS). Soil with pH greater than approximately 8.6 or conductivities greater than approximately 8 dS/m (mS/cm) will not be salvaged.

Topsoil and Subsoil Stockpiles

The coarse-loamy soil textures that dominate the Emery 2 soil survey are susceptible to wind erosion. Topsoil and subsoil stockpiles should be protected from both wind and water erosion.

Topsoil and subsoil that is salvaged from the Garley, Garley, moderately well drained, and other soils with *Unacceptable* properties (DOGM 2008) should be placed in stockpiles that are separate from the other topsoil or subsoil stockpiles. These soils with SAR levels in excess of 20 will require special treatment in order to establish vegetation.

Native Soil Profile Features

The combined depth of topsoil and subsoil varies in native soil profiles within the Emery 2 permit area depending on physiographic setting, depth to sandstone or shale, salinity, and sodicity (SAR).

Stockpile and Placement of Topsoil and Subsoil

Topsoil and subsoil should be salvaged and placed directly into stockpiles. Stockpiles should be identified with signs and protected from other mining activities. Stockpile locations should protect the topsoil from wind erosion, flooding, and stockpiled coal. A mixture of native grasses and shrubs should be seeded on the stockpile(s) to protect them from wind and water erosion.

Topsoil placement depths will range from a minimum of 9 cm (6 inches) up to approximately 30 cm (12 inches). Topsoil will not be available for reclamation in areas which were sandstone outcrops prior to disturbance. There is an approximately 1.70 acres of sandstone outcrops in the proposed Emery 2 disturbance area based on map unit composition and map unit acres, Table F-1.

Reclamation of Sodic Subsoil Areas

Unacceptable sodium adsorption ratios (SAR) in the Garley soils may be limiting to the establishment of grasses and shrubs during post-mining reclamation. These soils are naturally sodic within a few inches of the native surface. Black greasewood and shadscale are presently growing on these soils with scattered clumps of Indian ricegrass in localized areas. The reclamation seed mix should include grasses and shrubs that are tolerant of these SAR levels.

It is recommended that sodic subsoil be stockpiled separately to avoid mixing with other subsoil sources.

Reclamation

The primary keys to successful reclamation of disturbed areas within the Emery 2 permit area will be:

- Identification of sodic subsoil materials and stockpiling them separately from other subsoil sources;
- Replacement of sodic subsoil materials in areas less susceptible to erosion;
- Incorporation of rock outcrop areas into the final surface reclamation plan in proportions similar to native conditions prior to disturbance;
- Seeding the final surface with a mixture of native grasses and shrubs that are tolerant of the coarse-loamy, droughty, saline, and sodic conditions in the Emery 2 permit area .

Substitute Soil Materials

No sources of substitute soil material were identified during the Emery 2 soil survey.

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Appendix A

NRCS - Prime Farmland Assessment

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
540 West Price River Drive
Price, Utah 84501

January 8, 2010

Mr. John Gefferth
Consolidated Coal Company
P.O. Box 566
Sesser, IL 62884

Dear: Mr. Gefferth

The area south and west of the coal mine south of Emery, Utah as outlined by Robert Long CPSS in sections 32 and 33 T22S. R6E. contains no Prime or Unique farmlands or farmlands of Statewide importance because there is no developed irrigation system on these arid soils. Most of this area has soils with other limitations also, such as being shallow to bedrock or steep slopes.

If we can be of further assistance please let us know.

Leland Sasser

Leland Sasser NRCS Soil Scientist

Appendix B

Soil Profile Descriptions

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EM-1-09

Site ID: EM-1-09
Description Date: 9/29/2009
Describer: Robert Long
Soil Name As Correlated: Begay Family
Classification: Coarse-loamy, mixed, superactive, mesic Ustic Haplocambids
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Family

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 422584E, 4300701N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 33, Township 22 S, Range 6 E

Landscape: plateau
Landform: hill
Geomorphic Component: Side Slope
Profile Pos: Footslope

Slope: 7 percent
Elevation: 1847 meters (6060 feet)
Aspect: 314°
Shape: up/down: Concave; **across:** Concave
Drainage: Well drained
Runoff: Medium
Permeability: Moderate
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); SAVE4 - greasewood (*Sarcobatus vermiculatus*); ATCO - shadscale (*Atriplex confertifolia*)

Parent Materials: Alluvium over Sandstone
Bedrock: Calcareous sandstone at 80 centimeters (32 inches)
Particle Size Control Section: 25 to 80 centimeters (10 to 32 inches)
Diagnostic Features: Lithic contact: 80 centimeters (Restrictive layer) and Cambic horizon: 8 to 50 centimeters (3 to 20 inches)
Restrictions: Lithic bedrock: 80 centimeters

A --- 0 to 8 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light yellowish brown (2.5Y 6/4) moist; 63 percent sand; 20 percent silt; 17 percent clay; weak medium platy parting to moderate fine granular structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 3 percent subangular calcareous sandstone gravels; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; neutral, pH 7.3; clear smooth boundary; CaCO3 9.1 percent.

Bw1 --- 8 to 23 cm (3 to 9 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; 57 percent sand; 29 percent silt; 14 percent clay; structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions on bottom of rock fragments; 5 percent calcareous sandstone gravels; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; clear smooth boundary; CaCO3 7.2 percent.

Bw2 --- 23 to 50 cm (9 to 20 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 73 percent sand; 14 percent silt; 13 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 3 percent (common) fine masses of carbonate on vertical faces of peds and 4 percent (common) fine irregular carbonate concretions around rock fragments; 8 percent subangular calcareous sandstone gravels; electrical conductivity of 3.94 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 7.2 percent.

Bk --- 50 to 80 cm (20 to 32 inches); very pale brown (10YR 7/4) dry, channery sandy loam; yellowish brown (10YR 5/4) moist; 65 percent sand; 23 percent silt; 12 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds and 7 percent (common) medium carbonate concretions around rock fragments; 6 percent subangular calcareous sandstone gravels and 12 percent subangular calcareous

sandstone channers; electrical conductivity of 3.07 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; slightly alkaline, pH 7.6 ; abrupt smooth boundary; $CaCO_3$ 7.8 percent.

R --- 80 cm (32 inches); Ferron sandstone.

EM-2-09

Pedon ID: EM-2-09
Description Date: 9/29/2009
Describer: Robert Long

Soil Name As Correlated: Hideout
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477634E, 4300621N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateaus or tablelands
Landform: hill
Geomorphic Component: Side Slope
Profile Pos: Backslope: on middle third
Slope: 6 percent
Elevation: 1851 meters (6070 feet)
Aspect: 10°
Shape: up/down: ; across:
Complexity: Simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 1 - Sheet erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); ATCO - shadscale (*Atriplex confertifolia*); SAVE4 - black greasewood (*Sarcobatus vermiculatus*); JUOS - Utah juniper (*Juniperus osteosperma*); GUSA2 - broom snakeweed (*Gutierrezia sarothrae*); EPHED - Mormon tea (*Ephedra*); AMUT - Utah serviceberry (*Amelanchier utahensis*); PIED - twoneedle pinyon (*Pinus edulis*)

Parent Materials: slightly weathered, residuum weathered from calcareous sandstone
Bedrock: Strongly cemented calcareous sandstone at 19 centimeters (7.5 inches)
Particle Size Control Section: 0 to 19 centimeters (0 to 7.5 inches)
Diagnostic Features: Lithic contact: 19 centimeters (7.5 inches)
Restrictions: Lithic bedrock: 19 centimeters (7.5 inches)

A --- 0 to 5 centimeters (0 to 2 inches); pale brown (10YR 6/3) dry, sandy loam; brown (10YR 4/3) moist; 69 percent sand; 20 percent silt; 11 percent clay; moderate fine granular and weak medium platy structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 5 percent subangular calcareous sandstone gravels; electrical conductivity of 0.89 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter; abrupt smooth boundary; $CaCO_3$ 5.5 Percent.

C --- 5 to 19 centimeters (2 to 7.5 inches); brown (10YR 5/3) dry, sandy loam; brown (10YR 4/3) moist; 71 percent sand; 17 percent silt; 12 percent clay; weak medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; electrical conductivity of 0.78 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7, pH meter; abrupt smooth boundary; CaCO3 4.4 Percent.

R --- 19 centimeters (7.5 inches).

EM-3-09

Pedon ID: EM-3-09
Description Date: 9/29/2009
Describer: Robert Long

Soil Name As Correlated: Disturbed Land
Classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic torrio Torriorthents
Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 477516E, 4300469N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 11 percent
Elevation: 1861 meters (6105 feet)
Aspect: 350°
Shape: up/down: Linear; **across:** Linear

Drainage: Well drained
Runoff: Medium
Permeability: Moderately slow
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); SAVE4 - greasewood (*Sarcobatus vermiculatus*)

Parent Materials: Residuum
Bedrock: Calcareous shale at 46 centimeters (18 inches)
Particle Size Control Section: 36 to 46 centimeters (7 to18 inches)
Diagnostic Features: Lithic contact: 46 centimeters (18 inches)
Restrictions: Lithic bedrock: 46 centimeters (18 inches)

A --- 0 to 18 cm (0 to 7 inches); very pale brown (10YR 7/3) dry, channery loam; pale brown (10YR 6/3) moist; 47 percent sand; 33 percent silt; 20 percent clay; structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine irregular moderately cemented carbonate concretions around rock fragments; 15 percent subangular calcareous sandstone channers; electrical conductivity of 1.40 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary;: CaCO3 13.9 percent.

C --- 18 to 46 cm (7 to 18 inches); pale brown (10YR 6/3) dry, channery sandy clay loam; brown (10YR 5/3) moist; 53 percent sand; 25 percent silt; 22 percent clay; medium structure; friable, hard, nonsticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 2 percent (common) medium irregular moderately cemented carbonate concretions around rock fragments; 5 percent subangular calcareous sandstone flags and 15 percent subangular calcareous sandstone channers; electrical conductivity of 4.39 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt smooth boundary; CaCO3 13.4 percent.

R --- 46 cm (18 inches); hard shale.

EM-4-09

Pedon ID: EM-4-09
Description Date: 9/29/2009
Describer: Robert Long

Soil Name as Correlated: Hideout
Classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 477406E, 4300402N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: plateau
Landform: structural bench and plateau
Geomorphic Component: Tread
Profile Pos: Summit

Slope: 6 percent
Elevation: 1852 meters (6076.1 feet)
Aspect: 327°
Shape: up/down: Convex; **across:** Convex
Drainage: Well drained **Runoff:** Medium **Permeability:** Moderate
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Conifers
Existing Vegetation: PIED - twoneedle pinyon (*Pinus edulis*); JUOS - Utah juniper (*Juniperus osteosperma*); CEMOG - birchleaf mountain mahogany (*Cercocarpus montanus var. glaber*); ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*); ARNO4 - black sagebrush (*Artemisia nova*); OPUNT - pricklypear (*Opuntia*); GUSA2 - broom snakeweed (*Gutierrezia sarothrae*)

Parent Materials: Eolian

Bedrock: Calcareous sandstone at 20 centimeters (7.9 inches)
Particle Size Control Section: 0 to 20 centimeters (0 to 7.9 inches)
Diagnostic Features: Lithic contact: 20 centimeters (7.9 inches) (Restrictive layer)
Restrictions: Lithic bedrock: 20 centimeters (7.9 inches)

A --- 0 to 6 centimeters (0 to 2.4 inches); very pale brown (10YR 7/3) dry, loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 14 percent silt; 7 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.69 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; $CaCO_3$ 6.1 Percent.

C --- 6 to 20 centimeters (2.4 to 7.9 inches); pale brown (10YR 6/3) dry, sandy loam; brown (10YR 5/3) moist; 69 percent sand; 21 percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 0.95 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; $CaCO_3$ 6.4 Percent.

R --- 20 centimeters (7.9 inches); Ferron sandstone.

EM-5-09

Pedon ID: EM-5-2009
Description Date: 9/29/2009
Describer: Robert Long

Soil Name As Correlated: Lazear
Classification: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic torrio Torriorthents
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: Walker Flat, Utah
UTM: 477277E, 4300359N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Slope: 8 percent
Elevation: 1859 meters (6100 feet)
Aspect: 0°
Shape: up/down: Linear; **across:** Convex

Drainage: Well drained
Runoff: Medium
Permeability: Moderate
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); ARNO4 - black sagebrush (*Artemisia nova*); GUSA2 - broom snakeweed (*Gutierrezia sarothrae*); POA - bluegrass (*Poa*)

Parent Materials: Residuum
Bedrock: Calcareous sandstone at 20 centimeters (8 inches)
Particle Size Control Section: 0 to 20 centimeters (0 to 8 inches)
Diagnostic Features: Lithic contact: 20 centimeters (Restrictive layer)
Restrictions: Lithic bedrock: 20 centimeters (8 inches)

A --- 0 to 7 cm (0 to 3 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; 65 percent sand; 22 percent silt; 13 percent clay; moderate medium platy structure; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone channers and 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.65 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; $CaCO_3$ 22.5 percent.

C --- 7 to 20 cm (23 to 8 inches); light yellowish brown (10YR 6/4) dry, channery sandy clay loam; pale brown (10YR 6/3) moist; 63 percent sand; 16 percent silt; 21 percent clay; weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels and 15 percent subangular calcareous sandstone channers; electrical conductivity of 0.57 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; $CaCO_3$ 25.4 percent.

R --- 20 cm (8 inches); Ferron sandstone.

EM-6-09

Pedon ID: EM-6-09
Description Date: 9/30/2009
Describer: Robert Long

Soil Name As Correlated: Persayo family
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Pedon Type: Representative pedon for component
Current Taxon Kind: family

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477565E, 4300903N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: plateaus or tablelands
Landform: canyon
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 78 percent
Elevation: 1811 meters (5940 feet)
Aspect: 90°
Shape: up/down: ; across:
Complexity: Simple

Drainage: Well drained
Runoff: High
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); ATGA - Gardner's saltbush (*Atriplex gardneri*)

Parent Materials: moderately weathered, residuum weathered from calcareous shale
Bedrock: Very weakly cemented calcareous shale at 18 centimeters (7.1 inches)
Particle Size Control Section: 0 to 18 centimeters (0 to 7.1 inches)
Diagnostic Features: Paralithic contact: 18 centimeters (7.1 inches)
Restrictions: Paralithic bedrock: 18 to 34 centimeters (7.1 to 13.4 inches) and Paralithic bedrock: 34 centimeters (13.4 inches)

A --- 0 to 7 cm (0 to 3 inches); very pale brown (10YR 7/3) dry, channery loamy sand; pale brown (10YR 6/3) moist; 79 percent sand; 12 percent silt; 9 percent clay; weak medium platy structure parting to single grain; very friable, slightly hard, non-sticky, non-plastic; common very fine and few fine roots; common very fine and few fine tubular pores; 10 percent angular sandstone channers, 5 percent angular strongly cemented sandstone gravels, 5 percent angular sandstone flags, and 1 percent angular sandstone boulders; electrical conductivity of 2.32 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 6.4 percent.

2C --- 7 to 18 cm (3 to 7 inches); very pale brown (10YR 7/4) dry, para-channery sandy loam; light yellowish brown (10YR 6/4) moist; 71 percent sand; 15 percent silt; 14 percent clay; weak fine and medium subangular blocky structure; very friable, slightly hard, slightly sticky, non-plastic; many very fine, few fine, few medium roots; common very fine tubular pores; 20 percent angular weakly cemented shale parachanners; electrical conductivity of 2.71 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; abrupt smooth boundary; CaCO3 7.5 percent.

2Cr1 --- 18 to 34 cm (7 to 13 inches); decomposing Blue Gate member of the Mancos shale; common very fine and few fine roots; clear smooth boundary.

2Cr2 --- 34 to 38 cm (13 to 15 inches); Blue Gate member of the Mancos shale.

EM-7-09

Pedon ID: EM-7-09
Description Date: 9/30/2009
Describer: Robert Long

Soil Name As Correlated: Green River
Classification: Coarse-loamy, mixed, calcareous, mesic Oxyaquic Torrifluvents
Pedon Type: Modal pedon for map unit
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477190E, 4301339N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: valley
Landform: valley floor and stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 2 percent
Elevation: 1797 meters (5895 feet)
Aspect: 152°
Shape: up/down: Convex; **across:** Linear
Complexity: Simple

Flooding: Occasional; very brief **Ponding:** Rare; very brief **Drainage:** Moderately well drained
Runoff: Low
Permeability: Moderate
Erosion:
Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: TAMAR2 - tamarisk (*Tamarix*); SALIX - willow (*Salix*)

Parent Materials: Alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)

A --- 0 to 15 cm (0 to 6 inches); light yellowish brown (2.5Y 6/3) dry, sandy clay loam; light olive brown (2.5Y 5/3) moist; 57 percent sand; 15 percent silt; 28 percent clay; medium platy structure; very friable, slightly hard, nonsticky, nonplastic; electrical conductivity of 2.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; $CaCO_3$ 14.4 percent.

2A --- 15 to 28 cm (6 to 11 inches); pale yellow (2.5Y 7/3) dry, silt loam; grayish brown (2.5Y 5/2) moist; 37 percent sand; 52 percent silt; 11 percent clay; moderate medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.55 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 18.3 percent.

2C --- 28 to 43 cm (11 to 17 inches); light gray (2.5Y 7/2) dry, loam; light yellowish brown (2.5Y 6/3) moist; 43 percent sand; 48 percent silt; 9 percent clay; 2 percent medium distinct olive yellow (2.5Y 6/6) and 2 percent fine distinct olive yellow (2.5Y 6/6) mottles; moderate medium subangular blocky structure; very friable, hard, slightly sticky, nonplastic; many very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 1.36 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 15.9 percent.

3A --- 43 to 56 cm (17 to 22 inches); light gray (2.5Y 7/2) dry, silt loam; light olive brown (2.5Y 5/3) moist; 23 percent sand; 56 percent silt; 21 percent clay; 6 percent coarse prominent strong brown (7.5YR 5/8) and 6 percent medium prominent strong brown (7.5YR 5/8) mottles; strong coarse platy structure; very friable, hard, slightly sticky, slightly plastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; electrical conductivity of 3.46 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; abrupt smooth boundary; CaCO3 19.2 percent.

3C1 --- 56 to 78 cm (22 to 31 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 61 percent sand; 26 percent silt; 13 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 3.67 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 15.2 percent.

3C2 --- 78 to 102 cm (31to 40 inches); light yellowish brown (2.5Y 6/3) dry, loam; dark grayish brown (2.5Y 4/2) moist; 46 percent sand; 37 percent silt; 17 percent clay; massive parting to single grain; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 3.93 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 16.5 percent.

3C3 --- 102 to 130 cm (40 to 51 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; single grain and medium structure; very friable, slightly hard, slightly sticky, slightly plastic; many very fine interstitial pores; electrical conductivity of 2.21 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 14.5 percent.

3C4 --- 130 to 150 cm (51 to 59 inches); light gray (2.5Y 7/2) dry, sandy loam; light yellowish brown (2.5Y 6/3) moist; 69 percent sand; 25 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; many very fine interstitial pores; electrical conductivity of 1.6 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; CaCO3 14.3 percent.

EM-8-09

Pedon ID: EM-8-09
Description Date: 9/30/2009
Describer: Robert Long

Soil Name As Correlated: Garley
Current Taxonomic Class: Coarse-loamy, mixed, superactive, calcareous, mesic Typic Torrifluvents
Pedon Type: Representative pedon for component
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477585E, 4300886N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau canyon
Landform: stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 5 percent
Elevation: 1809 meters (5934 feet)
Aspect: 45°
Shape: up/down: Concave; **across:** Linear
Complexity: simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:**
Existing Vegetation: SAVE4 - black greasewood (*Sarcobatus vermiculatus*); ATCO - shadscale (*Atriplex confertifolia*); CHRYS9 - rabbitbrush (*Chrysothamnus*); ARNO4 - black sagebrush (*Artemisia nova*); ACHY - Indian ricegrass (*Achnatherum hymenoides*)

Parent Materials: alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Secondary carbonates: 32 to 88 centimeters (12.6 to 34.6 inches)

A --- 0 to 9 cm (0 to 4 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 79 percent sand; 13 percent silt; 8 percent clay; moderate medium platy structure; friable, hard, slightly sticky, slightly plastic; many very fine roots throughout, few fine roots throughout; common very fine tubular pores; electrical conductivity of 2.25 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.7; clear smooth boundary; $CaCO_3$ 8.8 percent.

C1--- 9 to 32 cm (4 to 13 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 10 percent silt; 5 percent clay; moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, few fine roots throughout, and few medium roots throughout; common very fine tubular pores; electrical conductivity of 3.82 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; abrupt smooth boundary; $CaCO_3$ 8.9 percent.

C2 --- 32 to 46 cm (13 to 18 inches); pale yellow (10YR 7/4) dry, very gravelly loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 40 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 3.91 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.8; abrupt wavy boundary; $CaCO_3$ 8.9 percent.

Ab1 --- 46 to 60 cm (18 to 24 inches); pale yellow (10YR 7/4) dry, loamy sand; light yellowish brown (10YR 6/4) moist; 85 percent sand; 9 percent silt; 6 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 8.29 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; very strongly alkaline, pH 9.3; clear smooth boundary; $CaCO_3$ 5.3 percent.

C3 --- 60 to 70 cm (24 to 28 inches); light yellowish brown (10YR 6/4) dry, very gravelly loam; light olive brown (10YR 5/4) moist; 50 percent sand; 40 percent silt; 10 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, few medium roots throughout and few coarse roots throughout; many very fine interstitial pores; 50 percent fine calcareous sandstone gravels; 2 percent thin calcium carbonate coatings on bottom of rock fragments; electrical conductivity of 9.77 dS/m by EC meter, saturated paste; very slightly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; abrupt wavy boundary; $CaCO_3$ 8.4 percent.

C4 --- 70 to 88 cm (28 to 35 inches); pale yellow (10YR 7/4) dry, sandy loam; light yellowish brown (10YR 6/4) moist; 79 percent sand; 10 percent silt; 11 percent clay; massive; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, and few fine roots throughout,; common very fine tubular pores; 2 percent fine masses of carbonate on faces of peds; electrical conductivity of 9.38 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; abrupt wavy boundary; $CaCO_3$ 6.3 percent.

AB2 --- 88 to 98 cm (35 to 66 inches); light yellowish brown (10YR 6/4) dry, very bouldery sandy loam; light olive brown (10YR 5/4) moist; 80 percent sand; 8 percent silt; 12 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 50 percent calcareous sandstone boulders; electrical conductivity of 4.35 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4; abrupt wavy boundary; $CaCO_3$ 5.5 percent.

C5 --- 98 to 108 cm (35 to 43 inches); light yellowish brown (10YR 6/4) dry, very bouldery sandy loam; light olive brown (10YR 5/4) moist; 77 percent sand; 14 percent silt; 9 percent clay; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; few very fine tubular pores; 50 percent calcareous sandstone boulders; electrical conductivity of 5.54 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; slightly alkaline pH 7.7; abrupt smooth boundary; $CaCO_3$ 6.8 percent.

C6 --- 108 to 120 cm (43 to 47 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; light olive brown (10YR 5/4) moist; 75 percent sand; 13 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; many very fine and common fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 5.59 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 3.2 percent.

C7 --- 120 to 150 cm (59 inches); light yellowish brown (10YR 6/3) dry, extremely bouldery sandy loam; olive brown (10YR 4/4) moist; 77 percent sand; 11 percent silt; 12 percent clay; very friable, slightly hard, slightly sticky, slightly plastic; common very fine roots throughout; few very fine tubular pores; 70 percent calcareous sandstone boulders; electrical conductivity of 6.17 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline pH 7.5; clear smooth boundary; $CaCO_3$ 6.0 percent.

EM-9-09

Pedon ID: EM-9-09
Description Date: 10/8/2009
Describer: Robert Long
Soil Name As Correlated: Garley
Classification: Coarse-loamy, mixed, superactive, mesic Typic Torrifluvents
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477210E, 4300409N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 32, Township 22 S, Range 6 E of the Uintah Meridian

Landscape: canyon
Landform: alluvial fan
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 5 percent
Elevation: 1827 meters (5994 feet)
Aspect: 21°
Shape: up/down: Linear; **across:** Concave

Drainage: Well drained
Runoff: Medium
Permeability: Moderate
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Grass/herbaceous cover; **Secondary Earth Cover:** Grassland rangeland
Existing Vegetation: SAVE4 - greasewood (*Sarcobatus vermiculatus*); ATCO - shadscale (*Atriplex confertifolia*); ACHY - Indian ricegrass (*Achnatherum hymenoides*); JUOS - Utah juniper (*Juniperus osteosperma*)

Parent Materials: Alluvium/ Colluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.3 inches)

A --- 0 to 9 centimeters (0 to 3.5 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; null percent sand; null percent silt; 6 percent clay; moderate medium platy structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores finely disseminated salts throughout; electrical conductivity of 1.01 dS/m by EC meter, saturated paste; slightly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; $CaCO_3$ 12.6 Percent.

Ac --- 9 to 25 centimeters (3.5 to 9.8 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 9 percent clay; moderate medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores finely disseminated salts throughout; electrical conductivity of 2.03 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; clear smooth boundary; $CaCO_3$ 12 Percent.

C2 --- 25 to 49 centimeters (9.8 to 19.3 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 8 percent clay; structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores finely disseminated salts throughout; electrical conductivity of 13.5 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; $CaCO_3$ 12.9 Percent.

C2 --- 49 to 75 centimeters (19.3 to 29.5 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, moderately hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; medium distinct strongly cemented masses of carbonate on vertical faces of peds; electrical conductivity of 15.9 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; gradual smooth boundary; $CaCO_3$ 11.7 Percent.

C3 --- 75 to 120 centimeters (29.5 to 47.2 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 10 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout, common medium roots throughout and common coarse roots throughout; common very fine tubular pores; 5 percent (common) fine faint masses of carbonate on vertical faces of peds; strongly effervescent by HCl, 1 normal; electrical conductivity of 11.3 dS/m

by EC meter, saturated paste; strongly alkaline, pH 8.5; clear smooth boundary; $CaCO_3$ 12.2 Percent.

2Bk --- 120 to 168 centimeters (47.2 to 66.1 inches); very pale brown (10YR 7/4) dry, very channery sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 8 percent clay; subangular blocky and medium structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; many very fine interstitial pores; 4 percent (common) faint carbonate concretions on bottom of rock fragments; 10 percent shale cobbles and 35 percent calcareous sandstone channers; electrical conductivity of 8.55 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; strongly alkaline, pH 8.6; $CaCO_3$ 23.2 Percent.

EM-10-09

Pedon ID: EM-10-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Braf
Classification: Coarse-loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Pedon Type: Modal pedon for map unit
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477094E, 4300475N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 32, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Tread **Profile Pos:** Summit
Slope: 7 percent
Elevation: 1840 meters (6036 feet)
Aspect: 343°
Shape: up/down: Convex; **across:** Convex

Drainage: Well drained
Runoff: Medium
Permeability: Moderately rapid
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Shrub cover
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); SAME3 - black sage (*Salvia mellifera*); ACHY - Indian ricegrass (*Achnatherum hymenoides*); OPUNT - pricklypear (*Opuntia*)

Parent Materials: Residuum
Bedrock: Calcareous sandstone at 45 centimeters (18 inches)
Particle Size Control Section: 25 to 47 centimeters (9.8 to 18 inches)
Diagnostic Features: Lithic contact: 45 centimeters (Restrictive layer)
Restrictions: Lithic bedrock: 45 centimeters (18 inches)

Notes: this profile does not meet requirements of a calcic horizon due to less than 5 percent identifiable secondary carbonates.

A --- 0 to 7 cm (0 to 3 inches); pale yellow (2.5Y 7/3) dry, loamy sand; light yellowish brown (2.5Y 6/3) moist; 84 percent sand; 8 percent silt; 8 percent clay; weak medium platy parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; many very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 7.9; clear smooth boundary; $CaCO_3$ 13.5 percent.

C1 --- 7 to 27 cm (3 to 11 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 20 percent silt; 10 percent clay; structure; very friable, moderately hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (very few) fine calcium carbonate coats on bottom of rock fragments; 10 percent subangular calcareous sandstone gravels; electrical conductivity of 0.50 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.8; clear smooth boundary; $CaCO_3$ 22.2 percent.

C2 --- 27 to 45 cm (11 to 18 inches); pale yellow (2.5Y 7/4) dry, flaggy sandy loam; light yellowish brown (2.5Y 6/4) moist; 76 percent sand; 16 percent silt; 8 percent clay; single grain; loose, loose, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; common very fine tubular pores; 2 percent (very few) fine calcium carbonate coats on bottom of rock fragments; 20 percent subangular calcareous sandstone flags and 10 percent subangular calcareous sandstone channers; electrical conductivity of 1.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; abrupt smooth boundary; $CaCO_3$ 18.7 percent.

R --- 45 cm (18 inches); Ferron sandstone.

EM-11-09

Pedon ID: EM-11-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Braf
Current Taxonomic Name: Braf
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477103E, 4300766N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 10 percent
Elevation: 1828 meters (5997 feet)
Aspect: 330°
Shape: up/down: Linear; **across:** Convex
Complexity: simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 3 - Sheet erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); ACHY - Indian ricegrass (*Achnatherum hymenoides*); ARNO4 - black sagebrush (*Artemisia nova*); OPPO - plains pricklypear (*Opuntia polyacantha*)

Parent Materials: residuum
Bedrock: Strongly cemented calcareous sandstone at 8 centimeters (3.1 inches)
Particle Size Control Section: 0 to 18 centimeters (0 to 7.1 inches)
Diagnostic Features: Lithic contact: 8 centimeters (3.1 inches)
Restrictions: Lithic bedrock: 8 centimeters (3.1 inches)

A --- 0 to 3 centimeters (0 to 1.2 inches); very pale brown (10YR 7/3) dry, channery sandy loam; light yellowish brown (10YR 6/4) moist; 70 percent sand; 14 percent silt; 16 percent clay; moderate medium platy structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 5 percent subangular calcareous sandstone gravels and 10 percent subangular calcareous sandstone channers; electrical conductivity of 1.55 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter; abrupt smooth boundary; $CaCO_3$ 20.5 Percent.

C --- 3 to 8 centimeters (1.2 to 3.1 inches); very pale brown (10YR 7/4) dry, sandy loam; brownish yellow (10YR 6/6) moist; 70 percent sand; 14 percent silt; 16 percent clay; moderate fine subangular blocky structure; very friable, slightly hard, slightly sticky, nonplastic; common fine roots throughout and common very fine roots throughout; common very fine tubular pores; 5 percent subangular calcareous sandstone gravels; electrical conductivity of 1.55 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6, pH meter; abrupt smooth boundary; $CaCO_3$ 20.5 Percent.

R --- 8 centimeters (3.1 inches); Ferron sandstone.

EM-12-09

Pedon ID: EM-12-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Garley, moderately well drained
Classification: Coarse-loamy, mixed, active, calcareous, mesic Typic Torrifluvents
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477106E, 4301242N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East

Landscape: valley
Landform: stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 3 percent
Elevation: 1802 meters (5912.1 feet)
Aspect: 56°
Shape: up/down: Linear; **across:** Linear
Complexity: Simple

Flooding: Rare; extremely brief **Ponding:** Rare; very brief **Drainage:** Moderately well drained
Runoff: Low
Permeability: Moderately rapid
Erosion: Class 3 - Tunnel erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: SAVE4 - greasewood (*Sarcobatus vermiculatus*)

Parent Materials: Alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)

A --- 0 to 15 cm (0 to 6 inches); light gray (2.5Y 7/2) dry, loam; light olive brown (2.5Y 5/3) moist; 48 percent sand; 38 percent silt; 14 percent clay; moderate coarse platy structure; friable, very hard, slightly sticky, nonplastic; common very fine roots throughout; common very fine tubular pores; electrical conductivity of 6.54 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; clear smooth boundary; CaCO3 17.5 percent.

C1 --- 15 to 35 cm (6 to 14 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 54 percent sand; 30 percent silt; 16 percent clay; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.97 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.1; unable to dig with shovel; clear smooth boundary; CaCO3 18.7 percent.

C2 --- 35 to 46 cm (14to 18 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 64 percent sand; 25 percent silt; 11 percent clay; weak fine and medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; electrical conductivity of 8.60 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.2; gradual smooth boundary; CaCO3 14.3 percent.

C3 --- 46 to 72 cm (18 to 28 inches); light yellowish brown (2.5Y 6/3) dry, loam; light olive brown (2.5Y 5/3) moist; 46 percent sand; 38 percent silt; 16 percent clay; weak medium subangular blocky structure; friable, hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 5 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 8.88 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; gradual smooth boundary; CaCO3 16.1 percent.

Ab --- 72 to 102 cm (28 to 40 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout, common fine roots throughout and common medium roots throughout; common very fine tubular pores; 2 percent (common) fine masses of carbonate on vertical faces of peds; electrical conductivity of 12.1 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 14.6 percent.

C4 --- 102 to 130 cm (40 to 52 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 34 percent silt; 12 percent clay; weak medium subangular blocky structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 5.55 dS/m by EC meter, saturated paste; electrical conductivity of 12.6 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary; CaCO3 15.2 percent.

C5 --- 130 to 164 cm (52 to 65 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam; grayish brown (2.5Y 5/2) moist; 54 percent sand; 30 percent silt; 16 percent clay; 2 percent fine prominent brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; friable, very hard, nonsticky, nonplastic; common very fine roots throughout; common very fine tubular pores; 2 percent (common) fine prominent spherical very weakly cemented masses of oxidized iron clear in matrix; 1 percent (few) fine masses of carbonate on vertical faces of peds; electrical conductivity of 9.64 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.3; CaCO3 14.8 percent.

EM-13-09

Pedon ID: EM-13-09
Description Date: 10/8/2009
Describer: Robert Long

Soil Name As Correlated: Persayo
Classification: Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Pedon Type: Modal pedon for map unit
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 476873E, 4300442N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 S, Range 6 E

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 42 percent
Elevation: 1832 meters (6012 feet)
Aspect: 230°
Shape: up/down: Linear; **across:** Convex

Drainage: Well drained
Runoff: High
Permeability: Moderately slow
Erosion: Class 3 - Sheet erosion

Primary Earth Cover: Grass/herbaceous cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*)

Parent Materials: Residuum
Bedrock: Calcareous shale at 40 centimeters
Particle Size Control Section: 25 to 40 centimeters
Diagnostic Features: Paralithic contact: 40 centimeters (Restrictive layer)

Restrictions: Paralithic bedrock: 40 centimeters (15.8 inches)

A --- 0 to 10 centimeters (0 to 3.9 inches); light yellowish brown (2.5Y 6/3) dry, very gravelly clay loam; dark grayish brown (2.5Y 4/2) moist; 33 percent sand; 40 percent silt; 27 percent clay; weak fine subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 20 percent angular calcareous shale channers and 40 percent angular calcareous shale gravels; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary.

C --- 10 to 40 centimeters (3.9 to 15.8 inches); light brownish gray (2.5Y 6/2) dry, silty clay loam; grayish brown (2.5Y 5/2) moist; 10 percent sand; 68 percent silt; 32 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine tubular pores; 10 percent flat angular very weakly cemented calcareous shale parachanners; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8.4; clear smooth boundary.

Cr --- 40 centimeters (15.8 inches); weathered Mancos shale.

EM-14-09

Pedon ID: EM-14-09
Description Date: 11/12/2009
Describer: Robert Long

Soil Name As Correlated: Braf
Current Taxonomic Name: Braf
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477475E, 4300929N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateaus or tablelands
Landform: hillslope
Geomorphic Component: Tread
Profile Pos: Shoulder
Slope: 8 percent
Elevation: 1855 meters (6086 feet)
Aspect: 340°
Shape: up/down: Convex; **across:** Linear
Complexity: Simple

Drainage: Well drained
Runoff: Medium
Erosion: Class 2 - Wind erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*); BOGR2 - blue grama (*Bouteloua gracilis*)

Parent Materials: residuum weathered from calcareous sandstone
Bedrock: Strongly cemented calcareous sandstone at 48 centimeters (18.9 inches)
Particle Size Control Section: 25 to 48 centimeters (9.8 to 18.9 inches)
Diagnostic Features: Lithic contact: 48 centimeters (18.9 inches)
Restrictions: Lithic bedrock: 48 centimeters (18.9 inches)

A --- 0 to 12 centimeters (0 to 4.7 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; null percent sand; null percent silt; 6 percent clay; weak medium subangular blocky structure; very friable, slightly hard, moderately sticky, nonplastic; common medium roots throughout, common fine roots throughout and many very fine roots throughout; common very fine dendritic tubular and many very fine interstitial pores; 3 percent (very few) carbonate coats on bottom surfaces of rock fragments; 15 percent subangular calcareous sandstone channers and 10 percent subangular calcareous sandstone gravels; strongly effervescent by HCl, 1 normal; neutral, pH 7.3, pH meter; clear smooth boundary.

C1 --- 12 to 38 centimeters (4.7 to 15 inches); light yellowish brown (10YR 6/4) dry, gravelly sandy loam; yellowish brown (10YR 5/4) moist; null percent sand; null percent silt; 6 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; many very fine interstitial pores; 4 percent (very few) carbonate coats on bottom surfaces of rock fragments; 5 percent subangular calcareous sandstone channers and 15 percent subangular calcareous sandstone gravelly; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5, pH meter; clear smooth boundary.

C2 --- 38 to 48 centimeters (15 to 18.9 inches); very pale brown (10YR 7/3) dry, gravelly loamy sand; pale brown (10YR 6/3) moist; null percent sand; null percent silt; 4 percent clay; weak medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very coarse interstitial pores; 2 percent (very few) carbonate coats on bottom surfaces of rock fragments; 15 percent subangular calcareous sandstone gravels; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4, pH meter; abrupt smooth boundary.

R --- 48 centimeters (18.9 inches); Ferron sandstone.

EM-15-09

Pedon ID: EM-15-09
Description Date: 11/12/2009
Describer: Robert Long

Soil Name As Correlated: Persayo
Current Taxonomic Name: Persayo
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic, shallow Typic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
Lat/Long:
UTM: 477421E, 4300927N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: hillslope
Geomorphic Component: Side Slope
Profile Pos: Backslope
Slope: 12 percent
Elevation: 1852 meters (6076.1 feet)
Aspect: 40°
Shape: up/down: Convex; **across:** Convex

Drainage: Well drained
Runoff: High
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: ATCO - shadscale (*Atriplex confertifolia*)

Parent Materials: Residuum
Bedrock: Calcareous shale at 48 centimeters (18.9 inches)
Particle Size Control Section: 25 to 48 centimeters (9.8 to 18.9 inches)
Diagnostic Features: Paralithic contact: 48 centimeters (18.9 inches)
Restrictions: Paralithic bedrock: 48 centimeters (18.9 inches)

A --- 0 to 17 centimeters (0 to 6.7 inches); light yellowish brown (2.5Y 6/3) dry, channery loam; light olive brown (2.5Y 5/3) moist; null percent sand; null percent silt; 22 percent clay; moderate medium subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common fine roots throughout and common very fine roots throughout; common fine dendritic tubular and common very fine dendritic tubular pores; 5 percent subangular calcareous sandstone gravels and 15 percent angular calcareous shale channers; strongly effervescent by HCl, 1 normal; clear smooth boundary.

Cr --- 17 to 48 centimeters (6.7 to 18.9 inches); light yellowish brown (2.5Y 6/4) dry, loam; light olive brown (2.5Y 5/3) moist; null percent sand; null percent silt; 23 percent clay; weak fine subangular blocky structure; friable, hard, slightly sticky, slightly plastic; common very fine roots throughout; common very fine dendritic tubular pores; strongly effervescent by HCl, 1 normal; gradual smooth boundary.

A --- 48 centimeters (18.9 inches); weathered Mancos shale.

EM-16-09

Pedon ID: EM-16
Site ID: EM-16
Description Date: 11/12/2009
Print Date: 1/8/2010
Describer: Robert Long
Soil Name As Described/Sampled: Monue family
Soil Name As Correlated:
Classification: Coarse-loamy, mixed, superactive, mesic Typic Haplocambids
Pedon Type: Modal pedon for map unit
Pedon Purpose: Full pedon description
Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
7.5' Quad: 38111-G3 - Walker Flat, Utah
UTM: 477110E, 4300392N -- Datum NAD83, Zone 12
Location Description:
Legal Description: Section 32, Township 22 S, Range 6 E of the Salt Lake Meridian

Landscape: canyon
Landform: alluvial fan and stream terrace
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 7 percent
Elevation: 1844 meters (6050 feet)
Aspect: 120°
Shape: up/down: Concave; **across:** Linear
Complexity: Simple

Drainage: Well drained
Runoff: Medium
Permeability: Moderately rapid
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Shrub cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: SAVE4 - greasewood (*Sarcobatus vermiculatus*); ACHY - Indian ricegrass (*Achnatherum hymenoides*)

Parent Materials: Alluvium
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Cambic horizon: 8 to 21 centimeters (3.1 to 8.3 inches)

A1 --- 0 to 8 cm (0 to 3 inches); light yellowish brown (2.5Y 6/3) dry, sandy loam gravel; light olive brown (2.5Y 5/3) moist; 64 percent sand; 28 percent silt; 8 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; 1 percent subangular calcareous sandstone gravels; electrical conductivity of 1.01 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; clear smooth boundary; CaCO3 13.4 percent.

Bw1 --- 8 to 21 cm (3 to 8 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 68 percent sand; 24 percent silt; 8 percent clay; structure; very friable, hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.6; clear smooth boundary; CaCO3 (Exists in NASIS Horizon) 11.4 percent.

Bw2 --- 21 to 46 cm (8 to 18 inches); pale yellow (2.5Y 7/3) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 58 percent sand; 33 percent silt; 9 percent clay; moderate medium subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout and common fine roots throughout; many very fine interstitial pores; electrical conductivity of 0.43 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; clear smooth boundary; CaCO3 11.6 percent.

C2 --- 46 to 80 cm (18 to 31 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 60 percent sand; 28 percent silt; 12 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) carbonate concretions on bottom of rock fragments; 2 percent subangular calcareous sandstone gravels; electrical conductivity of 0.45 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.5; gradual smooth boundary; CaCO3 13 percent.

C3 --- 80 to 122 cm (31 to 48 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/3) moist; 70 percent sand; 22 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very coarse interstitial pores; electrical conductivity of 5.89 dS/m by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.7; gradual smooth boundary; CaCO3 12.9 percent.

2C --- 122 to 170 cm (48 to 67 inches); light yellowish brown (10YR 6/4) dry, sandy loam; yellowish brown (10YR 5/4) moist; 68 percent sand; 24 percent silt; 8 percent clay; single grain; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 1 percent (few) salt masses in matrix and 1 percent (few) carbonate concretions on bottom of rock fragments; 4 percent subangular calcareous sandstone channers; electrical conductivity of 9.6 dS/m by EC meter, saturated paste; violently effervescent by HCl, 1 normal; moderately alkaline, pH 8; $CaCO_3$ 12.3 percent.

EM-17-09

Pedon ID: EM-17-09
Description Date: 11/12/2009
Describer: Robert Long

Soil Name As Correlated: Hideout
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477229E, 4300406N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East of the 29 Meridian
Landscape: plateau

Landform: structural bench and canyon
Geomorphic Component: Free face
Profile Pos: Footslope
Slope: 10 percent
Elevation: 1843 meters (6045 feet)
Aspect: 345°
Shape: up/down: Convex; **across:** Linear

Drainage: Well drained
Runoff: Medium
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Tree cover; **Secondary Earth Cover:** Shrubby rangeland
Existing Vegetation: PIED - twoneedle pinyon (*Pinus edulis*); JUOS - Utah juniper (*Juniperus osteosperma*); AMUT - Utah serviceberry (*Amelanchier utahensis*); ARTRW8 - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*)

Parent Materials: residuum weathered from calcareous sandstone
Bedrock: Moderately cemented calcareous sandstone
Particle Size Control Section: 0 to 19 centimeters (0 to 7.5 inches)
Diagnostic Features: Lithic contact: 19 centimeters (7.5 inches)
Restrictions: Lithic bedrock: 19 centimeters (7.5 inches)

A --- 0 to 4 centimeters (0 to 1.6 inches); pale brown (10YR 6/3) dry, very channery loamy sand; brown (10YR 4/3) moist; null percent sand; null percent silt; 6 percent clay; moderate fine platy structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; many very fine interstitial pores; 15 percent subangular calcareous sandstone flags and 30 percent subangular calcareous sandstone channers; strongly effervescent; abrupt smooth boundary.

C --- 4 to 19 centimeters (1.6 to 7.5 inches); brown (10YR 5/3) dry, channery sandy loam; brown (10YR 4/3) moist; null percent sand; null percent silt; 8 percent clay; weak medium subangular blocky and weak fine subangular blocky structure; very friable, slightly hard, nonsticky, nonplastic; common fine roots throughout and common very fine roots throughout; many very fine interstitial pores; 5 percent flat subangular calcareous sandstone flags and 20 percent subangular calcareous sandstone channers; strongly effervescent; abrupt smooth boundary.

R --- 19 centimeters (7.5 inches); Ferron sandstone.

EM-1-16

Pedon ID: EM-1-16
Description Date: 6/9/2016
Describer: Robert Long

Soil Name As Correlated: Monue family
Current Taxonomic Name: Monue family
Current Taxonomic Class: Coarse-loamy, mixed, superactive, mesic Typic Haplocambids
Pedon Type: Confirmation description
Current Taxon Kind: Family

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477468E, 4300731N -- Datum NAD83, Zone 12
Legal Description: Section 33, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: alluvial fan and canyon
Geomorphic Component: Base Slope
Profile Pos: Toeslope
Slope: 5 percent
Elevation: 1818 meters (5965 feet)
Aspect: 40°
Shape: up/down: Linear; **across:** Concave
Complexity: Simple

Drainage: Well drained
Runoff: Low
Erosion: Class 2 - Gully erosion

Primary Earth Cover: Shrub cover;
Existing Vegetation: SAVE4 - black greasewood (*Sarcobatus vermiculatus*); ATCA2 - fourwing saltbush (*Atriplex canescens*); ATCO - shadscale (*Atriplex confertifolia*); BRTE - cheatgrass (*Bromus tectorum*)

Parent Materials: slightly weathered, alluvium derived from sandstone and shale
Particle Size Control Section: 25 to 100 centimeters (9.8 to 39.4 inches)
Diagnostic Features: Cambic horizon: 12 to 75 centimeters (4.7 to 29.5 inches) and Secondary carbonates: 40 to 75 centimeters (15.7 to 29.5 inches)

A --- 0 to 12 centimeters (0 to 4.7 inches); pale yellow (2.5Y 7/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 8 percent clay; weak medium platy parting to single grain structure; very friable, hard, nonsticky, nonplastic; electrical conductivity of 0.3 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; neutral, pH 7.2, pH meter; clear smooth boundary.

Bk1 --- 12 to 40 centimeters (4.7 to 15.7 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 10 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; electrical conductivity of 0.4 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; slightly alkaline, pH 7.4, pH meter; gradual smooth boundary.

Bk2 --- 40 to 75 centimeters (15.7 to 29.5 inches); pale yellow (2.5Y 7/4) dry, loamy sand; light yellowish brown (2.5Y 6/4) moist; null percent sand; null percent silt; 6 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; 2 percent (very few) discontinuous carbonate coats on bottom surfaces of rock fragments; 5 percent subangular calcareous sandstone gravels; electrical conductivity of 1.4 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; neutral, pH 7.3, pH meter; clear smooth boundary.

C --- 75 to 110 centimeters (29.5 to 43.3 inches); light yellowish brown (2.5Y 6/4) dry, sandy loam; light olive brown (2.5Y 5/4) moist; null percent sand; null percent silt; 8 percent clay; single grain; loose, loose, nonsticky, nonplastic; 2 percent subangular calcareous sandstone gravels; electrical conductivity of 2 mmhos/cm by EC meter, saturated paste; strongly effervescent by HCl, 1 normal; neutral, pH 7.3, pH meter.

EM-2-16

Pedon ID: EM-2-16
Description Date: 6/9/2016
Describer: Robert Long

Soil Name As Described/Sampled:
Current Taxonomic Name: Hideout
Current Taxonomic Class: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
Pedon Type: Confirmation description
Current Taxon Kind: Series

County or Parish: UT015 - Emery
State or Territory: UT - Utah
UTM: 477309E, 4300606N -- Datum NAD83, Zone 12
Legal Description: Section 32, Township 22 South, Range 6 East of the 29 Meridian

Landscape: plateau
Landform: structural bench and canyon
Geomorphic Component: Free face
Profile Pos: Backslope
Slope: 8 percent
Elevation: 1833 meters (6014 feet)
Aspect: 265°
Shape: up/down: Linear; **across:** Linear
Complexity: complex

Drainage: Well drained
Runoff: High
Erosion: Class 2 - Sheet erosion

Primary Earth Cover: Tree cover;
Existing Vegetation: PIED - twoneedle pinyon (*Pinus edulis*); JUOS - Utah juniper (*Juniperus osteosperma*); CEMOG - birchleaf mountain mahogany (*Cercocarpus montanus var. glaber*)

Parent Materials: slightly weathered, residuum weathered from calcareous sandstone
Particle Size Control Section: 0 to 18 centimeters (0 to 7.1 inches)
Diagnostic Features: Lithic contact: 18 centimeters (7.1 inches)
Restrictions: Lithic bedrock: 18 centimeters (7.1 inches)

A --- 0 to 18 centimeters (0 to 7.1 inches); pale brown (10YR 6/3) dry, channery sandy loam; brown (10YR 5/3) moist; null percent sand; null percent silt; 14 percent clay; weak medium subangular blocky parting to single grain structure; very friable, slightly hard, nonsticky, nonplastic; common very fine roots throughout; 10 percent subangular calcareous sandstone channers and 5 percent subangular calcareous sandstone gravels; strongly effervescent by HCl, 1 normal; moderately alkaline, pH 8, pH meter; abrupt smooth boundary.

R --- 18 centimeters (7.1 inches); Ferron sandstone.

Map Unit A Transect

Transect Stop	Soil Type	Soil Depth
		cm
1	Hideout (EM-4-09)	20
2	Hideout	7
3	Sandstone Outcrop	
4	Sandstone Outcrop	
5	Sandstone Outcrop	
6	Begay family	54
7	Hideout	2
8	Sandstone Outcrop	
9	Hideout	20
10	Sandstone Outcrop	
	Average Soil Depth	10

Sandstone outcrop comprises 50 percent of map unit A based on this transect.

Appendix C

Laboratory Analysis

Appendix C - Table of Contents

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C-1	Laboratory analysis results for Emery 2 soil samples with topsoil suitability highlights (DOGM 2008).	C-1
C-2	Available water capacity, K factor, and wind erodibility group by soil horizon.	C-3

Laboratory Analysis Reports

Lab Report ID	Soil Profiles	Page
S0910098001	EM-1-09, EM-2-09, EM-4-09, EM-5-09, EM-6-09, EM-7-09, EM-8-09	C-5
S0910099001	EM-3-09	C-11
S0910332003	EM-9-09, EM-10-09, EM-12-09, EM-13-09	C-15
S0912073001	EM-16-09	C-18

Table C-1. Laboratory analysis results for Emery 2 soil samples with topsoil suitability highlights (Utah DOGM 2008).

SampleID	Begin Depth	End Depth	pH	Saturation	Electrical Conductivity	Organic Matter	SAR	Clay	Texture	Very Fine Sand	CO3	Nitrogen Nitrate	Available Phosphorus	CEC	Available Potassium	ESP	TOC	T.S. ABP	Selenium	Boron
	cm	cm	s.u.	%	dS/m	%		%		%	%	ppm	ppm	meq/100g	meq/100g	%	%	t/1000t	ppm	ppm
EM-1-09	0	8	7.3	31.1	2.25	1.4	0.56	17.0	Sandy Loam	18.9	9.1	5.4	10.7		0.33		0.1			
EM-1-09	8	23	7.4	32.5	2.32	1.7	0.45	14.0	Sandy Loam	20.5	7.2	<0.1	6.20		0.28		0.3			
EM-1-09	23	50	7.7	31.3	3.94	1.1	2.36	13.0	Sandy Loam	24.1	7.2	<0.1	4.60		0.23		<0.1			
EM-1-09	50	80	7.6	30.2	3.07	1.0	2.11	12.0	Sandy Loam	25.4	7.8	<0.1	5.33		0.18		<0.1			
EM-2-09	0	5	7.7	27.6	0.89	1.3	1.52	11.0	Sandy Loam	24.2	5.5	1.9	11.7		0.31		0.3			
EM-2-09	5	19	7.7	29.1	0.78	1.2	2.81	12.0	Sandy Loam	30.4	4.4	0.7	5.39		0.19		0.3			
EM-3-09	0	18	7.5	34.8	1.40	1.3	1.99	20.0	Loam	6.6	13.9	10.4	11.7	0.68	2.0			131	<0.02	0.35
EM-3-09	18	46	7.4	35.7	4.39	1.4	3.68	22.0	Sandy Clay Loam	6.3	13.4	2.1	4.40	0.31	1.8			111	<0.02	0.91
EM-4-09	0	6	7.7	30.3	0.69	1.4	0.28	7.0	Loamy Sand	25.0	6.1	6.8	9.72		0.35		0.4			
EM-4-09	6	20	7.5	33.3	0.95	1.9	1.48	10.0	Sandy Loam	23.6	6.4	<0.1	5.21		0.43		0.8			
EM-5-09	0	7	7.8	28.6	0.65	1.6	0.88	13.0	Sandy Loam	21.4	22.5	3.5	12.5		0.41		0.3			
EM-5-09	7	20	7.6	36.6	0.57	1.5	0.82	21.0	Sandy Clay Loam	18.2	25.4	1.5	5.94		0.60		<0.1			
EM-6-09	0	7	7.7	26.7	2.32	1.1	0.24	9.0	Loamy Sand	33.0	6.4	<0.1	8.44		0.13		0.2			
EM-6-09	7	18	7.7	30.3	2.71	1.2	0.27	14.0	Sandy Loam	32.2	7.5	3.4	5.44		0.17		<0.1			
EM-7-09	0	15	7.5	34.4	2.43	1.2	0.90	28.0	Sandy Clay Loam	5.6	14.4	1.8	5.20		0.16		<0.1			
EM-7-09	15	28	7.6	45.8	1.55	3.3	1.09	11.0	Silty Loam	2.7	18.3	3.9	16.2		0.44		1.1			
EM-7-09	28	43	7.7	35.6	1.36	1.6	1.09	9.0	Loam	2.7	15.9	<0.1	4.67		0.20		0.4			
EM-7-09	43	56	7.5	45.5	3.46	3.0	2.96	21.0	Silty Loam	2.3	19.2	32.0	5.89		0.31		0.7			
EM-7-09	56	78	7.6	31.6	3.67	1.3	4.25	13.0	Sandy Loam	14.2	15.2	8.3	4.26		0.13		0.1			
EM-7-09	78	102	7.5	36.6	3.93	1.5	3.08	17.0	Loam	6.6	16.5	8.6	4.84		0.20		0.1			
EM-7-09	102	130	7.6	33.8	2.21	1.0	1.64	9.0	Sandy Loam	5.4	14.5	1.6	4.71		0.13		<0.1			
EM-7-09	130	150	7.7	34.8	1.60	0.6	1.30	6.0	Sandy Loam	10.9	14.3	<0.1	3.98		0.10		<0.1			
EM-8-09	0	9	8.7	36.2	2.25	2.3	20.4	8.0	Loamy Sand	18.4	8.8	9.0	13.3	6.08	0.71	25.3	0.6			
EM-8-09	9	32	9.3	27.6	3.82	1.1	32.2	5.0	Loamy Sand	31.0	8.9	11.1	10.3	3.12	0.40	52.1	0.2			
EM-8-09	32	46	8.8	25.7	3.91	1.2	28.5	6.0	Loamy Sand	36.7	8.9	8.2	7.63	3.62	0.26	26.9	0.3			
EM-8-09	46	60	9.3	29.7	8.29	0.9	46.7	7.0	Loamy Sand	33.8	5.3	31.4	9.16	6.22	0.16	47.2	0.2			
EM-8-09	60	70	8.6	25.5	9.77	1.3	48.7	10.0	Loam	36.1	8.4	16.5	7.96	4.10	0.10	46.2	<0.1			
EM-8-09	70	88	7.9	29.5	9.38	1.0	29.5	11.0	Sandy Loam	26.6	6.3	25.4	7.98	5.14	0.14	30.1	0.2			
EM-8-09	88	98	7.4	31.7	4.35	4.3	8.81	12.0	Sandy Loam	30.2	5.5	4.9	9.83		0.13		2.6			
EM-8-09	98	108	7.7	32.5	5.54	1.2	15.7	9.0	Sandy Loam	23.6	6.8	<0.1	9.08		0.13		0.4			
EM-8-09	108	120	7.5	29.6	5.59	1.8	7.21	12.0	Sandy Loam	32.0	3.2	<0.1	12.6		0.09		0.3			
EM-8-09	120	150	7.5	32.4	6.17	2.1	8.71	12.0	Sandy Loam	27.4	6.0	<0.1	11.6		0.12		0.3			
EM-9-09	0	9	8.4	32.1	1.01	2.0	9.66	6.0	Sandy Loam	13.3	12.6	5.5	18.8	5.86	0.74	7.41	0.4			
EM-9-09	9	25	8.6	29.9	2.03	1.0	22.3	9.0	Sandy Loam	16.8	12.0	13.7	6.70	6.06	0.75	21.6	0.1			
EM-9-09	25	49	8.4	30.8	13.5	0.7	43.7	8.0	Sandy Loam	19.4	12.9	7.3	6.34	6.04	0.23	26.7	<0.1			
EM-9-09	49	75	8.6	31.4	15.9	1.3	47.2	10.0	Sandy Loam	16.3	11.7	1.4	6.78	5.30	0.17	33.3	0.1			
EM-9-09	75	120	8.5	29.5	11.3	1.4	32.3	10.0	Sandy Loam	18.3	12.2	1.5	4.51	5.14	0.10	38.8	<0.1			
EM-9-09	120	168	8.6	27.4	8.55	1.9	25.2	8.0	Sandy Loam	16.2	23.2	1.4	4.57	4.86	0.09	29.1	<0.1			
EM-10-09	0	7	7.9	32.3	0.64	1.6	1.28	8.0	Loamy Sand	32.2	13.5	6.2	10.8		0.29		0.4			
EM-10-09	7	27	7.8	32.7	0.50	1.7	0.91	10.0	Sandy Loam	18.2	22.2	3.2	5.06		0.23		0.4			
EM-10-09	27	45	7.6	32.3	1.97	1.4	0.25	8.0	Sandy Loam	18.7	18.7	8.3	8.72		0.26		0.4			
EM-11-09	0	8	7.6	29.9	1.55	2.0	2.78	16.0	Sandy Loam	18.0	20.5	12.4	7.28		0.57		0.3			
EM-12-09	0	15	8.1	34.6	6.54	2.7	35.2	14.0	Loam	4.0	17.5	83.8	13.1	14.1	1.19	18.9	0.6			
EM-12-09	15	35	8.1	33.0	8.97	1.9	34.9	16.0	Sandy Loam	12.9	18.7	49.1	4.88	10.2	0.44	20.3	0.3			
EM-12-09	35	46	8.2	36.2	8.60	1.2	28.5	11.0	Sandy Loam	7.4	14.3	43.6	4.16	6.50	0.26	24.8	0.3			
EM-12-09	46	72	8.3	36.2	8.88	1.2	25.8	16.0	Loam	4.5	16.1	52.9	4.34	8.78	0.36	59.9	0.4			
EM-12-09	72	102	8.4	36.4	12.1	1.0	35.5	12.0	Sandy Loam	3.0	14.6	37.6	3.86	8.58	0.35	40.0	0.2			
EM-12-09	102	130	8.4	35.2	12.6	1.2	32.7	12.0	Sandy Loam	6.0	15.2	24.1	3.51	8.66	0.30	18.1	0.1			
EM-12-09	130	164	8.3	36.5	9.64	1.3	24.3	16.0	Sandy Loam	5.5	14.8	23.1	3.73	10.3	0.31	24.9	<0.1			

Table C-1. Laboratory analysis results for Emery 2 soil samples with topsoil suitability highlights (Utah DOGM 2008).

SampleID	Begin Depth	End Depth	pH	Saturation	Electrical Conductivity	Organic Matter	SAR	Clay	Texture	Very Fine Sand	CO3	Nitrogen Nitrate	Available Phosphorus	CEC	Available Potassium	ESP	TOC	T.S. ABP	Selenium	Boron
	cm	cm	s.u.	%	dS/m	%		%		%	%	ppm	ppm	meq/100g	meq/100g	%	%	t/1000t	ppm	ppm
EM-13-09	0	10	7.9	34.2	2.44	3.2	0.90	27.0	Clay Loam	12.3	33.6	14.9	4.74	12.5	0.61	0.87	0.1			
EM-13-09	10	40	8.2	41.7	8.64	4.3	15.9	32.0	Silty Clay Loam	3.1	16.5	57.7	2.33	19.2	0.89	15.2	0.2			
EM-16-09	0	8	7.7	28.4	1.01	1.5	1.74	8.0	Sandy Loam	11.6	13.4	14.4	9.89	6.04	0.49	1.55	<0.1			
EM-16-09	8	21	7.6	34.4	0.43	1.1	0.84	8.0	Sandy Loam	10.3	11.4	<0.1	6.18	6.30	0.36	0.98	0.1			
EM-16-09	21	46	7.5	29.9	0.43	1.2	0.34	9.0	Sandy Loam	12.9	11.6	1.0	3.60	6.16	0.37	0.33	<0.1			
EM-16-09	46	80	7.5	32.1	0.45	1.2	0.30	12.0	Sandy Loam	13.8	13.0	0.3	4.40	6.52	0.27	0.34	0.1			
EM-16-09	80	122	7.7	30.2	5.89	1.0	5.44	8.0	Sandy Loam	17.2	12.9	0.6	3.43	6.24	0.11	5.46	<0.1			
EM-16-09	122	170	8.0	28.3	9.60	0.8	10.6	8.0	Sandy Loam	23.7	12.3	7.6	3.54	6.24	0.12	16.2	<0.1			

Topsoil suitability (Utah DOGM 2008)

Good	*Fair*	*Poor*	*Unacceptable*

Table C-2. Available water capacity, K factor, and wind erodibility group by soil horizon

SampleID	Begin Depth	End Depth	Capacity (Saxton 2006) Estimate	K Factor Estimate (Renard 1997)	Wind Erodibility Group (USDA - NRCS 1993)
	cm	cm	inch/inch		
EM-1-09	0	8	0.09	0.27	3
EM-1-09	8	23	0.10	0.35	3
EM-1-09	23	50	0.06	0.27	3
EM-1-09	50	80	0.07	0.37	3
EM-2-09	0	5	0.08	0.37	3
EM-2-09	5	19	0.08	0.34	3
EM-3-09	0	18	0.10	0.25	4L
EM-3-09	18	46	0.08	0.20	4L
EM-4-09	0	6	0.06	0.34	2
EM-4-09	6	20	0.08	0.33	3
EM-5-09	0	7	0.07	0.31	3
EM-5-09	7	20	0.07	0.28	4L
EM-6-09	0	7	0.05	0.30	2
EM-6-09	7	18	0.06	0.35	3
EM-7-09	0	15	0.10	0.14	4L
EM-7-09	15	28	0.16	0.30	4L
EM-7-09	28	43	0.14	0.40	4L
EM-7-09	43	56	0.17	0.39	4L
EM-7-09	56	78	0.10	0.20	3
EM-7-09	78	102	0.12	0.27	4L
EM-7-09	102	130	0.10	0.29	3
EM-7-09	130	150	0.08	0.18	3
EM-8-09	0	9	0.06	0.25	2
EM-8-09	9	32	0.04	0.25	2
EM-8-09	32	46	0.02	0.36	2
EM-8-09	46	60	0.01	0.14	2
EM-8-09	60	70	0.04	0.57	6
EM-8-09	70	88	0.03	0.26	3
EM-8-09	88	98	0.03	0.26	3
EM-8-09	98	108	0.03	0.26	3
EM-8-09	108	120	0.03	0.33	3
EM-8-09	120	150	0.03	0.29	3
EM-9-09	0	9	0.10	0.33	3
EM-9-09	9	25	0.08	0.28	3
EM-9-09	25	49	<0.01	0.25	3
EM-9-09	49	75	<0.01	0.28	3
EM-9-09	75	120	0.02	0.23	3
EM-9-09	120	168	0.02	0.16	3
EM-10-09	0	7	0.05	0.29	2
EM-10-09	7	27	0.07	0.27	3
EM-10-09	27	45	0.05	0.25	3
EM-11-09	0	8	0.07	0.22	3

Table C-2. Available water capacity, K factor, and wind erodibility group by soil horizon

SampleID	Begin Depth	End Depth	Capacity (Saxton 2006) Estimate	K Factor Estimate (Renard 1997)	Wind Erodibility Group (USDA - NRCS 1993)
EM-12-09	0	15	0.11	0.32	4L
EM-12-09	15	35	0.09	0.30	3
EM-12-09	35	46	0.06	0.24	3
EM-12-09	46	72	0.10	0.29	4L
EM-12-09	72	102	0.06	0.28	3
EM-12-09	102	130	0.06	0.29	3
EM-12-09	130	164	0.08	0.09	3
EM-13-09	0	10	0.07	0.17	4L
EM-13-09	10	40	0.13	0.15	4L
EM-16-09	0	8	0.09	0.15	3
EM-16-09	8	21	0.09	0.11	3
EM-16-09	21	46	0.11	0.20	3
EM-16-09	46	80	0.10	0.15	3
EM-16-09	80	122	0.06	0.15	3
EM-16-09	122	170	0.04	0.22	3
Topsoil suitability (Utah DOGM 2008)				Fair	Poor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
Work Order: S0910098

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910098-001	EM-1-09	0-8	7.3	31.1	2.25	1.4	26.9	4.78	0.68	2.21	0.56
S0910098-002	EM-1-09	8-23	7.4	32.5	2.32	1.7	30.1	3.20	0.70	1.83	0.45
S0910098-003	EM-1-09	23-50	7.7	31.3	3.94	1.1	26.2	28.4	0.67	12.3	2.36
S0910098-004	EM-1-09	50-80	7.6	30.2	3.07	1.0	28.2	10.3	0.41	9.27	2.11
S0910098-005	EM-2-09	0-5	7.7	27.6	0.89	1.3	5.10	1.32	0.49	2.72	1.52
S0910098-006	EM-2-09	5-19	7.7	29.1	0.78	1.2	3.05	0.86	0.22	3.93	2.81
S0910098-007	EM-4-09	0-6	7.7	30.3	0.69	1.4	4.35	1.37	1.01	0.47	0.28
S0910098-008	EM-4-09	6-20	7.5	33.3	0.95	1.9	4.68	2.83	1.30	2.88	1.48
S0910098-009	EM-5-09	0-7	7.8	28.6	0.65	1.6	3.08	1.31	0.44	1.30	0.88
S0910098-010	EM-5-09	7-20	7.6	36.6	0.57	1.5	2.78	1.58	0.32	1.22	0.82
S0910098-011	EM-6-09	0-7	7.7	26.7	2.32	1.1	32.0	3.01	0.59	1.02	0.24
S0910098-012	EM-6-09	7-18	7.7	30.3	2.71	1.2	31.4	9.77	0.97	1.20	0.27
S0910098-013	EM-7-09	0-15	7.5	34.4	2.43	1.2	29.6	4.55	0.62	3.73	0.90
S0910098-014	EM-7-09	15-28	7.6	45.8	1.55	3.3	11.7	3.73	1.12	3.02	1.09
S0910098-015	EM-7-09	28-43	7.7	35.6	1.36	1.6	10.0	2.64	0.42	2.75	1.09
S0910098-016	EM-7-09	43-56	7.5	45.5	3.46	3.0	25.3	14.0	0.49	13.1	2.96
S0910098-017	EM-7-09	56-78	7.6	31.6	3.67	1.3	23.8	15.3	0.35	18.8	4.25
S0910098-018	EM-7-09	78-102	7.5	36.6	3.93	1.5	27.8	20.3	0.53	15.1	3.08
S0910098-019	EM-7-09	102-130	7.6	33.8	2.21	1.0	15.5	10.2	0.37	5.88	1.64
S0910098-020	EM-7-09	130-150	7.7	34.8	1.60	0.6	10.3	6.54	0.30	3.78	1.30

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
Work Order: S0910098

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Phosphorus ppm	Available Potassium meq/100g
S0910098-001	EM-1-09	0-8	63.0	20.0	17.0	Sandy Loam	18.9	9.1	5.4	10.7	0.33
S0910098-002	EM-1-09	8-23	57.0	29.0	14.0	Sandy Loam	20.5	7.2	<0.1	6.20	0.28
S0910098-003	EM-1-09	23-50	73.0	14.0	13.0	Sandy Loam	24.1	7.2	<0.1	4.60	0.23
S0910098-004	EM-1-09	50-80	65.0	23.0	12.0	Sandy Loam	25.4	7.8	<0.1	5.33	0.18
S0910098-005	EM-2-09	0-5	69.0	20.0	11.0	Sandy Loam	24.2	5.5	1.9	11.7	0.31
S0910098-006	EM-2-09	5-19	71.0	17.0	12.0	Sandy Loam	30.4	4.4	0.7	5.39	0.19
S0910098-007	EM-4-09	0-6	79.0	14.0	7.0	Loamy Sand	25.0	6.1	6.8	9.72	0.35
S0910098-008	EM-4-09	6-20	69.0	21.0	10.0	Sandy Loam	23.6	6.4	<0.1	5.21	0.43
S0910098-009	EM-5-09	0-7	65.0	22.0	13.0	Sandy Loam	21.4	22.5	3.5	12.5	0.41
S0910098-010	EM-5-09	7-20	63.0	16.0	21.0	Sandy Clay Loam	18.2	25.4	1.5	5.94	0.60
S0910098-011	EM-6-09	0-7	79.0	12.0	9.0	Loamy Sand	33.0	6.4	<0.1	8.44	0.13
S0910098-012	EM-6-09	7-18	71.0	15.0	14.0	Sandy Loam	32.2	7.5	3.4	5.44	0.17
S0910098-013	EM-7-09	0-15	57.0	15.0	28.0	Sandy Clay Loam	5.6	14.4	1.8	5.20	0.16
S0910098-014	EM-7-09	15-28	37.0	52.0	11.0	Silty Loam	2.7	18.3	3.9	16.2	0.44
S0910098-015	EM-7-09	28-43	43.0	48.0	9.0	Loam	2.7	15.9	<0.1	4.67	0.20
S0910098-016	EM-7-09	43-56	23.0	56.0	21.0	Silty Loam	2.3	19.2	32.0	5.89	0.31
S0910098-017	EM-7-09	56-78	61.0	26.0	13.0	Sandy Loam	14.2	15.2	8.3	4.26	0.13
S0910098-018	EM-7-09	78-102	46.0	37.0	17.0	Loam	6.6	16.5	8.6	4.84	0.20
S0910098-019	EM-7-09	102-130	58.0	33.0	9.0	Sandy Loam	5.4	14.5	1.6	4.71	0.13
S0910098-020	EM-7-09	130-150	69.0	25.0	6.0	Sandy Loam	10.9	14.3	<0.1	3.98	0.10

These results apply only to the samples tested.

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Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
Work Order: S0910098

Lab ID	Sample ID	Depths cm	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0910098-001	EM-1-09	0-8	1.2	0.1	91.4
S0910098-002	EM-1-09	8-23	1.1	0.3	71.6
S0910098-003	EM-1-09	23-50	0.9	<0.1	72.2
S0910098-004	EM-1-09	50-80	0.9	<0.1	78.2
S0910098-005	EM-2-09	0-5	1.0	0.3	55.4
S0910098-006	EM-2-09	5-19	0.8	0.3	44.5
S0910098-007	EM-4-09	0-6	1.1	0.4	61.0
S0910098-008	EM-4-09	6-20	1.6	0.8	64.5
S0910098-009	EM-5-09	0-7	3.0	0.3	225
S0910098-010	EM-5-09	7-20	3.1	<0.1	254
S0910098-011	EM-6-09	0-7	1.0	0.2	63.9
S0910098-012	EM-6-09	7-18	0.7	<0.1	75.2
S0910098-013	EM-7-09	0-15	1.7	<0.1	144
S0910098-014	EM-7-09	15-28	3.3	1.1	183
S0910098-015	EM-7-09	28-43	2.3	0.4	159
S0910098-016	EM-7-09	43-56	3.0	0.7	192
S0910098-017	EM-7-09	56-78	2.0	0.1	152
S0910098-018	EM-7-09	78-102	2.1	0.1	165
S0910098-019	EM-7-09	102-130	1.8	<0.1	145
S0910098-020	EM-7-09	130-150	1.7	<0.1	143

These results apply only to the samples tested.

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Soil Analysis Report

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1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
Work Order: S0910098

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910098-021	EM-8-09	0-9	8.7	36.2	2.25	2.3	1.32	0.96	1.56	21.8	20.4
S0910098-022	EM-8-09	9-32	9.3	27.6	3.82	1.1	3.33	1.23	1.42	40.2	26.6
S0910098-023	EM-8-09	32-46	8.8	25.7	3.91	1.2	2.76	0.99	1.10	39.0	28.5
S0910098-024	EM-8-09	46-60	9.3	29.7	8.29	0.9	8.78	2.87	0.72	113	46.7
S0910098-025	EM-8-09	60-70	8.6	25.5	9.77	1.3	8.99	3.18	0.60	129	52.4
S0910098-026	EM-8-09	70-88	7.9	29.5	9.38	1.0	20.3	6.66	0.61	108	29.5
S0910098-027	EM-8-09	88-98	7.4	31.7	4.35	4.3	17.4	4.93	0.43	29.5	8.81
S0910098-028	EM-8-09	98-108	7.7	32.5	5.54	1.2	15.6	3.99	0.34	49.0	15.7
S0910098-029	EM-8-09	108-120	7.5	29.6	5.59	1.8	35.4	8.36	0.44	33.7	7.21
S0910098-030	EM-8-09	120-150	7.5	32.4	6.17	2.1	39.4	11.6	0.48	44.0	8.71

These results apply only to the samples tested.

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Soil Analysis Report

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Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
Work Order: S0910098

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Phosphorus ppm	Available Potassium meq/100g
S0910098-021	EM-8-09	0-9	79.0	13.0	8.0	Loamy Sand	18.4	8.8	9.0	13.3	0.71
S0910098-022	EM-8-09	9-32	85.0	10.0	5.0	Loamy Sand	31.0	8.9	11.1	10.3	0.40
S0910098-023	EM-8-09	32-46	85.0	9.0	6.0	Loamy Sand	36.7	8.9	8.2	7.63	0.26
S0910098-024	EM-8-09	46-60	85.0	8.0	7.0	Loamy Sand	33.8	5.3	31.4	9.16	0.16
S0910098-025	EM-8-09	60-70	50.0	40.0	10.0	Loam	36.1	8.4	16.5	7.96	0.10
S0910098-026	EM-8-09	70-88	79.0	10.0	11.0	Sandy Loam	26.6	6.3	25.4	7.98	0.14
S0910098-027	EM-8-09	88-98	80.0	8.0	12.0	Sandy Loam	30.2	5.5	4.9	9.83	0.13
S0910098-028	EM-8-09	98-108	77.0	14.0	9.0	Sandy Loam	23.6	6.8	<0.1	9.08	0.13
S0910098-029	EM-8-09	108-120	75.0	13.0	12.0	Sandy Loam	32.0	3.2	<0.1	12.6	0.09
S0910098-030	EM-8-09	120-150	77.0	11.0	12.0	Sandy Loam	27.4	6.0	<0.1	11.6	0.12

These results apply only to the samples tested.

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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

Long Resource Consultants, Inc.
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Morgan, UT 84050

Report ID: S0910098001

Project: Emery 2 Topsoil
Date Received: 10/7/2009

Date Reported: 11/11/2009
Work Order: S0910098

Lab ID	Sample ID	Depths cm	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0910098-021	EM-8-09	0-9	1.6	0.6	88.3
S0910098-022	EM-8-09	9-32	1.2	0.2	89.3
S0910098-023	EM-8-09	32-46	1.4	0.3	89.3
S0910098-024	EM-8-09	46-60	0.8	0.2	52.5
S0910098-025	EM-8-09	60-70	1.1	<0.1	84.0
S0910098-026	EM-8-09	70-88	0.9	0.2	62.9
S0910098-027	EM-8-09	88-98	3.2	2.6	55.0
S0910098-028	EM-8-09	98-108	1.2	0.4	68.0
S0910098-029	EM-8-09	108-120	0.7	0.3	32.4
S0910098-030	EM-8-09	120-150	1.1	0.3	60.4

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Soil Analysis Report

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1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910099001

Project: Emery 2 Overburden
Date Received: 10/7/2009

Date Reported: 11/10/2009
Work Order: S0910099

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910099-001	EM-3-09	0-18	7.5	34.8	1.40	1.3	8.26	1.71	1.19	4.45	1.99
S0910099-002	EM-3-09	18-46	7.4	35.7	4.39	1.4	31.9	15.7	0.38	17.9	3.68

These results apply only to the samples tested.

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Project: Emery 2 Overburden
Date Received: 10/7/2009

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Work Order: S0910099

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %
S0910099-001	EM-3-09	0-18	47.0	33.0	20.0	Loam	6.6	13.9
S0910099-002	EM-3-09	18-46	53.0	25.0	22.0	Sandy Clay Loam	6.3	13.4

These results apply only to the samples tested.

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Date Received: 10/7/2009

Date Reported: 11/10/2009
Work Order: S0910099

Lab ID	Sample ID	Depths cm	Nitrogen Nitrate ppm	Selenium ppm	Boron ppm	Phosphorus ppm	Available Potassium meq/100g	Total Carbon %	TOC %
S0910099-001	EM-3-09	0-18	10.4	<0.02	0.35	11.7	0.68	2.0	0.4
S0910099-002	EM-3-09	18-46	2.1	<0.02	0.91	4.40	0.31	1.8	0.3

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Lab ID	Sample ID	Depths cm	Total Sulfur %	T.S. AB t/1000t	Neutral. Potential t/1000t	T.S. ABP t/1000t
S0910099-001	EM-3-09	0-18	<0.01	<0.01	131	131
S0910099-002	EM-3-09	18-46	0.53	16.4	127	111

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910332003
(Replaces S0910332002)
Date Reported: 12/17/2009
Work Order: S0910332

Project: Emery 2 Topsoil
Date Received: 10/22/2009

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0910332-001	EM-9-09	0-9	8.4	32.1	1.01	2.0	1.18	0.78	1.46	9.54	9.66
S0910332-002	EM-9-09	9-25	8.6	29.9	2.03	1.0	1.19	0.74	0.93	21.9	22.3
S0910332-003	EM-9-09	25-49	8.4	30.8	13.5	0.7	24.7	19.5	1.04	206	43.7
S0910332-004	EM-9-09	49-75	8.6	31.4	15.9	1.3	24.7	42.4	0.72	273	47.2
S0910332-005	EM-9-09	75-120	8.5	29.5	11.3	1.4	20.6	37.8	0.22	175	32.3
S0910332-006	EM-9-09	120-168	8.6	27.4	8.55	1.9	21.0	24.0	0.17	120	25.2
S0910332-007	EM-10-09	0-7	7.9	32.3	0.64	1.6	4.15	1.44	0.45	2.14	1.28
S0910332-008	EM-10-09	7-27	7.8	32.7	0.50	1.7	2.96	1.23	0.32	1.32	0.91
S0910332-009	EM-10-09	27-45	7.6	32.3	1.97	1.4	27.9	4.97	0.85	1.02	0.25
S0910332-010	EM-11-09	0-8	7.6	29.9	1.55	2.0	7.24	5.01	0.77	6.88	2.78
S0910332-011	EM-12-09	0-15	8.1	34.6	6.54	2.7	7.12	3.02	3.60	79.3	35.2
S0910332-012	EM-12-09	15-35	8.1	33.0	8.97	1.9	24.0	7.67	1.90	139	34.9
S0910332-013	EM-12-09	35-46	8.2	36.2	8.60	1.2	24.8	14.4	1.29	126	28.5
S0910332-014	EM-12-09	46-72	8.3	36.2	8.88	1.2	21.7	27.7	0.84	128	25.8
S0910332-015	EM-12-09	72-102	8.4	36.4	12.1	1.0	16.0	23.3	1.24	157	35.5
S0910332-016	EM-12-09	102-130	8.4	35.2	12.6	1.2	21.0	31.3	1.42	167	32.7
S0910332-017	EM-12-09	130-164	8.3	36.5	9.64	1.3	18.7	24.5	0.76	113	24.3
S0910332-018	EM-13-09	0-10	7.9	34.2	2.44	3.2	27.1	6.37	1.90	3.69	0.90
S0910332-019	EM-13-09	10-40	8.2	41.7	8.64	4.3	20.1	33.8	2.24	82.6	15.9

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910332003
(Replaces S0910332002)
Date Reported: 12/17/2009
Work Order: S0910332

Project: Emery 2 Topsoil
Date Received: 10/22/2009

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Available Phosphorus ppm
S0910332-001	EM-9-09	0-9	64.0	30.0	6.0	Sandy Loam	13.3	12.6	5.5	18.8
S0910332-002	EM-9-09	9-25	70.0	21.0	9.0	Sandy Loam	16.8	12.0	13.7	6.70
S0910332-003	EM-9-09	25-49	76.0	16.0	8.0	Sandy Loam	19.4	12.9	7.3	6.34
S0910332-004	EM-9-09	49-75	68.0	22.0	10.0	Sandy Loam	16.3	11.7	1.4	6.78
S0910332-005	EM-9-09	75-120	76.0	14.0	10.0	Sandy Loam	18.3	12.2	1.5	4.51
S0910332-006	EM-9-09	120-168	74.0	18.0	8.0	Sandy Loam	16.2	23.2	1.4	4.57
S0910332-007	EM-10-09	0-7	84.0	8.0	8.0	Loamy Sand	32.2	13.5	6.2	10.8
S0910332-008	EM-10-09	7-27	70.0	20.0	10.0	Sandy Loam	18.2	22.2	3.2	5.06
S0910332-009	EM-10-09	27-45	76.0	16.0	8.0	Sandy Loam	18.7	18.7	8.3	8.72
S0910332-010	EM-11-09	0-8	70.0	14.0	16.0	Sandy Loam	18.0	20.5	12.4	7.28
S0910332-011	EM-12-09	0-15	48.0	38.0	14.0	Loam	4.0	17.5	83.8	13.1
S0910332-012	EM-12-09	15-35	54.0	30.0	16.0	Sandy Loam	12.9	18.7	49.1	4.88
S0910332-013	EM-12-09	35-46	64.0	25.0	11.0	Sandy Loam	7.4	14.3	43.6	4.16
S0910332-014	EM-12-09	46-72	46.0	38.0	16.0	Loam	4.5	16.1	52.9	4.34
S0910332-015	EM-12-09	72-102	54.0	34.0	12.0	Sandy Loam	3.0	14.6	37.6	3.86
S0910332-016	EM-12-09	102-130	54.0	34.0	12.0	Sandy Loam	6.0	15.2	24.1	3.51
S0910332-017	EM-12-09	130-164	54.0	30.0	16.0	Sandy Loam	5.5	14.8	23.1	3.73
S0910332-018	EM-13-09	0-10	32.0	41.0	27.0	Clay Loam	12.3	33.6	14.9	4.74
S0910332-019	EM-13-09	10-40	18.0	50.0	32.0	Silty Clay Loam	3.1	16.5	57.7	2.33

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0910332003
(Replaces S0910332002)
Date Reported: 12/17/2009
Work Order: S0910332

Project: Emery 2 Topsoil
Date Received: 10/22/2009

Lab ID	Sample ID	Depths cm	CEC meq/100g	Available Potassium meq/100g	Available Sodium meq/100g	Exchangeable Sodium meq/100g	ESP %	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0910332-001	EM-9-09	0-9	5.86	0.74	0.74	0.43	7.41	1.9	0.4	123
S0910332-002	EM-9-09	9-25	6.06	0.75	1.97	1.31	21.6	1.5	0.1	116
S0910332-003	EM-9-09	25-49	6.04	0.23	7.94	1.61	26.7	1.5	<0.1	119
S0910332-004	EM-9-09	49-75	5.30	0.17	10.4	1.76	33.3	1.4	0.1	106
S0910332-005	EM-9-09	75-120	5.14	0.10	7.16	2.00	38.8	1.6	<0.1	125
S0910332-006	EM-9-09	120-168	4.86	0.09	4.69	1.41	29.1	3.2	<0.1	257
S0910332-007	EM-10-09	0-7		0.29				2.2	0.4	148
S0910332-008	EM-10-09	7-27		0.23				3.1	0.4	221
S0910332-009	EM-10-09	27-45		0.26				2.6	0.4	181
S0910332-010	EM-11-09	0-8		0.57				2.8	0.3	205
S0910332-011	EM-12-09	0-15	14.1	1.19	5.41	2.67	18.9	2.5	0.6	160
S0910332-012	EM-12-09	15-35	10.2	0.44	6.66	2.07	20.3	2.4	0.3	178
S0910332-013	EM-12-09	35-46	6.50	0.26	6.19	1.61	24.8	2.0	0.3	140
S0910332-014	EM-12-09	46-72	8.78	0.36	9.90	5.26	59.9	2.3	0.4	160
S0910332-015	EM-12-09	72-102	8.58	0.35	9.14	3.78	40.0	2.0	0.2	145
S0910332-016	EM-12-09	102-130	8.66	0.30	7.45	0.49	18.1	2.0	0.1	155
S0910332-017	EM-12-09	130-164	10.3	0.31	6.68	2.55	24.9	1.9	<0.1	156
S0910332-018	EM-13-09	0-10	12.5	0.61	0.24	0.10	0.87	4.0	0.1	326
S0910332-019	EM-13-09	10-40	19.2	0.89	6.36	3.45	15.2	2.1	0.2	164

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
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Soil Analysis Report

Long Resource Consultants, Inc.
1960 West Deep Creek Road
Morgan, UT 84050

Report ID: S0912073001

Project: Emery 2 Topsoil
Date Received: 12/4/2009

Date Reported: 12/17/2009
Work Order: S0912073

Lab ID	Sample ID	Depths cm	pH s.u.	Saturation %	Electrical Conductivity dS/m	Organic Matter %	PE Calcium meq/L	PE Magnesium meq/L	PE Potassium meq/L	PE Sodium meq/L	SAR
S0912073-001	EM-16-09	0-8	7.7	28.4	1.01	1.5	4.67	1.02	0.82	2.93	1.74
S0912073-002	EM-16-09	8-21	7.6	34.4	0.43	1.1	2.98	1.05	0.50	1.20	0.84
S0912073-003	EM-16-09	21-46	7.5	29.9	0.43	1.2	2.33	0.75	0.37	0.42	0.34
S0912073-004	EM-16-09	46-80	7.5	32.1	0.45	1.2	2.63	0.98	0.20	0.41	0.30
S0912073-005	EM-16-09	80-122	7.7	30.2	5.89	1.0	32.6	26.4	0.14	29.6	5.44
S0912073-006	EM-16-09	122-170	8.0	28.3	9.60	0.8	31.7	45.0	0.18	65.5	10.6

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Soil Analysis Report

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Report ID: S0912073001

Project: Emery 2 Topsoil
Date Received: 12/4/2009

Date Reported: 12/17/2009
Work Order: S0912073

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Very Fine Sand %	CO3 %	Nitrogen Nitrate ppm	Available Phosphorus ppm
S0912073-001	EM-16-09	0-8	64.0	28.0	8.0	Sandy Loam	11.6	13.4	14.4	9.89
S0912073-002	EM-16-09	8-21	68.0	24.0	8.0	Sandy Loam	10.3	11.4	<0.1	6.18
S0912073-003	EM-16-09	21-46	58.0	33.0	9.0	Sandy Loam	12.9	11.6	1.0	3.60
S0912073-004	EM-16-09	46-80	60.0	28.0	12.0	Sandy Loam	13.8	13.0	0.3	4.40
S0912073-005	EM-16-09	80-122	70.0	22.0	8.0	Sandy Loam	17.2	12.9	0.6	3.43
S0912073-006	EM-16-09	122-170	68.0	24.0	8.0	Sandy Loam	23.7	12.3	7.6	3.54

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Project: Emery 2 Topsoil
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Date Reported: 12/17/2009
Work Order: S0912073

Lab ID	Sample ID	Depths cm	CEC meq/100g	Available Potassium meq/100g	Available Sodium meq/100g	Exchangeable Sodium meq/100g	ESP %	Total Carbon %	TOC %	Neutral. Potential t/1000t
S0912073-001	EM-16-09	0-8	6.04	0.49	0.18	0.09	1.55	1.5	<0.1	134
S0912073-002	EM-16-09	8-21	6.30	0.36	0.10	0.06	0.98	1.5	0.1	114
S0912073-003	EM-16-09	21-46	6.16	0.37	0.03	0.02	0.33	1.3	<0.1	108
S0912073-004	EM-16-09	46-80	6.52	0.27	0.04	0.02	0.34	1.6	0.1	122
S0912073-005	EM-16-09	80-122	6.24	0.11	1.23	0.34	5.46	1.7	<0.1	130
S0912073-006	EM-16-09	122-170	6.24	0.12	2.87	1.01	16.2	1.4	<0.1	120

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Appendix D

Site and Profile Photos

Photo D - 1. EM-1-09 soil profile of Begay family soils in map unit Ba with Wyoming big sage, black greasewood, and shadscale vegetation. Soil is moderately deep (Ferron sandstone at 80 cm) with coarse-loamy textural family. 1

Photo D - 2. EM-2-09 soil profile location of Hideout soils in map unit A. Vegetation includes scattered pinyon pine, Utah juniper, Utah Mormon tea, and Utah serviceberry. Depth to Ferron sandstone is 19 cm. 2

Photo D - 3. EM-3-09 soil profile location of Disturbed Land in map unit Bd. Depth to hard Mancos shale is 46 cm. Vegetation is limited to shadscale and black greasewood..... 3

Photo D - 4. EM-4-09 soil profile location of Hideout soil in map unit A. hideout soils are coarse-loamy. The surface is covered with 5 percent channers. Depth to Ferron sandstone is 20 cm. Vegetation is Utah juniper, pinyon pine, Birchleaf mahogany, and Utah serviceberry. 4

Photo D - 5. EM-5-09 soil profile location of Lazear soil on plateau in map unit Ba. Lazear soils are fine-loamy. Surface is covered with 10 percent gravels and 5 percent channers. Depth to Ferron sandstone is 20 cm. Vegetation is shadscale and black sage. Map unit A is in background with pinyon pine and Utah juniper. 5

Photo D - 6. EM-6-09 soil profile location of Persayo family soil on a very steep canyon sideslope (78 percent) in map unit Ca. The Persayo family soils in this map unit are coarse-loamy, compared to fine-loamy for the Persayo series. Depth to Mancos shale is 34 cm. Dominant vegetation is shadscale and Gardners saltbush. 6

Photo D - 7. EM-7-09 soil profile location of Green River soil in coarse-loamy alluvium in floodplain along Quitchapah Creek. This soil profile showed three distinct periods of deposition. The most recent deposition appeared to have been deposited during flooding on September 16, 2009. Distinct and prominent soil mottles were observed from 28 to 56 cm below the new surface. Dominant vegetation is tamarisk. 7

Photo D - 8. EM-8-09 soil profile location of Garley soil on cutbank in map unit Ca near northeast end of canyon. Surface is covered with 3 percent cobbles, 2 percent channers, and a few very large boulders (car to house size). SAR levels are unacceptable for use as topsoil from 0 to 88 cm and from 98 to 108 cm based on Utah DOGM Topsoil Guidelines (Utah DOGM 2005). Vegetation is dominated by black greasewood, shadscale, with small inclusions of rabbitbrush, black sage, and Indian ricegrass. 8

Photo D - 9. EM-9-09 soil profile of Garley soil in alluvial toeslope in map unit Cb. Soil is coarse-loamy with unacceptable SAR levels from 8 to 168 cm (Utah DOGM 2005). Surface is covered with 3 percent gravels, 2 percent channers, 1 percent flagstones, and a few very large boulders (car to house size). Dominant vegetation is black greasewood and shadscale with scattered clumps of Indian ricegrass. 9

Photo D - 10. EM-10-09 soil profile location of Braf soil in map unit D. Surface is covered with 6 percent gravel, 4 percent channers, 1 percent stones, and 1 percent flagstones. Ferron sandstone is at 45 cm. Vegetation is dominated by shadscale, black sage, Indian ricegrass, and prickly pear cactus. Area slopes to the northwest at 2 to 8 percent. 10

Photo D - 11. EM-11-09 soil profile location of Braf soil in map unit E. Area slopes to the northwest on broken slopes of 6 to 15 percent. Surface is covered with 10 percent channers and 5 percent gravels. This map unit is dominated by Ferron sandstone outcrops, visible in lower right corner of photo. Dominant vegetation is shadscale, black sage, Indian ricegrass, and prickly pear cactus. 11

Photo D - 12. EM-12-09 soil profile location of Garley, moderately well drained, soil on stream terrace above Quitchapah Creek in map unit G. Garley, moderately well drained, soils are coarse-loamy. SAR levels are unacceptable (SAR greater than 24) for use as topsoil from 0 to 164 cm (Utah DOGM 2005). This area is dominated by black greasewood and bare soils. 12

Photo D - 13. EM-13-09 soil profile location of Persayo soils on a very steep south facing slope in map unit F. Surface is covered with 40 percent gravels and 20 percent channers. Mancos shale is at 40 cm. Vegetation is limited to widely scattered shadscale. 13

Photo D - 14. EM-14-09 soil profile location of Braf soil in map unit D. Surface is covered with 15 percent channers and 10 percent gravels. Depth to Ferron sandstone is 48 cm. Vegetation is dominated by shadscale and scattered grasses. Dozer push piles in map unit Bd are visible (center left) on plateau southeast side of canyon (sandstone outcrop is upper portion of canyon sideslope). 14

Photo D - 15. EM-15-09 soil profile location of Persayo soil in map unit F. Surface is covered with 30 percent channers and 5 percent gravels. Depth to Mancos shale is 48 cm. This ridge slopes to the northeast at 12 percent. Vegetation is dominated by shadscale. Garley (map unit G) and Green River (map unit H) soils can be seen in the alluvial stream terrace and floodplain along Quitchapah Creek. 15

Photo D - 16. EM-16-09 soil profile location of Monue family soil in map unit Cb. Soil has developed from eolian deposits derived from the nearby Ferron sandstone. Surface is covered with 8 percent gravels and 3 percent channers. Vegetation is dominated by black greasewood and Indian ricegrass. The setting and vegetation for the Monue family soil is similar to the Garley soil in map unit Cb, but SAR and salinity do not become limiting in the Monue family soil until 80 cm. Monue family soils appear to have more Indian ricegrass cover than Garley soils (EM-8 and EM-9). The break between map units Ca (rock outcrop and steep shale slopes) and Cb is at the base of the Ferron sandstone outcrop. Map unit D (Farb soils) is located on the plateau above the canyon rim. 16

Photo D - 17. EM-17-09 soil profile location of Hideout soil on northwest facing structural bench in map unit Ca. Surface is covered with 35 percent channers, 10 percent flags, and 1 percent boulders. Soil is corase-loamy with Ferron sandstone is at 19 cm. Pinyon pine and Utah juniper dominate this area with scattered Wyoming big sage and utah serviceberry. 17

Photo D - 18. EM-01-16 soil profile location of Monue family soil in map unit Cb. Black greasewood is the dominant vegetation in the bottom of the canyon. 18

Photo D - 19. EM-02-16 soil profile location of Hideout soil on structural bench in canyon, map unit Ca. Pinyon pine and Utah juniper are the dominant vegetation. Surface is covered with channers and flags. Large boulders have fallen from the cliffs above the bench.... 19

Photo D - 1. EM-1-09 soil profile of Begay family soils in map unit Ba with Wyoming big sage, black greasewood, and shadscale vegetation. Soil is moderately deep (Ferron sandstone at 80 cm) with coarse-loamy textural family.

Photo D - 2. EM-2-09 soil profile location of Hideout soils in map unit A. Vegetation includes scattered pinyon pine, Utah juniper, Utah Mormon tea, and Utah serviceberry. Depth to Ferron sandstone is 19 cm.

Photo D - 3. EM-3-09 soil profile location of Disturbed Land in map unit Bd. Depth to hard Mancos shale is 46 cm. Vegetation is limited to shadscale and black greasewood.

Photo D - 4. EM-4-09 soil profile location of Hideout soil in map unit A. hideout soils are coarse-loamy. The surface is covered with 5 percent channers. Depth to Ferron sandstone is 20 cm. Vegetation is Utah juniper, pinyon pine, Birchleaf mahogany, and Utah serviceberry.

Photo D - 5. EM-5-09 soil profile location of Lazear soil on plateau in map unit Ba. Lazear soils are fine-loamy. Surface is covered with 10 percent gravels and 5 percent channers. Depth to Ferron sandstone is 20 cm. Vegetation is shadscale and black sage. Map unit A is in background with pinyon pine and Utah juniper.

Photo D - 6. EM-6-09 soil profile location of Persayo family soil on a very steep canyon sideslope (78 percent) in map unit Ca. The Persayo family soils in this map unit are coarse-loamy, compared to fine-loamy for the Persayo series. Depth to Mancos shale is 34 cm. Dominant vegetation is shadscale and Gardners saltbush.

Photo D - 7. EM-7-09 soil profile location of Green River soil in coarse-loamy alluvium in floodplain along Quitchapah Creek. This soil profile showed three distinct periods of deposition. The most recent deposition appeared to have been deposited during flooding on September 16, 2009. Distinct and prominent soil mottles were observed from 28 to 56 cm below the new surface. Dominant vegetation is tamarisk.

Photo D - 8. EM-8-09 soil profile location of Garley soil on cutbank in map unit Ca near northeast end of canyon. Surface is covered with 3 percent cobbles, 2 percent channers, and a few very large boulders (car to house size). SAR levels are unacceptable for use as topsoil from 0 to 88 cm and from 98 to 108 cm based on Utah DOGM Topsoil Guidelines (Utah DOGM 2005). Vegetation is dominated by black greasewood, shadscale, with small inclusions of rabbitbrush, black sage, and Indian ricegrass.

Photo D - 9. EM-9-09 soil profile of Garley soil in alluvial toeslope in map unit Cb. Soil is coarse-loamy with unacceptable SAR levels from 8 to 168 cm (Utah DOGM 2005). Surface is covered with 3 percent gravels, 2 percent channers, 1 percent flagstones, and a few very large boulders (car to house size). Dominant vegetation is black greasewood and shadscale with scattered clumps of Indian ricegrass.

Photo D - 10. EM-10-09 soil profile location of Braf soil in map unit D. Surface is covered with 6 percent gravel, 4 percent channers, 1 percent stones, and 1 percent flagstones. Ferron sandstone is at 45 cm. Vegetation is dominated by shadscale, black sage, Indian ricegrass, and prickly pear cactus. Area slopes to the northwest at 2 to 8 percent.

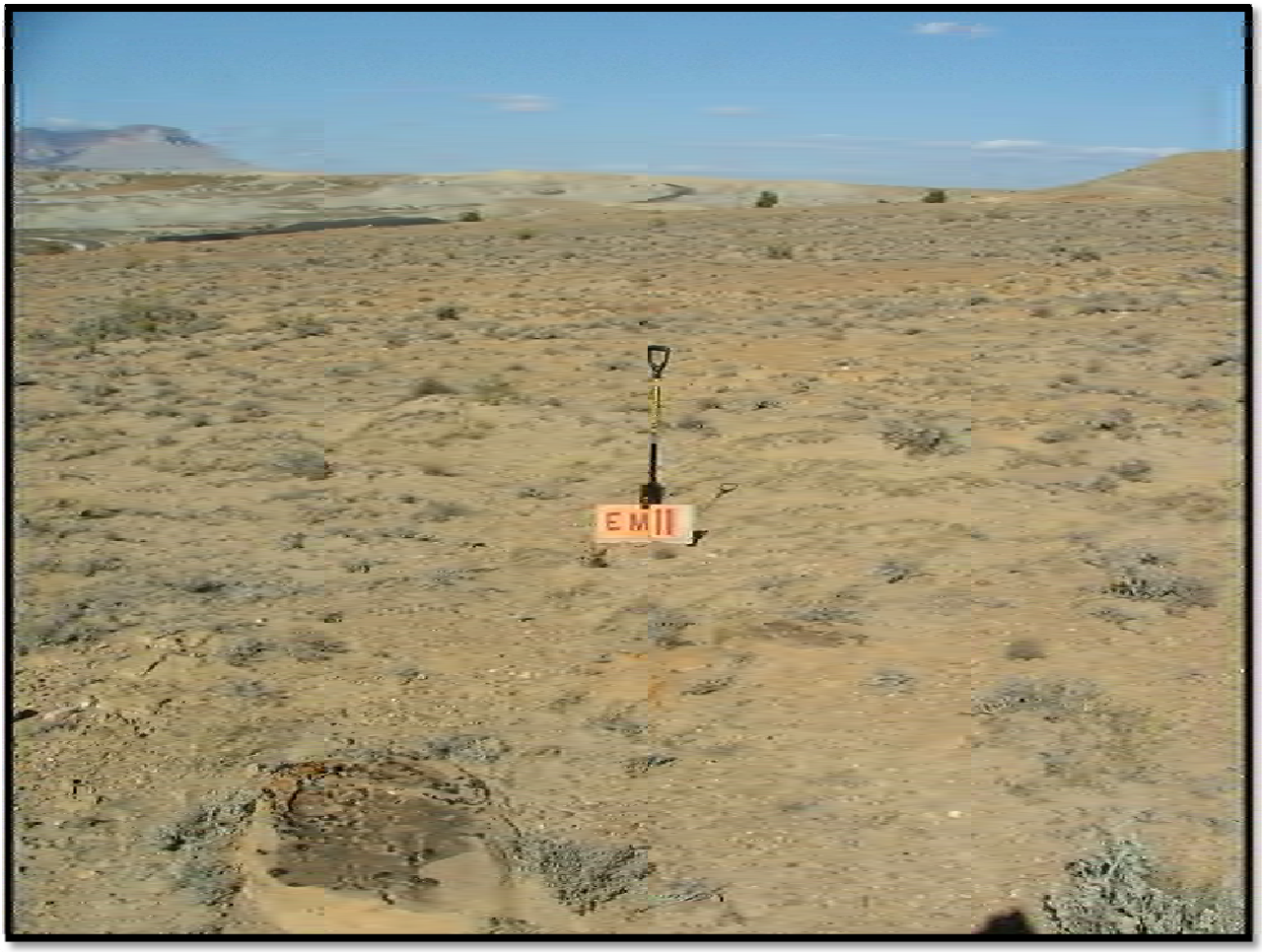

Photo D - 11. EM-11-09 soil profile location of Braf soil in map unit E. Area slopes to the northwest on broken slopes of 6 to 15 percent. Surface is covered with 10 percent channers and 5 percent gravels. This map unit is dominated by Ferron sandstone outcrops, visible in lower right corner of photo. Dominant vegetation is shadscale, black sage, Indian ricegrass, and prickly pear cactus.

Photo D - 12. EM-12-09 soil profile location of Garley, moderately well drained, soil on stream terrace above Quitchapah Creek in map unit G. Garley, moderately well drained, soils are coarse-loamy. SAR levels are unacceptable (SAR greater than 24) for use as topsoil from 0 to 164 cm (Utah DOGM 2005). This area is dominated by black greasewood and bare soils.

Photo D - 13. EM-13-09 soil profile location of Persayo soils on a very steep south facing slope in map unit F. Surface is covered with 40 percent gravels and 20 percent channers. Mancos shale is at 40 cm. Vegetation is limited to widely scattered shadscale.

Photo D - 14. EM-14-09 soil profile location of Braf soil in map unit D. Surface is covered with 15 percent channers and 10 percent gravels. Depth to Ferron sandstone is 48 cm. Vegetation is dominated by shadscale and scattered grasses. Dozer push piles in map unit Bd are visible (center left) on plateau southeast side of canyon (sandstone outcrop is upper portion of canyon sideslope).

Photo D - 15. EM-15-09 soil profile location of Persayo soil in map unit F. Surface is covered with 30 percent channers and 5 percent gravels. Depth to Mancos shale is 48 cm. This ridge slopes to the northeast at 12 percent. Vegetation is dominated by shadscale. Garley (map unit G) and Green River (map unit H) soils can be seen in the alluvial stream terrace and floodplain along Quitchapah Creek.

Photo D - 16. EM-16-09 soil profile location of Monue family soil in map unit Cb. Soil has developed from eolian deposits derived from the nearby Ferron sandstone. Surface is covered with 8 percent gravels and 3 percent channers. Vegetation is dominated by black greasewood and Indian ricegrass. The setting and vegetation for the Monue family soil is similar to the Garley soil in map unit Cb, but SAR and salinity do not become limiting in the Monue family soil until 80 cm. Monue family soils appear to have more Indian ricegrass cover than Garley soils (EM-8 and EM-9). The break between map units Ca (rock outcrop and steep shale slopes) and Cb is at the base of the Ferron sandstone outcrop. Map unit D (Farb soils) is located on the plateau above the canyon rim.

Photo D - 17. EM-17-09 soil profile location of Hideout soil on northwest facing structural bench in map unit Ca. Surface is covered with 35 percent channers, 10 percent flags, and 1 percent boulders. Soil is corase-loamy with Ferron sandstone is at 19 cm. Pinyon pine and Utah juniper dominate this area with scattered Wyoming big sage and utah serviceberry.

Photo D - 18. EM-01-16 soil profile location of Monue family soil in map unit Cb. Black greasewood is the dominant vegetation in the bottom of the canyon.

Photo D - 19. EM-02-16 soil profile location of Hideout soil on structural bench in canyon, map unit Ca. Pinyon pine and Utah juniper are the dominant vegetation. Surface is covered with channers and flags. Large boulders have fallen from the cliffs above the bench.

Appendix E

Profile Box Photos

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EM-1-09 - Begay family

Ustic Haplocambids, coarse-loamy, mixed, superactive, mesic

A 0-8 cm (0-3 inches)

Bw1 8-23 cm (3-9 inches)

Bw2 23-50 cm (9-20 inches)

Bk 50-80 cm (20-32 inches)

R 80 cm (32 inches)

EM-2-09 - Hideout

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

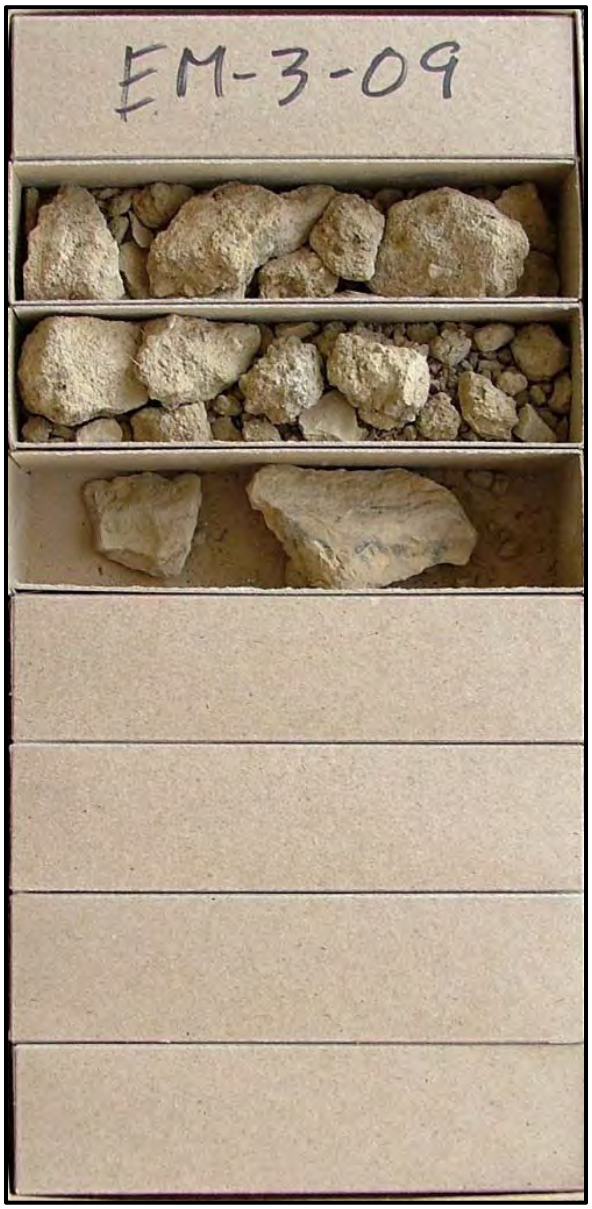
A 0-5 cm (0-2 inches)

C 5-19 cm (2-7 inches)

R 19 cm (7 inches)

EM-3-09 - Disturbed Land

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic



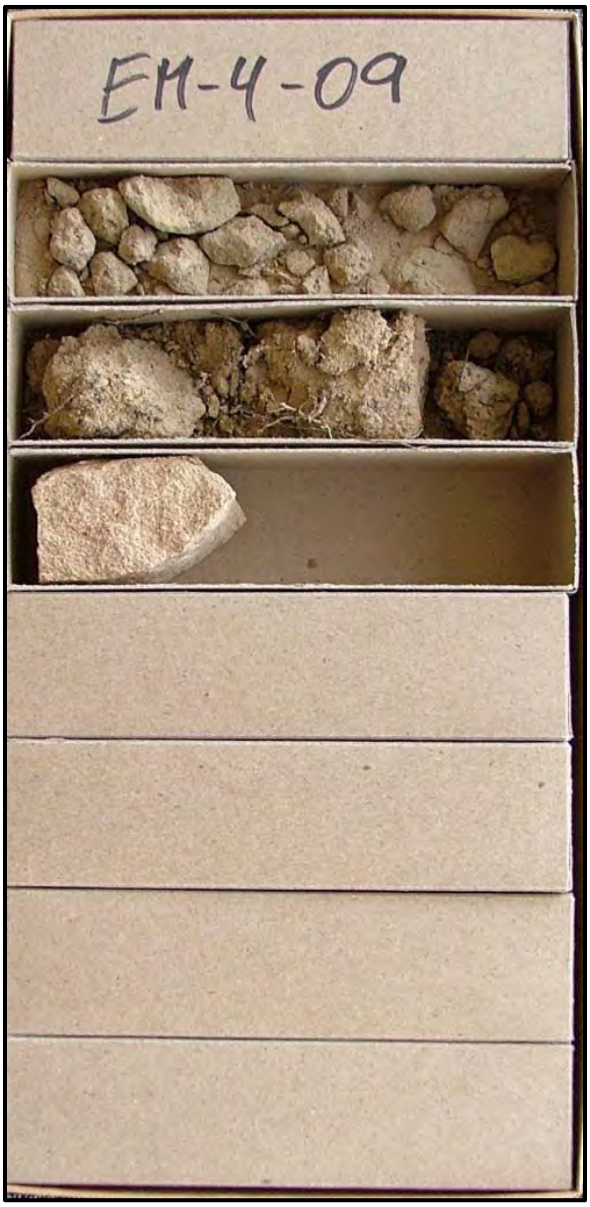
A 0-18 cm (0-7 inches)

C 18-46 cm (7-18 inches)

R 46 cm (18 inches)

EM-4-09 - Hideout

Lithic Ustic torriorthents, loamy, mixed, superactive, calcareous, mesic



A 0-6 cm (0-2 inches)

C 6-20 cm (2-8 inches)

R 20 cm (8 inches)

EM-5-09 - Lazear

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-7 cm (0-3 inches)

C 7-20 cm (3-8 inches)

R 20 cm (8 inches)

EM-6-09 - Persayo family

Typic Torriorthents, loamy, mixed active, calcareous, shallow, mesic

A 0-7 cm (0-3 inches)

2C 7-18 cm (3-7 inches)

Cr1 18-34 cm (7-13 inches)

Cr2 34-38+ cm (13-15+ inches)

EM-7-09 - Green River

Oxyaquic Torrifluvents, coarse-loamy, mixed, calcareous, superactive, mesic

A 0-15 cm (0-6 inches)

2A 15-28 cm (6-11 inches)

2C 28-43 cm (11-17 inches)

3A 43-56 cm (17-22 inches)

3C1 56-78 cm (22-31 inches)

3C2 78-102 cm (31-40 inches)

3C3 102-130 cm (40-51 inches)

3C4 130-150 cm (51-59 inches)

EM-8-09 - Garley

Typic Torrifluvents, coarse-loamy, mixed, calcareous, active, mesic

A 0-9 cm (0-4 inches)

C1 9-32 cm (4-13 inches)

C2 32-46 cm (13-18 inches)

Ab1 46-60 cm (18-24 inches)

C3 60-70 cm (24-28 inches)

C4 70-88 cm (28-35 inches)

Ab2 88-98 cm (35-39 inches)

C5 98-108 cm (39-43 inches)

C6 108-120 cm (43-47 inches)

C7 120-150 (47-59 inches)

EM-9-09 - Garley

Typic Torrifluvents, coarse-loamy, mixed, calcareous, active, mesic

A 0-9 cm (0-4 inches)

AC 9-25 cm (4-10 inches)

C1 25-49 cm (10-19 inches)

C2 49-75 cm (19-30 inches)

C3 75-120 cm (30-47 inches)

2Bk 120-168 cm (47-66 inches)

EM-10-09 - Braf

Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-7 cm (0-3 inches0

C1 7-27 cm (3-11 inches)

C2 27-45 cm (11-18 inches)

R 45 cm (18 inches)

EM-11-09 - Braf

Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-3 cm (0-1 inches)

C 3-8 cm (1-3 inches)

R 8 cm (3 inches)

EM-12-09 - Garley, moderately well drained

Typic Torrifluvents, coarse-loamy, mixed, calcareous, active, mesic

A 0-15 cm (0-6 inches)

C1 15-35 cm (6-14 inches)

C2 35-46 cm (14-18 inches)

C3 46-72 cm (18-28 inches)

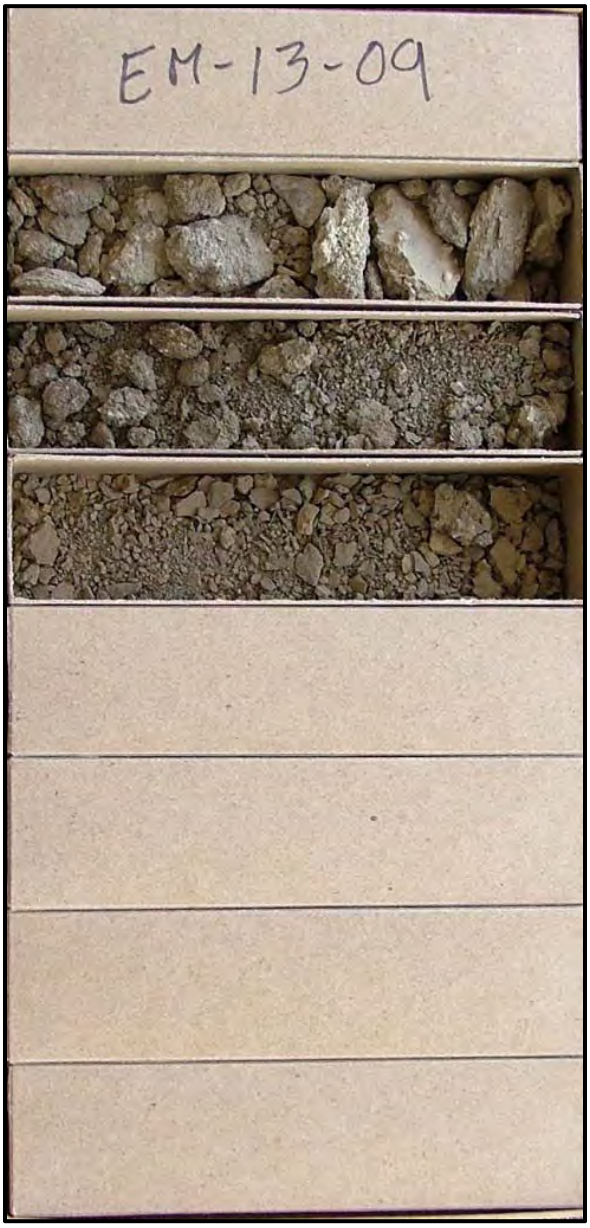
Ab 72-102 cm (28-40 inches)

C4 102-130 cm (40-51 inches)

C5 130-164 cm (51-65 inches)

EM-13-09 - Persayo

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow



A 0-10 cm (0-4 inches)

C 10-40 cm (4-16 inches)

Cr 40 cm (16 inches)

EM-14-09 - Braf

Lithic Torriorthents, loamy, mixed, superactive, calcareous, mesic

A 0-12 cm (0-5 inches)

C1 12-38 cm (5-15 inches)

C2 38-48 cm (15-19 inches)

Cr 48 cm (19 inches)
– no sandstone sample

EM-15-09 - Persayo

Typic Torriorthents, loamy, mixed, active, calcareous, mesic, shallow

A 0-17 cm (0-7 inches)

C 17-48 cm (7-19 inches)

R 48 cm (19 inches)

EM-16-09 - Monue family

Typic Haplocambids, coarse-loamy, mixed, superactive, mesic

A 0-8 cm (0-3 inches)

Bw1 8-21 cm (3-8 inches)

Bw2 21-46 cm (8-18 inches)

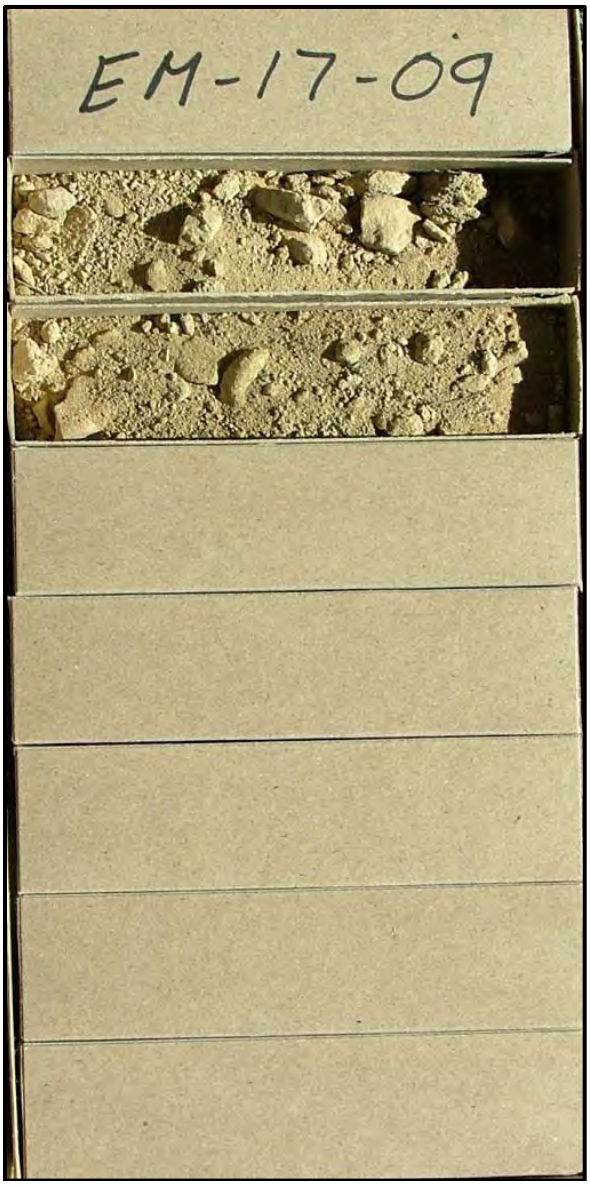
C1 46-80 cm (18-32 inches)

C2 80-122 cm (32-48 inches)

2C 122-170 cm (48-67 inches)

EM-17-09 - Hideout

Lithic Ustic Torriorthents, loamy, mixed, superactive, calcareous, mesic



A 0-4 cm (0-2 inches)

C 4-19 cm (2-7 inches)

Cr 19 cm (7 inches)
– no sandstone sample

EM-1-16

No box sample was collected.

EM-2-16

No box sample was collected.

Appendix F

Map Unit Salvage and Sandstone Estimates

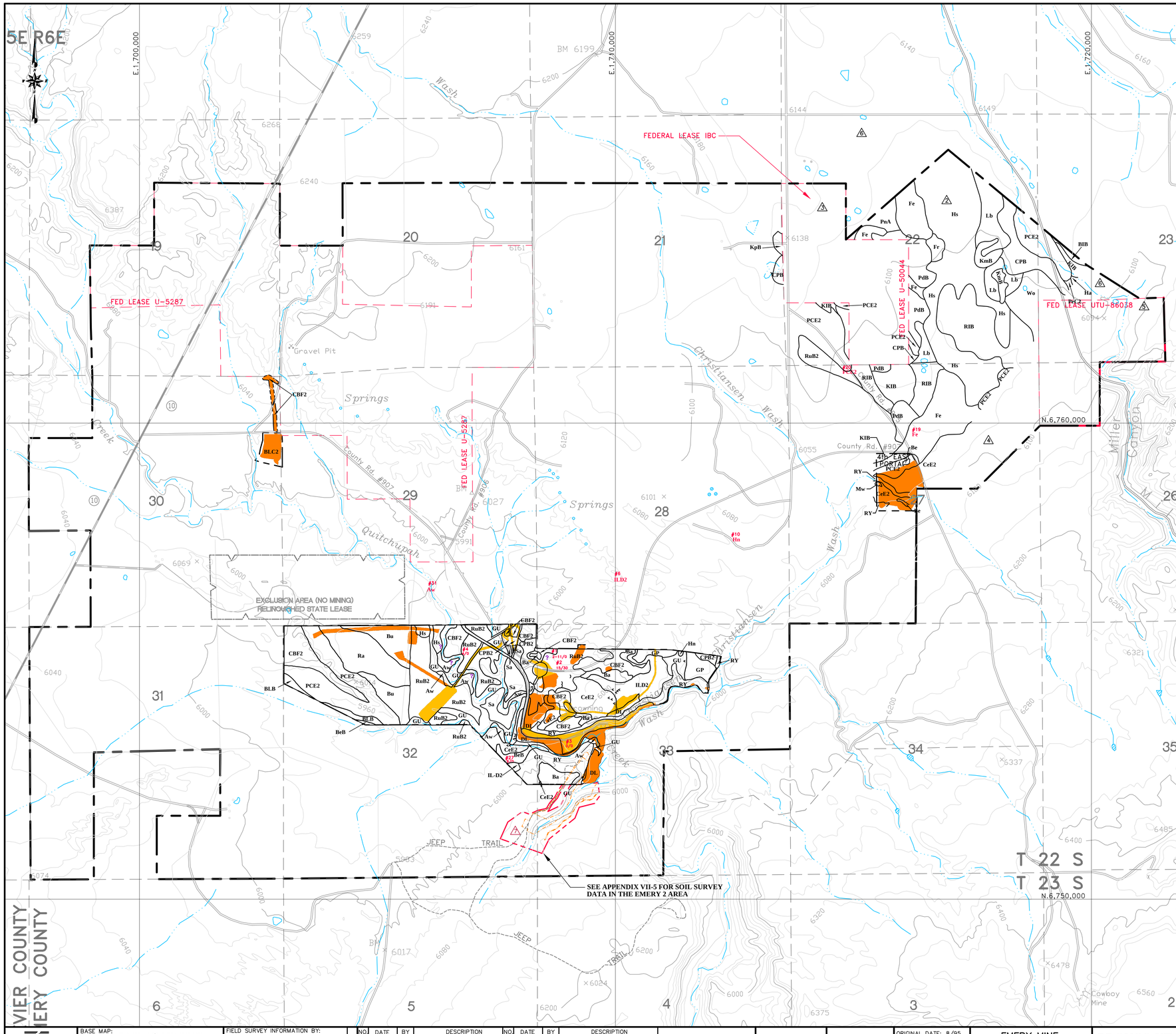
Table F - 1. Estimated topsoil and subsoil salvage depths for Emery 2 map units based on representative soil profiles as listed in the *Major Soil Types* section of Emery 2 Soil Survey Report.

Map Unit	Percent	Soil Series or Family	Topsoil Salvage Depth[1]	Weighted Topsoil Depth[2]	Total Weighted Topsoil Depth[3]	Subsoil Salvage Depth[4]	Weighted Subsoil Depth[5]	Total Weighted Subsoil Depth[6]	Total Weighted Topsoil Depth[7]	Total Weighted Subsoil Depth[8]	Total Weighted Salvage Depth[9]
			cm	cm	cm	cm	cm	cm	inches	inches	inches
A	**Rock Outcrop - Hideout complex, 3 to 8 percent slopes**										
	50	Sandstone outcrop	0	0.0		0	0.0				
	40	Hideout	20	8.0		0	0.0				
	10	Begay family	23	2.3		57	5.7				
					10			6	4	2	6
Ba	**Begay family - Lazear complex, 3 to 12 percent slopes**										
	50	Begay family	23	11.5		57	28.5				
	35	Lazear	20	7.0		0	0.0				
	10	Hideout	20	2.0		0	0.0				
	5	Sandstone outcrop	0	0.0		0	0.0				
					21			29	8	11	19
Bd	**Disturbed landscape, 3 to 15 percent slopes**										
	85	Disturbed soils	18	15.3		28	23.8				
	10	Begay family	23	2.3		57	5.7				
	5	Hideout	20	1.0		0	0.0				
					19			30	7	12	19
Ca	**Persayo family - Hideout - Rock Outcrop complex, 3 to 80 percent slopes**										
	50	Persayo family	18	9.0		0	0.0				
	20	Hideout	20	4.0		0	0.0				
	15	Sandstone Outcrop	0	0.0		0	0.0				
	8	Garley	9	0.7		0	0.0				
	7	Monue Family	46	3.2		76	5.3				
					17			5	7	2	9

Map Unit	Percent	Soil Series or Family	Topsoil Salvage Depth[1]	Weighted Topsoil Depth[2]	Total Weighted Topsoil Depth[3]	Subsoil Salvage Depth[4]	Weighted Subsoil Depth[5]	Total Weighted Subsoil Depth[6]	Total Weighted Topsoil Depth[7]	Total Weighted Subsoil Depth[8]	Total Weighted Salvage Depth[9]
			cm	cm	cm	cm	cm	cm	inches	inches	inches
Cb	**Monue family - Garley complex, 3 to 12 percent slopes**										
	60	Monue Family	46	27.6		76	45.6				
	30	Garley	9	2.7		0	0.0				
	10	Braf	27	2.7		18	1.8				
					33			47	13	19	32
D	**Braf sandy loam, 2 to 8 percent slopes**										
	85	Braf	27	23.0		18	15.3				
	10	Sandstone Outcrop	0	0.0		0	0.0				
	5	Persayo family	18	0.9		0	0.0				
					24			15	9	6	15
E	**Rock Outcrop - Braf complex, 6 to 15 percent slopes**										
	50	Sandstone outcrop	0	0.0		0	0.0				
	45	Braf	27	12.2		18	8.1				
	5	Persayo family	18	0.9		0	0.0				
					13			8	5	3	8
F	**Persayo very gravelly sandy loam, 15 to 45 percent slopes**										
	85	Persayo	10	8.5		30	25.5				
	10	Braf	27	2.7		18	1.8				
	5	Sandstone outcrop	0	0.0		0	0.0				
					11			27	4	11	15

Map Unit	Percent	Soil Series or Family	Topsoil Salvage Depth[1]	Weighted Topsoil Depth[2]	Total Weighted Topsoil Depth[3]	Subsoil Salvage Depth[4]	Weighted Subsoil Depth[5]	Total Weighted Subsoil Depth[6]	Total Weighted Topsoil Depth[7]	Total Weighted Subsoil Depth[8]	Total Weighted Salvage Depth[9]
			cm	cm	cm	cm	cm	cm	inches	inches	inches
G	**Garley fine sandy loam, 2 to 5 percent slopes**										
	85	Garley, mod well drain	0	0.0		0	0.0				
	10	Green River	15	1.5		135	13.5				
	5	Braf	27	1.4		18	0.9				
					3			14	1	6	7
H	**Green River, 1 to 2 percent slopes**										
	90	Green River	15	13.5		135	121.5				
	10	Garley, mod well drain	0	0.0		0	0.0				
					14			122	5	48	53

1. Topsoil salvage depth based on physical and chemical characteristics of the representative soil profile from Table 17.
2. Weighted topsoil depth is the product of multiplying the topsoil salvage depth by the component percent.
3. Total weighted topsoil depth is the sum of weighted topsoil depths for map unit.
4. Subsoil salvage depth based on physical and chemical characteristics of the representative soil profile from Table 17.
5. Weighted subsoil depth is the product of multiplying the subsoil salvage depth by the component percent.
6. Total weighted subsoil depth is the sum of weighted subsoil depths for map unit.
7. Total weighted topsoil depth for map unit converted to inches.
8. Total weighted subsoil depth for map unit converted to inches.
9. Sum of weighted topsoil depths for map unit (total estimated depth of topsoil and subsoil salvage).



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- ADJACENT AREA BOUNDARY ADDITION
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- e2 PHASE II DISTURBED AREA BOUNDARY
- SOIL TYPE BOUNDARY
- Aw — SOIL MAPPING UNIT
- SURFACE AFFECTED PRIOR TO 8/3/77
- SURFACE AFFECTED AFTER 8/3/77
- #14 — CORE SAMPLE SITE
- 6 / – — TOPSOIL DEPTH
- – / 22 — SUITABLE TOPSOIL DEPTH / MATERIAL BORROW DEPTH
- ? — SALINE/SODIC SPOT
- GULLIED
- ROCK OUTCROP

SURFACE OPERATIONS AREA

SOIL MAPPING UNITS

MAP SYMBOL	ACRES	MAPPING UNIT
Aw	9.0	ALLUVIAL LAND, 0 TO 3% SLOPES
Ba	13.5	BADLAND
BeB	24.0	BEEBE FINE SANDY LOAM, 0 TO 3% SLOPES
Be	0.6	BEGAY
BLB	4.1	BILLINGS SILTY CLAY LOAM, 1 TO 3% SLOPES
BLC2	4.5	BILLINGS SILTY CLAY LOAM, 1 TO 6% SLOPES
Bu	6.8	BUNDERSON
CeE2	41.3	CASTLE VALLEY EXTREMELY STONY VERY FINE SANDY LOAM 0 TO 20% SLOPES
CBF2	27.1	CHIPETA–BADLAND ASSOCIATION, 3 TO 30% SLOPES, ERODED.
CPB2	8.6	CHIPETA–PERSAYO COMPLEX, 1 TO 8% SLOPES, ERODED.
DL	16.1	DISTURBED LAND, 0 TO 15% SLOPES
Fe	2.5	FERRON SILT LOAM HEAVY VARIANT, 0 TO 3% SLOPES
GP	9.2	GP SILT LOAM, 0 TO 12% SLOPES
GU	38.6	GULLIED LAND, VARIABLE SLOPES
Hn	0.2	HUNTING CLAY LOAM, 0 TO 5% SLOPES
Hs	3.8	HUNTING CLAY LOAM, MODERATELY SALINE, 1 TO 3% SLOPES
ILD2	18.5	ILDEFONSO LOAM, 3 TO 30% SLOPES
KIB	1.4	KILLPACK SILTY CLAY LOAM, 0 TO 3% SLOPES
Mw	0.2	MONTWELL
PCE2	43.55	PERSAYO–CHIPETA COMPLEX, 1 TO 20% SLOPES
Ra	27.4	RAFAEL SILTY CLAY LOAM, 1 TO 3% SLOPES
RuB2	65.7	RAVOLA–BUNDERSON COMPLEX, 1 TO 3% SLOPES, ERODED
RY	34.6	ROCKLAND
Sa	14.5	SALTAIR SILTY CLAY LOAM, 0 TO 30% SLOPES
–	19.5	INDUSTRIAL (COAL MINING)
–	5.8	ROADS
TOTAL	442.45	

SURFACE DISTURBANCE AREA

	ACRES
PRIOR TO AUGUST 3, 1977 AREA	23.4
POST AUGUST 3, 1977 AREA	52.2
EMERY 2 EXPANSION DISTURBANCE AREA	10.3
TOTAL DISTURBED AREA	85.9

OTHER MAPPED SOILS NOT IN SURFACE OPERATIONS AREAS

MAP SYMBOL	MAPPING UNIT
CPB	CHIPETA–PERSAYO ASSOCIATION, 1 TO 3% SLOPES
Fr	FERRON SILT LOAM
Ha	HARDING VERY FINE SANDY LOAM
KmB	KILLPACK CLAY LOAM, HIGH WATER TABLE VARIANT, 1 TO 3% SLOPES
Lb	LIBBINGS SILTY CLAY LOAM
PeC2	PENOYER LOAM, 2 TO 6% SLOPES, ERODED
RIB	RAVOLA LOAM, 1 TO 3% SLOPES

SAMPLE

CORE SAMPLE SITES SURFACE OPERATIONS AREA

NO.	SOIL SERIES
1	CHIPETA–BADLANDS ASSOC.
2	RAVOLA–BUNDERSON COMPLEX
3	DISTURBED LAND
4	RAVOLA–BUNDERSON COMPLEX
27	BEEBE VARIANT

CORE SAMPLE SITES NEAR SURFACE OPERATIONS AREA

NO.	SOIL SERIES
6	GP SERIES
10	HUNTING
19	FERRON VARIANT
20	PERSAYO–CHIPETA COMPLEX
31	ALLUVIAL LAND

REGISTERED PROFESSIONAL ENGINEER No. 168246 RICHARD B. WHITE STATE OF UTAH — NOT VALID WITHOUT A SIGNATURE

VIER COUNTY
ERY COUNTY

EarthFax

BASE MAP:
U.S.G.S 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968.
EMERY EAST 1968, PHOTO REVISED 1978.
MESA BUTTE 1968, PHOTO REVISED 1978.
WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 ZONE 4.
LAMBERT CONF. UTAH, CENTRAL – US FEET
VERTICAL DATUM – NAVD 88–US FEET

FIELD SURVEY INFORMATION BY:
J. WALSH & ASSOCIATES 3/81
WARNER–WHITE 7/81
USDA–SCS 10/88

EXTERNAL REFERENCE:
G:\UC982\XREF–CURRENT\XREF–USGSMAP.DWG
G:\UC982\XREF–CURRENT\XREF–PERM–NP.DWG
G:\UC982\XREF–CURRENT\XREF–SECTION.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	8/20/01	TDK	ADD 1.45 AC. SURFACE DISTURBANCE 4TH EAST PORTAL SITE
2	6/30/05	JAG	ADDED FIRST NORTH I.B.C.
3	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION
4	05/09	JAG	22 NORTH, ADJ. VS. PERMIT DEC. 2009
5	08/09	JAG	22 NORTH, MILLER CANYON LBA UTU–86038
6	11/09	JAG	FINAL NORTH PANELS
7	01/17	JAG	e2 PHASE II ADDITIONAL PERMIT

0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 8/95
RE–DRAWN DATE: 12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO. ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VII–1
SOIL MAP

CHAPTER VIII

VEGETATION

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Revised 05/2007
Revised 1/2009
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Revised 9/2009
Revised 4/2010
Revised 10/2016

CHAPTER VIII

VEGETATION

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VIII-2 THREATENED, ENDANGERED, and Sensitive Species Survey Report, JBR Environmental Consultants, Inc., August 2002

VIII-3 Vegetation of the 4th East, 6th West, & 14th/15th West Areas Report: Mt. Nebo Scientific, April 2007 (includes T&E and sensitive species)

VIII-4 Biological Resources of the Full Extraction Pillar Splitting, Life of Mine Surface Area Report Mt. Nebo Scientific, November 2008

VIII-5 Biological Resources of the Zero Zero North Area, Mt. Nebo Scientific, June 2009

VIII-6 Biological Resources of the Zero Zero North LBA UTU-86038, Mt Nebo Scientific, Nov 2008 Plant Communities, Threatened, Endangered & Sensitive Species study, Burrowing Owl Survey, Prairie Dog Survey

VIII-7 Biological Resources of the Zero Zero North Wedge Mt. Nebo Scientific March 9, 2010

VIII-8 Vegetation, Wildlife and Sensitive Species of the Emery 2 Area, Mt. Nebo Scientific, December 2016

PLATES (In Map Pockets)

VIII-1 VEGETATION & LAND USE MAP

Revised 05/2007
Revised 1/09
Revised 6/09
Revised 9/09
Revised 4/10
Revised 12/2016

CHAPTER VIII, APPENDIX VIII-8
Vegetation, Wildlife and Sensitive Species of the Emery 2 Area

Inserted 10/2016

VEGETATION, WILDLIFE AND SENSITIVE SPECIES OF THE EMERY 2 AREA

AT THE EMERY MINE, UTAH

Prepared by

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Springville, Utah 84663
(801) 489-6937

by

Patrick D. Collins, Ph.D.

for

BRONCO UTAH OPERATIONS, LLC.
P.O. Box 527
Emery, Utah 84522

June 2016
October 2016
December 2016

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Introduction

Bronco Utah Operations has proposed to develop underground coal mining at the Emery Mine site. The new mining will occur south of previous operations into what is called the Emery 2 Area. The Emery Mine is located in south-central Utah, about 4 air miles south of the town of Emery. The new Emery 2 Area is shown on the USGS Walker Flat Quadrangle 7.5 series topographic map (Figure 1). Coal for the Emery Mine lies within the Ferron Sandstone member in the cretaceous beds of the Mancos Shale Formation. Much of the surface area of the mine site is located on the Blue Gate Shale Member of that same formation. The Emery 2 study area is situated in the salt deserts of Utah and is dominated by a Shadscale plant community. The study area lies between the Wasatch Plateau to the west and the San Rafael Swell to the east and has an average elevation of approximately 6,000 ft above sea level.

Onsite field studies in the Emery 2 study area were conducted in 2009, 2010 and 2016. In 2009 and 2010, the permit area was much larger than what is proposed at the present time. Although the size of *permit area* was decreased in 2016, the *study area* for vegetation and sensitive species remained the same as the earlier boundary. Although this report focuses more on the 2016 permit area, because results were available for a larger area from earlier studies, additional information has been included in this report to provide greater detail for vegetation and wildlife habitats adjacent to the new Emery 2 Area.

Plant communities that could be impacted by proposed new surface disturbances have been quantitatively sampled along with reference areas chosen to represent future revegetation success standards at the time of final reclamation. Initial sampling was conducted in 2009 and 2010 when the previous owners, Consolidation Coal Company (Consol Energy), were planning to expand their operations within the same general area.

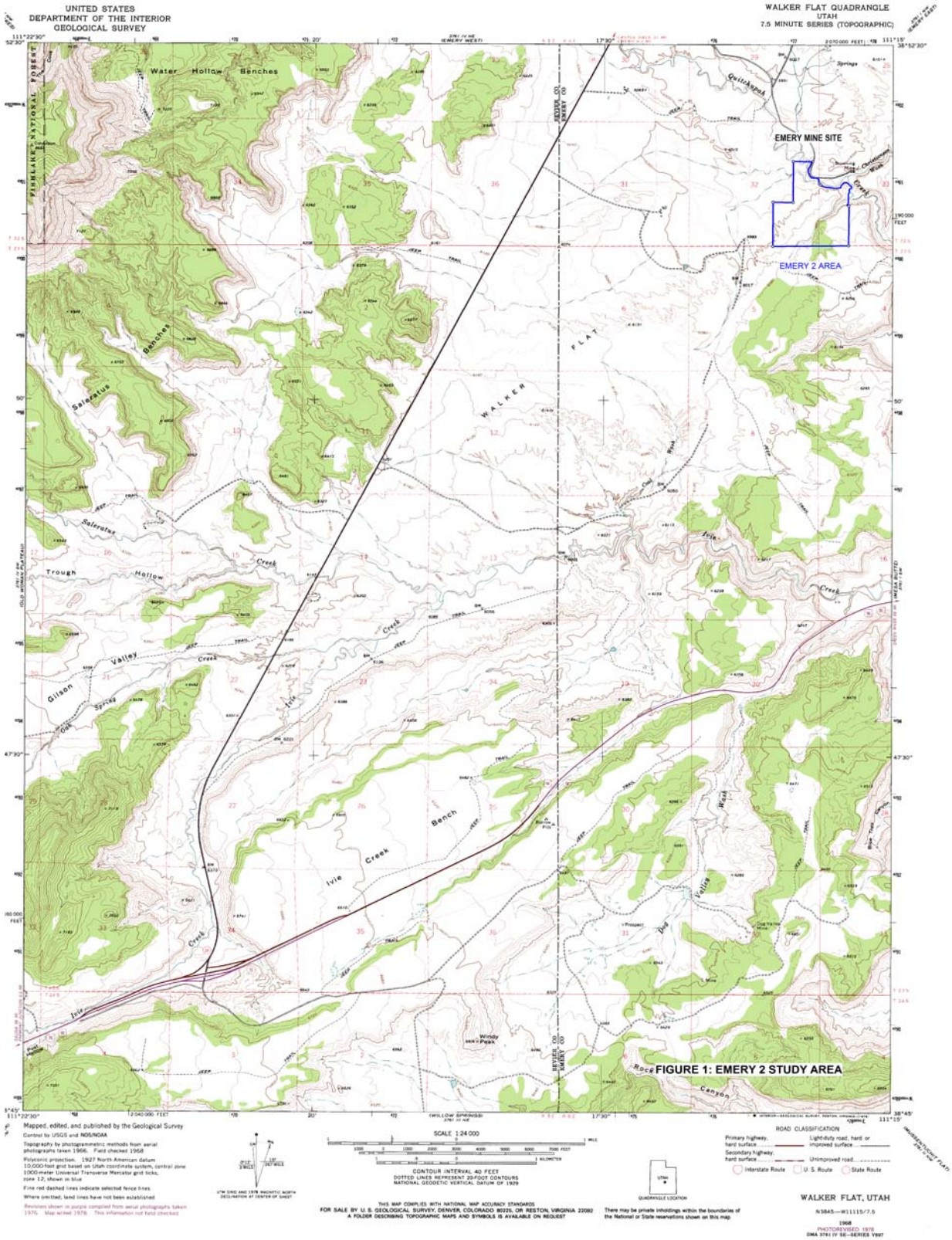

FIGURE 1: EMERY 2 STUDY AREA

Methods

Sampling methodologies used for this study were performed using guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM) and other applicable sources. Quantitative and qualitative data were recorded in September 2009, May 2010 and June 2016 within the plant communities that have been proposed for disturbance, as well as those to be used for future revegetation success standards called "reference areas". UTM coordinates for the sample areas have been included in the Results section below.

Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling in the communities were placed randomly within the boundaries of the proposed disturbed and reference areas. A transect placement technique was employed with the goal to adequately sample a representative subset of each site. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information was recorded on the raw data sheets such as: slope, exposure, grazing use, disturbance and/or other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 2008).

Woody Species Density

Density of woody plant species for the proposed disturbed and reference areas were estimated using the point-quarter method. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant

species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual. The number of individuals per acre was the end results of the calculations.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density values of each proposed disturbed plant community with the proposed reference area for that site.

High-Value Wildlife

The State of Utah, Department of Natural Resources geographic information system (GIS) database was consulted with regard to high-value habitats within and adjacent to the Emery 2 study area. The findings have been included in this report.

Threatened & Endangered Species Surveys

Prior to the field work, documents that provide the most recent accounting of the federally listed threatened, endangered and candidate species for Emery County, Utah were reviewed. Additionally, the State of Utah, Department of Natural Resources' biodiversity database was consulted with regard to threatened, endangered or otherwise sensitive species (TES) in the Emery 2 Area. Finally, the U.S. Fish & Wildlife Service's Information for Planning and Conservation database was utilized (IPaC). These information sources were used to drive the field surveys for sensitive species in the Emery 2 Area.

Once the target sensitive species were determined, a field reconnaissance visit was conducted at specific time periods, or during their flowering times, at known locations to note the growth stage at that specific point in time. Next, the onsite field surveys for the target species were conducted in the Emery 2 study area.

As mentioned above, at an earlier time the Emery 2 permit area was much larger than that proposed in 2016. In 2010, transect survey lines were placed over the vegetation study area that is shown on the attached map (Figure 2). During that year the transect lines were placed over the entire study area at regular intervals. In 2016, the most applicable transect lines for the new permit area were used in the survey – this survey focused on the smaller Emery 2 permit area.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been submitted with this report.

Seed Mixtures

Revegetation seed mixtures have been included in this report. They were formulated based on the results of the field studies.

Results

A vegetation map has been prepared that shows the plant communities located within the Emery 2 study area (Figure 2). This map shows the new permit area as well as adjacent plant communities and wildlife habitat types. A more generalized *Vegetation and Land Use Map* for the entire Emery Mine permit area can be found in the Mining & Reclamation Plan (Plate VIII-1).

Depending on the final mine plans, there are various plant communities that could be disturbed as a result of the proposed surface operations in the Emery 2 Area. Data have been collected in these plant communities in an attempt to accommodate any changes to the footprint of the current designed plans. These communities included: Pinyon-Juniper, Shadscale, Greasewood and Previously Disturbed Shadscale & Greasewood. Below is a summary of the results from sampling these plant communities.

Proposed Disturbed Pinyon-Juniper

(Sample Location = UTM NAD 27 - Center: 477382 E, 4300184 N)

A Pinyon-Juniper community is supported in the uplands above the Ferron Sandstone escarpments on the south end of the Emery 2 Area (Figure 2). As the community name suggests, the most common plant species here were pinyon-pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Woody species dominated the site with only a few forbs present. No grasses were observed in the sample quadrats (Table 1).

The total living cover which includes the sum of the overstory and understory was estimated at 19.43% (Table 2-A). Shrubs dominated this cover; the composition of the understory by lifeform was comprised of 71.21% trees/shrubs and 28.79% forbs (Table 2-B).

Total woody species density was estimated at 546 individuals per acre and was dominated by black sagebrush (*Artemisia nova*), Utah juniper and pinyon-pine (Table 3).

Pinyon-Juniper Comparison Area

(Sample Location = UTM NAD 27 - Center: 477334 E, 4300035 N)

Initially, a similar Pinyon-Juniper community was chosen to represent future revegetation success standards. It was also dominated by the same species as the proposed disturbed area described above, or pinyon-pine and Utah juniper (Table 4). Later, because the proposed disturbance in thos community was much smaller than earlier plans, it seemed more practical to reclaim the site to a Shadscale community – this community will probably have the majority of the surface disturbance for mining and subsequent reclamation activities.

Consequently, the area that was initially sampled to be used as a *Pinyon-Juniper Reference Area* will remain on the vegetation map along with the corresponding data in this report. It is now called a *Comparison Area* and can be used as representative baseline data for the community that may be disturbed by mining activities.

The total living cover for this community was estimated at 19.40%, 10.23% came from understory cover and 9.17% from overstory (Table 5-A). Composition of the understory cover was calculated at 81.60% trees/shrubs and 18.40% forbs (Table 5-B).

Total density of woody species was estimated at 639 individuals per acre and again was mostly comprised of black sagebrush, Utah juniper and pinyon-pine (Table 6).

Proposed Disturbed Shadscale

(Sample Location = UTM NAD 27 - Center: 477173 E, 4300431 N)

The proposed disturbed Shadscale community, the most important plant community of the study area in size, was dominated by shadscale (*Atriplex confertifolia*) by quite a large margin, but was followed by galleta (*Hilaria jamesii*), blue grama (*Bouteloua gracilis*) and black sagebrush (Table 7).

The total living cover for this community was estimated at 22.33% (Table 8-A). Composition consisted of 68.83% shrubs and 31.17% grasses; no forbs were present in the sample quadrats (Table 8-B).

Woody species density totaled 5,077 individuals per acre (Table 9) and was much dominated by shadscale, with the next most important plants consisting of black sagebrush and budsage (*Artemisia spinescens*).

Shadscale Reference Area

(Sample Location = UTM NAD 27 - Center: 477204 E, 4299742 N)

The reference area chosen to represent the Shadscale community was also dominated by shadscale followed by galleta, Indian ricegrass (*Stipa hymenoides*) and budsage (Table 10).

The total living cover for this community was estimated at 21.67% (Table 11-A). Lifeform composition was comprised of 66.79% shrubs and 33.21% grasses; no forbs were present in the quadrats here either (Table 11-B).

Total woody species density was estimated at 5,009 individuals per acre with the dominant shrubs consisting of shadscale, black sagebrush and budsage (Table 12).

Proposed Disturbed Greasewood (Uplands)

(Sample Location = UTM NAD 27 - Center: 477704 E, 4300223 N)

There were two greasewood types in the vegetation study area. The largest Greasewood community in the area was initially sampled [Greasewood Sample Area (Uplands), Figure 2] when more of this type was proposed for disturbance. The community was in many ways unlike the more typical Greasewood bottoms common in the lower elevations near Quitchupah Creek and also in the ephemeral drainage of the new permit area [see Greasewood Sample Area (Bottoms), Figure 2]. The Greasewood (Uplands) community that was first sampled had a fair component of saltbush species (*Atriplex* spp.) which the bottomland Greasewood community lacked. Because of these differences, the greasewood types were divided up and sampled separately (Upland vs. Bottoms). Different reference areas for these two types were also studied.

The dominant plant in this upland community by a wide margin was greasewood (*Sarcobatus vermiculatus*), but shadscale and fourwing saltbush (*Atriplex canescens*) were also important

components. Only shrubs, no forbs and grasses, were present in the sample quadrats. For a list of all plant species observed in the sample quadrats refer to Table 13.

The total living cover of the proposed disturbed Greasewood community was estimated at 28.33% (Table 14-A). As mentioned, the composition here was comprised of 100% shrub species (Table 14-B).

Woody species density was relatively high at 3,359 individuals per acre and was dominated by the same species that dominated the cover (Table 15).

Greasewood Reference Area (Uplands)

(Sample Location = UTM NAD 27 - Center: 477885 E, 4300158 N)

Like the proposed disturbed community it was chosen to represent, the Greasewood Reference Area (Uplands) and was dominated by greasewood, shadscale and fourwing saltbush. Similarly, the cover consisted only of shrubs, with no forbs and grasses present in the sample quadrats (Table 16).

The total living cover here was 29.83% (Table 17-A) and the composition was comprised of 100% shrubs (Table 17-B).

Woody species density totaled 3,216 plants per acre. This reference area had fewer greasewood plants than the proposed disturbed area, but supported many more Torrey's seepweed (*Suaeda nigra*) plants which are often a strong component in greasewood communities (Table 18).

Proposed Disturbed Greasewood (Bottoms)

(Sample Location = UTM NAD 27 - North to South: 477586 E, 4300587 N to 477503 E, 4300513 N)

As mentioned above, the proposed disturbed Greasewood (Bottoms) were sampled separate from the Greasewood (Uplands). Although greasewood was the dominant species in most of the bottomland areas, there were also isolated pockets where other shrub species such as fourwing saltbush, shadscale and sagebrush were the single dominant plant.

In fact, fourwing saltbush had a slightly higher cover value in the proposed disturbed sample area followed by greasewood (Table 19).

The total living cover here was 39.00% (Table 20-A), where shrubs, followed by forbs then grasses made up the lifeform composition (Table 20-B).

Woody species density was dominated by fourwing saltbush and greasewood and had a total value of 2,884 individuals per acre (Table 21).

Greasewood Reference Area (Bottoms)

(Sample Location = UTM NAD 27 - North to South: 477297 E, 4300243 N to 477229 E, 4300184 N)

As shown on Table 22, the Greasewood Reference Area (Bottoms) was dominated by greasewood, shadscale and broom snakeweed (*Gutierrezia sarothrae*).

The total living cover here was estimated at 40.33% (Table 22) and comprised of 84.85% shrubs, 14.12% grasses and 1.03% forbs (Table 23-B).

Woody species density totaled 3,322 plants per acre. This reference area had more greasewood plants and quite a bit more shadscale plants when compared to the proposed disturbed area (Table 24).

Previously Disturbed Shadscale & Greasewood

(Sample Location = UTM NAD 27 - Center: 477513 E, 4300321 N)

There was one area located within Shadscale and Greasewood communities that was previously disturbed by other activities (Figure 2). It appeared that there may have been drilling and other activities in the area; it also looked like much of the land surface had once been graded using heavy equipment. The land surface was not severely disturbed, but the plants present in this area reflected a change in species, composition and density when compared to the adjacent native plant communities, so the area was sampled separately.

The previously disturbed community was dominated by shadscale, black sagebrush and Indian ricegrass (Table 25).

The total living cover in the community was estimated at 16.25% (Table 26-A). Shrubs dominated the understory cover at 69.57%, followed distantly by forbs and grasses at 17.50% and 12.93%, respectively (Table 26-B).

The total woody species density in the area was 1,439 individuals per acre and, similar to the cover results, the dominant plants for this parameter were black sagebrush and shadscale (Table 27).

Community Comparisons

When the **total living cover** values for the proposed disturbed areas including Pinyon-Juniper, Shadscale and Greasewood communities were compared with their respective reference areas using Student's t-tests, the differences were *non-significant* statistically (Figure 3). Moreover, when the **woody species density** values of these same communities and reference areas were compared

Figure 3. A statistical comparison (Student's t-tests) of the **total living covers** of the proposed disturbed and reference areas.

	$\bar{x}$	s	n	t	df	SL
Pinyon-Juniper						
Proposed Disturbed:	19.43	19.55	30			
Reference Area:	19.40	17.54	30			
t-test				0.006	58	N.S.
Shadscale						
Proposed Disturbed:	22.33	5.59	30			
Reference Area:	21.67	6.62	30			
t-test				0.417	58	N.S.
Greasewood (Uplands)						
Proposed Disturbed:	28.33	8.69	30			
Reference Area:	29.83	7.24	30			
t-test				-0.726	58	N.S.
Greasewood (Bottoms)						
Proposed Disturbed:	39.00	8.21	15			
Reference Area:	40.33	10.87	15			
t-test				0.3781	28	N.S.
Shadscale & Greasewood						
Previously Disturbed:	16.25	10.23	20			
Reference Area:	–	–	–			
t-test				n/a	n/a	n/a

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom

n/a = not applicable
p = probability
SL= Significance Level
N.S.=Non-Significant

statistically, the differences were again *non-significant* (see attached Figure 4). In other words, there were no significant differences in those communities proposed for disturbance by future mining-associated activities when compared to those communities that have been chosen to represent future revegetation success standards for them. Accordingly, these results suggest that the reference areas chosen would probably be appropriate for future revegetation success standards following final reclamation.

Figure 4. A statistical comparison (Student's t-tests) of the **woody species densities** of the proposed disturbed area and reference areas.

	$\bar{x}$	s	n	t	df	SL
Pinyon-Juniper						
Proposed Disturbed:	545.93	239.63	30			
Reference Area:	639.17	325.78	30			
t-test				-1.263	58	N.S.
Shadscale						
Proposed Disturbed:	5077.30	2472.61	30			
Reference Area:	5008.53	2351.38	30			
t-test				0.110	58	N.S.
Greasewood (Uplands)						
Proposed Disturbed:	3359.19	1560.91	30			
Reference Area:	3215.53	1177.39	30			
t-test				0.402	58	N.S.
Greasewood (Bottoms)						
Proposed Disturbed;	2883.84	1204.71	15			
Reference Area:	3321.63	1704.11	15			
t-test				0.8125	28	N.S.
Shadscale & Greasewood						
Previously Disturbed:	1439.40	2268.73	20			
Reference Area:	–	–	–			
t-test				n/a	n/a	n/a

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom

n/a = not applicable
p = probability
SL= Significance Level
N.S.=Non-Significant

High-Value Wildlife Habitat

The State of Utah, Department of Natural Resources, Division of Wildlife Resources (DWR) geographic information system (GIS) database was consulted for the presence of high-value wildlife habitats. Of the species maintained on the database, important habitat of three species have been mapped by DWR within and adjacent to the Emery 2 study area. These habitats are described below.

First, Rocky Mountain elk (*Cervus canadensis*) habitat was located in the area. *Winter* habitat has been mapped in the most northern portion of the study area and adjacent to it. This winter habitat has been assigned a value of *substantial* by DWR (Figure 5).

Next, mule deer (*Odocoileus hemionus*) habitat has also been mapped in to the area by DWR. The habitat within the study area has been classified as substantial year-long habitat. Areas to the north and west of the study area, depending on the area, have been classified as *substantial winter* or *crucial winter* habitat and (Figure 6).

Finally, although not in the study area, black bear (*Ursus americanus*) habitat has been mapped in the adjacent in surrounding areas (Figure 7). Depending on the specific region, these habitats have been listed as *substantial year-long or crucial year-long* values by DWR.

Depending on the area and level of study conducted by biologists there, DWR habitat maps can be general and should be ground-truthed on site-specific basis to confirm and refine their findings and map boundaries.

Threatened, Endangered & Sensitive Species

A table of federally listed threatened, endangered and candidate species for the study area has been provided (Table 28). Table 28 shows all the listed species (plant and animal), results of the field surveys, potential habitats, as well as the likelihood of impact to the given species by the proposed mine-related activities in the project area. Of all the listed species, perhaps the most likely species to be present in the study were Last Chance townsendia (*Townsendia aprica*), Wright's fishhook cactus (*Sclerocactus wrightiae*), San Rafael footcactus (*Pediocactus despainii*) and Winkler's footcactus (*P. winkleri*). Additionally, the borrowing owl (*Athene cunicularia*), a species protected by the Migratory Bird Treaty Act (MBTA), is known to exist in the immediate area.

Of the target species mentioned above, similar habitat and a species of fishhook cactus (*Sclerocactus* sp.) were found in the vegetation study area (more about this below). The habitat where this cactus was found was in a relatively small portion of the general study area; this habitat was *not* found in the smaller Emery 2 permit area.

The Emery Mine site is situated close to where two species of fishhook cacti (*Sclerocactus* spp.) meet. The more common Whipple's fishhook (*S. whipplei*) has been observed in another portion of the Emery Mine permit area during previous vegetation studies by the author. Its geographic range extends from the northeast to the southeast cold desert regions of Utah, and also includes portions of Colorado, Arizona, New Mexico and Nevada. Another species, the Wright's fishhook cactus, is a federally listed endangered plant. This cactus is endemic to Utah's Emery and Wayne Counties. The Emery Mine site includes habitats that are very close to those utilized by both species.

Figure 8: *Sclerocactus whipplei var. roseus*

Whipple's fishhook is most often found at elevations that range from 3,700 ft to 8,000 ft above sea level. *S. whipplei* var. *rosea* (Figure 8), the variety found in this area, grows in various geologic strata, including the formations found in the Emery study area, or Mancos Shale at the contact point between the Ferron Sandstone and Bluegate Shale Members of this formation. This species also grows in a variety of plant communities including mixed desert shrub, pinyon-pine, sagebrush, and ponderosa pine.

The rare Wright's fishhook (Figure 9), on the other hand, is mostly found at lower elevations, or between 4,800 ft to 6,100 ft above sea level. Plant communities where this species grows is more restricted, and includes salt desert shrub and shrub-grass communities to pinyon-juniper. The geology is also more restricted for this species. Wright's fishhook cactus grows in the Mancos Shale Formation, but is more often found in the Tununk Shale and Ferron Sandstone Members and in the contact area between them. The species also, however, can also be found in the Bluegate Shale Member of the Mancos Shale Formation.

Figure 9: *Sclerocactus wrightiae*

Small populations of a species of fishhook cactus (*Sclerocactus* sp.) were found in vegetation study area (Figure 10). These plants were located at the contact area between the Bluegate Shale and Ferron Sandstone. If the plants were indeed Wright's fishhook, the endangered one, the elevation of these populations would be near the upper range of its elevational gradient (5,928 ft). All things considered, including habitat, geology, soils, elevation, exposures and diagnostic characteristics, the populations in this area appear intermediate between *S. whipplei* and

Figure 10: *Sclerocactus* sp.

S. wrightiae, possibly leaning closer to the former. Interestingly, Welsh, et al. in *A Utah Flora* (2008) evidently also found the difficulties in naming their collections in an area very close to the study area. They stated the following in the Utah Flora's description for *S. wrightiae*:

> "*The small flowers and short spines are evidently diagnostic. Occasional intermediates with S. whipplei var. roseus occur in Emery Co. near the Sevier Co. line – at edaphic ecotones marking the boundary between shale and sandstone member of the Mancos Shale Formation. This entity is almost an identical match both morphologically and ecologically to S. mesaverdae (Boissevain) L. Benson, and that name being older will have priority should the two be combined*".

The results of the sensitive species surveys suggest the cacti observed had morphological characteristics very close to both species of *S. whipplei* and *S. wrightiae*. Many of the plants observed appeared to be juveniles and too young to flower (it can take four years or more to mature enough to produce flowers). Yet, for other unknown reasons, the more mature plants in these small populations displayed few flowers when they were observed. When known populations of *S. whipplei* (on-site) and *S. wrightiae* (off-site) were visited during the same time periods in May and August, 2010, both species displayed many flowers.

As a second opinion, another botanist was taken to the site. Dr. Ronald J. Kass observed the *S. whipplei* populations in the Emery Mine and adjacent areas and well as the *Sclerocactus* sp. that were found at the drill sites in the Emery 2 study. Dr. Kass has probably conducted as many or more surveys for *S. wrightiae* as anyone in the country. His opinion and the findings in this report were consistent with the statements above.

This information was worth reporting but again, although these cactus individuals were within the vegetation study area, they were outside the Emery 2 permit area, or those areas that could be disturbed by the proposed new mining operations.

Revegetation Seed Mixtures

Seed mixtures for the above community types to be used at the time of revegetation have been included in the Appendix of this report.

Discussion

Study Goals & Objectives

In this study, the primary objectives were to: 1) provide quantitative baseline data for the plant communities that may be impacted by future mining-related activities, 2) provide quantitative data of similar communities that could be used in the future for revegetation success standards and 3) survey the area for potential threatened, endangered or sensitive species. In accomplishing these objectives, one should keep in mind that the goal is to eventually reclaim those plant communities that are disturbed by the mining-related activities, and as required by state and federal regulations, to a condition that is "*diverse, effective, and permanent*" and to their approximate natural, native conditions prior to disturbance. That said, the investigators should provide data that is quantitative and descriptive, yet practical for revegetation planning and implementation. The following information explains some of the considerations and decisions made by studying the plant communities in the Emery 2 Area.

Pinyon-Juniper Community Considerations

As mentioned before, initially a Pinyon-Juniper community was chosen to represent future revegetation success standards. It was also dominated by the same species as the proposed disturbed area described above, or pinyon-pine and Utah juniper. Later, because the

proposed disturbance in this community was reduced (totaled about 5% of the permit area), it seemed prudent and more practical to reclaim the site to a shadscale community, the same community that the majority of the surface disturbance and subsequent reclamation will involves. Because this small P-J area is adjacent to the Shadscale community and will be seeded with the same seed mix, the Shadscale Reference Area could be used for revegetation success standards.

Greasewood Community Considerations

Figure 2 shows the different greasewood communities in the study area. The major Greasewood community by total area in the Emery 2 study area was initially sampled. In this report, it has been called *Greasewood (Uplands)*. This community was unlike the more typical greasewood bottoms common in the area near Quitchupah Creek and in the drainage channel of the new permit area, which have been called *Greasewood (Bottoms)*. Although some plant species were common in both Greasewood community types, there were several differences, most notably species composition and total living cover. Additionally, a review of the *Order 2 Soil Survey of the Emery 2 Mine Disturbance Area* (Long Resource Consultants, June 2016) revealed that the soil chemistry for these two Greasewood types were quite different.

When the Greasewood community was first studied in 2009 and 2010, the greasewood community types were "lumped" together on the vegetation map because little or no disturbance was planned in the *bottoms*, the much smaller area by acreage. The quantitative sampling at that time was conducted in the *uplands*, the larger area. However, because the footprint of the Emery 2 permit area and proposed disturbed areas changed significantly in 2016, impacts to the bottoms became more likely. Because of these changes, additional field studies were conducted in the *bottoms* in 2016 to augment the existing greasewood baseline datasets and for reclamation planning purposes.

Shadscale Community Considerations

One of the most common plant communities in the salt deserts of Utah is Shadscale. It is also the dominant plant community of the Emery 2 Area. There were isolated areas within this community where species composition differed. For example, the Shadscale community was mapped on the upper benches of the study area, but also mapped on the slopes of the major drainage in the permit area. In the Shadscale community, shadscale plants usually the dominated cover and density, but in other relatively small areas, Castle Valley saltbush (*Atriplex gardneri* var. *cuneata*) and black sagebrush were the dominant plant species. This small patches of isolated communities were lumped into a larger plant community for reasons more practical for revegetation at the time of final reclamation.

Previously Disturbed Community Considerations

One area described above was disturbed previously by other surface activities. This disturbance was found contiguous both Greasewood and Shadscale communities. State regulations regarding revegetation success standards of areas that were previously disturbed and are to be "*redisturbed by coal mining and reclamation operations, at a minimum, the vegetative ground cover will be not less than the ground cover existing before redisturbance and will be adequate to control erosion*". Accordingly, a reference area will not be used at the time of final reclamation in this area, rather the quantitative data reported in this report will be used as the benchmark for final revegetation success standards.

Summary & Conclusions

There were five major plant community types studied in the Emery 2 study area including: 1) Pinyon-Juniper, 2) Shadscale, 3) Greasewood, 4) Previously Disturbed Shadscale & Greasewood, and 5) Tamarisk. The communities that could be impacted by mine-related activities include all the above with the exception of Tamarisk. Therefore, only the data for those communities that have the potential for disturbance, along with their corresponding reference areas, were reported in this document.

A vegetation map showing the plant communities, reference areas and sample locations has been prepared and attached to this report.

All reference areas appear to have meet the qualifications to be used for standards for revegetation success at the time of final reclamation and will be compared with the reclaimed areas. However, the Pinyon-Juniper community will be reclaimed with the Shadscale seed mix and compared with that reference area. Moreover, the previously disturbed Shadscale & Greasewood areas will also be seeded with Shadscale seed mixture. The revegetation success standards here will be that of the "current ground cover" (data found in this report) as the state regulations suggest.

Threatened, endangered and sensitive species surveys were conducted in 2010 and 2016. No TES species were found within the new permit area boundary.

Revegetation seed mixtures have been included in the Appendix of this report.

Table 1: Cover and frequency by plant species in the Emery 2 study area (2009).

Proposed Disturbed Pinyon-Juniper			n=30
	MEAN	**STANDARD DEVIATION**	**FREQUENCY**
OVERSTORY			
Juniperus osteosperma	4.67	11.83	20.00
Pinus edulis	3.17	8.11	26.67
UNDERSTORY			
TREES & SHRUBS			
Amelanchier utahensis	0.33	1.80	3.33
Artemisia nova	1.57	2.54	33.33
Artemisia tridentata	0.33	1.80	3.33
Juniperus osteosperma	2.23	5.00	20.00
Pinus edulis	4.83	11.74	26.67
Yucca harrimaniae	0.23	1.26	3.33
FORBS			
Cryptantha sp.	1.83	2.71	36.67
Eriogonum bicolor	0.17	0.90	3.33
Euphorbia fendleri	0.07	0.36	3.33
GRASSES			

Table 2: Total cover and composition for the Emery 2 study area (2009).

Proposed Disturbed Pinyon-Juniper		n=30
A. COVER	**MEAN**	**STD. DEV.**
Overstory (o)	7.83	13.27
Understory (u)	11.60	10.02
Litter	21.30	15.26
Bareground	24.93	21.67
Rock	42.17	22.53
o + u	19.43	19.55
B. % COMPOSITION		
Trees & Shrubs	71.21	39.87
Forbs	28.79	39.87
Grasses	0.00	0.00

Table 3: Woody species density in the Emery 2 study area (2009). **n=30**

Proposed Disturbed Pinyon-Juniper	Number/Acre
Amelanchier utahensis	13.65
Artemisia nova	200.18
Artemisia tridentata	4.55
Atriplex confertifolia	4.55
Cercocarpus ledifolius	4.55
Chrysothamnus nauseosus	4.55
Juniperus osteosperma	150.13
Opuntia sp.	18.20
Pinus edulis	141.03
Yucca harrimaniae	4.55
TOTAL	**545.93**

Table 4: Cover and frequency by plant species in the Emery 2 study area (2009).

Pinyon-Juniper Comparison Area			n=30
	MEAN	**STANDARD DEVIATION**	**FREQUENCY**
OVERSTORY			
Juniperus osteosperma	1.50	3.45	20.00
Pinus edulis	7.67	14.65	26.67
TREES & SHRUBS			
Artemisia nova	2.27	3.26	40.00
Juniperus osteosperma	1.77	4.98	16.67
Opuntia sp.	0.60	2.03	10.00
Pinus edulis	4.17	7.20	30.00
Yucca harrimaniae	0.07	0.36	3.33
FORBS			
Cryptantha sp.	0.23	0.96	6.67
Eriogonum bicolor	0.40	1.28	10.00
Euphorbia fendleri	0.40	1.28	10.00
Petradoria pumila	0.33	1.80	3.33
GRASSES			

Table 5: Total cover and composition for the Emery 2 study area (2009).

Pinyon-Juniper Comparison Area		n=30
A. COVER	**MEAN**	**STD. DEV.**
Overstory (o)	9.17	15.06
Understory (u)	10.23	5.79
Litter	20.27	16.75
Bareground	21.50	16.89
Rock	48.00	21.55
o + u	19.40	17.54
B. % COMPOSITION		
Trees & Shrubs	81.60	34.58
Forbs	18.40	34.58
Grasses	0.00	0.00

Table 6: Woody species density in the Emery 2 study area (2009). **n=30**

Pinyon-Juniper Comparison Area	Number/Acre
Artemisia nova	245.01
Atriplex confertifolia	5.33
Gutierrezia sarothrae	10.65
Juniperus osteosperma	170.44
Opuntia sp.	15.98
Pinus edulis	165.12
Yucca harrimaniae	26.63
TOTAL	**639.17**

Table 7: Cover and frequency by plant species in the Emery 2 study area (2009).

Proposed Disturbed Shadscale			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	2.17	4.60	23.33
Artemisia spinescens	1.67	2.98	26.67
Atriplex confertifolia	11.83	9.62	73.33
Gutierrezia sarothrae	0.17	0.90	3.33
Opuntia sp.	0.23	0.96	6.67
FORBS			
GRASSES			
Bouteloua gracilis	2.17	4.95	26.67
Hilaria jamesii	3.67	4.07	53.33
Stipa hymenoides	0.43	1.86	6.67

Table 8: Total cover and composition for the Emery 2 study area (2009).

Proposed Disturbed Shadscale		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	22.33	5.59
Litter	8.67	8.36
Bareground	49.00	14.34
Rock	20.00	12.45
B. % COMPOSITION		
Shrubs	68.83	31.96
Forbs	0.00	0.00
Grasses	31.17	31.96

Table 9: Woody species density in the Emery 2 study area (2009). n=30

Proposed Disturbed Shadscale	Number/Acre
Artemisia nova	930.84
Artemisia spinescens	550.04
Artemisia tridentata	42.31
Atriplex confertifolia	3427.18
Gutierrezia sarothrae	42.31
Opuntia sp.	42.31
Sarcobatus vermiculatus	42.31
TOTAL	**5077.30**

Table 10: Cover and frequency by plant species in the Emery 2 study area (2009).

Shadscale Reference Area	MEAN	STANDARD DEVIATION	FREQUENCY (n=30)
TREES & SHRUBS			
Artemisia nova	1.77	3.14	26.67
Artemisia spinescens	2.00	3.56	26.67
Atriplex confertifolia	8.43	7.67	73.33
Gutierrezia sarothrae	1.00	3.74	10.00
Opuntia sp.	1.17	3.34	13.33
FORBS			
GRASSES			
Bouteloua gracilis	0.73	2.29	10.00
Hilaria jamesii	4.47	4.85	53.33
Stipa hymenoides	2.10	2.93	36.67

Table 11: Total cover and composition for the Emery 2 study area (2009).

Shadscale Reference Area (n=30)	MEAN	STD. DEV.
A. COVER		
Understory	21.67	6.62
Litter	8.33	4.53
Bareground	51.17	12.09
Rock	18.83	13.52
B. % COMPOSITION		
Shrubs	66.79	22.19
Forbs	0.00	0.00
Grasses	33.21	22.19

Table 12: Woody species density in the Emery 2 study area (2009). n=30

Shadscale Reference Area	Number/Acre
Artemisia nova	1043.44
Artemisia spinescens	626.07
Atriplex confertifolia	3046.86
Gutierrezia sarothrae	83.48
Opuntia sp.	208.69
TOTAL	**5008.53**

Table 13: Cover and frequency by plant species in the Emery 2 study area (2009).

Proposed Disturbed Greasewood (Uplands)			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Atriplex canescens	4.33	10.55	16.67
Atriplex confertifolia	4.73	7.19	36.67
Gutierrezia sarothrae	0.17	0.90	3.33
Opuntia sp.	1.50	3.69	16.67
Sarcobatus vermiculatus	16.43	13.72	73.33
Suaeda nigra	1.17	3.34	13.33
FORBS			
GRASSES			

Table 14: Total cover and composition for the Emery 2 Study area (2009).

Proposed Disturbed Greasewood (Uplands)		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	28.33	8.69
Litter	15.80	7.76
Bareground	45.33	16.12
Rock	10.53	14.69
B. % COMPOSITION		
Shrubs	100.00	0.00
Forbs	0.00	0.00
Grasses	0.00	0.00

Table 15: Woody species density in the Emery 2 study area (2009). n=30

Proposed Disturbed Greasewood (Uplands)	Number/Acre
Atriplex canescens	531.87
Atriplex confertifolia	839.80
Gutierrezia sarothrae	139.97
Opuntia sp.	223.95
Sarcobatus vermiculatus	1315.68
Suaeda nigra	307.93
TOTAL	**3359.19**

Table 16: Cover and frequency by plant species in the Emery 2 study area (2009).

Greasewood Reference Area (Uplands)			n=30
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	0.17	0.90	3.33
Atriplex canescens	2.33	6.80	13.33
Atriplex confertifolia	8.67	11.03	50.00
Gutierrezia sarothrae	0.33	1.25	6.67
Opuntia sp.	1.50	4.11	13.33
Sarcobatus vermiculatus	16.33	15.16	60.00
Suaeda nigra	0.50	1.98	6.67
FORBS			
GRASSES			

Table 17: Total cover and composition for the Emery 2 study area (2009).

Greasewood Reference Area (Uplands)		n=30
A. COVER	**MEAN**	**STD. DEV.**
Understory	29.83	7.24
Litter	12.60	8.60
Bareground	45.00	14.43
Rock	12.57	8.64
B. % COMPOSITION		
Shrubs	100.00	0.00
Forbs	0.00	0.00
Grasses	0.00	0.00

Table 18: Woody species density in the Emery 2 study area (2009). **n=30**

Greasewood/Shadscale Reference Area (Uplands)	Number/Acre
Artemisia nova	187.57
Atriplex canescens	107.18
Atriplex confertifolia	1500.58
Gutierrezia sarothrae	53.59
Juniperus osteosperma	26.80
Pinus edulis	241.16
Sarcobatus vermiculatus	107.18
Suaeda nigra	991.45
TOTAL	**3215.53**

Table 19: Cover and frequency by plant species in the Emery 2 study area (2016)

Proposed Disturbed Greasewood (Bottoms)			n=15
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	1.33	4.99	6.67
Atriplex canescens	9.33	10.93	46.67
Atriplex confertifolia	2.00	5.10	13.33
Gutierrezia sarothrae	0.67	2.49	6.67
Sarcobatus vermiculatus	7.00	11.52	33.33
FORBS			
Lepidium montanum	3.33	7.23	20.00
Salsola tragus	2.67	7.72	13.33
Cleome lutea	3.67	7.63	20.00
GRASSES			
Bromus tectorum	7.33	9.46	46.67
Stipa hymenoides	1.67	6.24	6.67

Table 20: Total cover and composition for the Emery 2 study area (2016).

Proposed Disturbed Greasewood (Bottoms)		n=15
A. COVER	**MEAN**	**STD. DEV.**
Understory	39.00	8.21
Litter	14.00	8.60
Bareground	31.00	15.83
Rock	16.00	14.51
B. % COMPOSITION		
Shrubs	50.61	35.97
Forbs	28.67	39.90
Grasses	20.72	21.94

Table 21: Woody species density in the Emery 2 study area (2016). n=15

Proposed Disturbed Greasewood (Bottoms)	Number/Acre
Artemisia nova	192.26
Atriplex canescens	1441.92
Atriplex confertifolia	48.06
Gutierrezia sarothrae	336.45
Opuntia sp.	48.06
Sarcobatus vermiculatus	817.09
TOTAL	**2883.84**

Table 22: Cover and frequency by plant species in the Emery 2 study area (2016)

Greasewood (Bottoms) Reference Area			n=15
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	0.33	1.25	6.67
Atriplex confertifolia	9.67	9.57	60.00
Gutierrezia sarothrae	6.67	9.60	46.67
Sarcobatus vermiculatus	18.33	18.14	66.67
FORBS			
Lepidium montanum	0.67	2.49	6.67
GRASSES			
Stipa hymenoides	3.00	6.78	20.00
Stipa comata	1.67	6.24	6.67

Table 23: Total cover and composition for the Emery 2 study area (2016)

Greasewood (Bottoms) Reference Area		n=15
A. COVER	**MEAN**	**STD. DEV.**
Understory	40.33	10.87
Litter	15.33	12.04
Bareground	36.67	17.48
Rock	7.67	3.09
B. % COMPOSITION		
Shrubs	84.85	29.70
Forbs	1.03	3.84
Grasses	14.12	29.41

Table 24: Woody species density in the Emery 2 study area (2016). n=15

Greasewood (Bottoms) Reference Area	Number/Acre
Artemisia nova	166.08
Atriplex canescens	110.72
Atriplex confertifolia	1273.29
Gutierrezia sarothrae	664.33
Sarcobatus vermiculatus	1107.21
TOTAL	**3321.63**

Table 25: Cover and frequency by plant species in the Emery 2 study area (2010)

Previously Disturbed Shadscale & Greasewood			n=20
	MEAN	STANDARD DEVIATION	FREQUENCY
TREES & SHRUBS			
Artemisia nova	5.35	7.83	40.00
Atriplex confertifolia	5.40	9.22	35.00
Chrysothamnus nauseosus	0.50	2.18	5.00
Juniperus osteosperma	0.40	1.74	5.00
Sarcobatus vermiculatus	0.75	3.27	5.00
FORBS			
Bassia hyssopifolia	0.50	2.18	5.00
Eriogonum sp.	0.25	1.09	5.00
Kochia scoparia	0.75	1.79	15.00
GRASSES			
Bouteloua gracilis	0.60	2.20	10.00
Stipa hymenoides	1.75	3.55	20.00

Table 26: Total cover and composition for the Emery 2 study area (2010)

Previously Disturbed Shadscale & Greasewood		n=20
A. COVER	**MEAN**	**STD. DEV.**
Understory	16.25	10.23
Litter	8.25	13.06
Bareground	62.50	21.48
Rock	13.00	14.78
B. % COMPOSITION		
Shrubs	69.57	39.06
Forbs	17.50	36.31
Grasses	12.93	20.24

Table 27: Woody species density in the Emery 2 study area (2010) **n=20**

Previously Disturbed Shadscale & Greasewood	Number/Acre
Artemisia nova	539.78
Atriplex confertifolia	485.80
Atriplex canescens	35.99
Chrysothamnus nauseosus	89.96
Juniperus osteosperma	53.98
Opuntia sp.	17.99
Sarcobatus vermiculatus	215.91
TOTAL	**1439.40**

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

(1) This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

(2) Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

(3) Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

ENDANGERED		SITE-SPECIFIC NOTES
Empidonax traillii extimus(2)	Southwestern willow flycatcher	The southwestern willow flycatcher is known to breed in the southwestern U.S. Although the bird showed up in the IPaC database, the Division of Wildlife Resources (DWR) distribution map shows its distribution to be in the extreme southern regions of Utah, well below the Emery Mine project area. The Emery 2 permit area does not have dense willow riparian habitats where this bird is most frequently found. All evidence suggest that this species will not be impacted by the new mine activities.
Gila cypha (1)	Humpback chub	Humpback chub in Utah are now confined to a few white-water areas in the Colorado, Green, and White Rivers. These rivers do not occur in the study area. No perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining activities in the study area.
Gila elegans (1)	Bonytail	The bonytail is a very rare minnow originally native to the Colorado River system. This river does not occur in the study area, nor do perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining in the study area.
Mustela nigripes (1)	Black-footed ferret (extirpated)	Nearly becoming extinct, according to DWR records the black-footed ferret was reintroduced into Uintah County, Utah in late 1999. This mammal depends on prairie-dogs for food and their burrows for shelter. Although white-tailed prairie dogs are known to occur in the general Emery Mine area, there were no colonies found in the Emery 2 area during the survey periods. There will be no impact to this species from mining in the study area.

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

(1) This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

(2) Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

(3) Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

Pediocactus despainii (1,2)	San Rafael footcactus	A survey was conducted for this species in the Emery 2 Area as well as the adjacent vegetation survey areas. No individuals of this plant were found nor likely habitat in the project area. Consequently, no impact to this cactus is expected with the proposed new mining operations in the Emery 2 Area.
Ptychocheilus lucius (1)	Colorado pike minnow	This fish is a large minnow native to the Colorado River system and now only exists in the upper reaches of this river system. These rivers do not occur in the study area, nor do perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining in the study area.
Schoenocrambe barnebyi (1,2)	Barneby reed-mustard	Barneby reed-mustard grows in soils derived from strata much lower (older) in the geologic column than what is found in the project area such as Chinle and Moenkopi (Triassic) formations. The geology, soils and habitat do not occur in the project area. There will be no impact to this species from the mine-related operations in the study area.
Sclerocactus wrightiae (1,2)	Wright fishhook cactus	Wright's fishhook cactus is known to be present primarily in salt desert habitats on Mancos Shale, Dakota, Morrison, Summerville and Entrada Sandstone formations. Although Mancos Shale is found in the in the project area, the other formations are not. It is possible this species could occur in the project area. Consequently, a survey was conducted for this cactus in the Emery 2 Area as well as the adjacent vegetation survey area. No individuals of this plant were found in the permit area, but potential habitat does exist in the vegetation survey area. More information about this species and the survey is provided in the Results section of this report.
Xyrauchen texanus (1)	Razorback sucker	The razorback is native to the Colorado River system and now only exists in the upper reaches of this river system. This river does not occur in the study area, nor do perennial streams that are tributaries to the Colorado River system occur in the Emery 2 study area. There will be no impact to this species from mining in the study area.

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

[1] This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

[2] Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

[3] Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

THREATENED		
Coccyzus americanus [2]	Yellow-billed cuckoo	The historical range of this species is thought to have been found in Utah and across the Gt. Basin. According to DWR database information, the current range of yellow-billed cuckoo is limited to disjunct fragments of riparian habitat in northern Utah, western Colorado, southwestern Wyoming, southeastern Idaho, southern Nevada and California. This habitat in not found near or within the study area. Consequently, there will be no impact to this species from operations in the Emery 2 Area.
Cycladenia humilis var jonesii [1,2]	Jones cycladenia	Jones cycladenia grows in gypsiferous, saline soils derived from strata much lower (older) in the geologic column than what is found in the project area such as Summerville (Jurassic), Chinle (Triassic), and Cutler (Permian) formations. The project area soils are derived mostly from Manco Shale and Ferron sandstone formations of Cretaceous age. The geology, soils and habitat do not occur in the project area. There will be no impact to this species from mining in the study area.
Lynx canadensis [1]	Canada lynx	The Canada lynx range extends from Canada and Alaska south to Maine, the Rocky Mountains, and also to the Great Lakes region. DWR biologists state that, *although sightings of the Canada lynx in Utah over the past twenty years are exceedingly rare, the USDA Forest Service recently announced that Canada lynx hair was found in the Manti-La Sal National Forest in 2002*. DWR distribution maps show that the "predicted" habitat for this lynx to be on the Wasatch Plateau in northwestern Emery County and it may be "critical habitat". However, this habitat would be in montane coniferous forests of which do not occur in the near the Emery 2 study area. Consequently, there will be no impact to this species as a result of construction in the study area.

Table 28: Federally listed threatened, endangered and candidate species for Emery County, Utah.

(1) This list was compiled using known species occurrences and species observations from the Utah Natural Heritage Program's Biodiversity Tracking and Conservation System (BIOTICS). The list was accessed on-line June 24, 2016. Its last update was dated October 1, 2015.

(2) Additional species added from a search of the U.S. Fish & Wildlife Service database (IPaC); access date: June 23, 2016.

(3) Additional GIS data was used from Utah Division of Wildlife Resources, Conservation Data Center; access date: June 24, 2016.

Pediocactus winkleri (1,2)	Winkler's footcactus	A survey was conducted for this species in the Emery 2 area as well as the adjacent vegetation survey areas. No individuals of this plant were found nor likely habitat in the project area. Consequently, no impact to this cactus is expected with the proposed new mining operations in the Emery 2 Area.
Strix occidentalis lucida (2)	Mexican spotted owl	The primary habitats in Utah for this owl are various forest types and steep rocky canyons. DWR distribution maps do not show the spotted owl in Emery County. The required habitat and apparent distributional information indicate that the likelihood for impacts to this bird by the proposed mining is extremely unlikely.
Townsendia aprica (1,2,3)	Last chance townsendia	This species is usually found in pinyon-juniper communities. of which are found in the study area. There is a very small stand of pinyon-juniper trees in the permit area. A survey was conducted for this species in the Emery 2 Area as well as the adjacent vegetation survey areas. No individuals of this plant were found nor likely habitat in the project area. There should be no impact to this species as a result of the proposed new mine-related activities.

Color Photographs of the Sample Areas

Proposed Disturbed Pinyon-Juniper

Pinyon-Juniper Comparison Area

Proposed Disturbed Shadscale

Shadscale Reference Area

Proposed Disturbed Greasewood (Uplands)

Greasewood Reference Area (Uplands)

Proposed Disturbed Greasewood (Bottoms)

Greasewood Reference Area (Bottoms)

Previously Disturbed Shadscale & Greasewood

Previously Disturbed Shadscale & Greasewood

Tamarisk (no disturbance planned)

Tamarisk Reference Area (if needed in the future)

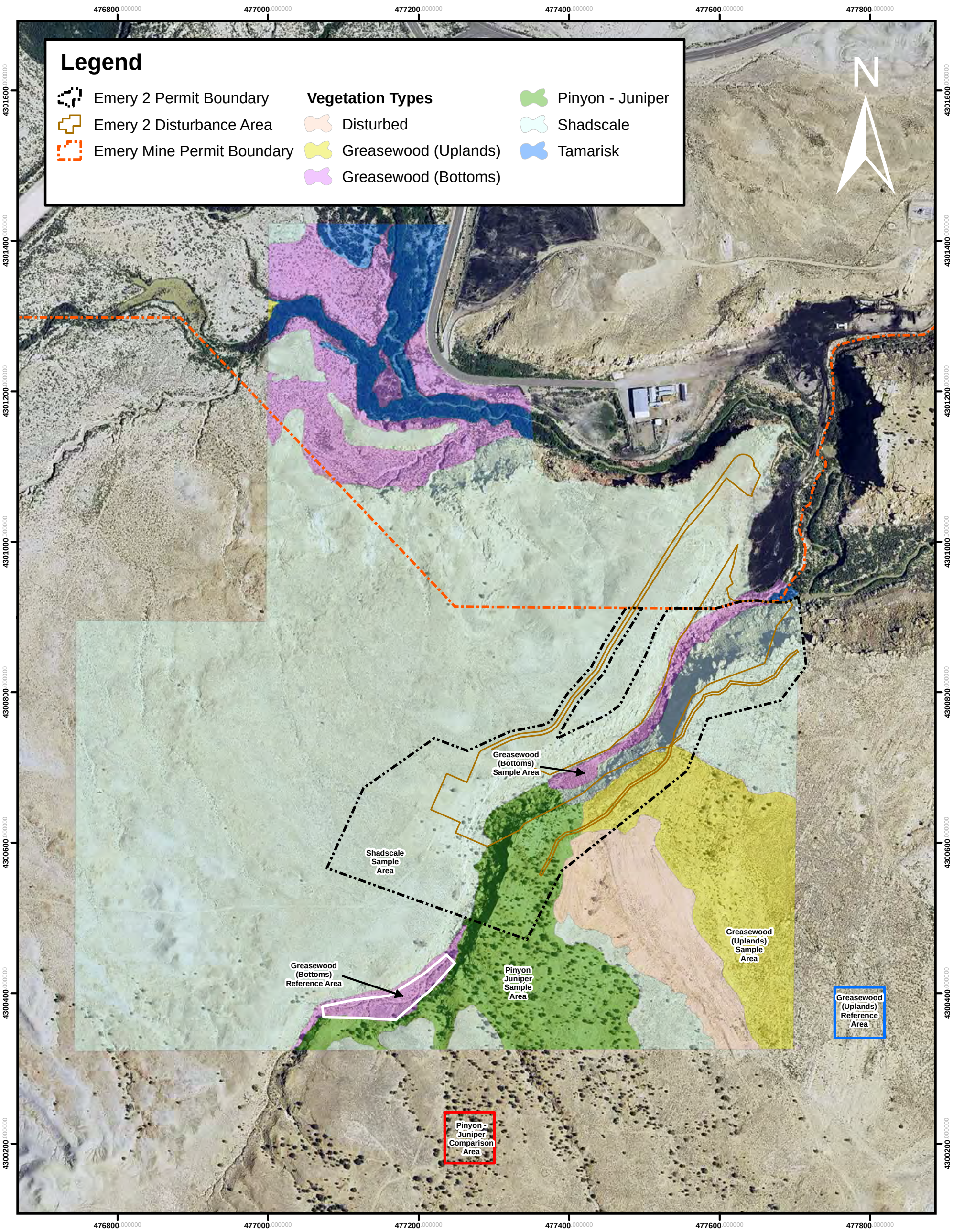

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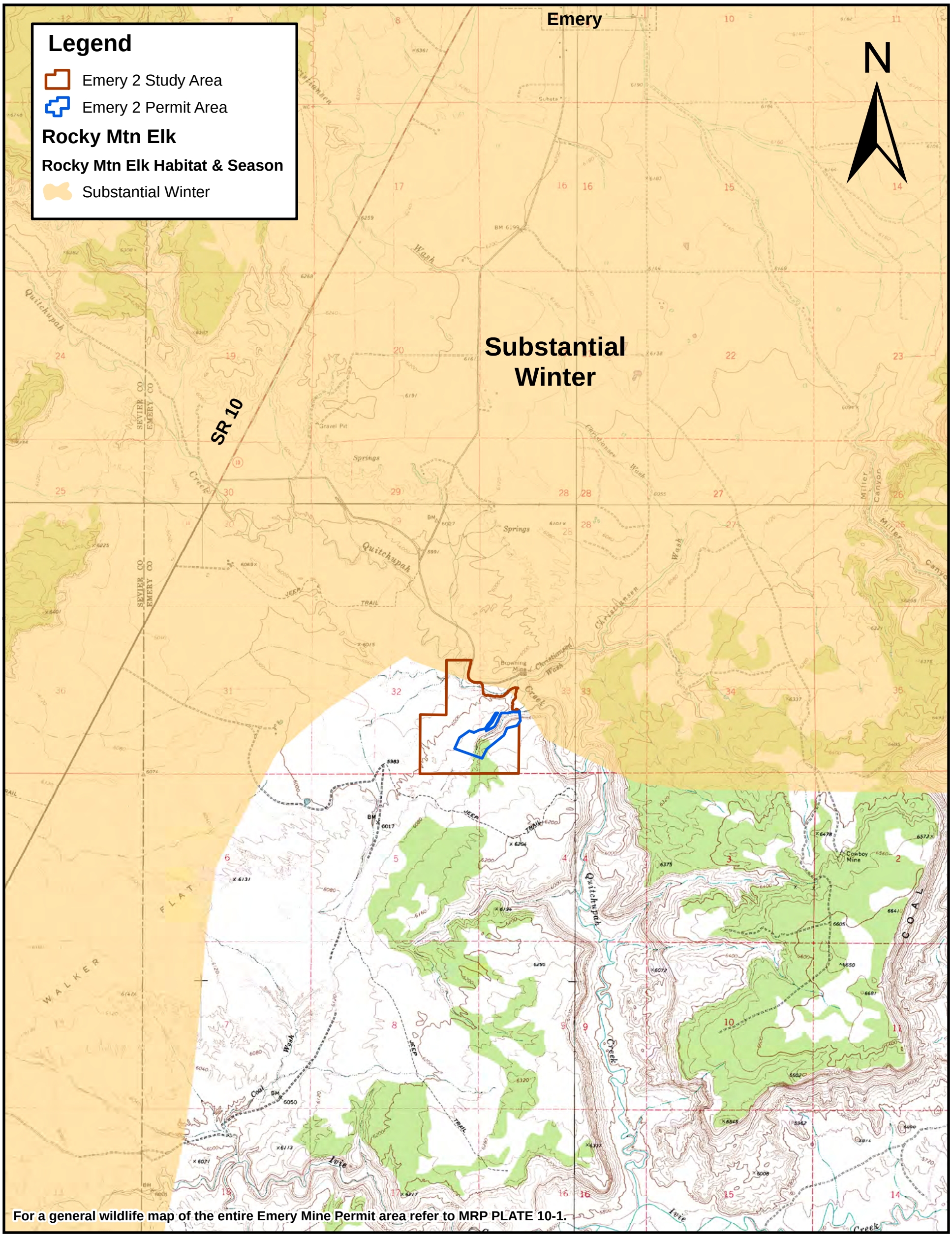
Figure 2. Emery 2 Study Area Vegetation Map

Rev. Dec 9, 2016
June 30, 2016 Base map NAIP 2014 UTM NAD 83 1 inch = 400 feet

Prepared By:

Mt Nebo Scientific
Springville, Utah

0 200 400 600 800 Feet



Bronco UTAH OPERATIONS, LLC

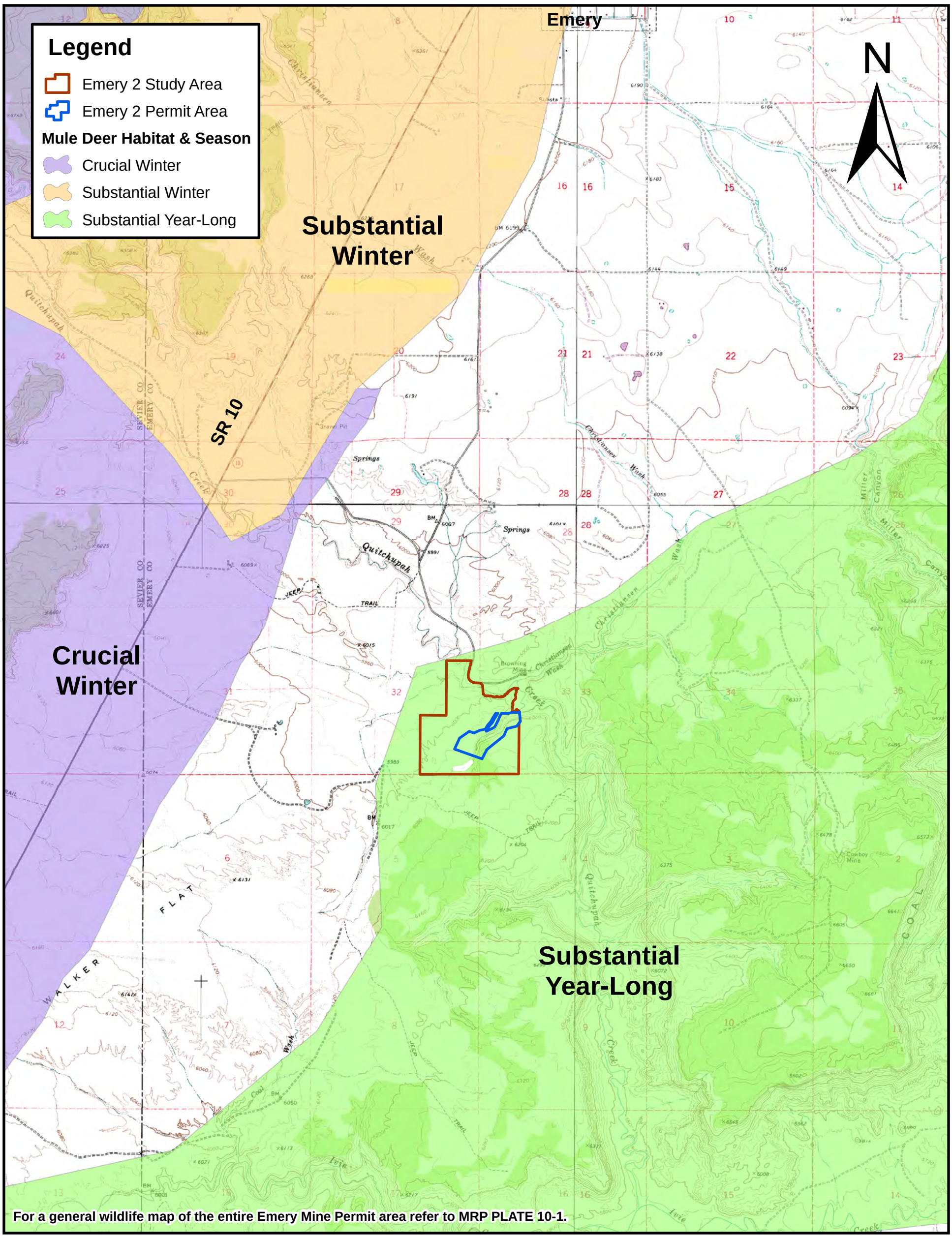
Figure 5. Rocky Mtn Elk Habitat and Season in Proximity to Emery 2 Mine Study Area

September 27, 2016
Base map - USGS Quadrangles
UTM NAD 83

GIS Data Source:
Rocky Mountain Elk Habitat
Biodiversity Database
Accessed: September 27, 2016
Utah Dept of Natural Resources
Salt Lake City, Utah

Prepared By:
Mt Nebo Scientific
Springville, Utah

0 1,500 3,000 4,500 6,000 Feet



Bronco UTAH OPERATIONS, LLC

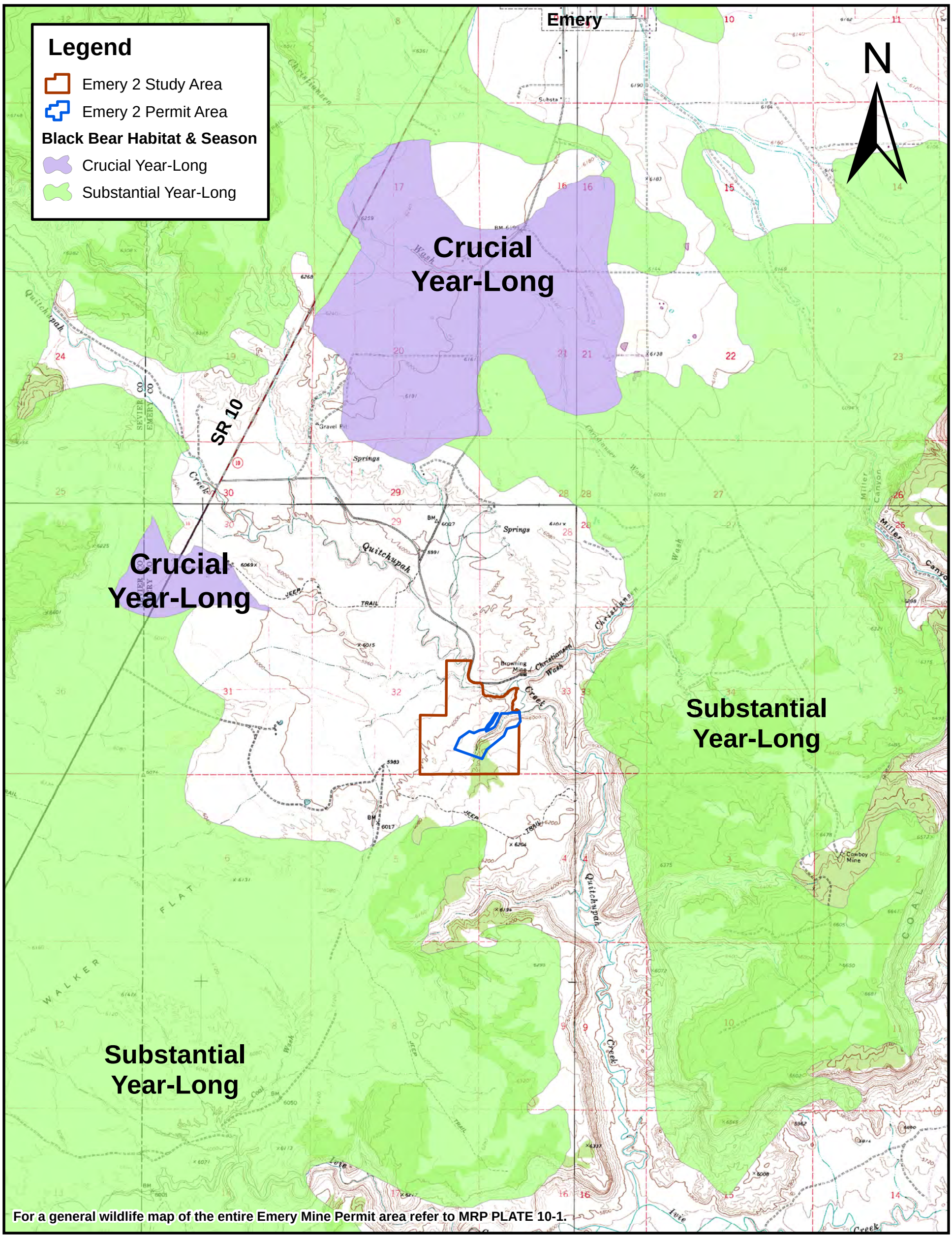
Figure 6. Mule Deer Habitat and Season in Proximity to Emery 2 Mine Study Area

September 27, 2016
Base map - USGS Quadrangles
UTM NAD 83

GIS Data Source:
Mule Deer Habitat
Biodiversity Database
Accessed: September 27, 2016
Utah Dept of Natural Resources
Salt Lake City, Utah

Prepared By:
Mt Nebo Scientific
Springville, Utah

0 1,500 3,000 4,500 6,000 Feet



Bronco UTAH OPERATIONS, LLC

Figure 7. Black Bear Habitat and Season in Proximity to Emery 2 Mine Study Area

September 27, 2016
Base map - USGS Quadrangles
UTM NAD 83

GIS Data Source:
Black Bear Habitat
Biodiversity Database
Accessed: September 27, 2016
Utah Dept of Natural Resources
Salt Lake City, Utah

Prepared By:
Mt Nebo Scientific
Springville, Utah

0 1,500 3,000 4,500 6,000 Feet

APPENDIX

Seed Mixtures for Revegetation

in the Emery 2 Area

Table A-1: Revegetation seed mixture for the Emery 2 study area

Pinyon-Juniper Community **Shadscale Community** **Previously Disturbed Shadscale & Greasewood**			
Scientific Name	Common Name	Rate PLS/Ac	No. Seeds Per Sq Ft
SHRUBS			
Artemisia nova	Black sagebrush	0.35	7.29
Atriplex canescens	Fourwing saltbush	5.00	6.31
Atriplex confertifolia	Shadscale	5.00	7.35
Ephedra viridis	Mormon tea	8.00	4.59
Ceratoides lanata	Winterfat	5.00	6.31
FORBS			
Eriogonum unbellatum	Sulfur buckwheat	1.50	7.20
Helianthus annuus	Sunflower	5.00	6.66
Linum perenne	Blue flax	1.00	6.38
Sphaeralcea grossulariaefolia	Gooseberry-leaf globemallow	0.50	5.74
Bouteloua gracilis		0.30	4.90
GRASSES			
Elymus smithii	Western wheatgrass	2.00	5.79
Hilaria jamesii	Galleta	2.00	7.30
Sporobolus airoides	Sand dropseed	0.15	6.03
Stipa hymenoides	Indian ricegrass	1.50	6.47
TOTALS		**36.95**	**88.31**

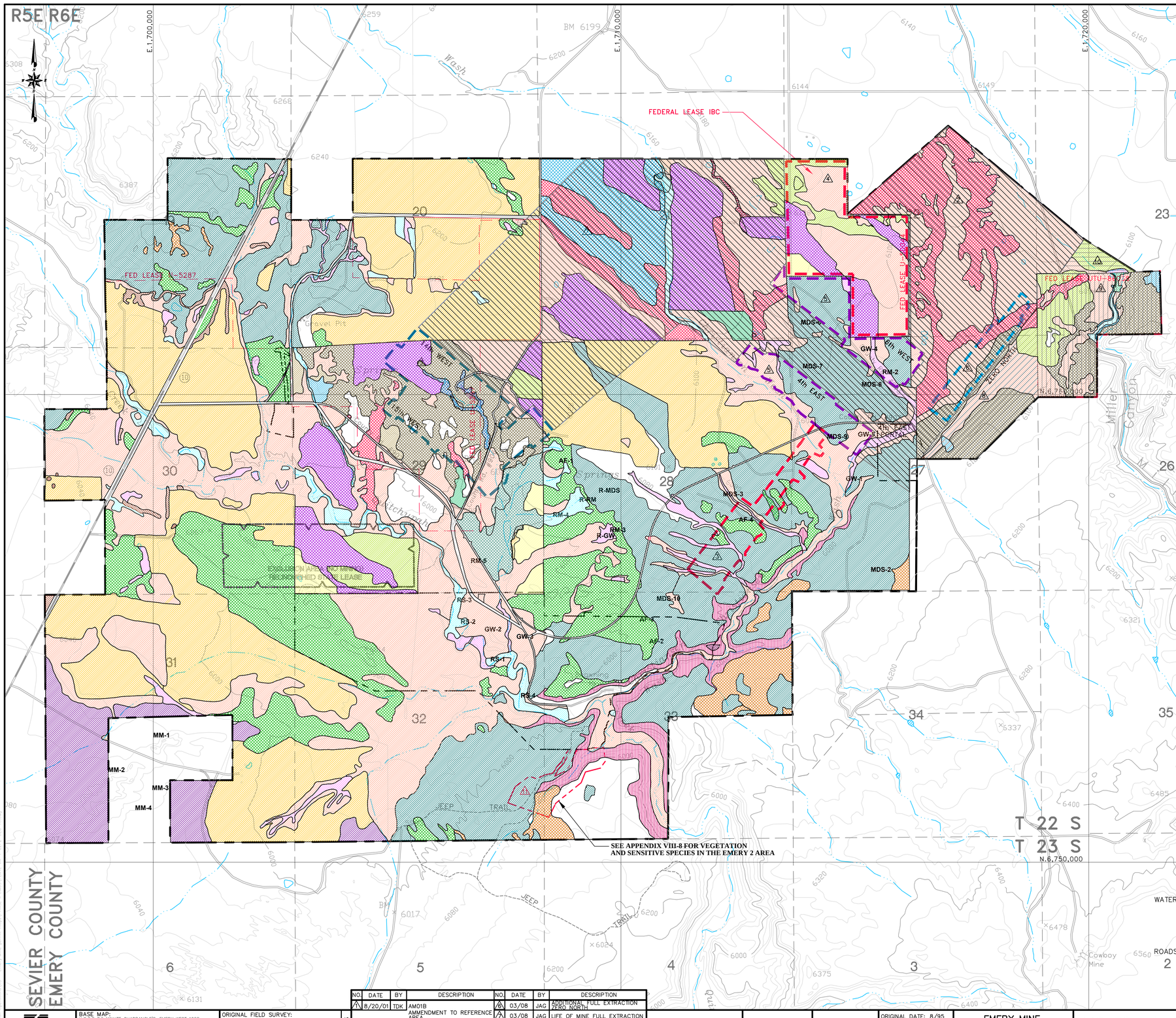
* Rates based on employing broadcast seeding methods (reduce by 50% when drill-seeded).
** Due to commercial availability, species can be substituted by a qualified botanist.

Table A-2: Revegetation seed mixture for the Emery 2 study area.

Greasewood (Uplands) Community **Greasewood (Bottoms) Community**			
Scientific Name	Common Name	Rate PLS/Ac	No. Seeds Per Sq Ft
SHRUBS			
Atriplex confertifolia	Shadscale	5.00	6.31
Atriplex canescens	Fourwing saltbush	5.00	6.89
Ceratoides lanata	Winterfat	5.00	6.31
Chrysothamnus nauseosus	Rubber rabbitbrush	0.75	6.89
Sarcobatus vermiculatus	Greasewood	1.00	6.57
FORBS			
Helianthus annuus	Sunflower	5.00	6.66
Sphaeralcea grossulariaefolia	Gooseberry-leaf Globemallow	0.75	8.61
GRASSES (and grass-likes)			
Distichlis spicata	Saltgrass	0.75	8.95
Elymus cinereus	Gt. Basin wildrye	4.00	8.72
Elymus smithii	Western wheatgrass	2.50	7.23
Sporobolus airoides	Sand dropseed	0.15	6.03
Stipa hymenoides	Indian ricegrass	1.50	6.47
TOTALS		**31.40**	**85.64**

* Rates based on employing broadcast seeding methods (reduce by 50% when drill-seeded).

** Based on commercial availability, species can be substituted by a qualified botanist.



LEGEND

- PERMIT AREA BOUNDARY (SOME VEGETATION REMOVED)
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- TO BE FULLY EXTRACTED
- TO BE FULLY EXTRACTED SEE CHAPTER VIII APPENDIX VIII-3, FIGURE 1 FOR VEGETATION IN THIS AREA
- TO BE FULLY EXTRACTED SEE CHAPTER VIII APPENDIX VIII-3, FIGURE 2 FOR VEGETATION IN THIS AREA
- FOR ADDITIONAL VEGETATION DETAIL SEE CHAPTER XII

- PASTURE LAND/HAYLAND (143 ACRES)
- PASTURE LAND/DRY (34 ACRES)
- PASTURE LAND/IRRIGATED (155 ACRES)
- RIPARIAN MEADOW
- RIPARIAN SHRUBLAND
- GREASEWOOD SHRUBLAND
- MIXED DESERT SHRUBLAND
- MATSCALE SHRUBLAND
- PINYON-JUNIPER WOODLAND
- COTTONWOOD WOODLAND
- ANNUAL FORBES
- SALT GRASS
- CATTAIL/SALTGRASS
- SHADSCALE
- OTHER SURFACE DISTURBANCE
- ROCK OUTCROP/TALUS
- SHADSCALE/WINTERFAT
- MAT SALTBRUSH
- WIREGRASS/SALTGRASS
- RUSSIAN OLIVE
- SAGEBRUSH
- TAMARISK
- AREA TO BE FULLY EXTRACTED

NOTE:
ALL ACRES IN ( ) ARE RENEWABLE RESOURCE LANDS.

REFERENCE SITE / SAMPLE SITE

MAP SYMBOL	COMMUNITIES
R-RM	RIPARIAN MEADOW
RM-1	RIPARIAN MEADOW
RM-2	RIPARIAN MEADOW
RM-3	RIPARIAN MEADOW
RM-4	RIPARIAN MEADOW
RM-5	RIPARIAN MEADOW
RS-1	RIPARIAN SHRUBLAND
RS-2	RIPARIAN SHRUBLAND
RS-3	RIPARIAN SHRUBLAND
RS-4	RIPARIAN SHRUBLAND
R-GW	GREASEWOOD SHRUBLAND
GW-1	GREASEWOOD SHRUBLAND
GW-2	GREASEWOOD SHRUBLAND
GW-3	GREASEWOOD SHRUBLAND
GW-4	GREASEWOOD SHRUBLAND
GW-5	GREASEWOOD SHRUBLAND

MAP SYMBOL	COMMUNITIES
R-MDS	MIXED DESERT SHRUBLAND
MDS-1	MIXED DESERT SHRUBLAND
MDS-2	MIXED DESERT SHRUBLAND
MDS-3	MIXED DESERT SHRUBLAND
MDS-4	MIXED DESERT SHRUBLAND
MDS-5	MIXED DESERT SHRUBLAND
MDS-6	MIXED DESERT SHRUBLAND
MDS-7	MIXED DESERT SHRUBLAND
MDS-8	MIXED DESERT SHRUBLAND
MDS-9	MIXED DESERT SHRUBLAND
MDS-10	MIXED DESERT SHRUBLAND
MM-1	MATSCALE SHRUBLAND
MM-2	MATSCALE SHRUBLAND
MM-3	MATSCALE SHRUBLAND
MM-4	MATSCALE SHRUBLAND
AF-1	ANNUAL FORBS
AF-2	ANNUAL FORBS
AF-3	ANNUAL FORBS
AF-4	ANNUAL FORBS

SURFACE OPERATIONS AREA

VEGETATION COMMUNITIES	ACRES
PRIME FARMLAND CROPLAND	NONE
PASTURE LAND / HAYLAND	NONE
RIPARIAN MEADOW	10.2
RIPARIAN SHRUBLAND	17.9
WATER	NONE
ROCK/ROCK OUTCROP/TALUS	17.1
GREASEWOOD SHRUBLAND	171.9
MIXED DESERT SHRUBLAND	95.7
MATSCALE SHRUBLAND	NONE
PINYON-JUNIPER WOODLAND	NONE
COTTONWOOD WOODLAND	NONE
ANNUAL FORBS	102.9
ROADS	5.8
INDUSTRIAL (COAL MINING)	19.5
OTHER DISTURBED LANDS	NONE
TOTAL	441.0

LAND USES	ACRES
GRAZING / WILDLIFE HABITAT	415.7
INDUSTRIAL (COAL MINING)	19.5
ROADS	5.8
TOTAL	441.0

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

REVISIONS NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION
1	8/20/01	TDK	AM01B AMMENDMENT TO REFERENCE AREA	6	03/08	JAG	ADDITIONAL FULL EXTRACTION ZERO NORTH
2	6/30/05	JAG	ADDED FIRST NORTH I.B.C.	7	03/08	JAG	LIFE OF MINE FULL EXTRACTION 4th EAST, ADJ. VS. PERMIT
3	09/05	JAG	1st SOUTH FULL EXTRACTION	8	05/09	JAG	22 NORTH, MILLER CANYON LBA UTU-86038
4	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION	9	08/09	JAG	
5	04/07	JAG	14/15W, 4E, 6W FULL EXTRACT	10	04/10	JAG	ZZN WEDGE
				11	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968, EMERY EAST 1968, PHOTO REVISED 1978, MESA BUTTE 1968, PHOTO REVISED 1978, WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES.
NAD 83 CONUS
ZONE 4302-UTAH, CENTRAL - US FEET
VERTICAL DATUM - NAVD 88-US FEET

ORIGINAL FIELD SURVEY:
3/80 AND REPORT 12/80 BY STOECKER-KLEMMERER AND ASSOC.

EXTERNAL REFERENCE:
G:\UC982\XREF-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREF-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREF-CURRENT\XREF-SECTION.DWG
G:\UC982\XREF-CURRENT\XREF-LOM.DWG

0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 8/95
RE-DRAWN DATE: 12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE VIII-1
VEGETATION AND LANDUSE MAP

CHAPTER X

PART C: AIR QUALITY

PAGE

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UMC 783.25(b)&(1) Cross-Sections, Maps, and Plans - Air Quality 1

UMC 784.2b Air Pollution Control Plan.....1

1. Existing Mine and Surface Facilities.....1

   a. Description of Fugitive Dust Sources
   b. Estimate of Uncontrolled Emissions
   c. Estimate of Controlled Emissions

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1. Existing Mine and Surface Facilities.....5

2. Proposed Preparation Facilities 6

3. Operation of Control Equipment.....6

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APPENDICES

X.C-1 Air Quality Impacts of a Coal Preparation Facility in Emery County, Utah

X.C-2 Approval Order: ~~& Application of "Notice of Intent of Modify Approval Order DAQE-117-95", Modification of 4 East Portal~~Modification to Approval Order DAQE-AN0229006-05 for Mine Expansion Project Number N10229-0010 (DAQE reference DAQE-AN102290010-16)

X.C-3 Norwest's Study of Control Measures to Minimize Fugitive Dusting at 4th East Portal

Revised 10/2002
Revised 09/2003
Revised 01/2017

CHAPTER X, PART C (AIR QUALITY) APPENDIX X.C-2

Air Permit Approval Order

State of Utah

GARY R. HERBERT
Governor

SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality

Alan Matheson
Executive Director

DIVISION OF AIR QUALITY
Bryce C. Bird
Director

DAQE-AN102290010-16

December 19, 2016

Kit Pappas
Bronco Utah Operations, LLC
Emery Mine
P.O. Box 527
Emery, UT 84522

Dear Mr. Pappas:

Re: Approval Order: Modification to Approval Order DAQE-AN0229006-05 for Mine Expansion
Project Number: N10229-0010

The attached document is the Approval Order for the above-referenced project. Future correspondence on this Approval Order should include the engineer's name as well as the DAQE number as shown on the upper right-hand corner of this letter. The project engineer for this action is Ms. Catherine Wyffels, who may be reached at (801) 536-4232.

Sincerely,

Bryce C. Bird
Director

BCB:CW:kw

cc: Southeastern Utah District Health Department

STATE OF UTAH

Department of Environmental Quality

Division of Air Quality

APPROVAL ORDER: Modification to Approval Order DAQE-AN0229006-05 for Mine Expansion

Prepared By: Ms. Catherine Wyffels, Engineer
Phone: (801) 536-4232
Email: cwyffels@utah.gov

APPROVAL ORDER NUMBER

DAQE-AN102290010-16

Date: December 19, 2016

Bronco Utah Operations, LLC
Emery Coal Mine
Source Contact:
Kit Pappas, Engineer
Phone: (435) 286-2027
Email: jpappas@broncoutah.com

Bryce C. Bird
Director

Abstract

Bronco Utah Operations, LLC (BUOLLC) has requested a modification to AO DAQE-AN0229006-05, dated July 20, 2005. BUOLLC is planning to expand operation of its Emery Mine to a new mine portal for underground mining. As part of this expansion, BUOLLC will add new coal processing equipment. All equipment previously permitted will no longer be used and will be removed from the AO. Emissions associated with the removed equipment were deducted accordingly, resulting in a net decrease of the PTE at this source.

This source is located in Emery County, which is an attainment area of the NAAQS for all pollutants. NSPS 40 CFR 60 Subparts A (General Provisions) and Y (Standards of Performance for Coal Processing Plants) regulations apply to this source. NESHAP and MACT regulations do not apply to this source. Title V of the 1990 Clean Air Act applies to this area source.

The emission changes, in TPY, will be as follows: PM_{10} = -7.10, NO_x = -1.98, SO_2 = -0.13, CO = -0.45, VOC = -0.04. $PM_{2.5}$ and HAPs emissions were not previously estimated.

The potential emissions, in TPY, are as follows: PM_{10} = 10.50 and $PM_{2.5}$ (subset of PM_{10}) = 1.26. Emissions of all other criteria pollutants and HAPs are not anticipated from this source.

This air quality AO authorizes the project with the following conditions and failure to comply with any of the conditions may constitute a violation of this order. This AO is issued to, and applies to the following:

Name of Permittee:

Bronco Utah Operations, LLC
Emery Mine
P.O. Box 527
Emery, UT 84522

Permitted Location:

Emery Coal Mine
S33 T22S R6E
Emery, UT 84522

UTM coordinates: 477,706 m Easting, 4,301,056 m Northing, UTM Zone 12
UTM Datum: NAD83

SIC code: 1222 (Bituminous Coal Underground Mining)

Section I: GENERAL PROVISIONS

I.1 All definitions, terms, abbreviations, and references used in this AO conform to those used in the UAC R307 and 40 CFR. Unless noted otherwise, references cited in these AO conditions refer to those rules. [R307-101]

I.2 The limits set forth in this AO shall not be exceeded without prior approval. [R307-401]

I.3 Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved. [R307-401-1]

I.4 All records referenced in this AO or in other applicable rules, which are required to be kept by the owner/operator, shall be made available to the Director or Director's representative upon request, and the records shall include the two-year period prior to the date of the request. Unless otherwise specified in this AO or in other applicable state and federal rules, records shall be kept for a minimum of two (2) years. [R307-401-8]

I.5 At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this AO, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to

the Director which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded. [R307-401-4]

I.6 The owner/operator shall comply with UAC R307-107. General Requirements: Breakdowns. [R307-107]

I.7 The owner/operator shall comply with UAC R307-150 Series. Emission Inventories. [R307-150]

Section II: SPECIAL PROVISIONS

II.A The approved installations shall consist of the following equipment:

II.A.1 **Emery Mine**

II.A.2 **Conveyors**

Quantity: 4
Modification Date: 2016
NSPS Applicability: Subpart Y

II.A.3 **Telescoping Chute**

Manufacture Date: 2016
NSPS Applicability: Subpart Y

II.A.4 **Screen**

Size: 8x20
Manufacture Date: 1992
NSPS Applicability: Subpart Y

II.A.5 **Crusher**

Rating: 1,500 tons/hr
Manufacture Date: 1998
NSPS Applicability: Subpart Y

II.A.6 **Storage Bin**

Modification Date: 2016
NSPS Applicability: Subpart Y

II.A.7 **Truck Loadout Station**

NSPS Applicability: Subpart Y

II.A.8 **Storage Piles**

NSPS Applicability: Subpart Y

II.B Requirements and Limitations

II.B.1 Site Wide Requirements

II.B.1.a The owner/operator shall notify the Director in writing when the Emery Mine is operational. To ensure proper credit when notifying the Director, send your correspondence to the Director, attn: Compliance Section.

If the construction and/or installation have not been completed within 18 months from the date of this AO, the Director shall be notified in writing on the status of the construction and/or installation. At that time, the Director shall require documentation of the continuous construction and/or installation of the operation and may revoke the AO. [R307-401-8]

II.B.1.b The owner/operator shall not exceed 2,000,000 tons of coal production per rolling 12-month period. [R307-401-8]

II.B.1.c To determine compliance with a rolling 12-month total the owner/operator shall calculate a new 12-month total by the 20th day of each month using data from the previous 12 months. Records of production shall be kept for all periods when the plant is in operation. The records of production shall be kept on a daily basis. Production shall be determined by scale house records, sales records, or other approved method determined by the Director. [R307-401-8]

II.B.1.d Unless otherwise specified in this AO, visible emissions shall not exceed the following values:

A. All crushers - 10% opacity

B. All screens - 10% opacity

C. All conveyor transfer points - 10% opacity

D. All other points - 20% opacity

[R307-401-8]

II.B.1.e Unless otherwise specified in this AO, opacity observations of emissions from stationary sources shall be conducted according to 40 CFR 60, Appendix A, Method 9. [R307-201-3]

II.B.2 Haul Roads and Fugitive Dust Sources Requirements

II.B.2.a The owner/operator shall not allow visible emissions from haul roads and fugitive dust sources to exceed 20 percent opacity. [R307-205]

II.B.2.b Visible emission determinations for fugitive dust emissions from haul-road traffic and mobile equipment in operational areas shall use procedures similar to Method 9. The normal requirement for observations to be made at 15-second intervals over a six-minute period, however, shall not apply. Visible emissions shall be measured at the densest point of the plume but at a point not less than 1/2 vehicle length behind the vehicle and not less than 1/2 the height of the vehicle. [R307-201]

II.B.2.c All unpaved haul roads used by mobile equipment shall be water sprayed and/or chemically treated to control fugitive dust. Application shall be used except when the ambient temperature is below freezing (32°F). [R307-401-8]

II.B.2.d Records of water/chemical treatment application shall be kept for all periods when the plant is in operation. The records shall include the following items:

A. Date and time treatments were made;

B. Number of treatments made and quantity of water applied;

C. Rainfall amount received, if any; and

D. Records of temperature, if the temperature is below freezing.

[R307-401-8]

II.B.2.e All paved haul roads used by mobile equipment shall be swept or sprayed as needed to meet the required opacity limitation in this AO or as determined necessary by the Director. [R307-401-8]

II.B.2.f All storage piles and unpaved operational areas shall be water sprayed to minimize generation of fugitive dust and meet the required opacity limitation in this AO. Water shall be applied as dry conditions warrant or as determined necessary by the Director. [R307-401-8]

II.B.2.g The owner/operator shall comply with all applicable requirements of R307-205 for Fugitive Emission and Fugitive Dust sources. To be in compliance, this facility must operate in accordance with the most current version of R307-205. [R307-205]

II.B.2.h The owner/operator shall comply with a fugitive dust control plan acceptable to the Director for control of all dust sources associated with the Emery Mine. The owner/operator shall comply with the most current fugitive dust control plan approved by the Director. [R307-401-8]

II.B.3 **Screens, Crushers, Conveyors Requirements**

II.B.3.a The owner/operator shall install water sprays or chemical dust suppression sprays at the following points to control fugitive emissions:

A. All crushers

B. All screens

C. All conveyor transfer points

[R307-401-8]

II.B.3.a.1 The sprays shall operate as needed to meet the required opacity limitation in this AO or as determined necessary by the Director. Water sprays are not required to operate during freezing weather conditions. [R307-401-8]

Section III: APPLICABLE FEDERAL REQUIREMENTS

In addition to the requirements of this AO, all applicable provisions of the following federal programs have been found to apply to this installation. This AO in no way releases the owner or operator from any liability for compliance with all other applicable federal, state, and local regulations including UAC R307.

NSPS (Part 60), A: General Provisions

NSPS (Part 60), Y: Standards of Performance for Coal Preparation and Processing Plants
Title V (Part 70) Area Source

PERMIT HISTORY

This AO is based on the following documents:

Incorporates	Additional Information dated October 20, 2016
Incorporates	Additional Information dated September 15, 2016
Incorporates	Additional Information dated August 10, 2016
Incorporates	Additional Information dated August 8, 2016
Is Derived From	NOI dated July 22, 2016
Supersedes	AO DAQE-AN0229006-05 dated July 20, 2005

ADMINISTRATIVE CODING

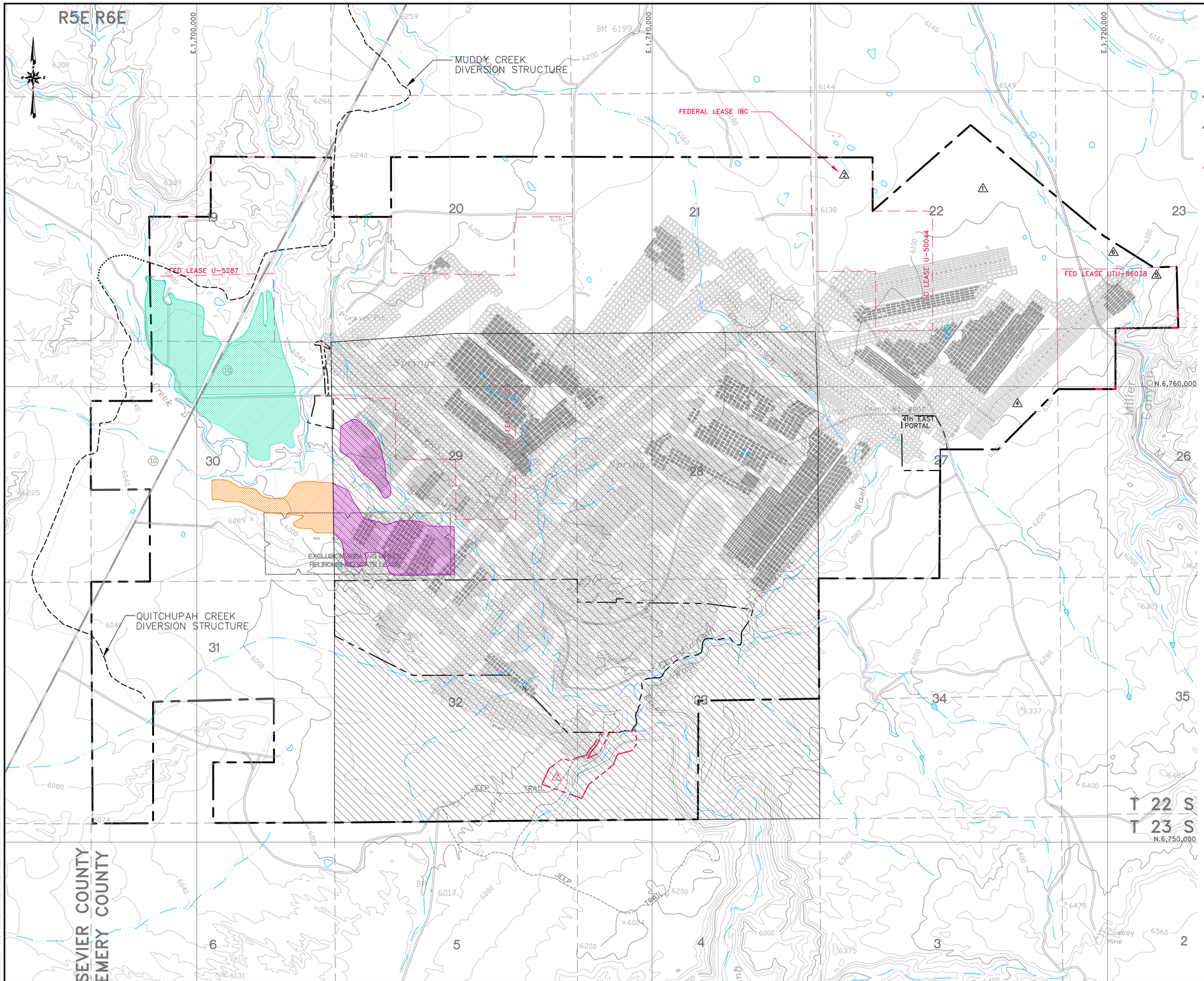
The following information is for UDAQ internal classification use only:

Emery County
CDS SM
NSPS (Part 60), Title V (Part 70) Area Source, Attainment Area

ACRONYMS

The following lists commonly used acronyms and associated translations as they apply to this document:

40 CFR	Title 40 of the Code of Federal Regulations
AO	Approval Order
BACT	Best Available Control Technology
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CDS	Classification Data System (used by EPA to classify sources by size/type)
CEM	Continuous emissions monitor
CEMS	Continuous emissions monitoring system
CFR	Code of Federal Regulations
CMS	Continuous monitoring system
CO	Carbon monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent - 40 CFR Part 98, Subpart A, Table A-1
COM	Continuous opacity monitor
DAQ/UDAQ	Division of Air Quality
DAQE	This is a document tracking code for internal UDAQ use
EPA	Environmental Protection Agency
FDCP	Fugitive dust control plan
GHG	Greenhouse Gas(es) - 40 CFR 52.21 (b)(49)(i)
GWP	Global Warming Potential - 40 CFR Part 86.1818-12(a)
HAP or HAPs	Hazardous air pollutant(s)
ITA	Intent to Approve
LB/HR	Pounds per hour
MACT	Maximum Achievable Control Technology
MMBTU	Million British Thermal Units
NAA	Nonattainment Area
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOI	Notice of Intent
NO_x	Oxides of nitrogen
NSPS	New Source Performance Standard
NSR	New Source Review
PM_{10}	Particulate matter less than 10 microns in size
$PM_{2.5}$	Particulate matter less than 2.5 microns in size
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
R307	Rules Series 307
R307-401	Rules Series 307 - Section 401
SO_2	Sulfur dioxide
Title IV	Title IV of the Clean Air Act
Title V	Title V of the Clean Air Act
TPY	Tons per year
UAC	Utah Administrative Code
VOC	Volatile organic compounds



LEGEND

- PERMIT AREA BOUNDARY
- ADJACENT AREA FOR NON-WATER RESOURCES. FOR THE AREA OF HYDROLOGIC EVALUATION, SEE PLATE VI-4
- e2 PHASE II ADDITIONAL PERMIT BOUNDARY
- AREA 1: ACTIVE FLOOD IRRIGATED, "GRANDFATHERED" WITHIN CONTEXT OF AVF REGULATIONS
- AREA 2: ACTIVE FLOOD IRRIGATED BY WATER DIVERTED FROM MUDDY CREEK, 159 ACRES HISTORIC USE ALFALFA
- AREA 3: ACTIVE FLOOD IRRIGATED WITH QUITCHUPAH CREEK WATER, 37 ACRES HISTORIC USE ALFALFA
- GRANDFATHERED AREA

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
STATE OF UTAH

EarthFax

BASE MAP:
U.S.G.S. 7.5 MINUTE QUADRANGLE'S. EMERY WEST 1968. EMERY EAST 1968, PHOTO REVISED 1978. MESA BUTTE 1968, PHOTO REVISED 1978. WALKER FLATE 1968, PHOTO REVISED 1978.

COORDINATE SYSTEM:
STATE PLANE COORDINATES. NAD 83 CONUS ZONE 4302-UTAH, CENTRAL. - US FEET VERTICAL DATUM - NAVD 88-US FEET

EXTERNAL REFERENCE:
G:\UC982\XREF-CURRENT\XREF-USGSMAP.DWG
G:\UC982\XREF-CURRENT\XREF-PERM-ZZNW.DWG
G:\UC982\XREF-CURRENT\XREF-SECTION.DWG
G:\UC982\XREF-CURRENT\XREF-WORKS-ZZNLBA.DWG

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	6/30/05	JAG	ADDED FIRST NORTH I.B.C.
2	12/12/06	JAG	1st NORTH FED LEASE IBC, FULL EXTRACTION
3	04/07	JAG	UPDATE MINING PLAN
4	05/09	JAG	ZZ NORTH, ADJ. VS. PERMIT DEF. 3099
5	08/09	JAG	ZZ NORTH, MILLER CANYON LBA UTU-86038
6	04/10	JAG	ZZN WEDGE
7	12/16	JAG	e2 PHASE II ADDITIONAL PERMIT

0' 1000'
SCALE: 1" = 1000'
CONTOUR INTERVAL = 40'

DRAWN BY: SWF
CHECKED BY: JAG
ORIGINAL DATE: 7/95
RE-DRAWN DATE:12/05
APPROVED BY: JAG
DWG DATA: G:\UC1665\05\PHASE II DWGS

EMERY MINE
EMERY COUNTY, UTAH
PERMIT NO.
ACT015/015

BRONCO UTAH OPERATIONS, LLC
P.O. BOX 527
PRICE, UT 84522

PLATE XI-1
ALLUVIAL VALLEY FLOOR ALONG UPPER QUITCHUPAH CREEK