C/007/0013
Received 4/27/17
Task #5448

UtahAmerican Energy,

Lila Canyon Project
P. O. Box 910
East Carbon, Utah 84520
Phone: (435) 888-4000
(435) 650-3157
Fax: (435) 888-4002

November 18, 2016

Utah Division of Oil, Gas & Mining
Utah Coal Program
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, UT 84114-5801

Attn: Daron Haddock
Permit Supervisor

Re: Lila Canyon Mine, UtahAmerican Energy, Inc. C/007/013
New Storage Pad / New BLM Right-of-Way

Dear Mr. Haddock,

UtahAmerican Energy, Inc. proposes to construct a New Storage Pad and new connecting roadways at the Lila Canyon Mine in Emery County, Utah. The New Storage Pad will be constructed within the disturbed boundary area, south of the existing Electrical Substation.

The New Storage Pad is needed to allow for a new location to unload/load large trucks carrying equipment/materials for the mine, and to store said equipment/materials more efficiently. Currently, large trucks are required to enter the main employee/visitor parking area to unload/load equipment and materials, which causes a great deal of congestion in the parking area and increases the likelihood of an accident involving these large vehicles. The New Storage Pad will provide a location where trucks can be unloaded/loaded with a greater margin of safety than currently exists. Furthermore, moving the large trucks to another pad will reduce congestion on the Mine Facilities / Truck Loadout Access Road, further reducing the chances of accidents. Additionally, the New Storage Pad will allow equipment and materials to be stored more efficiently and away from the employee/visitor parking area. The New Storage Pad will remain throughout the life of the mine and be reclaimed according to the approved reclamation plan.

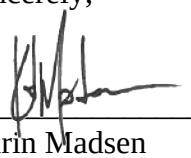
UtahAmerican Energy, Inc. has been granted a new right-of-way (#UTU-91789) by the Bureau of Land Management (BLM) to conduct work on the existing county road that runs along the western boundary of the surface facilities. A portion of one of the two (2) new roadways for the New Storage Pad is located within the new right-of-way. A copy of the right-of-way documents are included in the new Appendix 1-7. The disturbed area boundary for the surface facilities has been adjusted to accommodate the new right-of way.

A new plate is being added to the MRP, Plate 8-1, that shows the long-term plan for the surface facilities. Plate 5-2 has been revised to show the current, temporary as-built layout of the surface facilities. Plate 5-2 will be revised as new long-term facilities are constructed or installed, until the long-term plan, shown on Plate 8-1, is reached.

The attached submittal provides the drawings and text revisions/additions associated with the New Storage Pad and the new BLM right-of-way. If you have any questions, or need any additional information regarding this submittal, please contact either PJ Jensen or me directly at 435-888-4000.

Thank you for your time and attention.

Sincerely,



Karin Madsen
Engineering Tech
UtahAmerican Energy, Inc.

APPLICATION FOR PERMIT PROCESSING

Permit Change X	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: ACT/007/013
L16-005 Lila Canyon New Storage Pad						Mine: Lila Canyon
						Permittee: UtahAmerican Energy, Inc.

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

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

☐ Yes	☐ No	1. Change in the size of the Permit Area? ____ acres Disturbed Area? ____ acres ☐ increase ☐ decrease.
☐ Yes	☐ No	2. Is the application submitted as a result of a Division Order? DO #
☐ Yes	☐ No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes	☐ No	4. Does application include operations in hydrologic basins other than as currently approved?
☐ Yes	☐ No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes	☐ No	6. Does the application require or include public notice/publication?
☐ Yes	☐ No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes	☐ No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes	☐ No	9. Is the application submitted as a result of a Violation? 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 application require or include soil removal, storage or placement?
☐ Yes	☐ No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	☐ No	17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes	☐ No	18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes	☐ No	19. Does the application require or include certified designs, maps, or calculations?
☐ Yes	☐ No	20. Does the application require or include subsidence control or monitoring?
☐ Yes	☐ No	21. Have reclamation costs for bonding been provided for?
☐ Yes	☐ No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes	☐ No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

X Attach 1 complete digital copy of the application.

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.

Karin Madsen / Engineering Tech / 11-18-16
Signed - Name - Position - Date

Subscribed and sworn to before me this 18th day of November, 2016.

Notary Public

My Commission Expires: March 27, 2017
Attest: STATE OF Utah
COUNTY OF Carbon

LINDA KERNS
NOTARY PUBLIC • STATE of UTAH
COMMISSION # 663615
COMM. EXP. 03/27/2017

Received by Oil, Gas & Mining

ASSIGNED TRACKING NUMBER

Application for Permit Processing
Detailed Schedule of Changes to the MRP

L16-005 Lila Canyon New Storage Pad	Permit Number: ACT/007/013
	Mine: Lila Canyon
	Permittee: UtahAmerican Energy, Inc.

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

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☐ REPLACE	☐ REMOVE	Plates: 5-2, 5-7d, 7-2, 7-5, 7-6a, 7-6b, 8-1, Surface Facilities Base Map
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 1 Table of Contents, Pgs: 8, 10-15
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 2 Table of Contents, Pgs: 9-21 (text and page numbering)
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 3 Table of Contents, Pgs: 5, 6, 8, 9, 13, 15, 22, 28
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 4 Pgs: 2, 3, 9
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 5 Table of Contents, Pgs: 1, 2, 3, 6, 7-85 (text and page numbering)
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 7 Pgs: 21, 48, 71, 73, 75, 76, 77, 81, 88, 89, 90
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 1-7
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 7-4
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
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☐ ADD	☐ REPLACE	☐ REMOVE	

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

WordPerfect Document Compare Summary

Original document: K:\Lila\Most Recently Approved MRP Chapters\Chapter 1.wpd
Revised document: K:\Lila\2016\L16-005 New Storage Pad\Originals\Chapter 1 Edits.wpd
Deletions are shown with the following attributes and color:
~~Strikeout~~, Blue RGB(0,0,255).
Deleted text is shown as full text.
Insertions are shown with the following attributes and color:
Double Underline, Redline, Red RGB(255,0,0).

The document was marked with 22 Deletions, 29 Insertions, 0 Moves.

Lila Canyon Extension

Chapter 1
Legal

Volume 1 of 7

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100. GENERAL CONTENTS.

110. Minimum Requirements

111. Intent

The information included within this chapter of the permit application is intended to satisfy the minimum requirements of R645-301-100. All relevant information on the ownership and control of persons who conduct coal mining and reclamation operations, the ownership and control of the property to be affected by the operation, the compliance status and history of those persons, and other important information is provided. The format for the permit application was used to facilitate expedient review and approval.

112. Identification of Interests.

112.100. The applicant, **UtahAmerican Energy, Inc.,** is a corporation organized and existing under the laws of Utah and qualified to do business in Utah.

112.200. The name, address, telephone number, and employer identification number of the applicant, resident agent, and person who will pay the abandoned mine land reclamation fee is as follows:

112.210. The Applicant **UtahAmerican Energy, Inc.,** will also be the operator.

UtahAmerican Energy, Inc.
P.O. Box 986
Price, Utah 84501

Employer Identification Number: 34-1874726

112.220. The resident agent of the applicant, UtahAmerican Energy, Inc., is:

Karin Odendahl
UtahAmerican Energy, Inc.
P.O. Box 986
Price, Utah 84501

112.230. The abandoned mine land reclamation fee will be paid by:

Robert E. Murray
UtahAmerican Energy, Inc.
46226 National Road
St. Clairsville, Ohio 43950

112.300. The person's name, address and employer identification number for each person who owns or controls the applicant is listed under Appendix 1-1. In addition Appendix 1-1 shows the persons ownership or control relationship to the applicant, percentage of ownership, and location in the organizational structure.

112.310. Persons who own or control names, address social security numbers and employer identification numbers can be found in Appendix 1-1.

112.320. Persons ownership or control relationship to the applicant can be found in Appendix 1-1.

112.330. Title of the person's position and date position was assumed can be found in Appendix 1-1.

112.340. **UtahAmerican Energy, Inc.,**
The American Coal Company
PennAmerican L.P.
Canterbury Coal Company
Energy Resources, Inc.
Oklahoma Coal Company
Ohio Valley Coal Company
MonValley Transportation Center, Inc.
KenAmerican Resources, Inc.
Belmont Coal, Inc.
UMCO Energy, Inc.
Maple Creek Mining, Inc.

Onieda Coal, Inc.
Spring Church Coal Company

Permit numbers, regulatory authority and issuance dates are found in Appendix 1-2.

112.350. There are no pending coal mine permit applications in any State in the United States.

112.400. Miscellaneous information for coal mining and reclamation operations owned or controlled by the applicant or by any person who owns or controls the applicant follows.

112.410. The name, address, identifying numbers, including employer identification number, Federal or State permit numbers and MSHA number, with date of issuance and the regulatory authority issuing the permit can be found in Appendix 1-2.

112.420. Ownership or control relationship to the applicant is presented in Appendix 1-1.

112.500. The name and address of each legal owner of the surface and mineral property to be mined is shown on Plate 4-1 for surface ownership and Plate 5-4 for coal ownership, and is as follows:

Surface Owners:

Josiah K Eardley:
2433 S HWY 10
Route 1, Box 119
Price, Utah 84501

Bronco Coal Company:
P.O. Box 217
Cleveland, Utah 84518

UTAHAMERICAN ENERGY, INC.:
46226 National Road
St. Clairsville, Ohio 43950

UNITED STATES DEPARTMENT OF THE INTERIOR:
Bureau of Land Management
Utah State Office
324 South State
Salt Lake City, Utah 84111

STATE OF UTAH:
Utah School and Institutional Trust Lands Administration (SITLA)
675 East 500 South Suite 500
Salt Lake City, Utah 84114-5703

COLLEGE OF EASTERN UTAH FOUNDATION:
451 East 400 North
Price, Utah 84501

Subsurface Owners:

UTAHAMERICAN ENERGY, INC.:
46226 National Road
St. Clairsville, Ohio 43950

Bronco Coal Company:
P.O. Box 217
Cleveland, Utah 84518

STATE OF UTAH:
Utah School and Institutional Trust Lands Administration (SITLA)
675 East 500 South Suite 500
Salt Lake City, Utah 84114-5703

UNITED STATES DEPARTMENT OF THE INTERIOR:
Bureau of Land Management
Utah State Office
324 South State
Salt Lake City, Utah 84111

COLLEGE OF EASTERN UTAH FOUNDATION:
451 East 400 North
Price, Utah 84501

112.600. The name and address of each owner (surface and

subsurface) of all property contiguous to the proposed permit area is shown on Plate 4-1 for surface, and Plate 5-4 for subsurface. Plate 1-1 is the official boundary map and it will be used to clarify any questions about the permit boundaries. Plate 1-2 shows the disturbed area.

Contiguous Surface Owners:

UNITED STATES DEPARTMENT OF THE INTERIOR:
Bureau of Land Management
Utah State Office
324 South State
Salt Lake City, Utah 84111

STATE OF UTAH:
Utah School and Institutional Trust Lands Administration (SITLA)
675 East 500 South Suite 500
Salt Lake City, Utah 84114-5703

Josiah K Eardley*:*
2433 S HWY 10
Route 1, Box 119
Price, Utah 84501

Bronco Coal Company:
P.O. Box 217
Cleveland, Utah 84518

UTAHAMERICAN ENERGY, INC.:
46226 National Road
St. Clairsville, Ohio 43950

WILLIAM MARSING LIVESTOCK INC.:
4330 E 8900 N
Price, Utah 84501

COLLEGE OF EASTERN UTAH FOUNDATION:
451 East 400 North
Price, Utah 84501

Contiguous Subsurface Owners:

UNITED STATES DEPARTMENT OF THE INTERIOR:
Bureau of Land Management
Utah State Office
324 South State
Salt Lake city, Utah 84111

STATE OF UTAH:
Utah School and Institutional Trust Lands Administration (SITLA)
675 East 500 South Suite 500
Salt Lake City, Utah 84114-5703

UTAHAMERICAN ENERGY, INC.:
46226 National Road
St. Clairsville, Ohio 43950

Bronco Coal Company:
P.O. Box 217
Cleveland, Utah 84518

COLLEGE OF EASTERN UTAH FOUNDATION:
451 East 400 North
Price, Utah 84501

112.700. The following is a list of MSHA numbers associated with the permit.

MSHA ID Number: 42-00100 (Horse Canyon)
MSHA ID Number 42-02241 (Lila Canyon)
Refuse Pile I.D. Number: 1211-UT-09-02241-01

United States Department of Labor
Mine, Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225

112.800. In February 2002, UEI submitted a lease by application to the

BLM. Four thousand acres were identified as an area of interest to the south and east of current UEI reserves. The LBA delineation and recoverable reserves ha~~s~~ve yet to be determined by the BLM. If the area of interest is offered for lease, and If UEI bids on the LBA, and if UEI is the successful bidder, then it could be anticipated that mining in the leased area would occur once current Lila reserves are exhausted. (Approximately in the year 2020)

112.900. After **UtahAmerican Energy, Inc.,** is notified that the application is approved, but before the permit is issued, **UtahAmerican Energy, Inc.,** will update, correct or indicate that no change has occurred in the information previously submitted under R645-301-112.100 to R645-301-112.800.

113. Violation Information.

113.100. Neither **UtahAmerican Energy, Inc.,** ~~or~~nor any subsidiary, affiliate, or persons controlled by or under common control with the applicant, has had any federal or state permit to conduct coal mining and reclamation operations suspended or revoked in the five years preceding the date of submission of the application.

113.110. No federal or state permits to conduct coal mining and reclamation operations has been suspended or revoked in the five years preceding the date of submission of the application.

113.120. Neither **UtahAmerican Energy, Inc.,** nor any subsidiary, affiliate, or persons controlled by or under common control with the applicant, have forfeited a performance bond or similar security deposited in lieu of bond.

113.200. Since no suspensions revocations, or forfeitures have taken place section 113.200 with subsections is not applicable.

113.300. A list of violations received by the applicant or any subsidiary, affiliate or persons controlled by or under common control with the applicant in connection with any coal mining and reclamation operation during the three year period proceeding the application date is provided in Appendix 1-3. MSHA numbers for the operations listed in Appendix 1-3 can be found in Appendix 1-2.

113.310. Violation information such as: Identifying numbers including Federal and State permit numbers, date issued, and name of issuing agency is included in Appendix 1-3.

113.320. A brief description of violations alleged in the notice is included in Appendix 1-3.

113.330. The date, location, and type of any administrative or judicial proceeding is included in Appendix 1-3.

113.340. The current status of violations is included in Appendix 1-3.

113.350. Actions taken to abate the violation is included in Appendix 1-3.

113.400. After **UtahAmerican Energy, Inc.,** is notified that the application is approved, but before the permit is issued, **UtahAmerican Energy, Inc.,** will update, correct or indicate that no change has occurred in the information previously submitted under R645-301-113.

114. Right-of-Entry Information.

A Right-of-Way application and the subsequent Environmental Assessment (EA) ha~~s~~ve been submitted to the BLM. The EA was issued for public comment in the summer of 2000. A Finding of No Significant Impact (FONSI) and record of decision were issued in October 2000. An appeal was filed and a stay requested. The stay was not acted on and an uninhibited Right-of-Way could be issued in the spring of 2003. Appendix 1-6 contains BLM correspondence in regards to Right-of-Entry as provided by the pending Right-of-Way and its related use.

114.100. **UtahAmerican Energy, Inc.,** currently holds 5,544.01 acres of federal coal contained in six federal leases, purchase in June 2000 from Intermountain Power Agency and assigned to UEI by the BLM. (See Table 1-1 and Plate 5-4). These leases are contained in the South Lease - North Block LMU filed May 1996. The leases as described in the North Block LMU are not under any pending litigation. **UtahAmerican Energy, Inc.,** bases its legal right to enter and conduct mining activities in the permit area pursuant to the language contained in the Federal Coal Lease, Part I Lease Rights Granted which reads as follows:

> "That the lessor, in consideration of the rents and royalties to be paid and the covenants to be observed as hereinafter set forth, does hereby grant and lease to the lessee the exclusive right and privilege to mine and dispose of all the coal in, upon, or under the following described tracts of land, situated in the State of Utah.... together with the right to construct all such works, buildings, plants, structures and appliances as may be necessary and convenient for the mining and preparation of the coal for market, the manufacture of coke or other products of coal, the housing and welfare of employees, and subject to the conditions herein provided, to use so much of the surface as may reasonably be required in the exercise of the rights and privileges herein granted."

The surface right-of-entry is in the form of BLM ~~right-of-ways~~rights-of-way. See Appendix ~~-~~1-~~1~~7 for~~ a~~ BLM letters assigning rights-of-way numbers.

114.200. Since no private mineral estate is involved this section does not apply.

114.210. Since no private mineral estate is involved this section does not apply.

114.220. Since no private mineral estate is involved this section does not apply.

114.230. Since no private mineral estate is involved this section does not apply.

Table 1-1
Federal Coal Leases Held by Permittee (See Plate 5-4)

Federal Coal Lease	TownShip & Range	Section	Description	Acres
#SL-066490	T16S, R14E	11	E1/2	2440.00
	T16S, R14E	12	W1/2	
	T16S, R14E	13	W1/2	
	T16S, R14E	14	E1/2,SW1/4	
	T16S, R14E	15	E1/2SE1/4	
	T16S, R14E	22	NE1/4NE1/4	
	T16S, R14E	23	N1/2,E1/2SW1/4,SE1/4	
	T16S, R14E	24	NW1/4,W1/2SW1/4	
	T16S, R14E	26	N1/2NE1/4	
#U-014218	T16S, R14E	12	E1/2	320
#U-0126947	T16S, R14E	13	E1/2	1059.81
	T16S, R14E	24	E1/2	
	T16S, R14E	25	N1/2NE1/4,SE1/4NE1/4	
	T16S,R15E	19	SE1/4SW1/4, Lots 3 & 4	
	T16S,R15E	30	E1/2NW1/4,SW1/4NE1/4, Lots 1 & 2	
#U-014217	T16S,R14E	25	SW1/4NE1/4	40
#SL-069291	T16S,R14E	24	E1/2SW1/4	280
	T16S,R14E	25	NW1/4	

	T16S,R14E	26	SE1/4NE1/4	
#SL-066145	T16S,R14E	3	Lots 1-3, 7-11, Ne1/4SW1/4,SE1/4	1404.20
	T16S,R14E	10	E1/2	
	T16S,R14E	11	W1/2	
	T16S,R14E	14	NW1/4	
	T16S,R14E	15	N1/2NE1/4,SE1/4NE1/4	
Totals	Six Leases			5544.01

115. Status of Unsuitability Claims.

115.100. The proposed permit area is not within an area designated as unsuitable for mining. **UtahAmerican Energy, Inc.,** is not aware of any petitions currently in progress to designate the area as unsuitable for coal mining and reclamation activities.

115.200. Since no exemption is requested this section does not apply.

115.300. UtahAmerican Energy, Inc., will not conduct mining operations within 300 feet of a currently occupied dwelling. However, UtahAmerican Energy, Inc., will conduct mining or mining related activities within 100 feet of a public road. UtahAmerican Energy, Inc., has received permission from Emery County to construct facilities and operate coal mining activities within 100 feet of a public road. Refer to the Emery County letter found in Appendix 1-4.

116. Permit Term.

116.100. The anticipated starting and termination dates of the coal mining and reclamation operations are as follows:

Phase	Begin	Complete
Mining Pad, Support Structures, and Portals	June 2005	Dec. 2005
Begin Underground work	June 2005	
Terminate Mining	Dec. 20~~19~~27	

Reclamation operation dates can be found in Table 3-3.

Approximately 5,992.07 surface acres, which include federal, state and private land~~s~~, are included within the permit area. These surface acres are described in Table 4-2, and coal acres are shown on Table 4-2A.

The existing perimeter of the disturbed area contains approximately ~~42.6~~40.26 surface acres within the disturbed area~~ but~~. However, only 3~~3~~7.~~9~~02 acres will be disturbed; leaving ~~8~~3.~~7~~24 acres of undisturbed islands within the total disturbed area boundary.

116.200. The initial permit application is for a five year term with anticipated successive five year permit renewals.

116.210 Since the initial permit application is for a term of five years this section does not apply.

116.220 Since the initial permit application is for a term of five years this section does not apply.

117. Insurance, Proof of Publication and Facilities or Structures Used in Common

117.100. The Certificate of Liability Insurance is included as Appendix 8-2.

117.200. A copy of the newspaper advertisement of the permit extension and proof of publication can be found in Appendix 1-5.

117.300. Since no structures are going to be shared by two or more

separately permitted coal mining permit applications this section does not apply.

118. Filing Fee.

A filing fee of $5.00 has been submitted.

120. Permit Application Format and Contents.

121. The permit application contains current information and is written in a clear and concise manner in a format satisfactory to the Division.

122. Referenced materials not on file at the Division, or readily available to the Division, will be provided upon request of the Division by the applicant. On August 22, 2000 Dave Darby confirmed a copy of the R2P2 is on file at the Salt Lake City Division office.

123. A notarized statement, attesting to the accuracy of the information can be found in Appendix 1-5.

130. Reporting of Technical Data.

131. Persons or organizations that collected or analyzed data, the dates associated with the collection and/or analysis of the data, can be found in Appendix 1-5.

132. Resumes for the professional qualified persons who planned, directed the collection of or analyzed data can be found in Appendix 1-5.

140. Maps and Plans.

141. Maps have been presented in a consolidated format, to the extent possible, and include all the types of information that are set forth on U.S. Geological Survey of the 1:24,000 scale series. Maps of the permit area are to the scale of 1:6,000 or larger. Maps of the adjacent

area will clearly show the lands and waters within those areas.

142. Maps and plans submitted with the permit application distinguish among each of the phases during which coal mining and reclamation operations were or will be conducted at any place within the life of operations.

150. Completeness

This permit extension to the existing Horse Canyon Permit ACT/007-013 to conduct coal mining and reclamation operations is complete and includes the minimum information required under R645-301 and, if applicable, R645-302. Plates 1-1 and 1-2 show the ~~permittee~~permit area and proposed disturbed area boundaries.

This permit extension i~~o~~s intended to add the Lila Canyon Mine as part “B” to the existing permit, and to leave unchanged the current approved Horse Canyon Mine as part “A”. The Horse Canyon Mine “part A” is for ~~reclamation~~historical purposes only.

WordPerfect Document Compare Summary

Original document: K:\Lila\Most Recently Approved MRP Chapters\Chapter 2.wpd
Revised document: K:\Lila\2016\L16-005 New Storage Pad\Originals\Chapter 2 Edits.wpd
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The document was marked with 166 Deletions, 201 Insertions, 0 Moves.

Horse Canyon Extension
Lila Canyon Mine

Chapter 2
Soils

Volume 1 of 7

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R645-301-200. Soils.

210. Introduction.

211. Premining soil sources description.

212. Information in this chapter includes soil characteristics, chemical and physical analyses, and their interpretations for soils management and reclamation plans. Information is both qualitative and quantitative in nature.

Evaluation of suitable soil materials, stockpiling, and reclamation procedures are presented in section 220, 230, 240 and 250.

220. Environmental Description.

Environmental setting:

The proposed Lila Canyon Mine location is in eastern Emery County, Utah on the east side of the Price River drainage basin at the western edge of the Book Cliffs. The Book Cliffs are oriented northwest-southeast in the vicinity of the proposed permit area. The mine surface facilities would be located at the mouth of Lila Canyon, mostly on an alluvial pediment surface. Lithology is primarily sedimentary rocks of sandstone and shale. Below the steep slopes of the Book Cliffs are alluvial pediments and shale exposures. The elevation differences in the area of the mine site range from approximately 5,800 at the mouth of Lila Canyon to over 8,800 feet on top of Lila Point. Elevations of the proposed mine facilities site range from 5,800 feet to 6,500 feet.

The average annual precipitation in the area of the mine site is 12-14 inches with the majority of the precipitation occurring from October to March. The mean annual air temperature is 45-47 degrees F and the average frost-free period is 80 to 120 days. The basic vegetation is a pinyon-juniper and grass type.

221. Prime Farmland Investigation.

A Prime Farmland Investigation was conducted by Leland Sasser, Soils Scientist for the USDA Natural Resource Conservation Service (NRCS) in January of 1998. Mr. Sasser confirmed that no such lands

are present with the described permit area. This is due to the lack of a developed irrigation system on the arid soils present, as well as the high erodibility of soils present within the area. It has been determined that no alluvial valley floors are present on the proposed disturbed areas of the Lila Canyon Mine Project. This determination was made by the use of detailed soil surveys and site observations. Also, the order 3 intensity level soil survey by the National Resources Conservation Services shows no alluvial valley floors in the area. A copy of these negative determinations is included as Appendix 2-1.

222. Soil Survey.

222.100. An order 3 intensity level soil survey for Emery County is currently in progress by the USDA, National Resources Conservation Service (NRCS). Soil mapping at a scale of 1:24,000, along with map unit descriptions, has been provided by NRCS to cover the entire Lila Canyon Mine project area. This soil map is presented as Plate 2-1. The detail is suitable for general planning and evaluation purposes over the mining project area.

Since more specific information was needed for the area to be disturbed at the proposed mine facilities site; a detailed soil survey was conducted by Daniel Larsen, Soil Scientist, Environmental Industrial Services in August 1998. Additional information was collected near the ventilation break outs on June 15, 1999. The detailed soil survey report is presented in Appendix 2-3. A soils map, soil descriptions, and laboratory soil testing data are included. The detailed soils map for the mine facilities site (disturbed area) is presented in Plate 2-2.

222.200. Soil types for the proposed project area are identified on Plate 2-1 and in Appendix 2-3. At the mine facilities site the dominant soil is the Strych series. The order 3 intensity soil survey information provided by the Natural Resources Conservation Service identifies four soil map units at the mine surface facilities site:

BNE2	Strych very bouldery, fine sandy loam, 3 to 20 percent slopes
BMD	Strych very stony fine sandy loam, 3 to 30

	percent slopes
NGG2	Gerst-strych-badland complex, 30 to 70 percent slopes
RZH	Rock outcrop-Atchee-Rubbleland Complex

The detailed soil survey of the facilities site identifies six soil map units:

SBG - Strych boulder fine sandy loam, 5 to 15 percent slopes (grass)

VBJ - Strych very bouldery fine sandy loam 5 to 15 percent slopes (juniper)

XBS - Strych extremely bouldery sandy loam, 10 to 45 percent slopes

RBL - Rubbleland-Strych-Gerst complex, 20 to 70 percent slopes

DSH - Strych fine sandy loam variant, 3 to 8 percent slopes

RBT - Rock outcrop - Travessilla family complex.

These unit designations are specific to this inventory. The Travessilla family has been revised by NRCS and based the changes the Atchee series is more appropriate in Map Unit RBT (personal conversation with Leland Sasser. July, 1999).

Permit Area "B"Soils

Soils in Permit Area "B" include the following Soil Map Units identified in the Soil Survey of the Emery Area, Utah by the Natural Resource Conservation Services:

DHG2	Comodore-Datino Complex
DSG 2 (HUG)	Midfork-Tingey-Comodore Complex

GNA	Neto fine sandy loam
KXH	Podo-Rock outcrop Complex
MHE (MSC)	Podo sandy loam, 1 to 8 percent slopes
MRG	Vassilla-Rock outcrop-Gerst Association
MTH	Cabba-Guben-Rock outcrop Complex
MUE	Cabba-Podo-Doney Complex
NGG2	Gerst-Strych-Badland Complex
NVF2	Gerst-Rubbleland-Badland
NXC	Lazear-Rock outcrop Complex, High rainfall
RR	Rock outcrop
RWG	Rock outcrop-Rubbleland-Vassilla Complex
RZH	Rock outcrop-Atchee-Rubbleland Complex
UMF2	Guben-Pathead-Rabbitex Association
VOH	Guben-Rock outcrop Complex

222.300. Soil descriptions from the NRCS order 3 mapping are contained in Appendix 2-2. Soil descriptions from the detailed soil survey of the facilities site are given in Appendix 2-3.

The soils at the proposed Lila Canyon mine facilities site have formed dominantly in deep, stony and bouldery deposits on an alluvial fan and adjacent mountain toe slopes under a semi-arid climate. Rock fragments (gravel to boulders) are composed almost entirely of sandstone.

Notable features related to soils at the site are the high percentage of stones and boulders that are present on the surface and the relatively hot and dry site conditions. Minimal topsoil development and an accumulation of carbonates in the subsoil are typical characteristics of these soils along with a high rock fragment content. Soil textures are typically fine sandy loam or sandy loam. Thin layers of sandy clay loam and loamy sand are intermittently present.

The dominant soils are well drained and have moderately rapid permeability. Soil erosion potential is moderately low over most of the area, but ranges from low to severe (on shale exposures). Rooting depths observed were mostly at 30 to 48 inches.

222.400 Present and potential productivity determinations of the existing soils conducted by Mr. George Cook of the NRCS in the summer of 1998 are presented in Appendix 3-2.

223. The soil survey was conducted according to the standards of the National Cooperative Soil Survey as described in the Soil Survey Manual (Soil Survey Staff, 1993), the National Soil Survey Handbook, (soil Survey Staff, 1993), and Keys to Soil Taxonomy, seventh edition (Soil Survey Staff, 1996).

224 Soil inventories indicate that no borrow area will be needed for substitute topsoil. There is an adequate amount of suitable soil as indicated by root distribution and soil characteristics over the proposed area to be disturbed.

230. Operation Plan.

231. General Requirements.

231.100 In reference to topsoil in this plan, it is considered to be the soil down to a maximum depth of 18". The typically dark colored A horizon often referred to as topsoil is very thin (< 6 inches) under the environmental conditions of the project site. Topsoil generally consists of the A and B horizon materials that have suitable characteristics for plant growth and show natural rooting present within the soil. Of the salvageable soil identified, the upper 6 to 12 inches is the most suitable. Below this depth, there is generally an increase in carbonates and rock fragments. However, this layer supports plant roots and is not considered as substitute topsoil in this case.

Where topsoil is to be salvaged, the soils will be removed with one or more of the following types of equipment: crawler-tractor, grader, front-end loader, and/or trackhoe. A soil scientist will

provide on-site consultation during the topsoil removal process to maximize harvest of quality topsoil. Topsoil material will be hauled by truck and stockpiled at designated storage areas located near, but away from the mine yard. This will allow the soil materials to be located away from mining activities to minimize the potential impacts from mine-related activities. The storage areas will be located away from any drainage areas. Drainage ditches will be located along the sides of the stockpiles to divert drainage away from the stockpile surface. Drainage will be diverted by ditches to the downslope end of the stockpile and will be treated by silt fences prior to entering the undisturbed drainage. Refer to Plates 5-2 and 5-7 for the location of the proposed topsoil storage area. Refer to Appendix 7-4 for details of the drainage control designs proposed for these alternate sediment control areas (ASCAs).

During stripping and handling the soils will be in a loose or friable condition. If the soil sticks to the equipment, the soil will be allowed to dry to a friable state prior to removable. If the soil is too dry and hard to handle, water will be added until the soil is wetted to a loose and friable condition.

The stockpiled material will be loosely piled and have an irregular, pitted surface to help retain runoff from precipitation events and to reduce erosion.

The stockpile will be seeded and mulched during the first favorable period for revegetation. Species selected would give an effective, quick-growing vegetative cover to protect it from wind and water erosion. The seed mix to be utilized for stockpile revegetation is presented in Table 3-4. If supplemental seeding is needed, it will be done the following year. If seeding does not immediately follow topsoil pile construction, the pile will be roughened again immediately prior to seeding. Side slopes will be monitored for erosion and will be repaired if erosion appears to be excessive.

Undisturbed islands located within the disturbed area will not be disturbed unless the mine reclamation plan is amended to allow for the disturbance. The islands will be signed as undisturbed to help protect them from any disturbance.

231.200. Soil inventories indicate that no topsoil substitutes will be

needed.

231.300. Topsoil will be tested as per Section 243. If testing identifies a potential problem, additional samples may be collected to determine the extent and severity of the problem.

Vegetation monitoring will compare the results of plant growth on the replaced topsoil with the growth on the in-place soil materials. If there is a distinct difference between the two areas, the Operator will consult with the DOGM to determine the nature of the problem and will make corrections as recommended for improvement.

231.400. Construction of the topsoil storage site will begin by removing any large boulders and existing vegetation. Diversion ditches will be installed after the stockpiles are in place to channel drainage away from the stockpiles. Once the topsoil stockpile has been created with the material removed during construction of the proposed mine site, it will be reseeded and will remain in place until final reclamation occurs.

The surface of the stockpile will be left rough and irregular to increase retention of rainfall and snow melt. Seeding will be done following placement of the topsoil, and between Sept. 15 and Jan. 15, to take advantage of winter moisture. If seeding does not immediately follow topsoil pile construction, the pile will be roughened again immediately prior to seeding.

A silt fence or berm/ditch configuration will be installed at the perimeter of the pile to protect it from water erosion and vehicular traffic. Maintenance of the topsoil pile, during the life of the mining operation, will consist of: seeding the new stockpile, reseeding if erosion or other elements cause a loss of vegetation, and maintenance of the ditches and/or silt fence in the stockpile areas.

232. Topsoil and Subsoil Removal

232.100 Prior to topsoil removal, eight five gallon buckets of screened 1/4" cryptobiotic soil will be recovered and stored in a cool dry place for redistribution on the topsoil pile. Topsoil material will be removed from those areas of the mine yard where material will be excavated in order to achieve final yard configuration and

which have been identified as suitable topsoil for reclamation based on the soil survey. This includes the access road to and around the topsoil pile. This material will be used to construct a berm around the topsoil pile.

The following volumes represent soil resources that may be available for salvage, storage and subsequent redistribution during reclamation. The actual amount salvaged will be reported to DOGM following topsoil removal and stockpiling operations.

AVAILABLE SOIL RESOURCES

Map Unit	Potential Salvage Depth In.	Potential Acres	Potential Estimated Volume YD3	**Actual Salvage Depth In.**	**Actual Salvaged Acres**	**Actual Salvaged Top Soil YD3**
SBG	48	11.83	76343	**18**	**11.61**	**28100**
VBJ	30	9.62	38801	**18**	**3.40**	**8227**
XBS	12	12.09	19505	**12**	**8.81**	**14207**
DSH	40	1.56	8389	**18**	**1.16**	**2809**
RBL	8	9.34	10046	**8**	**2.17**	**2340**
RBT	6	3.79	3057	**6**	**0.56**	**450**
TOTAL(2)		48.23	156141		**27.95**	**56133**
Bank to Loose Cubic Yards *1.18 (Amount topsoil pile is designed to hold.)						(1) **66237**

(1) An additional 800 yd^3 will come from the access road around the topsoil pile. This material will be placed in the berm around the topsoil pile.
(2) The 48.23 acres was taken from a soil survey and does not accurately reflect the operators intention to include 42.6 acres of disturbance within the disturbed area boundary.

The actual areas of topsoil salvage and the respective amounts are found on Plate 2-3a. To date, topsoil salvaged is 65,745 cubic yards. Approximately 5,000 cubic yards of topsoil will be salvaged from currently undisturbed areas for the construction of the new Storage Pad.

The actual topsoil salvage will consist of removing a surface layer up to 18 inches thick over the disturbed area. If shale is encountered within 18 inches only the soil above the shale ~~will be~~will be salvaged. (Plate 2-3). This ~~would cover~~new disturbance will

bring a total of about ~~34~~37.02 acres where soil would be salvaged and stored in the topsoil stockpile for the surface facilities' reclamation.

Total volumes of soil stored in the topsoil pile would be approximately ~~56,000~~70,745 bank cubic yards. Removal of stones and boulders would be considered in volume estimates where they are part of the soil layer removed.

The stockpile has been sized to allow for bulking or swell of the soil as it is removed from the bank state to the loose state. A bulking number of 1.18 has been used. The area allowed for new topsoil storage for the new Storage Pad is 5~~6~~,000 new bank cubic yards x 1.18 which equals ~~66~~5,~~000~~900 loose cubic yards extra to be placed on the topsoil pile, totaling 71,645 cubic yards overall.

Boulders of approximately three feet in diameter and larger will be separated from the topsoil and piled or placed at appropriate locations such as adjacent to roads, pads etc. No attempt will be made to collect the large boulders into common piles. Boulders above ground level are in addition to topsoil volumes and may account for approximately 10,000 cubic yards.

UEI is not stockpiling large stones "boulders". Boulders will be pushed to the side and left during construction and then upon reclamation the boulders will be pushed back into the approximate location form which they came. Rocks of 36" or less will be stored in the topsoil pile with the soil and will be redistributed with the soil.

The approximate ~~66,000~~71,645 total loose cubic yards of topsoil will be stored in a topsoil pile as shown on Plate 5-2. This topsoil pile will be approximately 350' long and 250' wide with 2:1 slopes. The height of topsoil pile needed is approximately ~~31~~41 feet. The pile as designed has the capability of storing well over the required ~~60,000~~71,645 cubic yards. See Figure 1 for topsoil pile calculations.

Soil from the proposed ventilation break out sites ~~near~~to the coal outcrop will not be salvaged. The slope above the north breakout fan is approximately 70%. Rock cover on the surface is an approximate~~ly~~ 60% slope. As a result of the very limited

ground disturbance, and lack of access, soil cannot be reasonably salvaged. At these small isolated sites ~~soil~~, topsoil will not be salvaged or stored (See R645-301-232.700 and 232.710).

The sequence for topsoil removal in general, would be starting from the lower elevations of the site and working up slope. Surface disturbance may not be required on all of the acreage identified as the disturbed area. After removal of the topsoil to be salvaged, underlying soil materials will be used as fill or left in place.

All practical precautions will be taken during design, construction, and reclamation to assure that shales or shale material will not be pushed over the top of or mixed with subsoils. Contamination of the subsoil with shale will not be permitted. The certified soils specialist, or by a person who is determined qualified by the operator and the Division, on site during the construction and reclamation~~s~~ phases will carefully observe the construction and reclamation phases and prevent, to the extent possible, the mixture of shales and subsoils. Additional topsoil removal, in excess of 18" minimum, may be necessary to prevent the shale from contaminating the subsoil.

232.200. Since topsoil is sufficient this section does not apply.

232.300. The surface soil down to 18" or to the shale which ever is the least will be removed and stored.

232.400. This section is addressed in 232.700.

Lila Canyon Topsoil Calculations

Pile Height Elevation In F(in feet)	Pile Length l(in Ffeet)	Pile Width l(in Ffeet)	Volume L X W CYDSVolume Ends CYDS Area (in feet)	Volume LxW (in cubic yards)	Plus Slope Volume (in cubic yards)	One Foot Total Lift Volume (in cubic yards)	Total Cumulative Volume C(in cubic Yyards)
0	350	250	324087,500	0.7400	32400.7400	0.00	0.00
1	346	246	315285,116	3,152.44	2244.07641515	3,196.2659	3,196.59
2	342	242	306582,764	3,065.33	2143.56	3,108.7889	9502 6,305.3748
3	338	238	297980,444	2,979.41	2142.4812503.2696	3,022.37	9,327.85
4	334	234	289478,156	2,894.67	2142.1937	2,937.04	15419.11 12,264.89
5	330	230	281175,900	2,811.11	2041.78	2,852.89	18251.11 15,117.78
6	326	226	272873,676	2,728.74	2041.5919	21000.44 2,769.93	17,887.70
7	322	222	264771,484	2,647.56	40.59	2,688.15	20,575.3023668.3085
8	318	218	256769,324	2,567.56	2040.00	26255 2,607.56	23,183.8541
9	314	214	248867,196	2,488.74	1939.7041	28764.30 2,528.15	25,711.56
10	310	210	241165,100	2,411.11	19.4131194 38.81	2,449.93	28,161.48
11	306	206	233463,036	2,334.67	19.1138.22	2,372.89	33548 30,534.5937
12	302	202	225961,004	2,259.41	1837.8163	2,297.04	35826 32,831.8141
13	298	198	218559,004	2,185.33	1837.5204	2,222.37	38030.67 35,053.78
14	294	194	211257,036	2,112.44	36.44	2,148.2240161.3389	37,202.67
15	290	190	204055,100	2,040.74	1735.85	2,076.9342220.0059	39,279.26
16	286	186	197053,196	1,970.22	1735.6326	2,005.48	44207.85 41,284.74
17	282	182	190051,324	1,900.89	1734.67	1,935.56	43,220.3346126.307
18	278	178	183249,484	1,832.74	1734.07	1,866.81	45,087.0447975.8511
19	274	174	176547,676	1,765.78	16.7433.48	1,799.26	49758 46,886.37
20	270	170	170045,900	1,700.00	16.4451474 32.889	1,732.89	48,619.26
21	266	166	163544,156	1,635.41	1632.30	1,667.70	50,286.1553126.3796
22	262	162	157242,444	1,572.00	1531.8570	1,603.70	54714.22 51,890.67
23	258	158	150940,764	1,509.78	1531.11	1,540.5689	56239 53,431.56
24	254	154	144839,116	1,448.74	1530.52	1,479.26	57703 54,910.5681

25	250	150	138837,500	1,388.89	1429.9693	1,418.81	59107 56,329.4163
26	246	146	133035,916	1,330.22	14.676045229.3033	1,359.56	57,689.19
27	242	142	127234,364	1,272.74	28.74	14.3761739 01.4148	58,990.67
28	238	138	121632,844	1,216.44	1428.15	1,244.0759	62969.9360,235.26
29	234	134	116131,356	1,161.33	1327.56	1,188.7889	64145.0461,424.15
30	230	130	110729,900	1,107.41	26.96	1,134.4837	65265.9362,558.52
31	226	126	105428,476	1,054.67	1326.37	1,081.1904	66333 63,639.7856
32	222	122	100327,084	1,003.11	1225.78	1,028.89	67349 64,668.7844
33	218	118	25,724	952.74	12.5968315 25.1119	977.93	65,646.37
34	214	114	24,396	903.56	12.3024.59	928.15	69230.9666,574.52
35	210	110	23,100	855.56	1224.00	70098.52879.56	67,454.07
36	206	106	21,836	808.74	23.41	832.15	68,286.22
37	202	102	20,604	763.11	22.81	785.93	69,072.15
38	198	98	19,404	718.67	22.22	740.89	69,813.04
39	194	94	18,236	675.41	21.63	697.04	70,510.07
40	190	90	17,100	633.33	21.04	654.37	71,164.44
41	**186**	**86**	**15,996**	**592.44**	**20.44**	**612.89**	**71,777.33**
42	182	82	14,924	552.74	19.85	575.59	72,349.93

Figure 1

232.410. This section is addressed in 232.700.

232.420. This section is addressed in 232.700.

232.500. Topsoil will be considered as the upper 18 inches of soil in most cases. Subsoil ranging in thickness from 12 to 30 inches from cutslope sites will be used as fill material for site development and replaced in an approximate original sequence during reclamation.

In order to verify subsoil depths, soil pedestals or other survey methods will be utilized for proper identification. Pedestals of undisturbed soil will be left at selected locations as reference points to show the type of soil thickness that has been removed from the slope cut areas. Records will be maintained to keep track of what materials are removed and where they are placed (topsoil storage or fill). Pedestals will vary in size depending on depth of cut. They will be designed to maintain stability of the soil column.

These soil pedestals may have to be removed once they have been properly logged to facilitate the mining operation.

An As-Built map will be prepared to show where soil materials have been used as fill material. This will include thickness records for topsoil, subsoil, and substrata. This information will be used to verify subsoil salvage depths according to Salvageable Soils Map Appendix A-2 of Appendix 2-3. This as -built map ~~will be~~is incorporated into the Mining Reclamation Plan as Plate 2-3a.

If shale is encountered in the slope cuts, the shale material will be separated from the other soil and returned to or near its original position upon reclamation.

Subsoils that are stored as pad material will be protected by a surface that is covered by asphalt, concrete, or gravel. The subsoil material will be under parking areas, buildings, roads, and storage sites. Graveled areas will have an impervious

membrane placed between the subsoil and gravel. Precautions will be taken to avoid contamination. In the unlikely event visual observations indicate that subsoil has become contaminated from oil and grease, salts, or other visual contaminates, the contaminated soil will be disposed of at a sanitary landfill site (probably East Carbon).

232.600. Topsoil will be removed from excavation areas and stockpiled prior to construction activity. Vegetation and boulders that might interfere with topsoil salvage will be removed prior to removal and stockpiling of the topsoil.

The topsoil will be removed in two Phases. The first phase will remove topsoil, vegetation and boulders in an area large enough to allow for mining of diligence tons. The second phase which will remove the remainder of the approved topsoil and vegetation as per the MRP. The timing between phases is undetermined at this time and will be dictated by coal demand and market. The areas identified for disturbance left undisturbed after phase 1, will be treated as per the MRP.

232.700. It is anticipated that topsoil can be salvaged on areas to be disturbed. Approximate thickness of subsoil by Soil Map Unit are: SBG - 30 inches, DSH - 22 inches, and VBJ - 12 inches.

232.710. Soil removal from some local sites may be difficult due to rockiness and steep slopes. The area between the rock slopes and the ROM coal stockpile is an area of concern. In the area between the rock slopes and ROM coal stockpile the disturbance is minimal. The topsoil will not be removed from this area due to steep slopes. To protect this area from coal contamination the conveyor will be enclosed. Jersey Barriers will be installed to prevent the coal stockpile from encroaching this area. Topsoil will be removed in all areas of disturbance except for the area between the ROM coal pile and the rock slopes where either one or two bents will be constructed. Available underlying soils will be salvaged from stony disturbed areas. Areas too steep and rocky for equipment and where it would be unsafe or impractical for construction activities (approximately 5.95 Acres) will not be included in the site development plan.

232.720. No substitute soil materials will be needed.

233. Topsoil Substitutes and Supplements.

233.100. Soil inventories indicate that no substitute topsoil material will be necessary. Available soil material on the site is adequate for reclamation purposes.

233.200 Preliminary inventories show that no topsoil borrow area is needed.

233.300. This section is addressed in 233.400.

233.310. This section is addressed in 233.400.

233.320. This section is addressed in 233.400.

233.330. This section is addressed in 233.400.

233.340. This section is addressed in 233.400.

233.400 Soil Inventories show that no topsoil or topsoil substitute borrow area will be needed. Adequate amounts of suitable soil for plant growth are present based on root distribution and soil characteristics.

234. Topsoil Storage.

234.100. It will not be possible to redistribute the topsoil immediately. Therefore, the topsoil will be stockpiled for the purpose of final reclamation of the mine site. The rock storage areas are shown on Plate 5-2.

Access to the ventilation break outs will be from inside the mine. There will be minimal surface disturbance with the breakouts.

so no topsoil will be salvaged. Refer to the Surface Area map Plate 5-2 and 5-2a for the approximate location of the ventilation breakouts.

Presently there is not a subsoil stockpile required for this project, therefore, details are not provided.

234.200. Section 232.100 contains information on the topsoil stockpile.

234.210. The stockpile site selected is on the Strych soil. It is a well drained and stable site on cobbly alluvium.

234.220. The stockpile will be located and protected to avoid contamination. Unacceptable compaction will not be permitted. In areas where undisturbed soils are in close proximity to coal mining or reclamation activities, "Undisturbed Area" signs will be placed at or near the contact between disturbed and undisturbed. Quarterly inspections will be made to insure there is not an accumulation of coal dust or coal related debris. In the event coal dust is observed, water sprays according to air quality permit (DAQE-702-99) or alternative measures such as wind fence, or broadening of the topsoil salvage area will be employed to control the coal dust and fines.

234.230. The stockpile will be mulched and seeded with the seed mix presented in Table 3-4. Up to 1% by volume of the sifted soil crusts will be added to each load of Wood fiber mulch applied to the top soil pile. The slopes will have an irregular, pitted surface to help retain precipitation and minimize runoff. Silt fencing will be placed at the base of the stockpile.

234.240. Plans are to leave the topsoil in place for the life of the mine.

234.300. These regulations are not applicable to the action described within this permit document.

234.310. These regulations are not applicable to the action described within this permit document.

234.320. These regulations are not applicable to the action described within this permit document.

240. Reclamation Plan.

241. Reclamation of the proposed disturbed area will begin once all surface facilities and structures have been demolished and removed. Disturbed areas will be restored to approximate original contour. Disturbed areas will be re-graded using pad material. Subsoil from Soil Map Units SBJ, DSH, and VBJ that are used as construction fill will be identified and used during reclamation as root zone subsoils. This information will be collected during the original grading operation and incorporated into the As-Built drawing referred to in Section 232.500. The grading sequence with regards to subsoil will be as follows:

a. Grade all areas where no subsoil is being stored.
b. Replace subsoil on areas from which it was removed.
c. Rip the subsoil to a minimum of 16 inches.
d. Replace topsoil.
e. Replace boulders
f. Gouge the topsoil.

After the disturbed areas have been recontoured and retopsoiled they can then be revegetated.

Sediment control during reclamation will be met by continued use of the sediment pond located below the yard area. All main culverts and an adequate amount of fill to maintain existing headwalls will be left intact during this reclamation phase.

After approximate original contour (AOC) is achieved, the surface will be prepared. The soil will be sampled in a maximum of five locations to be determined jointly by the Division and the Operator. The sampled soil will be analyzed for the parameters descried in tables 3 and 7 of the January 2008 “Guidelines for Management of Topsoil and Overburden”.

Where practical, the disturbed area will be scarified prior to soil redistribution. The rippers found on the rear of a cat will be used to scarify the disturbed area. The total surface where practical will be ripped on a maximum spacing of 6' to a depth of 16 inches. Pocking, after topsoil redistribution, will be the primary method used to roughen the surface. Pocking consists of imprinting the surface with a pattern of depressions as per Figure 1 in Appendix 5-8. The purpose of these pocks is to capture and retain water (moisture), and provide a cradle for seedlings and other plant materials. To enhance the ability of the soil to absorb moisture, best technology currently available at the time of reclamation will be applied to the soil surface.

In order to regenerate naturally existing soil organisms and assist in reactivating soil activity, an inoculum will be applied to the soil to reestablish soil bacteria, microhorizia and mycelium. To enhance soil microbial establishment and promote more rapid stabilization of the soil the seed mixture (as listed in Chapter 3) will be either hand broadcast over the area or sprayed using a hydromulcher. A wood fiber mulch will be hydro sprayed over the seed bed, then the surface will be sprayed with a tackifier. See Appendix 5-8.

242. Soil Redistribution.

242.100 Topsoil materials that were previously stockpiled will be redistributed on the same areas in a thickness which approximates the reclaimed thickness on the scarified, postmining regraded surface. For example if 8" of topsoil is removed from one area and 16" from another area, reasonable efforts will be made to replace 8" where the 8" was removed from and 16" where the 16" was removed from. (See Plate 2-3 Soil Salvage and Replacement). The material will be hauled to the regraded area by dump truck or loader. The material will be placed using a front-end loader, crawler tractor, and/or trackhoe on steeper slopes and/or crawler tractor on the flat areas. After the backfill is placed to approximate original contour and the topsoil is respread, the site will be revegetated. Boulders will be replaced to achieve a near natural surface condition. The backfill will include subsoil material which was used as fill during the operational phase. Using as-built drawings, refer to 232.500, the subsoil will be replaced to its approximate original position prior to replacement of topsoil from the topsoil stockpile. Subsoil will be replaced in its approximate position in the reconstructed soil profile.

242.110. This section has been addressed in 242.100.

242.120. This section has been addressed in 242.100.

242.130. This section has been addressed in 241.

242.200. This section has been addressed in 242.100.

242.300. This section has been addressed in 242.100.

242.310. This section has been addressed in 242.100.

242.320. This section has been addressed in 242.100.

243. Soil Nutrients and Amendments. Nutrients and soil amendments will be applied to the redistributed material if deemed necessary by assessment of the laboratory analyses. Nutrients and amendments will be added, to make the redistributed soil similar to the undisturbed soils and aid in establishment of the vegetative cover. The nutrients will be added by hydro seeding.

The topsoil will be sampled and tested prior to replacement. Sampling will either be performed by a Certified Soil Scientist or by a person who is determined qualified by the operator and the Division. Grab samples will be collected from the stockpile after its height is reduced to 10 feet at the deepest end. Four or five grab samples should be sufficient to determine what the effects of darkness, compaction, and sterility have been on the fertility of the topsoil The grab samples will be analyzed for nitrogen, phosphate and potassium. Fertilizer, if needed, will be applied to the topsoil prior to seeding and mulching activities.

244. Soil Stabilization.

244.100 Exposed surface areas will use vegetative stabilization where practical to control erosion and fugitive dust. Revegetative efforts (including regrading, topsoiling, fertilizing and mulching) will be conducted prior to the end of October.

244.200 After approximate original contour (AOC) is achieved, the surface will be prepared. Pocking will be the primary method used to roughen the surface. Pocking consists of imprinting the surface with a pattern of depressions as per Figure 1 in Appendix 5-8. The purpose of these pocks is to capture and

retain water (moisture), and provide a cradle for seedlings and other plant materials.

In the event that soil crusts form on the topsoil stockpile, the Permittee will add up to 2 ounces of the sifted soil crusts to each load of Wood fiber mulch which will be applied to the reclaimed areas that have been regraded and covered by topsoil or substitute topsoil. (See Appendix 5-8).

244.300. Any rills and gullies of an excessive nature, which form on regraded and retopsoiled areas and disrupt the approved postmining land use or cause or contribute to a violation of water quality standards for receiving streams, will be filled, regraded or stabilized. The area will then be reseeded.

244.310. This section has been addressed in 244.300.

244.320. This section has been addressed in 244.300.

250. Performance Standards.

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

252. All stockpiled topsoil, subsoil and topsoil substitutes or supplements will be located, maintained and redistributed according to plans given under sections 230 and 240.

WordPerfect Document Compare Summary

Original document: K:\Lila\Most Recently Approved MRP Chapters\Chapter 3.wpd
Revised document: K:\Lila\2016\L16-005 New Storage Pad\Originals\Chapter 3 Edits.wpd
Deletions are shown with the following attributes and color:
~~Strikeout~~, Blue RGB(0,0,255).
Deleted text is shown as full text.
Insertions are shown with the following attributes and color:
Double Underline, Redline, Red RGB(255,0,0).

The document was marked with 33 Deletions, 41 Insertions, 0 Moves.

Horse Canyon Extension
Lila Canyon Mine

Chapter 3
Biology

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300. BIOLOGY

310. Introduction.

311. Vegetative, fish, and wildlife resources of the permit area and adjacent areas are described in section 320.

312. Potential impacts to vegetative, fish and wildlife resources and methods proposed to minimize these impacts during coal mining and reclamation operations are described in sections 330 and 340.

313. Proposed reclamation designed to restore or enhance vegetative, fish and wildlife resources to a condition suitable for the designated post-mining land use are described under section 340.

320. Environmental Description.

321. Vegetation Information: The permit application contains the following vegetation information.

321.100. This section presents a discussion of the vegetation resources in the Lila Canyon Mine Extension Area and adjacent areas. The work was authorized initially by Kaiser Steel Corporation in 1982 and was referred to as the "South Least Tract." In 1985 Kaiser Coal incorporated a portion of the data from the South Lease and expanded it to include the Horse Canyon mine permit area. In 1990 this data was again updated and used to formulate the Mine Reclamation Plan for the Horse Canyon mine site and adjacent disturbance. This information can be found in the Horse Canyon MRP.

The Lila Canyon mine permit area encompasses a portion of the reclaimed Horse Canyon Mine and virtually all of the South Lease area (See Plate 1-1 Permit Area Map). Aerial photography was used to map the vegetation within the permit area.

A vegetation inventory was commissioned by UtahAmerican Energy, Inc. in 2003 to determine vegetation resources specific to the Lila Canyon Mine surface area. A copy of the report is included in Appendix 3-1.

As requested by the Division, Canyon sweetvetch, Cliffs

blazing star and creutzfeldt-flower will be surveyed for at least the year construction begins or one year prior to construction.

321.200. A determination of the productivity of the land within and around the permit extension area was implemented by Dean Stacy, Range Management Specialist for the NRCS Natural Resources Conservation Service, and is included in Appendix 3-2. Productivity of the vegetation in the grass-shrub resource area was 450#/acre. The pinyon juniper area to be disturbed the production was estimated to be 250 to 350 #/acre. The pinyon Juniper area, within the disturbed area, will be reclaimed to a grass shrub community.

322. Included in the permit extension application is fish and wildlife resource information for the extension area and adjacent areas.

322.100. The scope and detail of the fish and wildlife resource information presented in this chapter is sufficient to design the protection and enhancement plan.

322.200. Site specific resource information necessary to address the respective species or habitats is included.

322.210. The United States Fish and Wildlife Service publish yearly, in the federal Register, lists of endangered and threatened species. TABLE 3-1 cites federally listed threatened or endangered species which may occur in this area of Utah. Three species listed are potential inhabitants of the general area of Lila Canyon; the black-footed ferret, MSO, and bald eagle.

The 2000 model for Mexican Spotted Owl Habitat was used to identify potential MSO habitat. The results can be found in Appendix 3-4.

The proposed addition to the permit area does not contain habitat for southwestern willow flycatchers. There are no perennial water sources or riparian areas in either the current

permit area or the proposed addition, and according to verbal information from UEI's consultant, there are few, if any, willows or similar riparian-type vegetation associated with the seeps and springs in the proposed addition to the permit area. There may have been a few willows or shrubs, but there were no dense patches as would be required by southwestern willow flycatchers.

Lila Canyon Mine will have below-ground electrical power lines. These lines will be constructed to minimize potential hazards to all raptors new to the site, all will be designed and constructed in accordance with the guidelines set forth in Environmental Criteria for Electric Transmission Systems or as approved by DOGM.

322.220. The permit area for Lila Canyon Mine is located within the Price River Resource Area. Surface water in the adjacent areas drains into Grassy Trail Creek and Cottonwood Wash, both tributaries of the Price River. The environment around the ~~42.6~~40.26 acre mine site is within the Upper Sonovan life zone. The dominate Vegetation communities within the proposed disturbed area are pinyon-juniper and grass-shrub. Community types surrounding the proposed disturbed area are primarily pinyon-juniper, mixed conifer, spruce-fir, grass, and sagebrush-grass.

The Upper Sonovan life zone can provide habitat for approximately one hundred and forty-two species of wildlife. Two separate reports by the Utah Division of Wildlife Resources (DWR) identify species having potential to inhabit the region. The species that is considered to be of high interest in the local area is the Pronghorn. Pronghorns are found as year-long residents within and adjacent to the permit area. These animals were transplanted to this site by the

DWR in 1972 and are part of the Icelander Antelope Herd Unit II. Pronghorn prefer open sagebrush-desert and shrub-grassland habitats in areas of the Western United States. They are primarily browsers but are known to forage on grasses and forbs during spring and summer (FWS, 1978).

The pinyon-juniper woodlands, and interspersed sagebrush parks are winter range for mule deer. Many of the drier slopes are essentially juniper stands of scattered trees. The mule deer winter use is restricted to periods when snow is available or surface water is present during snow melt in the early spring, and the UDWR has rated this winter range as high priority.

Elk winter range is located at higher elevations than that of the disturbed area and is not a factor in the disturbed site.

Other wildlife in the pinyon-juniper woodlands are reptiles, passerine birds, lagomorphs, and small rodents.

The talus slopes in the canyon are home to rodents and reptiles. They are also used by chukars. Snake dens are unknown in the talus slopes.

The cliffs are generally north-facing and have potential as raptor nesting sites. Spring raptor inventories were initiated in the spring of 1998. The results of the annual raptor surveys are included in Appendix 3-5.

~~The intermittent / ephemeral stream channels~~

TABLE 3-1

FEDERALLY LISTED ENDANGERED AND THREATENED ANIMAL SPECIES

Mammals	
Black-footed ferret (1)	(Mustela nigripes)
Birds	
Bald eagle (2)	(Haliaeetus leucocephalus)
*Southwestern willow flycatcher (2)	
Mexican Spotted Owl (3)	(Strix occidentalis lucida)
Fish	
Colorado squawfish	(Ptychocheilus lucius)
Bonytail Chub	(Gila elegans)
Humpback Chub	(Gila cypha)
Razorback Sucker	(Xyrauchen texanus)

(1) No confirmed sightings have occurred in Utah in recent years.

(2) Nests in Utah.

* No suitable nesting habitat within the permit area.

(3) Nests in Utah. (See Appendix 3-4 for Mexican Spotted Owl Habitat Survey Plan)

(A complete list of all potential T&E species found in Emery County is included in Appendix 3.3)

The intermittent / ephemeral stream channels lack~~s~~ riparian vegetation; thus many bird species of high federal interest would not utilize this area; example southwestern will flycatcher. The lack of trees or large shrubs precludes the use of woodpeckers. The stream channels do not support fish or an established invertebrate fauna.

The UDWR has submitted general information to be included in the wildlife plans of previous permit applications. Their information covers all the biogeological areas found on the Tavaputs Plateau which includes the Upper Sonoran, Transition, Canadian, and Hudsonian life zones. As noted previously only the Upper Sonoran life zone is represented within the permit area.

This UDWR general information is included in this application because it provides an overall description of the wildlife and wildlife habitats in the general area. The information is also useful in providing habitat information for design of the reclamation of the disturbed area. Thus the past wildlife habitat conditions can be emulated by reclamation and wildlife accommodated as they return to the mine site area upon final reclamation. (See Appendix 3-6, abbreviated)

The DWR has submitted information over the years in commenting on the various wildlife plans submitted in prior permit applications.

The ranking of wildlife values on coal-producing lands in Utah are found in Table 3-2 and are in the following list. The four rankings are in effect until June 30, 2006. The new rankings will have only two categories as shown.

Current
1 = Crucial-critical habitat
2 = High priority habitat
3 = Substantial value habitat
4 = Seasonal - Limited

After June 2006
1= Crucial
2= Substantial

Table 3-2 Ranking of Wildlife Habitat (Prior to 2004)

Species	Management Area
Rocky Mt. Big Horn (Seasonal)	5,411 Acres
Elk (Winter habitat)	19,840 Acres
Elk (Summer habitat)	1,280 Acres
Mule Deer (Critical)	9,280 Acres
Mule Deer (Year Long)	16,000 Acres
Pronghorn Antelope (Year Long)	12,160 Acres

It is important to note that the actual disturbed area (approximately ~~42.6~~40.26 total acres) is not critical elk or deer winter range, but is habitat for Rocky Mountain Big Horn Sheep.

According to DWR, Rocky Mountain Bighorn Sheep spend all year along the escarpments in the Lila Canyon area of the Book Cliffs. DWR and the Division visited the proposed disturbed area on June 11, 2002. Prior to the visit, the DWR representative was concerned that sheep may need to move further up the cliff when traveling the escarpments because of the mine and that sheep would likely leave the area. After the visit, the DWR representative felt that the sheep use of Lila Canyon may not be affected. The change in opinion may be due to the fact that the DWR representative was not familiar with the specifics of the mine plan until the site visit.

Rocky Mountain Big Horn Sheep appear to have a low tolerance for disturbance. Considering the low population density and the abundance of suitable similar habitat this impact appears to be slight.

The loss of range for Big Horn Sheep is mitigated and is defined in the Environmental Assessment submitted in association with the Right-Of-Way applications.

The USFWS recognizes that the permit area is within range of endangered species, including the black-footed ferret, MSO, and the bald eagle (Letter dated February 4, 1998, Appendix 3-3).

Raptor surveys were initiated in 1998 and continue annually with the exception of 2004. These surveys were initiated before ground-breaking of the Lila project. The results of these surveys are in Appendix 3-5. The entire Book Cliffs escarpment within the permit area was inventoried for cliff nesting raptors. In addition, a 1-mile buffer zone was inventoried around areas of potential development.

An active golden eagle nest, with young, was documented during the 1999 spring raptor survey. In 2005 nest 946 contained a chick that was possibly dead. USFWS, Laura Roma, UDWR, Chris Colt, and BLM, Dave Mills determined, during the EA process, that there was a high probability these nest sites would be abandoned. A cooperative agreement with the regulatory agencies and UEI was finalized and is made part of the mitigation for the Lila Canyon EA. One nest discussed above, also lies in an area of potential subsidence which is a mute point due to its close proximity to the mine site. Since the nests are located so close to the mine surface facility and that there was a high probability these nest sites would be abandoned, these nests will be mitigated by a prey base off-site vegetation treatment project approved by the USFWS, UDWR and BLM (See page 19 for BLM mitigation information).

Although it was predicted that these nests might be abandoned, the Operator will coordinate closely with USFWS, DWR, and the Division to

avoid "take" of golden eagles prior to construction and during operations. Immediately following any raptor survey that shows that the eagles are tending nests or nesting, the operator will contact the USFWS and DOGM. The agencies will immediately coordinate to determine appropriate measures.

Although the Operator will avoid "take", the operator agreed to the BLM-lead mitigation project that is based on the premise that there is sufficient nest sites in the area to accommodate the population base. The limiting factors appears to be available prey base. Mitigation is designed to enhance the prey base while concurrently enhancing habitat for big game, deer, elk, and bighorn sheep.

It is estimated that mining operations will use an average of approximately 81 acre feet of water annually. The USFWS considers that this volume of water will adversely affect the four endangered Colorado River fish. UEI will report actual water depletion values annually in their annual report.

The USFWS recovery program is reasonable and prudent alterative to avoid the likelihood of jeopardy to these fish.

322.230. All known species or habitats needing special protection have been addressed.

322.300. Copies of the MRP have been submitted to the Division to allow for distribution to USFWS.

323. Maps or aerial photographs of the permit area and adjacent areas have been provided. Plates 3-1 and 3-1A are maps that show all critical habitat, raptor nests and all special habitat features. These plates will be updated on an as needed bases to reflect current conditions such as new raptor nests and/or changes in wildlife use.

323.100. The location of the proposed reference area is shown

on Figure 1 of Appendix 3-1. Appendix 3-1 is the report for the 2003 vegetation inventory. The reference area for the mine site disturbance was established during the summer of 2003. The reference area was chosen in an area which represents the natural premining conditions of the permit area. The reference area will facilitate the determination of successful revegetation and the resultant final bond release for the Applicant.

323.200. Monitoring locations are shown on Plate 3-1 and can also be found on the raptor inventory map in Appendix 3-5.

323.300. Protection facilities: There will be no facilities used exclusively for the protection or enhancement of fish and wildlife.

323.400. Plate 3-2 Identifies each vegetative type and plant community. The sample locations used during the vegetation inventory can be found on Figure 1 of Appendix 3-1. Wildlife use areas can be correlated to vegetation with the incorporation of the Wildlife Map, Plate 3-1.

Appendix 7-8 provides a description of each water monitoring location. In Summary monitoring locations L-6-G, L-7-G, and L-11-G have a habitat overstory of Douglas Fir-Mountain Brush association. Water monitoring location L-8-G has a habitat of predominantly pinyon - juniper and sagebrush grass associations. Water monitoring locations L-9-G, L-10-G, and L-12-G have some minor wet meadow habitat with an overstory of pinyon-juniper and sagebrush grass immediately adjacent along each side of the sites. Water monitoring sites L-16-G and L-17-G are both seeps and have a habitat of a mix of grasses and salt desert shrub with some invasive tamarisk.

Sites L-1-S, L-2-S, L-3-S, L-13-S, L-14-S and L-15-S are dry washes with a habitat consisting of sagebrush with an overstory of pinion-juniper.

Monitoring site L-4-S and L-5-G are for sediment pond

discharge and for the mine discharge and have a habitat consisting of an overstory of pinion-juniper.

330. Operation Plan. A plan for protection of vegetation, fish and wildlife resources follows:

331. The Lila permit area is approximately ~~4664~~5544.~~32~~01 acres, of which only ~~42.6~~approximately 40.26 acres are within the surface disturbance area. All incidental disturbance, which will not be utilized in operations, will be revegetated with an interim seed mix proven beneficial to wildlife. The revegetation plan is addressed in Section 341 and the seed mixes are addressed in Tables 3-4 and 3-5. Revegetation will occur the first desirable period following disturbance and/or abandonment.

332. The extent and degree of subsidence will be in large dependent on both the amount of overburden as well as the mining method. Employees and or consultants of the operator have numerous years of experience mining the Bookcliffs and Wasatch areas and none have observed nor are aware of any negative impacts on wildlife or vegetation, as a result of subsidence, with the exception of

1) Escarpment Failure which is not anticipated.

2) Disruption of Surface and / or Ground Water, which is not anticipated.

(1) Escarpments will be protected by implementing escarpment barriers. An escarpment barrier of a minimum of 200', within which no second mining will take place, will be used to protect escarpments immediately above the coal seam and protect against unplanned holeouts.

(2) Disturbance of Surface and / or Ground Water. Considering, the permit area has no surface water with the exception of intermittent or ephemeral flow associated with precipitation events and / or snow melt, subsidence should have no adverse effect. The ephemeral stream channels, in the area's of potential subsidence, will be monitored to insure there are no adverse impacts to the ephemeral flow.

No negative impacts to vegetation are anticipated. However, vegetation will be monitored in conjunction with subsidence

monitoring, utilizing infrared aerial photography once every five years for those areas that are undermined. This will be done in accordance with the subsidence control plan. (See Section 525). Any loss of or diminished appearance of vegetation will be noted, confirmed on the ground, and a corrective plan to mitigate the loss will be submitted to the Division of Oil, Gas, and Mining for their approval and concurrence prior to implementation.

It is anticipated that the saturated zone will most certainly produce some water when intercepted in the course of mining. The effect could be positive in the event the mine were to discharge surplus water to the surface. Assuming the water quality was suitable for wildlife, a valuable enhancement fixture could be sustained at a minimum through the life of the mine. While it is possible subsurface disruption of ground water could occur as a result of subsidence it is problematically slight. (See Appendix 7-3 Probable Hydrologic Consequences (PHC).)

The losses of wildlife habitat and or vegetation through subsidence is not anticipated. The mined portion of the permit area will be monitored visually each spring for evidence of subsidence. In the event vegetation and or wildlife habitat where impacted; mitigation could take the form of: 1) habitat enhancement - through selected manipulation of existing undisturbed areas to increase productivity of preferred forage species, and 2) off site water sources such as construction of guzzlers and stock water impoundments.

Each of the above would need to be analyzed on a site specific bases, taking all agencies (UDWR, UDOGM, and BLM) input into a viable, workable, course of action to be implemented by the mine and as stipulated in the Lila Canyon EA.

Table 3-3
Time Table of Reclamation

April 16, 202~~0~~8	Begin Demolition
November 15, 202~~0~~8	Complete Demolition
April 16, 202~~1~~9	Commence Earthwork
August 30, 202~~1~~9	Completion of Phase 1 (Earthwork) Lower Area
September 1, 202~~1~~9	Begin Earthwork Road / Portal Upper Area
October 1, 202~~1~~9	Seeding and Mulching (Weather dependent) Completion of Earthwork Upper Area
November 1, 202~~1~~9	Fencing
November 15, 202~~1~~9	Reclamation Completed
July 20~~25~~33	Ocular Estimates of Success (Remedial seeding if necessary September 20~~26~~34)
October ~~2023~~2031	Planting Seedlings (If Needed)
July 20~~27~~35	Quantitative Vegetation Inventory
August 20~~29~~37	Quantitative Vegetation Inventory Site and Reference Area
August ~~2034~~2042	Quantitative Vegetation Inventory of Referenced Area and Project Site, Bond Release Criteria

The tentative life of a mine is twenty years depending on market and mining conditions. As such, the time table is generic and no set year will be specified for the cessation and abandonment of operations.

333. Major Impact: The major impact to the wildlife in and around Lila Mine site will be loss of habitat. The loss of habitat will occur during the construction of the site, and will be residual throughout the life of the mine. The operational activities at the site will impact the wildlife slightly. But as observed at operations located in both the Book Cliffs and Wasatch plateau, most of the wildlife in the area will either accept or adjust their behavior to coexist with the operation.

The examples below are just some of the observations that the operator has experienced that demonstrates most wildlife accepts or adjusts to coexist with mining operations:

> At U.S. Fuel Company, deer were observed crawling under railcars. Deer were observed fawning just inside old portals for three consecutive years.
>
> At Genwal, deer have been observed on a consistent basis crossing a perennial stream to drink from the sediment pond. Bear and elk have been observed on numerous occasions from the bathhouse, office, and parking lot grazing only a few hundred feet away.
>
> At Beaver Creek, deer have been observed drinking from the sediment pond on an almost daily basis. Bear, lion and elk were observed from the bathhouse offices. Deer were observed crawling under low conveyors instead of using a 10' elk crossing only 20' away.
>
> At Kaiser, Rocky Mountain Bighorn Sheep were observed from the mine office on a regular basis.
>
> At Horse Canyon, Bighorn Sheep have been observed in and around the #1 and #2 sediment ponds. The Bighorns have been photographed grazing directly across the road from the inactive mine facilities.

Dust abatement and dust control as outlined in Chapter 5, such as covered conveyors, water sprays, and the minimization of large stockpiles will adequately protect adjacent undisturbed area within and surrounding the surface facilities.

It was determined that all nests within a ½ mile radius of the surface facilities have a high probability of being abandoned by indirect

disturbance associated with mine activities. The Lila Canyon EA # UT-070-99-22, outlines mitigation recommended through a cooperative effort between Utah Department of Wildlife Resources, Bureau of Land Management, U.S. Fish and Wildlife and UtahAmerican Energy, Inc. where mitigation would be implemented to increase prey base off-site. The construction of alternative nests was considered to be ineffective. Eagle distribution was not limited by suitable nest sites but by available prey.

An MSO two-year calling survey will be completed according to Appendix 3-4. Results as described in Appendix 3-4 will be reported to the Division, UDWR, and USFWS. This two-year survey will include four night time surveys with no more than one survey prior to end of April and at least three surveys prior to end of July. Results will be submitted to USFWS, DWR, and the Division immediately following of each night time survey. If owls are observed, the agencies will immediately coordinate to determine appropriate measures.

Construction at the mine to upgrade drainage controls and to construct the road will have a minor impact on wildlife in the area. The impact will mainly be increased human activity associated with the construction and a small, less than 42.6 acre, loss of habitat for the mine site, roads and sedimentation pond. These impacts will have little or no affect on the wildlife because they will be completed in an environmentally sound manner.

UEI will instruct all personnel as to current regulations regarding the use of off-road vehicles, firearm regulations, and where current UDWR proclamations are available. This training will be part of the annual refresher offered to all employees. The company will encourage strict compliance with these regulations.

DWR will be notified of any road kills involving large game and request to have them removed to safeguard raptors. Mine personnel will be instructed to remove road kills a safe distance from the road way.

The Lila Canyon Mine has agreed to mitigate the loss of wildlife habitat as well as the potential loss of habitat use due to disturbance.

This mitigation is under advisement of the wildlife professionals of both the BLM and the Utah Division of Wildlife Resources. The mitigation designed will offset impacts to bighorn sheep, mule deer, elk, and chukker specifically. The mitigation committed to in association with the Lila Mine EA is :

(1) Install two guzzlers
(2) Participate in a BLM habitat enhancement program on 76.14 acres-conversion from Pinyon/Juniper to shrubs, forbs, and grasses.

NOTE: The 76.14 acres is less than the EA 2000 EA acres of 93.11. This difference is a result of the EA evaluating more acreage than what will actually be disturbed. The 2000 EA considered what it calls the Lila Canyon Road which will not be constructed, thus not disturbed. The Lila Canyon Road, not being constructed, refereed to in the EA, contains 16.97 acres. The actual acres for habitat enhancement will be 93.11 -13.23 - 3.74 = 76.14 acres of enhancement.

The overseeing agency for the EA mitigation/enhancement will be the BLM. The implementation dates, and project locations will not be determined until the BLM notice to proceed is given, after permit approval. The Permittee will submit the BLM mitigation plan as an Appendix to this volume within one year of the initial mine construction. The BLM plan will include: project goal, expected benefits, project procedures, company commitment, implementation dates, project location and agencies contacts.

333.100. This section is addressed in 333. And 333.300.

333.200. This section is addressed in 333. And 333.300.

333.300 The goal of the mine is to construct all facilities and conduct mining in such a manner to minimize adverse impacts to wildlife. These measures will include but are not limited to:

1. Interim revegatation with desirable plant species for wildlife, with the exception of transportation corridors.

2. Speed limits on all roads to lesson potential for possible animal/vehicular collisions.

3. Wildlife awareness training to be incorporated into the annual safety training for all employees.

4. Possible restrictions on firearms on the mine site, and restrictions on off road vehicle usage to lesson disturbance.

5. The Operator will ensure that DWR surveys for cliff nesting raptors within proposed facilities areas at least two years prior and one year following construction. The Operator will conduct annual raptor surveys.

   As part of normal mining operation requirements, the Permittee must submit all results of the raptor surveys to the Division in Annual Reports and must immediately contact the Division, BLM, and USFWS following any raptor survey that shows that eagles are tending nests or nesting. The agencies will immediately coordinate to determine if the Permittee must implement appropriate measures. If the agencies recommend mitigation, the Permittee must submit all plans to the Division for incorporation into Appendix 3 of the MRP.

6. An active golden eagle nest, with young, was documented during the 1999 spring raptor survey. The nest is located in the left fork of Lila Canyon within the 1-mile buffer zone. (See Plate 3-1). A consultation with USF&W, BLM, and UDWR was held in the fall of 1999. Line of site and potential mitigation was addressed during this meeting. The results of this consultation are addressed in Sec 322.220 and the Lila Canyon EA. This nest was not active in 2000, 2001, 2002, or 2003. A survey was not done in 2004. In 2005 nest 946 contained a possibly dead chick. (See Appendix 3-5 for updated inventories)

7. The Operator will adhere to exclusionary periods when initiating construction and final reclamation projects. The exclusionary periods include: raptors (Feb 1 - July 15), Bighorn sheep lambing (May 1 - June 15), and Pronghorn (May15 - June 20).

   In the event of unforeseen changes in construction or mine plans, or in the case of emergency situations that may force the Permittee to conduct activity near or within the 0.5 mile buffer zone of raptor nest and during

raptor exclusionary periods (February 1 to July 15 for golden eagles), the Permittee will immediately contact the Division, BLM, DWR, and USFWS. The agencies will immediately coordinate to determine appropriate measures that may include conducting ground surveys, in coordination with DWR, to determine if birds are tending nests or nesting and possibly determine the life stage of the offspring; developing a mitigation plan, in coordination with the agencies, for possible impacts to nests or birds; or ceasing operations until the end of breeding season to avoid 'take'. If the agencies recommend surveys, the Permittee must submit all survey results to the Division in Annual Reports. If the agencies recommend mitigation, the Permittee must submit all mitigation plans to the Division for incorporation into Appendix 3 of the MRP.

The Applicant does not plan to monitor any wildlife species during the life of the operation with the exception of raptors. Spring raptor surveys will be conducted at a minimum of a 1-mile radius around any new or potentially disruptive mining activity, 2-years prior and annually after the proposed activity. The Operator will contact the USFWS and the Division immediately following raptor surveys if raptors are observed tending nests or nesting.

The mine will emphasize their commitment to legal requirements of firearm and off-road vehicle-use by employees. This type of program has been adopted by the operator and will continue throughout the operation. An education program aimed at minimizing potential negative impacts by employees will be presented during the Operators annual retaining programs. Employees will be informed about the wildlife in the area and about which species are protected. They will be counseled to refrain from poaching or harassing animals and about the need to preserve the wildlife. They will also be instructed on the danger of animals on the road during dusk and night hours and consequently the need to reduce speed to avoid colliding with animals difficult to see in these periods of poor light. All threatened or endangered wildlife sighted within or adjacent to the

permit area will be reported to the appropriate state and / or federal agency.

The location and construction of the haulage road, as well as measures for the protection of surface hydrology, from sedimentation, including the sedimentation pond and other drainage control structures, are discussed in Chapter 7, Hydrology.

Any waters discharged from the facility will be monitored in accordance with UPDES Permit No.UTG040024. Major disturbances will be scheduled to avoid deer / antelope fawning times.

No use of pesticides or chemicals that have serious consequences to plants or wildlife will be used on the permit area, unless recommended by a regulatory agency and under their direction.

Prevention of fires and their spreading outside the permit area will be accomplished through; water sprays, and fire extinguishers located at all facilities . Wild fires will be addressed by the appropriate state and federal agencies. Operation and reclamation activities will be done in compliance with the Endangered Species Act of 1973. As instructed by the Bureau of land Management and the Utah Division of Wildlife Resources, fencing will be removed when DOGM determines that all reclamation standards have been met. Further measures taken to enhance wildlife habitat during reclamation are discussed under the “Reclamation Plans” section of this chapter.

The interim reseeding of small areas will provide some small amounts of additional forage and seed. Reseeding will particularly benefit rodents and passerine birds seeking seeds in this sparse vegetative type. The seeding of sediment pond slopes usually provides a bonus crop of seeds as the plants are watered by intermittent runoff.

Within the disturbed area, there are areas of undisturbed ground such as in topsoil storage areas. These areas will be posted so as to preclude trespass by vehicles and/or mine equipment. In addition, dust

control will be practiced throughout the life of the mine to minimize impacts from blowing dust .

The sediment ponds on the disturbed area will hold water during short periods and will provide some additional surface water for wildlife. The stored water may prolong use of that portion of the winter range by deer because water is often the limiting factor on dry winter ranges. Migrating small birds and mourning doves will also utilize this water to recuperate during their flights, as well as a small indigenous flock of chukkers. In the event the water in the pond were to contain any material which would be hazardous to wildlife (ex: oil, grease), the material would be removed by the use of petroleum selected filtration material. The filtration material will be used when an apparent sheen is visible on the pond. If hazardous materials are observed the Division will be notified immediately to develop a protection plan for wildlife. The pond will be monitored visually daily by surface personnel for signs of oil and grease.

340. Reclamation Plan.

A reclamation plan for final revegetation is presented below.

341.100. TABLE 3-3 is a timetable of reclamation activities upon cessation of operation. The tentative life of a mine is twenty years depending on market and mining conditions. As such, the time table is generic and no set year will be specified for the cessation and abandonment of operations.

341.200. This section is addressed in 341.210.

341.210. TABLE 3-4 indicates the species and amounts per acre of seeds to be used in revegetation.

The seed mixture used to revegetate the disturbed areas at Lila Canyon Mine is given on TABLE 3-4, along with the rates of application. The seed mixture was developed for the disturbed area with respect to a number of considerations. Climatic conditions of area and the availability of water were reviewed to assess

the need for drought-tolerant species. The vegetation information was evaluated to determine the seed mixture needs corresponding to productivity, cover and diversity requirements. Data was gleaned from the soils report to select species adapted to the physical and chemical characteristics of the potential seedbed.

341.220. The disturbed area will be reclaimed after all operations have ceased at the mine site and all pertinent structures have been removed. The coal will be loaded out and the surface will be left relatively free of debris. The area will be recontoured to approximate pre-mine configurations. The soil will then ripped to a depth of 16 -18 inches.

The previously salvaged top soil will then be redistributed over the total disturbed area. Soil depth and soil cover are addressed in Chapter 2.

The seedbed will be prepared by completing the final grading and again either gouged or ripped to a depth of 6-18 inches or to bedrock. Ripping the soil will be completed at a speed that maximizes the action of the ripper shanks and promotes spoil material disruption to the required depth.

During the final ripping or gouging process, seedbed material will be collected and sent to a laboratory for analysis to determine fertilizer requirements. The fertilizer recommendations will be added to the soil at the specified rate of application. Seed and fertilizer will be distributed utilizing a hydroseeder . Fertilizer and seed will not be mixed during hydroseeding operations.

Hydroseeding operations will not be conducted when wind velocities would interfere with the even distribution of the material. All efforts will be made to attain an even distribution of seed. (See Appendix 5.8)

Once Hydroseeding is complete, the area will be hydromulched, see Appendix 5-8 and Section 341.230.

The area will be seeded and fertilized (if needed) with the recommended species (see TABLE 3-4), and nutrients at the specified rate of application. At present a general recommendation indicates that 100 pounds per acre of 16-16-8 will need to be added as a nutrient.

All efforts will be made to insure the quality of materials purchased for reclamation activities are maintained throughout all work. Commercially purchased seed will have the seed names, lot number, percentages of purity, germination, hard seed and percentage of maximum weed seed count clearly marked on each container. No seed will be accepted if they contain seeds of a state-recognized noxious weed species. Sources for “common” seed should be those with climatic and elevational characteristics as close to site characteristics as possible. Legume seed will be inoculated with the correct Rhizobium.

341.230. The site will be hydro-seeded with seed and an initial 500#/acre of mulch and 100#/acre of tac agent. Followed shortly by an additional 1500 to 2000#/acre of mulch. Finally, an additional 100#acre of tac and fertilizer, choice and application rate to be determined by the testing in section 243, will be applied. Fertilizer and seeds will not be mixed together during the hydro-mulching operations.

341.240. There will be no irrigation or supplementary water used during or after the revegetation of the area. There are no planned pest or disease control measures for the mine site reclamation. Pest or disease control measures may be included in this plan if results from the test plot and / or reference area indicate a need. The measures will be consistent with proper

rangeland and wildlife management.

341.250. A reference area for the mine site disturbance was established adjacent to the proposed facilities during the summer of 2003 (Figure 1, Appendix 3-1). The reference area was chosen in an area which represents the natural premining conditions of the permit area. This reference area will facilitate the determination of successful revegetation and the resultant final bond release for the Applicant.

Comparisons of the revegetated area and the reference area will be made using the data obtained from the ninth and tenth year sampling. This data will be used to obtain statistical information that will show the site meets the requirements for bond release.

341.300. The methods outlined have a proven performance based on the successful reclamation of the Horse Canyon Mine in the immediate drainage to the north (less than two miles) in like habitat and aspect.

The Operator will conduct a study to determine the optimum time for seeding warm seasons species (refer to page 29).

Table 3.4/3.5
INTERIM AND FINAL RECLAMATION SEED MIX
Recommended Seed Mix for Lila Canyon Mine

Species	Latin Name	Seeds/lb	# Seeds per Acre Planted	%Mix Planted	Seeding Rate Lbs / acre	Seeds / ft^2
Grasses						
Needle And Thread	Stipa Comata	115,000	230,432	5	2.00	5.3
Indian Ricegrass	Achnatherum humenoides	141,000	282,269	6	2.00	6.5
Basin Wild Rye	Leymus cinereus	130,000	129,373	3	1.00	3.0
Galleta	Hilaria jamesii	314,500	313,632	6	1.00	7.2
Bluebunch Wheatgrass	Pseudoroegneria spicata	140,000	139,392	3	1.00	3.2
Slender Wheatgrass	Elymus trachycaulus	159,000	317,988	6	2.00	7.3
Blue Gamma	Bouteloua gracilis	825,000	827,640	17	1.00	19.0
Subtotal						51.4
Forbs						
Blue Flax	Linum lewisii	293,000	294,030	6	1.00	6.8
Palmer Penstemon	Penstemon palmeri	610,000	152,460	3	0.25	3.5
Globemallow	Sphaeralcea ambigua	500,000	250,470	5	0.50	5.8
Indian Paintbrush	Castilleja linariaefolia	4,915,000	479,160	10	0.10	11.0
Fringed Sage	Artemisia frigida	4,536,000	435,600	9	0.10	10.0
Subtotal						37.0
Shrubs						
Wyoming Big Sage	Artemisia tridentata	2,576,000	653,400	13	0.25	15.0
Green Rabbitbrush	Chrysothamnus nauseosus	400,000	41,382	1	0.10	1.0
Fourwing Saltbush	Atriplex canenscens	52,000	43,560	1	0.84	1.0
Winterfat	Ceratoides lanata	56,700	56,628	1	1.00	1.3
Shadscale	Antriplex confertifolia	64,900	64,904	1	1.00	1.5
Cliffrose	Cowania mexicana	64,600	64,469	1	1.00	1.5
Black Sage	Artemisia nova	907,200	230,868	5	0.25	5.3
Subtotal						26.5
TOTAL PER ACRE		**16,799,900**	**5,007,658**	**100**	**16.39**	**115**

342. Fish and Wildlife. A fish and wildlife plan follows:

342.100. The sediment ponds will be maintained through the life of the operation and will be removed when effluent criteria is met following reclamation.

342.200. Rangeland for domestic stock is the secondary intended postmining land use with wildlife habitat as the primary land use. Plant species appropriate for enhancing the wildlife habitat were selected on the basis of known wildlife requirements including nutritional value for fish and wildlife, use as cover for fish and wildlife and ability to support and enhance fish and wildlife habitat. The Pinyon/Juniper area will be enhanced and reclaimed to the Grass/Shrub community type. The habitat type provides excellent winter range for big game, as well as, an increase in rodent populations which in turn are beneficial to raptors. The Lila Canyon EA has stipulated that in excess of 70 acres of wildlife habitat will be enhanced to help offset negative impacts.

342.210. This section is addressed in 342.200.

342.220. This section is addressed in 342.200.

342.230. This section is addressed in 342.200.

342.300. This section is not applicable.

342.400. This section is not applicable.

350. Performance Standards

351. All coal mining and reclamation operations will be carried out according to plans provided under R645-301-330 through R645-301-340.

352. Lila Canyon Mine will implement contemporaneous reclamation on all areas that are disturbed through construction or in the course of mining that will not be utilized for future activity that constitutes continued disturbance.

353. General Requirements. The Permittee will establish on regraded areas and on all other disturbed areas a vegetative cover that is in accordance with the approved permit and reclamation plan. The first available season following abandonment / completion the area will be seeded and mulch in accordance with the approved reclamation plan.

353.100 The contemporaneous seed mix TABLE 3-5 is capable of self-regeneration.

The seed mix in Table 3-5 is designed to be compatible with native plant species and beneficial to the animals indigenous to the area for both forage and cover.

All seed used in contemporaneous revegetation will be certified and in compliance with all state and federal laws governing seeding.

353.130. The vegetative cover will be at least equal in extent of cover to the natural vegetation of the area; and

353.140. Capable of stabilizing the soil surface from erosion.

353.200. The reestablished plant species will:

353.210. Be compatible with the approved postmining land use:

353.220. Have the same seasonal characteristics of growth as the original vegetation:

353.230. Be capable of self-regeneration and plant succession:

353.240. Be compatible with the plant and animal species of the area; and:

353.250. Meet the requirements of applicable Utah and federal seed, poisonous and noxious plant; and introduced species laws or regulations.

353.300. The Division may grant exception to the requirements of 353.220 and 353.230 when the species are necessary to achieve a quick-growing, temporary, stabilizing cover, and measures to establish permanent vegetation are included in the approved permit and reclamation plan.

353.400. There are no prime farm lands within the permit area or anticipated crop lands.

354. Timing: Seeding will occur between September 30 and may proceed up until March 30 depending on snow and frost condition

DOGM has expressed a concern over the fall planting of the warm season species, Blue grama and Galleta. Both of these species are in evidence at the Horse Canyon Site, which was reclaimed in the fall of 1991. However, UEI is committed to use these species in the interim seed mix, adjacent to the sediment pond. Area 1, the Southeast corner, and Area 4 the Northwest corner of the pond disturbance, will be seeded mid summer (July) following the construction. Area 2, the Southwest quarter and Area 3 the Northeast quarter of the disturbance, will be seeded late fall (October) following construction. The line separating the four areas will be staked on the ground. Ocular estimates of the success of the reclamation will be implemented each fall for 3 years following the reclamation. In year 4, if there appears to be an apparent difference in success, a quantitative sample will be taken. The sample will identify both species composition as well as overall vegetative cover for both areas.

If in the event a conclusion as to the timing of planting results in a significant degree of success, the reclamation plan can be modified during the 5 year renewal process.

355. Mulch will be applied on the same bases as indicated for permanent reclamation.

356. Standards for Success:

356.100 Success of revegetation will be judged on the effectiveness of the vegetation for the approved postmining land use, the extent of cover compared to the extent of cover of the reference area.

356.110. Standards for success, statistically valid sampling techniques for measuring success, and approved methods are identified in the Division's "Vegetation Information Guidelines, will be followed closely. (See “Lila Canyon Vegetation Inventory” found in Appendix 3-1)

356.120. Standards for success recommended in the “Vegetation Information Guidelines” will be followed closely. *(*See “Lila Canyon Vegetation Inventory” found in Appendix 3-1)

356.200. Standards for success will be applied in accordance with the approved postmining land use of wildlife and incidental use by domestic stock.

356.210. This Section does not apply since the area is post mining wildlife habitat, with incidental use by domestic stock.

356.220. This Section does not apply since there are no agriculture lands within the permit area and no prime farm lands. See Chapter 2, Appendix 2-1 (Prime Farmland Letter).

356.230. Success of vegetation will be determined on the basis of tree and shrub stocking and vegetative ground cover. Such parameters are described as follows:

The requirements for cover, productivity and woody plant density are, at least 90% of the cover, woody plant density and productivity of the reference area with 90% statistical adequacy. The site will be

sampled in a manner similar to the method used to sample the reference area.

Diversity will be determined with the following method:

1) All species encountered with at least a 20% frequency in the vegetation sampling will be categorized into life forms. The life form categories that will be used are native grass, native broadleaf forbs, native shrub, desirable introduced, and undesirable. Undesirable species are those generally classified as weeds or that are poisonous to livestock. If there is any question whether a species should be considered undesirable, the Division and UtahAmerican will consult with the Emery County Weed Department.

2) The standard will be that the reclaimed area must have at least as many native grass, native broadleaf forbs, and native shrub species occurring at 20% or greater frequency as the reference area. For example, if the reference area has 3 native shrub species occurring at 20% or greater frequency, the reclaimed area must also have this many species. The species do not need to be the same.

Essentially the same method would be used to judge seasonality, but the only categories would be warm and cool season.

Erosion control relative to both vegetation density and species composition would be based on effluent standards as committed in the UDPES permit. All drainages leading away from the permit area will be sampled as often as practical. When effluent standards are met, the vegetation will have demonstrated its erosion control effectiveness. Woody plant density for the entire area will be established with 1,500

plants per acre, unless the Divisions consultation with area agencies determines a different density.

356.231. (See Section 256.230)

356.232. Tree stocking / woody plant density will meet or exceed UDOGM guidelines for bond release.

356.233. Success standards for vegetative ground cover: (See Section 256.230)

356.240. This Section does not apply since no portion of the permit area will be used for industrial, commercial or residential use.

356.250. No pre-law mining occurred on the Lila Canyon Permit area.

356.300. Lila Canyon Mine is committed to maintain siltation structures until vegetative cover is adequate to allow runoff to meet affluent limits as directed by UDOGM at a minimum two years following vegetation establishment.

356.400. Lila Canyon Mine will have all disturbance associated with removal of siltation structures seeded and mulch in accordance with the approved revegetation plan.

357. Revegetation: Extended Responsibility Period.

357.100. The period of extended responsibility for successful vegetation will begin after the last year of seeding, fertilization, irrigation, or other work, excluding approved husbandry practices.

357.200. Vegetation parameters will equal or exceed the approved success standard during the growing seasons for the last two years of the responsibility period. The period of extended responsibility will continue for five or ten years based on precipitation data.

357.210. Since Lila Canyon has an average annual precipitation of less than 26.0 inches this section is not applicable.

357.220. The mine plan area averages nine inches at the lowest elevation (area of greatest disturbance) to fourteen to sixteen inches at the highest elevation. Lila Canyon Mine will assume the ten year bond liability period.

357.300. Husbandry Practices - General Information

357.301. Lila Canyon Mine would like to reserve the right to apply for augmentation of reclaimed area extending the bond liability period on a site specific case scenario.

357.302. Husbandry practices proposed for the reclaimed areas are not necessitated by inadequate grading practices, adverse soil conditions, or poor reclamation procedures.

357.303. The Division will consider the entire area that is bonded within the same increment, as defined in R645-301-820.110, when calculating the extent of area that may be treated by husbandry practices.

357.304. If it is necessary to seed or plant in excess of the limits set forth under R645-301-357.300, the Division may allow a separate extended responsibility period for these reseeded or replanted areas in accordance with R645-301-820.330.

357.310. Reestablishing trees and shrubs

357.311. Trees or shrubs may be replanted or reseeded at a rate of up to a cumulative total of 20% of the required stocking rate through 40% of the extended responsibility period.

357.312. Lila Canyon Mine has incorporated wood plant / tree seeding into the seed mix (see TABLE 3-4). If after two years following seeding and mulching it is apparent that woody plant density / tree cover appear to be insufficient for bond release; the mine may elect to re-enter selected areas and augment the direct seeding with either / or containerized or bare root seedlings, this determination will need to be made on a site specific bases. The goal for bond release is the establishment of 1500 woody plants per acre.

357.320. Based on similar reclamation projects in adjacent areas, the need to control weeds other than by selected removal is unlikely. In the unlikely event that weed control is required by chemical means, R645-357357.321 will be followed. In the unlikely event that weed control is required by Biological means, R645-357.323 will be followed. In the unlikely event that weed control is required by mechanical means, R645-357.322 will be followed.

357.321. In the unlikely event that weed control is required by Chemical means, R645-357.321 will be followed by mine personnel.

357.322. In the unlikely event that weed control is required by Mechanical means, R645-357.322 will be followed by mine personnel.

357.323. In the unlikely event that weed

control is required by Biological means, R645-357.323 will be followed by mine personnel.

357.324. In the unlikely event that weed control practices damage desirable vegetation, R645-357.324 will be followed by mine personnel.

357.330. Wildlife habitat is the priority post mining land use. As such, control of wildlife is not anticipated.

357.331. Wildlife habitat is the priority post mining land use. As such, control of wildlife is not anticipated.

357.332. Mine personnel do not anticipate a need to implement control measures for small mammals or insects. However, in the unlikely event that control is necessary, R645-357.332 will be followed. The Division must approved animal control methods sited in R645-357.332.

357.340. Natural Disasters and Illegal Activities Occurring After Phase II Bond Release. Where necessitated by a natural disaster, excluding climatic variation, or illegal activities, such as vandalism, not caused by any lack of planning, design, or implementation of the mining and reclamation plan on the part of the Permittee, the seeding and planting of the entire area which is significantly affected by the disaster or illegal activities will be allowed as an accepted husbandry practice and thus will not restart the extended responsibility period. Appendix C of the Division's "Vegetation Information Guidelines" references publications that show methods used to revegetate damaged land.

Examples of natural disasters that may necessitate reseeding which will not restart the extended responsibility period include wildfires, earthquakes, and mass movements originating outside the disturbed area.

357.341. The extent of the area where seeding and planting will be allowed will be determined by the Division in cooperation with the Permittee.

357.342. All applicable revegetation success standards will be achieved on areas reseeded following a disaster, including R645-301-356.232 for areas with a designated postmining land use of forestry or wildlife.

357.343. Seeding and planting after natural disasters or illegal activities will only be allowed in areas where Phase II bond release has been granted.

357.350. No Irrigation is anticipated.

357.360. Rills and gullies in excess of eight inches width and / or depth will be repaired on a seasonal bases. Repairs will be made in such manner that minimizes additional disturbance and yet is cost effective based on site specific conditions.

357.361. After the first 20% of the extended responsibility period but prior to the end of the first 60% of the responsibility period or until Phase II bond release, whichever comes first, highly erodible area and rill and gully repair will be considered augmentative, and will thus restart

the responsibility period, if the area to be repaired is greater than 3% of the total disturbed area or if a continuous area is larger than one acre.

357.362. The extent of the affected area will be determined by the Division in cooperation with the Permittee.

357.363. The area affected by the repair of highly erodible areas and rills and gullies is defined as any area that is reseeded as a result of the repair. Also included in the affected areas are interspacial areas of thirty feet or less between repaired rills and gullies. Highly erodible areas are those areas which cannot usually be stabilized by ordinary conservation treatments and if left untreated can cause severe erosion or sediment *damage.*

357.364. The repair and/or treatment of rills and gullies which result from a deficient surface water control or grading plan, as defined by the recurrence of rills and gullies, will be considered an augmentative practice and will thus restart the extended responsibility period.

357.365. The areas of concern on the initial reclamation are those natural drainage channels which will be reconstructed during the earth moving phase of reclamation. Specific design and specifications are included in Chapter 7 (Drainage Design). All regraded areas in excess of three percent slope will be sacrificed to aid in the

retention of moisture and minimize erosion. Areas in excess of 3:1 slopes will receive additional mulch and tac to facilitate vegetation establishment.

358. Protection of Fish, Wildlife Values: Mine personnel will be trained annually on environmental awareness, a portion of the training will deal with wildlife concerns, such as avoidance during stress periods, caution in driving to and from work during peak usage periods, recognition of any threatened and endangered species etc. Speed limits will be posted to minimize vehicular / wildlife accidents. In addition, all suitable water encountered during mining will be discharged in such a manner to make it available to wildlife.

358.100. Appendix 3-3 is a letter from U.S. Fish and Wildlife Service identifying all threatened and endangered species that could occur in the permit area or within a one-half mile proximity. All mine personnel will be trained about these species and notify the environmental coordinator at the mine. The environmental coordinator will confirm, if possible, the identification, notify USFWS and the Division, and then take what ever actions are necessary to safeguard both the species and it's habitat.

In addition, a threatened and endangered species inventory will be conducted prior to any disturbance. Historical as well as current threatened and endangered inventories are included in Appendix 3-4.

Prior to any new surface disturbance a raptor inventory will be conducted to ensure that no raptors or their nests or young would be adversely impacted through any mining or mine related activity. A copy of historical raptor data as well as current survey results are attached as Appendix 3-5.

A one-half mile buffer zone of no new disturbance during critical nesting periods will be maintained during that portion of the year that the nest sites are active.

As part of normal mining operation requirements, the Permittee must submit all results of the raptor surveys to the Division in Annual Reports and must immediately contact the Division, BLM, and USFWS following any raptor survey that shows that eagles are tending nests or nesting. The agencies will immediately coordinate to determine if the Permittee must implement appropriate measures. If the agencies recommend mitigation, the Permittee must submit all plans to the Division for incorporation into Appendix 3 of the MRP.

In the event of unforeseen changes in construction or mine plans, or in the case of emergency situations that may force the Permittee to conduct activity near or within the 0.5 mile buffer zone of raptor nest and during raptor exclusionary periods (February 1 to July 15 for golden eagles), the Permittee will immediately contact the Division, BLM, DWR, and USFWS. The agencies will immediately coordinate to determine appropriate measures that may include conducting ground surveys, in coordination with DWR, to determine if birds are tending nests or nesting and possibly determine the life stage of the offspring; developing a mitigation plan, in coordination with the agencies, for possible impacts to nests or birds; or ceasing operations until the end of breeding season to avoid 'take'. If the agencies recommend surveys, the Permittee must submit all survey results to the Division in Annual Reports. If the agencies recommend mitigation, the Permittee must submit all mitigation plans to the Division for incorporation

358.200. No coal mining and reclamation operations will be conducted in a manner which would result in the unlawful taking of a bald or golden eagle, its nests, or any of the eggs.

358.300. This section is addressed in 358.200.

358.400. There are no wetlands and / or riparian areas within the area of potential disturbance.

358.500. Each operator will, to the extent possible using the best technology currently available:

358.510. All power and transmission lines will be designed with the best technology available to safeguard raptors.

358.520. All structures; fences, conveyors etc., will be designed to allow free movement of large mammals except in those areas where it is necessary to preclude large animals for their own safety; example: power substations, oil storage area etc.

358.530. All structures; fences, conveyors etc., will be designed to allow free movement of large mammals except in those areas where it is necessary to preclude large animals for their own safety; example: power substations, oil storage area etc.

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Horse Canyon Extension
Lila Canyon Mine

Chapter 4
Land Use & Air Quality

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CHAPTER 4

400 LAND USE AND AIR QUALITY

410. Premining and Postmining Land Use: Pre-mining land use of the Lila Canyon permit area includes grazing, wildlife habitat, coal mining, and limited recreation, such as hunting. Other than grazing no agricultural activities have been or are currently being performed in the permit area.
Post-mining land use will not differ from land use as defined prior to the construction of the mine. Post-mining land use will include grazing, wildlife habitat, and recreational activities.

411. Environmental Description

411.100 Pre-mining land use of the Lila Canyon permit area includes grazing, wildlife habitat, coal mining, and limited recreation, such as hunting. Other than grazing no agricultural activities have been or are currently being performed in the permit area.

411.110 Pre-mining land use of the Lila Canyon permit area includes grazing, wildlife habitat, coal mining, and limited recreation, such as hunting. Other than grazing, limited agricultural activities have been or are currently being performed in the permit area. The mine permit area has not been conducive to agricultural practices due to lacking water sources, the steep, rugged terrain, and poor soil types.

To help minimize confusion a summary of Lila Canyon Permit Extension acreage is listed below:

Total federal coal held by the permittee:
5,544.01 acres. Shown on Table1-1.

Total Permitted surface acres:
5,992.07 acres combination of federal, state and private lands. Shown in Table 4-2, 4-2A and described in Section 116.100.

Surface disturbance area:
~~42.6~~40.26 acres discussed is Section 116.100, Section 542.200, Appendix 5-8. Includes areas of undisturbed within the disturbed area.

Top Soil removal / Actual Disturbance:

3~~3~~7.~~86~~02 Acres discussed in Section 232.100". This is the actual area anticipated to be disturbed for the life of the mine.

The permit area for the Lila Canyon mine is depicted on Plate 4-1. Included in this map are: the boundary of the permit area, the area which will include surface facilities, and the new portals. Existing roads, power lines, and railroads are identified. Private, federal, and state ownership are also identified on this plate. Wildlife habitats have been identified on Plate 3-1 and grazing allotment boundaries are depicted on Plate 4-2.

Table 4-1 lists the various owners of land within and around the permit area. The permit area is approximately 5992.07 acres. Within the permit area, 1446.64 acres comprise private land and 289.06 acres comprise state lands. The remaining 4,256.37 acres is federal land owned and managed by the United States Bureau of Land Management (BLM). Table 4-2 describes the surface ownership and Table 4-2A describes the coal ownership of the permit and surrounding area.

Lila Canyon lies within a region identified by the BLM as the Range Valley Mountain Habitat Management Plan Area (U-6-WHA-T4). This region was designated as such by a technical committee comprising state, federal, local government agencies and private citizens. This Habitat Management Plan area was established in September 1991 to provide management for the wildlife species of the area, including federally protected wildlife and plant species, big game, upland and small game waterfowl, unique and limited high value wildlife habitat, and access management. Big game and raptor habitat within the Lila Canyon Mine permit area, along with the Range Valley Mountain HMA, have been identified on Plate 3-1.

Table 4-1

ENTITY	OWNER	LAND USE
Federal Government	U.S. Bureau of Land Management	Range Valley Mountain Habitat Management Plan U-6-WHA-T4 Federal Coal Leases: U-0126947 U-014217 U-014218 SL-066145 SL-066490 SL-069291 *Federal Grazing Allotments*: Little Park Coon Spring Cove Icelander Range Creek *Areas of Wilderness Character* Turtle Canyon WSA
State Government	State of Utah	
County Government	Emery County*	
Private	Josiah and Etta Marie Eardley Intermountain Power Agency Bronco Coal Company College of Eastern Utah Brent Davies* William Marsing Livestock, Inc.*	

*Close proximity to permit area

Table 4-2
Surface Ownership Permit Area Both Horse Canyon and Lila Canyon

Township	Range	Section	State Acres		Federal Acres		Private Acres	
			A	B	A	B	A	B
15 S	14 E							
		33					60.70 (2)	
							49.90 (4)	
		34					23.62 (2)	
							25.68 (4)	
							25.20 (3)	
16 S	14 E							
		2	248.30	0.76				
		3			127.03		204.30 (4)	
		4					189.00 (4)	
		5					20.00 (1)	
		8					40.00 (1)	
		9					120.00 (4)	
		10			28.20		30.85 (1)	76.00 (1)
		11			14.78	108.86	120.19 (2)	341.20 (2)
		12		40.00		600.00		
		13				640.00		
		14				640.00		
		15				157.50		120.00 (1)
		22				40.00		
		23				560.00		
		24				640.00		
		25				320.00		
		26				80		
16 S	15 E	19				110.00		
		30				190.00		
			State Acres		Federal Acres		Private Acres	
			A	B	A	B	A	B
SUB TOTAL			248.30	40.76	170.01	4086.36	909.44	537.20
Total “A” Horse Canyon			1327.75					
Total “B” Lila Canyon			4664.32					
GRAND TOTAL			5992.07					

Table 4-2A
Coal Ownership Permit Area Both Horse Canyon and Lila Canyon
By Lease

Township	Range	Section	Federal Lease Number	State Acres		Federal Acres		Private Acres	
				A	B	A	B	A	B
15 S	14 E								
		33	SL-046512			60.70		49.90 (3)	
		34	SL-046512			23.62		25.68 (3)	
								25.20 (2)	
16 S	14 E								
		2		248.30	0.76				
		3	SL-066145			221.27		110.06 (4)	
		4						189.00 (4)	
		5						20.00 (1)	
		8						40.00 (1)	
		9						120.00 (1)	
		10	SL-066145			59.05	76.00		
		11	SL-066145			134.97	130.06		
			SL-066490				320.00		
		12	SL-066490				320.00		
			U-014218				320.00		
		13	U-0126947				320.00		
			SL-066490				320.00		
		14	SL-066145				160.00		
			SL-066490				480.00		
		15	SL-066490				80.00		
			SL-066145				120.00		
			BLM (No Coal)				77.50		
		22	SL-066490				40.00		
		23	SL-066490				560.00		
		24	SL-066490				240.00		
			SL-069291				80.00		
			U-0126947				320.00		
		25	SL-069291				160.00		

Table 4-2A Continued Coal Ownership Permit Area Both Horse Canyon and Lila Canyon									
			U-0126947				120.00		
			U-014217				40.00		
		26	SL-066490				40		
			SL-069291				40.00		
16 S	15 E	19	U-0126947				110.00		
		30	U-0126947				190.00		
				State Acres		Federal Acres		Private Acres	
				A	B	A	B	A	B
SUB TOTAL				248.30	0.76	499.61	4663.56	579.84	0.00
Total "A" Horse Canyon				1327.75					
Total "B" Lila Canyon				4664.32					
GRAND TOTAL				5992.07					

Please note:
(1) UEI
(2) Eardley
(3) Bronco Coal Company
(4) CEUF

Federal coal leases relative to the Lila Canyon Mine permit area are depicted on Plate 5-4. There are six federal coal leases comprising the permit area, all of which are assigned to Utah American Energy, Inc. The acreage for each lease is presented on Table 1-1.

Grazing allotments in the Lila Canyon Mine permit area are depicted on Plate 4-2. These grazing allotments have remained unchanged for the past 10 years. The permit area is located primarily within the Little Park Allotment and to a lesser extent within the Cove Allotment. Table 4-3 , along with Plate 4-2, describes the allotments, owners, acreage, and animal unit month (AUM's).

The boundary of the Turtle Canyon Wilderness Study Area (WSA) in relation to the permit area is shown on Plate 4-4.

Table 4-3 Grazing Allotments

ALLOTMENT#	ALLOTMENT	OWNER	ACREAGE	AUM's
24031	Cove	Boyd Marsing	12,754	750
34029	Coon Spring	Boyd Marsing	6,879	300
437039	Icelander	James Jensen Dix Jensen	43,897	3016
34066	Little Park	Edwin Jensen Glen Jensen	18,473	242
24096	Range Creek	Waldo Wilcox	43,900	284

411.120 Land use Description

The Lila Canyon Mine permit area has not and does not support a diversity of land uses due to soil types, topography, and hydrology of the area. The land surface of the permit area consists of rugged, southwest facing cliffs of the Book Cliffs. Many of which are deeply dissected by steep ephemeral drainages. The elevation in the mine permit area ranges from approximately 5,600 feet to 5,800 feet near and around the surface facilities site, to approximately 6,500 feet at the proposed portals location. The elevations along the ridge top predominantly range between 8,800 feet and 9,300 feet. The elevation at the top of Lila Canyon, near the mouth of the creek, is 8,530 feet. Large boulders and sandstone slabs clutter the sides and bottoms of cliff areas, as a result of cliff weathering. The base of the Book Cliffs consists of Mancos Shale Lowlands, of numerous southwesterly oriented ridges and drainages.

Three noteworthy drainages lie within and around the permit area. Grassy Wash originates in the area between Horse Canyon and Lila Canyon and flows southwest and south toward the Price River. The transportation and utility corridor will depart from Highway 191, Route 6 at the northeast corner of Section 1, Township 17S Range 13E and progress in the northeast direction to the mine permit area. The new road will cross the Grassy Wash drainage near the southwest corner of section 29, Township 16S Range 14E. The Marsh Flat drainage originates within close proximity of the mine permit area at Township 16S Range 14E Section 35. This drainage flows in the southwest direction toward the Price River. The Little Park Wash bisects the permit area in the north-south direction. This drainage enters the north ~~bound~~boundary of the permit area at an approximate elevation of 7,600 feet and leaves the southern bound of the permit area at an approximate elevation of 6,200 feet. This drainage essentially parallels the western edge of the Book Cliffs and flows throughout the permit area at elevations of above 6,400 feet. Little Park Wash eventually drains into the Price River about eight miles down gradient of the southern bound of the mine permit area.

Water uses within the mine permit area are limited to stock watering, mining, and domestic uses at mine sites. Sources for water within and around the Mine Permit area include various springs, ephemeral washes, Little Park Wash, Horse Canyon Creek, and one underground water well historically used for sprinkling purposes for operation and maintenance of the mine. A water rights search was conducted for the mine permit area and is included within Table 7-2.

Due to topography, limited available water resources, soil types, limited access, and remote location, it is evident that the land within the mine permit area historically has not been capable of supporting a diversity of uses. The greatest variety of compatible uses for this land is a combination of recreation, wildlife habitat, grazing, and coal mining.

411.130 According to Bryant Anderson, administrator of Emery County Planning and Zoning (Anderson, 1998), all land within the Mine Reclamation Permit area is zoned M&G-1 for mining and grazing. Grazing is the most pervasive existing use of the land in the Lila Canyon area.

The BLM is the land manager for most of the area within the permit. The permit area consists of 5,992.07 acres of which the BLM manages 4256.37 of the acres. Within the permit area, there are 1446.64 privately owned acres, and 289.06 State owned acres. Refer to Plate 4-1 for ownership boundaries.

The Turtle Canyon Wilderness Study Area (WSA) overlaps a small portion of the permit area. No surface facilities or associated impacts will occur within the WSA.

411.140. Cultural and historical resources investigations have been performed in the vicinity of the permit area in the past. Significant studies include "An Archaeological/Historical Inventory of Kaiser Steel corporation Horse Canyon Mine Lease, East Carbon County, Utah". This report was written in March 1986 by Don Southworth and Asa S. Nielson for the Mining and Reclamation Plan submitted to the Division by

Intermountain Power Agency. A cultural Resource Inventory of the Kaiser Steel Corporation South Lease Mine Property and a Test Excavation (42EM1343 in Emery County, East Central Utah conducted by Rebecca Rauch (1981). These and additional survey reports of the area are included in Appendix 4-1.

Detailed archeological ground surveys were conducted at the Lila Canyon mine site and associated disturbed area, by Montgomery Archaeological personnel. These surveys were conducted in 1998, 1999, and 2006 and are included within Appendix 4-1.

Within the Horse and Lila Canyon Permit areas and the nearby Southern portion of the Kaiser Steel Corporation South Lease mine property, there are five known historic resources that are either on or eligible for listing on the National register. There is one listed site (42EM1222) 2.5 miles from the facility area. One eligible site (42EM1343) has been recovered and another (42EM2517) will be recovered prior to construction. The other two eligible sites (42EM2255 and 42EM2256) are not expected to be impacted by operations.

411.141. Historic resources are depicted on Plate 4-3.

411.141.1 The locations of listed or eligible cultural and historical resources in the area are discussed in Appendix 4-1 and shown on Plate 4-3.

There are no publicly owned parks.

411.141.2 No cemeteries are located in or within 100 feet of the proposed permit area.

411.141.3. No land within the proposed permit area is within the boundaries of any units of the National System of Trails or the Wild and Scenic Rivers System.

411.142. Consultation efforts for cultural and historical resources are in process. Final concurrence from the SHPO will be included in this MRP prior to permit approval.

UEI will also include measures to prevent or minimize

adverse impacts to listed sites within the permit area, if sites are discovered during the consultation process.

411.143. The Operator has provided archeology survey reports. Three of these surveys included intensive survey and analysis of areas that would be directly impacted by the Lila Canyon mining operations.

Two other surveys include spot surveys and analysis of areas that are expected to have a low probability of indirect mining impacts to the surface.

411.144 Of the 22 cultural and historical sites identified in the area, only one, 42EM1222, is listed on the National Register of Historic Places. This site is approximately 2.5 miles from the Lila Canyon surface facility and therefore, impacts are not expected to occur at this site.

BLM will develop a recovery plan for 42EM2517 that will occur after mine plan approval and before construction.

411.200. Previous mining and exploration activities have occurred within the proposed permit area within the last twenty years. In the mid-1950's, the road along the bottom of Lila Canyon was constructed to allow exploration of the resources. The road intersects the Horse Canyon Highway approximately 1.4 miles to the north and loops back to the south to intersect Highway 191 and 6 to the south (see Plate 4-1). Two sealed breakouts (Plate II-2 of Horse Canyon Plan) are located in the left fork of Lila Canyon where the Lila Canyon fan was installed in the 1950's. The Lila Canyon fan was used until the closure of Horse Canyon post 1977, and therefore, the current Coal Regulatory Program has jurisdiction over this disturbance and it is included in the permit area.

411.210. Coal was removed from the outcrop of Horse Canyon and transported back through the Horse Canyon Mine. Excavation indicates only a small amount of coal was previously removed.

411.220. In the past, coal was removed from the Sunnyside Seam.

411.220. Because the old portal has been sealed, it is difficult to

ascertain the total amount of coal which had been removed.

411.240. The exact date of the coal outcrop excavations is unknown. It is believed that coal was removed during the late 1950's or early 1960's.

411.250. The land use prior to outcrop excavation was the same as currently exists within the area. Wildlife habitat, grazing, and coal exploration was previously and is currently the predominant land use in the area.

412. Reclamation Plan

412.100. Post mining land use will be the same as currently exists today, that being: wildlife habitat, grazing, and limited recreational activities.

412.110. After all mining activity has been completed and the disturbed area regraded and reseeded, the site will enter a post reclamation phase. During the first ten years, the site will be monitored for vegetative success and erosion control. The reclaimed, revegetated area may be fenced to discourage livestock grazing until final reclamation has been achieved and the reclamation bond released.

Support activities to achieve the post-mining land use plan included: site monitoring, remedial actions including regrading, reseeding, remulching and replanting; and fencing as necessary to restrict access and grazing on the site until the reclamation bond has been released.

412.120. After the reclamation bond has been released, the property will be returned to the care of the surface land owners, which, for the most part, is the BLM. Management of the site will be according to the BLM's current range management plan for the region existing at that time.

412.130. Since premining land use is the same as postmining land use this section is not applicable.

412.140. This post-mining program is in accordance with the Emery County and BLM management framework plans. See Correspondence with Emery County Zoning Administrator, Bryant Anderson, and the BLM, regarding the zoning of lands within the Lila Canyon Extension included within Appendix 4-2. A Large Scale Industrial Site Plan was required by the county for any significant mining or industrial operations. A copy of the approval for the Large Scale Industrial Site Plan can be found in Appendix 4-2.

Based on the desire expressed by the BLM and/or Emery County, at the time of reclamation of the mine site, mine personnel would agree to work with the BLM and/or Emery County to achieve future land use objectives.

412.200. A Large Site Plan Approval has been filed with Emery County regarding the plans to mine coal in the Lila Canyon area. The approval process and a copy of this application are included in Appendix 4-2. A copy of the BLM post mine land use determination can be found in Appendix 4-2.

412.300. The mine operator does not propose to leave fills containing excess spoil.

413. Performance Standards

413.100 All disturbed areas will be restored to the conditions equal to or better than existed prior to disturbance.

413.200 Wildlife habitat and grazing will resume following reclamation activities of the mine site. No alternative postmining land uses, nor higher or better uses are being proposed.

413.300. No alternative post-mining land use is being proposed at this time.

414. Premining Land use: It is the operations intent to return the mine properties to its pre-mine use. The reclamation practices to be implemented as outlined in chapter five have a proven record of

success.

420. Air Quality.

421. Compliance with the Clean Air Act: Mining and reclamation operations will be conducted in compliance with the requirements of the Clean Air Act and other applicable state, federal statues.

422. Compliance Efforts: Appendix 4-3 contains the "Intent to Approve" and the actual "Approval Order" for the air quality permit obtained from the Utah Bureau of Air Quality. The initial air quality permit is for 1.5 million tons. Revisions to the air quality permit will be made to accommodate future increases in production.

423. Since Lila Canyon Mine is an underground operation this section is not applicable.

423.100 Since Lila Canyon Mine is an underground operation this section is not applicable.

423.200 Since Lila Canyon Mine is an underground operation this section is not applicable.

424. Since Lila Canyon Mine is an underground operation this section is not applicable.

425. Since Lila Canyon Mine is an underground operation this section is not applicable.

REFERENCES

Stephens, Don, U.S. Bureau of Land Management, Federal Coal Leases Map, 1990.

Division of Water Rights, PLAT program

Emery County Recorder's Office

WordPerfect Document Compare Summary

Original document: K:\Lila\Most Recently Approved MRP Chapters\Chapter 5.wpd
Revised document: K:\Lila\2016\L16-005 New Storage Pad\Originals\Chapter 5 Edits.wpd
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Chapter 5
Engineering

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Chapter 5

500. ENGINEERING

510. Introduction

This section presents the engineering portion for the Lila Canyon Extension to the Horse Canyon Mine Reclamation Plan and is based upon previous publications, permit applications for the adjacent Sunnyside and South Lease areas and design which follows basic engineering standards. The objective of this chapter is to provide sufficient engineering design to support the mining and reclamation plan for the Lila Canyon Mine (ACT/007/013) and to satisfy the rules found in R645-301-500. All of the activities associated with the coal mining and reclamation operations are designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plan. The engineering section of the permit application is divided into the introduction, the operation plan, operational design criteria, reclamation plan, and performance standards. All design criteria associated with the operation and reclamation plans have been met.

511. General Requirements.

511.100 The permit application includes a description of the proposed coal mining and reclamation operations with appropriate maps, plans, and cross sections.

511.200 A description of the proposed mining operation and its potential impacts to the environment as well methods and calculations utilized to achieve compliance with design criteria ~~is~~are addressed within this chapter.

511.300 A description of the proposed reclamation plan is included in this chapter.

512. Certification

512.100. Cross Sections and Maps that require certification have been prepared by, or under the direction of, and certified by a qualified, registered, professional engineer, with assistance

from experts in related fields when needed. Cross Sections and Maps will be updated as needed or required by the Division. Listed below are some of the maps and cross sections that have been certified by a qualified registered professional engineer.

512.110. A map showing the extent of known existing mine workings and the approximate year mined has been included and certified by a qualified registered professional engineer and included as Plate 5-1.

512.120. All Surface facilities (temporary and long-term) and operations are shown on the appropriate maps, and have been certified by a qualified registered professional engineer.

512.130 Maps showing final surface configuration with cross sections have been included and certified by a qualified registered professional engineer. (See Plate 5-6, 5-7c, and Appendix 5-4)

512.140 Appropriate~~d~~ hydrology drawings and cross sections have been certified by a qualified registered professional engineer. (See Chapter 7)

512.150 Geologic cross sections and maps that are required to be certified, have been certified by a qualified registered professional engineer. See Chapter 6 and Plate 7-1B.

512.200 Plans and Engineering Designs which may include: Excess spoil piles, durable rock fills, coal mine waste, impoundments, primary roads and variances from approximate original contour. These Plans and Designs have been certified by a qualified registered professional engineer if appropriate.

512.210 Lila Canyon Mine is an underground operation, therefore it is anticipated that no excess Spoil will be produced. This section does not apply.

512.220 The professional engineer experienced in the design of

earth and rock fills has certified that the durable rock fill design will ensure the stability of the fill and that the fill meets design requirements.

512.230 The professional engineer experienced in the design of coal mine waste piles has certified the design of the coal mine waste disposal facility. (See Appendix 5-7)

512.240 Prudent engineering practices ~~was~~are used in the design and construction of impoundments in the permit area. The impoundment designs have been certified by a qualified registered professional engineer. (See Plate ~~7-6~~s 7-6a and 7-6b)

512.250 The professional engineer has certified the design and construction or reconstruction of primary roads as meeting the appropriate design criteria.

512.260 The operator is not requesting a variance from the approximate original contours (AOC).

513. Compliance With MSHA Regulations and MSHA Approvals.

513.100 Neither Coal processing waste dams ~~or~~nor embankments are anticipated during the term of this permit. Therefore, this section is not applicable.

513.200 Planned impoundments and sedimentation ponds do not meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a). Therefore, this section is not applicable.

513.300 Underground development waste transported to the surface, coal processing waste and excess spoil will not be disposed of underground. However, material such as overcast material, rock falls, and slope material, not transported to the surface, may be disposed of underground according to the appropriate MSHA regulations.

513.400 Refuse piles meet the requirements of MSHA, 30 CFR 77.214 and 30 CFR 77.215 and all appropriate R645 regulations. (See Appendix 5-7)

513.500 Shafts, drifts, adits, tunnels, exploratory holes, entryways or

other opening to the surface from the underground will be capped, sealed, backfilled or otherwise properly managed consistent with MSHA, 30 CFR 75.1711.

513.600 Surface water discharges into the underground mine workings is not anticipated or planned, Therefore, this section is not applicable.

513.700 Surface mining within 500 feet to an active underground mine is not planned nor anticipated. Therefore, this section does not apply.

513.800 Coal mine waste fires plans will be submitted to MSHA and the Division for their approval prior to extinguishing any coal mine waste fires. (See Appendix 5-3)

514. Inspections

All engineering inspections, except the quarterly inspections of impoundments not subject to MSHA, will be conducted by a qualified registered professional engineer or other qualified professional specialist under the direction of the professional engineer.

514.100 Lila Canyon is an underground operation and it is not anticipated that any spoil will be produced. Therefore, this section does not apply.

514.200 Refuse Piles. A professional engineer or specialist experienced in the construction of similar earth and waste structures will inspect the refuse pile during construction.

514.210 Regular inspections by the engineer or specialist will also be conducted during placement and compaction of coal mine waste materials. If it has been determined that a danger of harm exists to the public health and safety or the environment, more frequent inspections will be conducted. Inspections will continue until the refuse pile has been finally graded and revegetated or until a later time as required by the Division.

514.220 The refuse pile inspections will be performed at least quarterly throughout construction and during the

following construction periods:

514.221 In addition to quarterly inspections, an inspection will be performed during foundation preparation which includes the removal of all organic material and topsoil;

514.222 Since no under-drain or protective filter systems are planned, this section is not applicable.

514.223 In addition to quarterly inspections, an inspection will be performed during the installation of the final surface drainage systems.

514.224 In addition to quarterly inspections, an inspection will be performed after the final grading and the facility has been revegetated.

514.230 The division will be provided a certified report prepared by, or under the supervision of, the qualified registered professional engineer after each inspection. The report will certify that the refuse pile has been constructed and maintained as designed and in accordance with the approved plan and R645 Rules. This report will include statements stating the appearances of instability, structural weakness, and other hazardous conditions if found. (See Appendix 5-1)

514.240 Since protective filters and under-drain are not required in the current design criteria this section is not applicable.

514.250 Required refuse pile reports will be retained at or near the mine site in an area convenient to the resident agent and the qualified registered professional engineer. Appendix 5-1 is an example of the refuse pile inspection form.

514.300 Impoundments

514.310 A professional engineer or specialist experienced in the construction of impoundments will inspect impoundments.

514.311 During construction, inspections will be made on a regular basis, and upon completion of the pond ts. The inspections will be performed at least yearly. Inspections will continue yearly until the pond is removed or the performance bond is released.

514.312 After each inspection the qualified registered professional engineer will promptly provide to the Division, a certified report. This report will state that the impoundment has or has not been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include a discussion of any appearances of instability, structural weakness or other hazardous conditions. All so included in the report will be the depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability.

514.313 Required impoundment inspection reports will be retained at or near the mine site in an area convenient to the resident agent and the qualified registered professional engineer. Appendix 5-2 is an example of the impoundment inspection form.

514.320 Since the pond contained in the Lila Canyon Project is less than 20 feet high and stores less than 20 acre-feet of water, it is not subject to MSHA, 30 CFR 77.216. Therefore, this section does not apply.

515. Reporting and Emergency Procedures.

515.100 If a slide occurs, the operator will telephone DOGM to notify

them of the situation and recommend remedial measures to be taken to alleviate the problem. Additional remedial measures required by DOGM will be implemented.

515.200 During impoundment inspections, any potential hazards noted will be reported to DOGM, along with measures to be implemented to eliminate the hazard.

515.300 In the case of temporary cessation of operations the following will apply:

515.310 All provisions of the approved permit will be complied with during temporary cessation or abandonment.

515.311 In case of temporary cessation, the operator will support and maintain all surface access openings to underground operations, and secure surface facilities in areas in which there are no current operations, but operations are to be resumed under an approved permit.

515.312 Since Lila Canyon Mine is an underground operation, this section does not apply.

515.320 Prior to a temporary cessation of coal mining and reclamation operations which is expected to last longer than 30 days, or when a temporary cessation is extended longer than 30 days, the operator will submit to the Division a notice of intention to cease or abandon operations. The following will be included in the notice of temporary cessation.

515.321 The temporary cessation notice will contain the exact number of surface acres and the horizontal and vertical extent of subsurface strata included in the permit area. In addition, a description of the reclamation activities accomplished and activities such as backfilling regrading, revegetation, environmental monitoring, underground opening closures and water treatment activities that will continue during the temporary cessation.

515.322 Since the Lila Canyon Mine is an underground operation, this section does not apply.

516. Prevention of Slides: Since the Lila Canyon Mine is an underground operation, this section does not apply.

520. Operation Plan.

At first glance it would appear to a non-mining person that the best access to UEI's leases would be from the existing (sealed) Horse Canyon portals using the current Horse Canyon surface disturbance. However, the existing Horse Canyon site is not suitable for a large longwall operation. The old Horse Canyon Mine was not designed to produce 4.5 million tons as will be Lila. Some strategic pillars in the old mains were extracted upon retreat preventing any future access. The number of entries in the old works ~~are~~is not adequate for ventilation purposes. Portions of the old mine are flooded preventing reentry. The distance from the old portals to the current leases would result in unacceptable travel times for crews and supplies. Rehabilitating and maintaining an old mine is extremely hazardous and expensive. As a result of the conditions described above it has been determined that new portals at the Lila Canyon site ~~is~~are the most logical and only feasible access to the permittee's coal leases.

Lila Canyon Current Temporary / Long-term Mine Facilities List
~~Lila Canyon Mine~~

~~A list of final~~Current temporary and long-term structures and facilities are shown on Plate 5-2. The Keyed Mine Facilities from Plate 5-2 are numbered as follows:

Buildings

~~1) Office/Bathhouse~~
~~2) Shop/Warehouse~~
~~3) Security Shack~~

1) Temporary Bath House
2) Temporary Office Trailer
3) Temporary Office / Shop Building
4) Temporary Storage Shed (Wooden)

5) Temporary Storage Building (Metal)
7) Temporary Office Building
9) Temporary Storage Tent with concrete floor
22) Temporary Crusher/Screen Building

Utilities

4) Mine Substation
5) Surface Power Lines
6) Water Treatment Plant
7) *No Number Mine Substation*
8) Potable Water Tank
8) Process Water tank
9) Sewer Tank
10) Drain Field10) Power Poles
11) Electrical Transformer
12) Overhead Power Transmission Lines
13) Buried Power Transmission Lines
28) Electrical Grounding Field
37) Non-Potable Water Storage Tanks
40) Concrete Electrical Junction Box
41) Temporary Concrete Septic Tank

Mine Facilities

11) Ventilation Fan
12) 60-inch Conveyor from tunnels to Coal Stockpile
13) (ROM) Underground Belt from Stockpile to Crusher
14) 48-inch Conveyor from Crusher to Loadout Bin
15) Drop from Loadout Bin to Truck Loadout
16) Reclaim Tunnel, Escape Tunnel, Fan and Fan House
17) ROM Storage Pile, Coal Stacking Tube, 30 ton 14) Rock Dust Silo
18) Crusher Screen Plant
19) Truck Scale and Loadout
20) Coal Loadout Storage Bin
21) Guardrails
22) Underground Pipes
23) Chain Link Fence
16) Temporary Underground Reclaim Room
17) Temporary Concrete Retaining Wall
18) Temporary Loadout Conveyor (48")

19) Temporary Loadout MCC Building
20) Temporary Loadout Structure
21) Temporary Crusher Conveyor (48")
23) Temporary Crushed Coal Conveyor (48")
24) Temporary Crusher MCC Building
27) Concrete Equipment Pad
30) Existing ROM Coal Conveyor from Underground (60")
31) Steel Portal Canopy Structure
32) Concrete Conveyor Bay at Belt Portal
34) Mine MCC Building / Electrical Tower
35) Backup Ventilation Fans
36) Main Mine Ventilation Fan / Electrical Tower
39) Chain Link Fencing
43) Temporary Conveyor Counterweight Structure
44) Jersey Barrier Guard Rails
45) Concrete Trash Chute

Support Facilities

~~24) Non-Coal Waste Area~~
~~25) Equipment & Supplies Storage Area~~
~~26) Topsoil Pile~~
~~27) Refuse Pile~~
~~28) Sediment Pond~~
~~29)~~ *No Number* *Mine Facilities Access Road / Truck Loadout Road*
No Number *Rock Slopes*
No Number *Sediment Ponds*
No Number *Slope Access Road / Portal Access Road*
~~*30) Rock Slopes*~~
~~*31) Mine Facilities Road / Truck Loadout Road*~~
~~*32) Office/Bathhouse/Warehouse Asphalt Parking Area*~~
~~*33) Mine Parking*~~
~~*34) Fuel Tanks*~~
~~*35)*~~ *No Number* *New Storage Pad*
No Number *New Storage Pad Access Road*
No Number *New Storage Pad Service Road*
No Number *Topsoil Pile*
6) Temporary Concrete Walkway
15) Temporary Fuel Storage Tanks
25) Diversion Weir with Slide Gates
29) Sediment Pond Spillway Structure
42) Temporary Loadout Light Board
38) Powder and Cap Magazines

Note: Long-Term Underground Pipes are not shown.
36) Note: Culvert locations are shown on Plate 7-25.

A description of newcurrent temporary and long-term structures and facilities:

BUILDINGS

Office/Bathouse **1) Temporary Bath House**

The office and bathhouse buildingtemporary bath house is shown on Plate 5-2. This building will jointly house all support personnel such as accounting, administration, engineering, and safety and will provide a comfortable office environment for all employees. Bathhousecomplex is made up of five (5) interconnected portable structures (trailers and metal intermodal structures). Shower and toilet facilities will be found for all male employees are at this location. Female employees utilize a separate, nearby temporary trailer for showers and toilet facilities (see #2 below). The bathhouse will proved forbath house provides a location for underground miners to change from clean street clothes to clothing suitable for underground use. The area will provedprovides showers for employees for use after their scheduled work shifts so they can cleanupclean up prior to returning home. Both the bathhouse and office buildings will be of prefab construction and will rest on a concrete pad. The pad dimensions will be approximately 150' by 100' by 12". The facility will be designed to accommodate up to 200 employees working rotating shifts.

Shop Warehouse

The shop warehouse buildingThe trailers and metal intermodal structures rest upon stacked concrete blocks for stability and leveling purposes. Once the long-term bath house (per Plate 8-1) is constructed, the temporary bath house and all supporting structures will be removed.

2) Temporary Office Trailer

The temporary office trailer is a prefabricated, self-contained, modular trailer, similar to those often seen on construction sites. The trailer can be moved using a vehicle with a tow hitch. Each trailer typically contains two (2) or three (3) offices and one (1) restroom. Each trailer is equipped with a waste water storage tank for the rest room. The waste water storage tank is

emptied on a regular basis. One (1) temporary office trailer has been modified to provide shower and toilet facilities for female employees similarly to the temporary bath house (see #1 above). The office trailers are used by mine personnel in support positions to mine operations. Multiple trailers are currently used. The locations of these trailers are shown on Plate 5-2. Once long-term office areas are constructed, the temporary office trailers and all supporting structures will be removed.

3) Temporary Office / Shop Building

The Temporary Office / Shop Building is shown on ~~p~~Plate 5-2. ~~Parts and supplies consumed during the mining process will be stored in the warehouse to be issued as needed. The shop area will be~~The building is a prefabricated metal building on a concrete foundation system, with a 4" thick concrete floor slab. The building is split down the middle width-wise with one side being the shop area, and the other office space for mine personnel in support positions to mine operations. The shop area is used to perform minor equipment repairs~~ and overhauls. The shop warehouse will be a prefab modular type building approximately 100' by 150' and will rest on a 4" concrete pad.~~

~~**Security Shack**~~

~~The Security Shack shown of Plate 5-2, when used will provide security to the mine site. The security shack will be used primarily at times when the mine is not in production. Security may be provided to protect the public from hazards associated with a mine site and to protect company property from unauthorized use. The security shack will be~~. The building measures approximately 30' by 62'. Once long-term offices and the long-term Shop/Warehouse have been constructed, the temporary office / shop building will be razed.

4) Temporary Storage Shed (Wooden)

The temporary wooden storage shed measures approximately 10' by 20' by ~~8`~~ ~~and will be of prefab construction and will rest on a 4"~~8' high, with a wooden floor structure. The shed is used to store various equipment and supplies needed for mine operations. Multiple sheds are currently used. The locations of these sheds are shown on Plate 5-2. Once the long-term Shop/Warehouse has been constructed, the temporary storage sheds will be removed.

5) Temporary Storage Building (Metal)

The temporary metal storage building is a prefabricated, metal, intermodal

container used for storage. These structures are sometimes referred to as "conex containers." The containers are typically 20' to 40' long by 8' wide by 8.5' high. These structures are used to store various equipment and supplies needed for mine operations. The metal storage structures typically provide a higher level of security than do wooden sheds. Multiple metal storage buildings are currently used. The locations of these buildings are shown on Plate 5-2. Once the long-term Shop/Warehouse has been constructed, the temporary storage buildings will be removed.

7) Temporary Office Building

The temporary office / storage building is shown on Plate 5-2. The office space is used by mine personnel in support positions to mine operations. The building measures 20' by 12' by 10' high. The building is a wood frame on a concrete foundation. The floor is a 4" thick concrete slab.

Once the long-term office areas and Shop/Warehouse have been constructed, the temporary office building will be razed.

9) Temporary Storage Tent with Concrete Floor

The temporary storage tent is constructed of an arched metal wall/roof structure covered with a canvas overlay. The tent rests on a 6" concrete floor slab. Two tents are currently in use at the mine site. One tent measures 30' by 30'. The other measures 70' by 48'. The tents are used to store large wares and supplies needed for mining operations that need some protection from the weather. The temporary storage tents with concrete floors are shown on Plate 5-2. Once the long-term Shop/Warehouse has been constructed, the temporary storage tents and associated concrete floor slabs will be removed.

22) Temporary Crusher / Screen Building

The temporary crusher / screen building is shown on Plate 5-2, and houses the screen and crusher assemblies. The screen assembly sorts the coal as it enters the building, via the temporary crusher conveyor (see #21 below), between the larger lump sizes that need to be crushed (2"-8" in size) and the smaller nuggets that do not need to be crushed (less than 2" in size). The crusher assembly reduces the larger 2" to 8" sized coal lumps to nuggets measuring less than 2" in size. The coal that is now 2" or less in size falls onto the crushed coal conveyor (see #23 below) and exits the building. The building itself is constructed of a wide flange steel frame and rests on a 12" thick monolithic concrete slab base. The building measures approximately 48' by 22', and stands approximately 58' at its peak. The temporary crusher / screen building has been constructed to meet MSHA regulations. Once the long-term coal handling facilities have been constructed, the temporary crusher / screen building will be razed.

UTILITIES

Mine Substation

The mine substation ~~will be located as~~is shown on Plate 5-2~~ will proved~~, and provides power to surface and underground areas of the mine property. The substation ~~will comprise of~~includes approximately four transformers setting on a concrete pad approximately 20' by 20' by 12" and fully fenced. The total fenced area of the substation is approximately ~~40'~~215' by ~~40'~~112'. Power ~~will be~~is fed into the transformers at ~~46~~138 KVA and will be transformed down to usa~~g~~ble voltages for both the surface and underground facilities. It is anticipated that voltages of 110V, 220V, 440V will be used on the surface, and 12,470 volts will be utilized underground. The mine substation ~~will be~~is constructed~~ in a way~~ to fulfill all appropriate MSHA regulations.

~~Underground Power Lines~~

~~Within the disturbed area both surface and underground power lines will be utilized. Underground lines will be run where feasible. As builds will be provided. Underground Power Lines will be left in place upon reclamation.~~

~~Water Treatment Plant~~

~~The water treatment plant is located on the north-east side of the surface facility area. The plant will rest on a 15' by 15' slab. Process water will flow through the treatment plant at which time it will be treated and made suitable for potable water uses. The potable water will be stored in the potable water tank until it is used. The location of the water treatment plant can be found on Plate 5-2.~~

The Mine Substation will remain throughout the life of the mine, and will be removed during final reclamation.

8) Potable Water Tank

~~Water treated by the water treatment plant and intended to be used as potable water will be~~ The potable water tank is shown on Plate 5-2. Potable water is purchased off-site and is transported to the mine site via

tanker truck, which in turn fills the tank. The potable water is stored in this 15' diameter by 20' high tank. The tank willmetal tank. Water from this tank is used for toilets and showering in the temporary bath house (see #1 above). The tank is set on a 15' by 15' concrete pad designed for adequate support of the tank. The location of the potable water tank can be found on Plate 5-2.

Process Water Tank

Process water, water to be used for mine use or to be treated for potable use, will be stored in this tank. The 15' diameter by 20' high process The potable water tank will rest on a 15' by 15' concrete pad. Process water tank will be filled by using mine discharge water or may be hauled in from off site. The location of the process water tank can be found on Plate 5-2.

Sewer Tank

The sewer tank has been designed to facilitate 200 employees working on rotating shifts. The sewer tank will be located under the south end of the office and bathhouse parking area. The location of the sewer tank can be foundremain throughout the life of the mine, and will be removed during final reclamation.

10) Power Poles

Multiple wooden power poles are utilized throughout the disturbed area. Locations of power poles are shown on Plate 5-2. The design for the Sewer Tank can be found in Appendix 5-4.

Drain Field

The drainpower poles are large, upright wooden poles used to support overhead power transmission lines and other wires as needed. The power poles will remain throughout the life of the mine and will be removed during final reclamation.

11) Electrical Transformer

An electrical transformer is used to adjust and transfer electrical energy in electric power applications. Each transformer rests on a 4" thick concrete

slab of suitable size to support the weight of the transformer. The transformer feeds various mine facilities. Multiple transformers are currently utilized. Their locations are shown on Plate 5-2. Transformers will be removed as their respective temporary facilities are removed and replaced upon the completion of long-term facilities (see Plate 8-1).

12) Overhead Power Transmission Lines

Within the disturbed area, both overhead and underground power lines will be utilized. Overhead power lines will be run where underground power lines are not feasible. Vertical power poles (see #10 above) support the overhead lines to provide adequate and safe clearances below the power transmission lines. The overhead power transmission lines have been spaced to protect raptors. As-built drawings will be provided upon completion of the long-term surface facilities. Overhead power lines will be remain through the life of the mine, and will be removed upon final reclamation.

13) Buried Power Transmission Lines

Within the disturbed area both overhead and buried power lines will be utilized. Buried power transmission lines will be run where feasible. All buried power transmission lines will be run in conduits. As-built drawings will be provided upon completion of the long-term surface facilities. Long-term underground power lines will remain throughout the life of the mine. Upon final reclamation, the long-term underground power transmission lines will be abandoned and left in place.

28) Electrical Grounding Field

The electrical grounding field is composed of a grounding grid and rods buried below the soil. The electrical grounding field has been designed ~~to facilitate 200 employees working on rotating shifts The drain field will be located at a lower elevation and south of the sewer tank~~and constructed to meet MSHA requirements and regulations. It is used to ground the Mine Substation (see above). The location of the ~~drain field can be found on Plate 5-2. The design for the drain field can be found in Appendix 5-4.~~

~~**Ventilation Fan**~~

~~The ventilation fan will be located on #0 Portal. The location of the portal and fan~~electrical grounding field is shown on Plate 5-2.

~~60-inch Conveyor from tunnels to Coal Stockpile(Main Conveyor)~~

~~The Run of Mine underground belt will provide for a means for coal to be conveyed from the working faces to the run of mine coal storage pile on the surface. The belt will provide capacity to convey to the surface, all coal mined in the underground workings. Preliminary design suggests that the conveyor that extends from the bottom of the rock slopes to the stacking tube at the coal storage area, shown on Plates 5-2 and 5-8, will have the following specifications: 60" wide, speed approximately 700 fpm with a length of approximately 810 feet long. Since the ground beneath the conveyor will not be disturbed due to the steepness and remoteness of the area, this conveyor will be completely contained within a tube type structure.~~

~~(ROM) Underground Belt from Stockpile to Crusher/ Screen~~

~~The Reclaim conveyor will provide for a means for coal to be conveyed from the coal stockpile to the crusher. The belt will provide capacity to convey to the screen and crusher at a suitable rate for crushing and screening. Preliminary design suggests that the reclaim conveyor, shown on Plates 5-2 and 5-8, will have the following specifications: 60" wide, speed approximately 700 fpm with a length of approximately 670 feet long. The portions of the conveyor running on the surface will be covered.~~

~~60-inch Conveyor from Crusher to Loadout Bin~~

~~The Loadout conveyor will provide for a means for coal to be conveyed from the crusher to the loadout bin. The belt will provide capacity to convey to the loadout at the same rate as the Reclaim conveyor. Preliminary design suggests that the Loadout conveyor, shown on Plates 5-2 and 5-8, will have the following specifications: 60" wide, speed approximately 500 fpm with a length of approximately 230 feet long. The portions of the conveyor running on the surface will be covered.~~

~~**Drop from Loadout Bin to Truck Loadout**~~

~~Coal will be dropped from the loadout bin to the trucks being loaded. The drop rate will provide capacity to the trucks at a rate suitable for truck loading.~~

~~**Reclaim Tunnel, Escape Tunnel, Fans**~~

~~Design for the escape and reclaim tunnels is not complete. Standard practice is to construct the tunnels from either concrete or corrugated metal. The reclaim tunnel is approximately 350' long with a 14' diameter. The escape tunnel will be approximately 300' long with a diameter of 4'. Appropriate safety and environmental concerns will be addressed upon detailed design. The preliminary layout~~ The electrical grounding field will remain throughout the life of the mine, and will be removed during final reclamation.

37) Non-Potable Water Storage Tanks

Three non-potable water storage tanks are used to store water for mine-related purposes including dust suppression on roadways and other points as required by the approved Air Quality Order. The location of the non-potable water storage tanks is shown on ~~Plates 5-2 and 5-8.~~

~~**ROM Storage Pile**~~

~~The run of mine storage pile receives coal directly from the underground works and provides storage for the coal until it is crushed and loaded into trucks~~Plate 5-2. The non-potable water storage tanks will remain throughout the life of the mine, and will be removed upon final reclamation.

40) Concrete Electrical Junction Box

The location of the concrete electrical junction box is shown on Plate 5-2. The concrete electrical junction box is a buried 6' by 6' by 6' concrete box with 6" thick walls, top and floor. A steel manhole allows access to the interior of the box. Within the junction box, high-voltage connections are made that allow power to be transferred from the Mine Substation to the overhead power lines. The concrete electrical junction box will remain throughout the life of the mine, and will be removed upon final reclamation.

41) Temporary Concrete Septic Tank

The temporary concrete septic tank facilitates the existing employees working

on rotating shifts. The tanks are used in conjunction with the tanks that are a part of the bath house trailer (see #1 above) and other temporary office trailers (see #2 above). The tanks will be pumped out regularly. Multiple tanks are currently used. The locations of these tanks are shown on Plate 5-2. The temporary concrete septic tanks will be removed upon the completion of the long-term office areas and long-term bath house facilities.

MINE FACILITIES

14) Rock Dust Silo

The Rock Dust Silo is a tower silo used to store bulk rock dust for use within the mine. Rock dust is used to reduce the combustible fraction of coal dust in the air within the mine. The silo is constructed of a steel container supported by a steel frame on a concrete foundation with a 6" thick concrete pad and apron. The rock dust silo will remain throughout the life of the mine, and will be removed during final reclamation.

16) Temporary Underground Reclaim Room

The temporary underground reclaim rooms form a portion of the temporary coal handling facilities for the mine. The reclaim rooms are buried concrete and steel structures, measuring approximately 20' by 17' by 17' high. The floor, roof, and all walls, except one (1) wall, are constructed of steel reinforced concrete. The remaining wall is constructed of plate steel and steel angles, with an opening for a tubed conveyor structure. The roof of the structure has an opening and gate that allows coal to fall from the bottom of the stockpile above onto a conveyor belt for transportation to ~~a unit train loadout. The coal from the underground run of mine belt will be dropped into a stacking tube located in the center of the run of mine storage pile. This tube will help reduce any fugitive dust. The stacking tube will be approximately 80' high and will allow for approximately 200,000 tons of open storage in the run of mine storage pile. A 30 ton rock dust bin will be located in this area. The run of mine storage pile is shown on Plates 5-2 and 5-8.~~

~~**Crusher**~~

~~The enclosed crusher will crush coal from the 8" minus down to a 2" minus size, at the rate of approximately 1000 tons per hour. The coal will be first screened then the oversized will be crushed. Crushed coal will be stored temporarily in a 500 ton storage bin located above the truck loadout. The crusher and screen locations are shown in Plates~~

~~5-2 and 5-8.~~

~~**Truck Scale and Loadout**~~

~~Coal will be reclaimed from the coal storage bin, weighed and then loaded into coal haul trucks for transportation to the various unit train loadouts. A small loadout shack will be constructed to provide cover and protection for the various equipment and controls need for the coal loading process. The truck scale and loadout~~either the Crusher Building or Loadout Structure. Two (2) temporary underground reclaim rooms are currently in use. These structures are shown on Plate~~s~~ 5-2~~ and 5-8.~~

~~**Coal Storage Bin**~~

~~The coal storage bin is part of the truck loadout and is shown of Plate 5-2. The coal storage bin is where crushed coal is stored waiting to be loaded into coal haul trucks. The bin provides for surge capacity and allows for better control of crushing time. The coal storage bin provides for a enclosed dry location for temporary~~. At the completion of the long-term coal handline facilities' construction, the rooms will be filled with rocks and other backfill material, then left in-place after final reclamation.

17) Temporary Concrete Retaining Wall

The temporary concrete retaining walls form a portion of the temporary coal handling facilities for the mine. The walls are constructed of steel reinforced concrete, and provide support for conveyor assemblies emanating from the temporary underground reclaim rooms (see #16 above). Two (2) temporary concrete retaining walls are currently in use. These structures are shown on Plate 5-2. At the completion of the long-term coal handling facilities' construction, the temporary concrete retaining walls will be razed.

18) Temporary Loadout Conveyor (48")

The temporary loadout conveyor is a portion of the temporary coal handling facilities for the mine. The temporary loadout conveyor moves crushed coal from the temporary underground reclaim room (see #16 above) below the crushed coal storage~~. Coal is delivered from the crusher to the coal storage bin by use of a 60" covered surface conveyor running at a speed of approximately 700 FPM. The preliminary layout~~ pile to the top of the temporary loadout structure (see #20 below) in order to fill coal haulage trucks. The conveyor structure is a steel framework running a 48" conveyor belt. A large portion of the conveyor is contained within a 9' diameter steel plate tube that extends underground to the temporary underground reclaim room (see #16 above). The temporary loadout conveyor is shown on ~~Plates 5-2 and 5-8.~~

~~**Coal Stacking Tube.**~~

~~The final design for the coal stacking tube is not yet complete. Preliminary design indicates that the stacking tube will be approximately 15' Diameter and approximately 80 feet high. Standard practice is to construct the tube of either concrete or steel. The preliminary layout~~Plate 5-2. At the

completion of the long-term coal handling facilities' construction, the temporary loadout conveyor will be removed.

19) Temporary Loadout MCC Building

The temporary loadout MCC building is a portion of the temporary coal handling facilities for the mine. The building is the Motor Control Center (MCC) for the temporary loadout conveyor (see #18 above). The structure is a steel plate building measuring approximately 6' by 16' by 8' tall. The electrical control for the conveyor motor and other electrical components for the temporary loadout assembly are housed within the MCC building. The temporary loadout MCC building is shown on ~~Plates 5-2 and 5-8.~~

~~**Culverts**~~

Plate 5-2. At the completion of the long-term coal handling facilities' construction, the temporary loadout MCC building will be removed.

20) Temporary Loadout Structure

The temporary loadout structure is a portion of the temporary coal handling facilities for the mine. The loadout structure is a wide flange steel-framed structure on a concrete foundation system, with a 6" thick concrete pad and apron. The top of the structure supports the motor that drives the temporary loadout conveyor (see #18 above). Coal is transferred, via the temporary loadout conveyor, from the crushed coal stockpile to the top of the loadout structure, where it falls through a spreader assembly into coal haulage trucks below for delivery off-site. The temporary loadout structure is shown on Plate 5-2. At the completion of the long-term coal handling facilities' construction, the temporary loadout structure will be removed.

21) Temporary Crusher Conveyor

The temporary crusher conveyor is a portion of the temporary coal handling facilities for the mine. The temporary crusher conveyor conveys coal from the temporary underground reclaim room (see #16 above) below the ROM coal stockpile to the temporary crusher / screen building (see #22 above) for sorting and crushing. The conveyor structure is a steel framework running a 48" conveyor belt. A portion of the conveyor is contained within a 9' diameter steel plate tube that extends underground to the temporary underground reclaim room (see #16 above). The temporary crusher conveyor is shown on Plate 5-2. At the completion of the long-term coal handling facilities' construction, the temporary crusher conveyor will be

removed.

23) Temporary Crushed Coal Conveyor (48")

The temporary crushed coal conveyor is a portion of the temporary coal handling facilities for the mine. The temporary crushed coal conveyor conveys coal from the temporary crusher / screen building (see #22 above) that has been sorted and crushed on the Upper Pad to the crushed coal stockpile on the Middle Pad. The conveyor structure is a steel framework, supported by steel bents on concrete foundations, running a 48" conveyor belt. The temporary crushed coal conveyor is shown on Plate 5-2. At the completion of the long-term coal handling facilities' construction, the temporary crushed coal conveyor will be removed.

24) Temporary Crusher MCC Building

The temporary crusher MCC building is a portion of the temporary coal handling facilities for the mine. The building is the Motor Control Center (MCC) for the temporary crusher / screen building (see #22 above). The structure is a steel plate building measuring approximately 6' by 16' by 8' tall. The electrical control for the conveyor motors and other electrical components for the temporary crusher / screen building are housed within the MCC building. The temporary crusher MCC building is shown on Plate 5-2. At the completion of the long-term coal handling facilities' construction, the temporary crusher MCC building will be removed.

27) Concrete Equipment Pad

The concrete equipment pad is a portion of the temporary coal handling facilities for the mine. The pad is a 12" thick, steel reinforced concrete slab. The drive motor and take-up equipment for the temporary crushed coal conveyor (see #21 above) rest upon this concrete pad. The concrete equipment pad is shown on Plate 5-2. The concrete equipment pad will remain until final reclamation, at which point it will be buried with other concrete materials as described in the Reclamation Plan.

30) Existing ROM Coal Conveyor from Underground (60")

The ROM (Run of Mine) coal conveyor from underground is a part of the temporary AND long-term coal handling facilities for the mine. The ROM coal conveyor from underground ties into the coal conveyor system within the underground mine workings to convey mined coal from the working face to the surface. The surface portion of the ROM coal conveyor measures approximately 300' long. The assembly is a steel framework, supported by steel bents on concrete foundations, running a 60" conveyor belt. The ROM coal conveyor from underground is shown on Plate 5-2. The existing ROM coal conveyor from underground will remain through the life of the mine. The

alignment and elevation of the conveyor structure are such that when the long-term coal handling system is constructed, the existing ROM coal conveyor structure will be extended to the future ROM coal stacking tube as shown on Plate 8-1. The entire assembly (existing and future) will be removed upon final reclamation.

31) Steel Portal Canopy Structure

A steel portal canopy structure is constructed at each portal of the mine. The canopy consists of steel wide flange posts and beams, and sheathed with steel plate. The canopy structure protects the portals (openings) to the underground workings. The canopies are constructed to meet MSHA regulations. Multiple steel portal canopy structures are utilized for the mine. The locations of the steel portal canopies are shown on Plates 5-2 and 5-2a, and in Appendix 5-9. The steel portal canopy structures will each remain throughout the life of the mine, or until its respective portal is no longer necessary and is sealed and reclaimed; whichever comes first. All remaining steel portal canopy structures will be removed during final reclamation.

32) Concrete Conveyor Bay at Belt Portal

The concrete conveyor bay at the belt portal is a portion of the temporary AND long-term coal handling facilities for the mine. The bay was originally used to house the belt drive for the original ROM conveyor structure, which has since been removed. The concrete conveyor bay now cradles and supports the westernmost end of the ROM coal conveyor from underground (see #30 above) at the surface. The concrete conveyor bay is shown on Plate 5-2. The concrete conveyor bay will remain in place for the life of the mine, and will be removed upon final reclamation.

34) Mine MCC Building / Electrical Tower

The Mine MCC (Motor Control Center) building is the main hub for electrical power running from the surface to the underground mine workings. Nearly all power to the underground mine equipment runs through this 21' by 12' by 11.5' tall, steel plate building. The Mine MCC building shares a concrete foundation with an electrical tower that is approximately 45.5' tall, and constructed of 10"x10" tube steel. The electrical tower receives overhead power lines extending from the Mine Substation (see above). Some power lines extend to the Main Mine Ventilation Fan (see #36 below), but most power runs to a transformer at the base of the tower, then into the Mine MCC Building for distribution to the underground mine workings. The Mine MCC Building, Electrical Tower and transformer all share a common poured concrete foundation. The Mine MCC Building / Electrical Tower assembly is shown on Plate 5-2. The Mine MCC Building / Electrical Tower will remain through the life of the mine, and the entire assembly and foundation will be

removed upon final reclamation.

35) Backup Ventilation Fans

The original ventilation fans for the mine remain in-place on a concrete foundation. These fans are attached to Portal #0. When the main mine ventilation fan (see #36 below) came online, the original ventilation fans became the backup ventilation fans. The backup ventilation fans are 250 horsepower fans that will blow fresh air into the mine's underground workings in the event that the main mine ventilation fan (see #36 below) fails. The backup ventilation fans are shown on Plate 5-2. The backup ventilation fans and their respective concrete foundation will remain in-place through the life of the mine, and will be removed at final reclamation.

36) Main Mine Ventilation Fan / Electrical Tower

The main mine ventilation fan is a 1,500 horsepower blowing fan, located on the ledge that is the exposed top of the Sunnyside Sandstone, at the North Breakout of the underground workings. The fan's purpose is to blow fresh air into the underground mine workings for mine personnel throughout the mine, and to ventilate all open areas within the mine. The fan blows into Portal #2 of the North Breakout. The main mine ventilation fan rests on a poured concrete foundation that it shares with a 35' tall electrical tower, similar to the electrical tower at the Mine MCC Building (see #34 above). Overhead power transmission lines (see #12 above) extend from the Mine MCC Building/Electrical tower (see #34 above) to provide power for the main mine ventilation fan. The main mine ventilation fan and associated concrete pad and electrical tower have been constructed to meet MSHA regulations and requirements. The location of the Main Mine Ventilation Fan is shown on Plate 5-2. The fan, electrical tower and concrete foundation will remain throughout the life of the mine, and will be removed upon final reclamation.

39) Chain Link Fencing

Six foot high chain-link fencing has been, and will be installed as shown on Plate 5-2. The fencing will be constructed to protect the public and wildlife from the Mine Substation (see above) and along sections of County Road RS-2477, along the western edge of the permit boundary. The fencing will remain throughout the life of the mine, and will be removed upon final reclamation.

43) Temporary Conveyor Counterweight Structure

The temporary conveyor counterweight structure adds weight to conveyor belts to keep them taut during operation. The Temporary Loadout Conveyor (see #18 above) and the Temporary Crusher Conveyor (see #21 above) each have a temporary conveyor counterweight structure. The structure is

constructed of a steel framework that guides the counterweight for the respective conveyor. The structure rests on a 12" thick, steel reinforced concrete slab. The locations of the temporary conveyor counterweight structures are shown on Plate 5-2. Upon the completion of the long-term coal handling facilities' construction, the temporary conveyor counterweight structures will be removed.

44) Jersey Barrier Guard Rails

A Jersey Barrier is a prefabricated, modular concrete barrier used to guide vehicular traffic and minimize damage in cases of incidental contact. When placed end-to-end, these barriers prevent vehicles from running off designated roadways. Jersey barrier guard rails are installed according to MSHA requirements. The locations of the jersey barrier guard rails are shown on Plate 5-2. The jersey barrier guard rails will be utilized throughout the life of the mine and will be removed upon final reclamation.

45) Concrete Trash Chute

The concrete trash chute is used for deposition and storage of trash until the refuse can be hauled to a nearby State-approved solid waste disposal area (landfill). The trash chute is constructed of concrete walls and floor; open at one end to allow for vehicles to dump and remove trash as necessary. Chain link fencing will be stretched horizontally across a portion of the top of the chute to prevent the wind from blowing lighter pieces of trash out of the enclosure. The location of the Concrete Trash Chute is shown on Plate 5-2. The concrete trash chute will remain through the life of the mine, and will be removed upon final reclamation.

SUPPORT FACILITIES

Mine Facilities Access Road / Truck Loadout Road

The mine facility road, shown on Plate 5-2, begins at the edge of County Road 164 (Lila Canyon Road), and allows for access to the Lower Pad and the temporary loadout structure (see #20 above). The road has been located in the most practical location taking into consideration grade, stability, and alignment. Employees will use this road to access the office & bathhouse facilities on the Lower Pad. Coal haul trucks use this road to access the temporary truck loadout (see #20 above) on the Middle Pad. All supplies will be hauled on a short portion of this road from the Lower Pad and Storage Area Pad to the slope access road. The road is paved with crushed granite and is regularly watered with a sprinkler system in order to minimize dust and provide a good surface for heavy truck traffic, as well as facility access. The facility access road is approximately 30' wide to provide for two-lane traffic,

and has the appropriate drainage controls to insure long term life and low maintenance. The road has been constructed according to the appropriate R645-534 and R645-527 regulations. The road will remain throughout the life of the mine, and will be removed upon final reclamation.

Rock Slopes

Access to the underground workings of the Lila Canyon Mine is provided through two rock slopes driven from the top of the Mancos shale, sloping up to the intersection of the coal seam. One portal provides access for men, equipment and material to the mine. The second access slope contains the underground portion of run-of-mine belt line that attaches to the existing ROM Coal Conveyor from Underground at the surface (see #30 above) that transports mined coal to the run of mine stock pile at the Upper Pad. The two rock slopes incline upward at approximately 12%, from a starting elevation of approximately 6150'. The intersection of the coal seam and the rock slope takes place at approximately the 6,300 feet elevation. The lengths of the slopes were minimized by taking advantage of the coal seam dip which is approximately 12% to the east. The rock material removed from the slopes has been used as fill material for the pads of the surface facilities. The rock slope material / underground development waste contains mostly shale, sandstone and mudstone. Traces of coal may be found, but the amount is insignificant. There are no known coal seams or significant rider seams found below the Sunnyside Seam in the Lila Canyon Portal Area. The rock slope and rock slope material fill locations are shown on Plate 5-2. The rock slopes will be sealed at the portals according to MSHA regulations at the completion of mining operations, and reclaimed per the Reclamation Plan.

Sediment Ponds

The sediment ponds have been designed to provide for adequate sediment protection for the project area. Surface water running off disturbed areas will be routed into the sediment ponds. The sediment ponds have been designed according to the appropriate R645 regulations, and the designs can be found in Appendix 7-4, and Plates 7-6a and 7-6b. Because the sediment ponds do not meet the requirement of 30 CFR 77.216(a), an MSHA number for the sediment ponds is not required. Sediment Pond #1 is located on the southwest corner of the property. Sediment Pond #2 is located on the northwest corner of the property. Both ponds are shown on Plate 5-2. Please refer to Chapter 7 for detailed information on drainage reporting to both ponds. Both sediment ponds will remain through the life of the mine, and will be removed during final reclamation according to the approved reclamation plan.

Slope Access Road / Portal Access Road

The slope access road connects to the facility access road near the northeast corner of the Middle Pad, and follows an alignment that takes into consideration grade and direct access. The slope access road is used to provide access to the rock slopes (see above), which in-turn provides access to the underground workings. The slope access road is used as access for all men, material and equipment needed within the mine. Since the slope access road provides for frequent access for men, equipment and materials for a period of six months or longer, the slope access road is classified as a primary road and will be paved. The slope access road has been designed, constructed, and maintained according to appropriate R645 regulations. The slope access road is shown on Plate 5-2. The slope access road will remain throughout the life of the mine, and will be removed during final reclamation.

New Storage Pad

A new supply and materials storage pad will be constructed directly south of the Mine Substation (see above), but within the existing disturbed boundary line as shown on Plate 5-2. The new pad will be constructed similarly to the existing Lower, Middle and Upper Pads. The new storage pad is needed so large trucks delivering and/or collecting materials and supplies will not congest the parking and supply areas already in-place on the Lower Pad, or interfere with the Mine Facilities Access Road / Truck Loadout Road (see above) and trucks preparing to load coal or loaded trucks hauling coal from the mine site. Moving the delivery trucks to the new storage pad will reduce vehicular congestion, and decrease the possibility of accidents resulting from said congestion. The new storage pad will be utilized throughout the life of the mine, and will be reclaimed per the Reclamation Plan.

New Storage Pad Access Road

The new storage pad access road will extend from the Middle Pad to the New Storage Pad (see above), which lies just south the Mine Substation (see above). The new storage pad access road will be used to provide access between the two pads for mine personnel, equipment and supplies. Since the new storage pad access road will provide access for men, equipment and materials for a period of six months or longer, the new storage pad access road is classified as a primary road, and will be paved. The new storage pad access road has been designed and will be constructed and maintained according to appropriate R645 regulations. The new storage pad access road is shown on Plate 5-2. The new storage pad access road will remain throughout the life of the mine, and will be removed upon final reclamation.

New Storage Pad Service Road

The new storage pad service road, shown on Plate 5-2, will begin at the edge of County Road 164 (Lila Canyon Road), and will allow for access to the new

storage pad (see above) directly south of the Mine Substation (see above). The first approximately 350 feet of the new storage pad service road from County Road 164 (Lila Canyon Road) will be a reworking of the existing County Road RS-2477. The new storage pad service road will then continue to the new storage pad (see above). The new storage pad service road will be approximately 30 feet wide and provide access for trucks to deliver and/or collect supplies, materials or equipment related to mine activities, without increasing congestion on the mine facilities access road / truck loadout road (see above). Since the new storage pad service road will provide access for men, equipment and materials for a period of six months or longer, the new storage pad service road is classified as a primary road, and will be paved. The new storage pad service road has been designed and will be constructed and maintained according to appropriate R645 regulations. The new storage pad service road is shown on Plate 5-2. The new storage pad service road will be removed during the course of construction of the long-term coal handling facilities. The portion of the new storage pad road that lies along the existing County Road RS-2477 may remain or be reclaimed. The BLM and Emery County will be consulted when appropriate, and the Division will be advised as to the course of action for the roadway (remain or be reclaimed). Access to the new storage pad (see above) will be rerouted through the new truck loadout road when the long-term truck loadout road is completed. When this happens, the existing truck loop will become the new truck loading/unloading area per Plate 8-1 for the future warehouse on the Upper Pad.

Topsoil Pile

The topsoil pile has been located on the southwest end of the surface facilities. The pile has been designed to contain adequate topsoil for redistribution according to the reclamation plan found in Chapter 5. The proposed location provides for good protection from wind contamination, as well as protection from mine related activities. The location of the topsoil pile is shown on Plate 5-2. The topsoil will be redistributed across the disturbed area according to the mine reclamation plan.

6) Temporary Concrete Walkway

Temporary concrete walkways have been constructed at temporary buildings, the temporary bath house (see #1 above) and temporary office trailers (see #2 above). The walkways are generally 6' wide by 4" thick. The locations of the temporary concrete walkways are shown on Plate 5-2. The temporary concrete walkways will be removed as their respective temporary buildings are removed.

15) Temporary Fuel Storage Tanks

The temporary locations of the fuel storage tanks are on the Middle Pad as shown on Plate 5-2. The tanks are bulk fuel storage tanks containing gasoline or diesel fuel for mine vehicles. The tanks are supported by steel legs above integral steel secondary containment basins. Upon completion of the long-term surface facilities' construction, the fuel tanks will be relocated to their long-term location on the Upper Pad, as shown on Plate 8-1. The fuel tanks will remain in their long-term locations for the life of the mine, and will be removed upon final reclamation.

25) Diversion Weir with Slide Gates

A weir constructed of steel-reinforced concrete will be constructed across disturbed area ditch DD-14a (see Chapter 7). The weir will support two (2) slide gates to direct surface water flow to the undisturbed culvert UC-1 or to Sediment Pond #1. During times of precipitation and/or active surface runoff within the disturbed area boundary, water flowing in ditch DD-14a will be diverted to Sediment Pond #1. Otherwise, any flowing surface water will be directed to the undisturbed culvert UC-1 and bypass the pond in accordance with the current UPDES permit. The location of the diversion weir with slide gates is shown on Plate 5-2. The diversion weir will remain throughout the life of the mine and will be removed during final reclamation.

29) Sediment Pond Spillway Structure

As shown on Plate 5-2, and in Chapter 7, Sediment Ponds #1 and #2 each have a spillway structure constructed of corrugated metal pipe to allow for surplus water to exit the respective pond. Each spillway is equipped with an oil skimmer structure. See Plates 7-6a and 7-6b for detailed drawings. The sediment pond spillway structures will remain throughout the life of the mine and will be removed during final reclamation.

38) Powder and Cap Magazines

Powder and cap magazines will be mobile, temporary, and supplied by the explosive distributer. Upon reclamation, the powder and cap magazines will be returned to the distributer.

42) Temporary Loadout Light Board

The temporary loadout light board consists of a free standing metal post pedestal with traffic control lights for the temporary loadout structure (see #20 above). The pedestal is mounted upon a steel reinforced concrete pad. The lights provide information to coal haul truck drivers as coal is loaded into their trucks at the temporary loadout structure. The temporary loadout light board location is shown on Plate 5-2. Upon the completion of the long-term coal handling facilities' construction, the temporary light board and concrete support pad will be removed.

Long-Term Underground Pipes

The locations of the long-term underground pipes have yet to be determined. Once detailed engineering design is completed, the underground pipes will be added to Plate 5-2, or other appropriate plates as required. Long-term underground pipes will be abandoned and left in place upon final reclamation.

Culverts

A complete list and design for the culverts can be found in Appendix 7-4, Tables 9 and 10~~,~~; and are shown on Plate 7-~~2~~5. A summary of the culverts follows:

Culvert	Length	Size
DC-1	60'	18"
DC-2	60'	18"
DC-3	65'	18"
DC-4	~~270'~~400'	24"
DC-5	~~250'~~350'	24"
DC-6	107'	24"
DC-7	155'	24"
DC-8	167'	24"
DC-9	186'	24"
DC-10	60'	24"
DC-11	~~35'~~101'	24"
DC-12a	140'	~~30~~24"
DC-12b	79'	24"
DC-12c	357'	24"
DC-12d	9'	~~30~~24"
DC-13	~~45'~~60'	24"
DC-14	~~25'~~	~~24"~~
40'	24"	
DC-15	45'	18"
DC-16	25'	18"
DC-17	120'	18"
DC-18	27'	18"
SP2-1	165'	~~24~~18"
UC-1	480'	60"

~~Guard Rails~~

~~Approximately 1,520 feet of Guard rails will be installed on the mine access road according to the detailed engineering plan being prepared. Appropriate MSHA and UDOT requirements will be taken into consideration.~~

Underground Pipes

Locations of the underground pipes have yet to be determined. Once detailed engineering design is completed the underground pipes will be added to Plate 5-2 or other appropriate Plates. Under ground pipes will be left in place upon reclamation.

Chain Link Fence

Approximately 1,500' of a six foot high chain link fence will be constructed as shown on Plate 5-2. The fence will be constructed to protect the public, and proved security along the section of county road that runs adjacent to the property.

Non-Coal Waste Area

An area for non-coal waste has been identified on Plate 5-2. Non-coal waste such as papers, timbers, cans, and miscellaneous scrap that is brought to the surface will be disposed of in a metal bin or "dumpster" located in the non-coal waste area identified on Plate 5-2. Metal will be separated from other forms of trash for salvage. Material not salvageable will be transported to the East Carbon Development Corporation (ECDC) dump

As per the approved Air Quality Order and R645-201-534.300, all primary roads will be paved or surfaced with rock, crushed gravel, asphalt or other approved disposal site for permanent disposal. Once a dumpster has reached capacity, the full dumpster will be replaced with an empty dumpster, and then the full dumpster will be hauled by a contract hauler to the specified disposal site.

Equipment & Supplies Storage Area

The equipment and supply storage area is approximately 350' by 400'. This storage area will be used to store mine supplies and equipment from the time of delivery until they are needed underground. Supplies such as timbers, bolts, plates, rock-dust, pipes, resin, screens, concrete blocks, steel, cables, and numerous other materials may be stored in this area. Equipment both new and used will be stored in this area. Many various longwall pieces such as shields, pan-lines, shears, chains, head and or tail drives, transformers, belt drives, pumps and numerous other material will be stored in this storage area. This secure area provides for a good storage area for

~~diesel, gasoline, hydraulic, and roadway chemicals. All oil tanks will have appropriately designed berms or retaining walls. The equipment and supplies storage area is shown on Plate 5-2. Any explosives will be stored here according to appropriate MSHA regulations.~~

~~Topsoil Pile~~

~~The topsoil pile has been located on the south west end of the surface facilities. The pile has been designed to contain adequate topsoil for redistribution according to the reclamation plan found in Chapter 5. The proposed location provides for good protection from wind contamination as well as protection from mine related activities. The location of the topsoil pile is shown on Plate 5-2.~~

~~Mine Development Waste Pile~~

~~A temporary mine development waste area has been designed to provide a location for the storage of underground development waste that is brought to the surface. Any underground development waste, other than rock slope material, will be placed in the temporary pile then blended back into the coal stream for sale. The rock slope material will be used as fill as per Appendix 5-7. The capacity of the temporary pile will only be a few hundred tons. The area for the rock slope material is shown on Plate 5-2.~~

~~Sediment Pond~~

~~The sediment pond has been design to provide for adequate sediment protection for the project area. All water running off the disturbed area will be routed into the sediment pond for treatment. The sediment pond has been designed according to the appropriate R645 regulations and the designs can be found in Appendix 7-4 and Plate 7-6. Because the sediment pond does not fit into the requirement of 30 CFR 77.216(a) an MSHA number for the proposed pond is not required. The sediment pond is located on the south-west end of the property and shown on Plate 5-2.~~

~~Slope Access / Portal Access Road~~

~~The slope access road splits off the facility access road near the north-east corner of the equipment and supply storage area, and follows an~~

~~alignment that takes into consideration grade and direct access. The slope access road will be used to provide access to the rock slopes which in-turn proved access to the underground workings. The slope access road will be used as access for all men, material and equipment need in the mine. Since the slope access road provides for frequent access for men, equipment and materials for a period of six months or longer the slope access road is classified as a primary road and will be paved. The slope access road will be designed, constructed, and maintained according to appropriate R645 regulations. The slope access road is shown on Plate 5-2.~~

~~Rock Slopes~~

~~Access to the underground workings of the Lila Canyon Mine will be provide by two rock slopes driven from the top of the Mancos shale up-dip to the intersection of the coal seam. One portal will proved for access for men, equipment and material to the mine. The second access slope will contain the run of mine belt line from the underground workings of the mine to the run of mine stock pile. There is a possibility that only one larger slope will be driven and then divided. to provide for two separate entries. The two 1,227 foot long slopes will slope up at approximately 12%, from a starting elevation of approximately 6150'. The intersection of the coal seam and the rock slope will take place at approximately 6,300 feet elevation. The length of the slopes were minimized by taking advantage of the coal seam dip which is approximately 12% to the east. The rock material removed from the slopes will be used as fill material for the surface facilities. The rock slope material / underground development waste will contain mostly shale, sandstone and mudstone. Traces of coal may be found but the amount will be insignificant. There are no known coal seams or significant rider seams found below the Sunnyside Seam in the Lila Canyon Portal Area. The rock slope locations are shown on Plate 5-2.~~

~~Mine Facilities Road / Truck Loadout Road~~

~~The mine facility road shown on Plate 5-2 begins at the edge of County Road 164 and allows for access to the various surface facilities. The road has been located in the most practical location taking into consideration grade, stability, and alignment. Employees will use this road to access the office & bathhouse facilities. Coal haul trucks will use this road to access the scales and truck loadout. All supplies will be hauled on a short portion of this road from the supply storage area to the slope access road. The road will be paved during construction of the facilities and before coal ming operations begin in order to to minimize dust and provide good surface for heavy truck~~

~~traffic as well as facility access. The facility access road will be approximately 24' wide to provide for two lane traffic and will have the appropriate drainage controls to insure long term life and low maintenance. The has been constructed and will be maintained according to the appropriate R645-534 and R645-527 regulations.~~

~~**Office/Bathhouse/Visitor Parking Area**~~

~~Parking will be as shown on Plate 5-2. Parking facilities for office, mine, and warehouse employees will be provided jointly as shown. This area will also provide parking for all vendors, and visitors. The surface of the 220' by 350' area will be paved. The parking area is located and designed to allow for convenient and safe parking of personal vehicles. The sewer tank and drain field will be located on the north end of this parking area.~~

~~**Mine Parking**~~

~~A mine parking area will be provided as shown on Plate 5-2. The mine parking area is where all mine and mine related mobile equipment will be parked when on the surface. This is the location where the underground work crews will be loaded into man trips for transportation to the various work areas. The mine parking area will be paved. The mine parking area will be approximately 70' by 220'.~~

~~**Fuel Tanks**~~

~~Fuel tanks will be located in the Equipment & Supplies Storage Area and be installed as discussed under Equipment & Supplies Storage Area. A 1,500 gallon diesel tank, 500 gallon hydraulic tank and a 500 gallon gasoline tank will be needed.~~

~~**Powder and Cap Magazines**~~

~~Powder and cap magazines will be mobile temporary, and supplied by the explosive distributer. Upon reclamation the powder and cap magazines will be returned to the distributer.~~

~~As per the approved Air Quality Order all roads will be paved and the~~material. Roads and pad areas used by mobile equipment will be treated with water or other dust suppressant~~, o~~. Open stockpiles will be watered as conditions warrant.

521. Included in this section are maps, cross sections, narratives, descriptions and calculations used to satisfy the relevant requirements. This section describes and identifies the lands subject to coal mining and reclamation operations

covering the estimated life of the project.

521.100 This application includes the cross sections, maps and plans needed to present the relevant information required by the Division. This information includes the following:

521.110. Plate 5-1 Shows area previously mined and approximate dates of mining.

521.111 Plates 5-1 ~~of part 'B"~~ and 2-2 ~~of part "A"~~ shows the location and extent of known workings of inactive, or abandoned underground mines. The surface portals or mine openings to the surface are shown. Plates 5-1 and 2-2 ~~of part "A"~~ have been prepared and certified by or under the direction of a registered professional engineer.

Doelling lists several coal mines and mining activity ~~in~~ within or adjacent to the permit area. Doelling lists the Calkins prospect, the Lila Canyon prospect, and the Prentiss prospect. In addition, Doelling lists several coal mines: Prentiss, Utah Blue Diamond, Blue Diamond and Heiner Mines. The research has shown that the Prentiss, Utah Blue Diamond, Blue Diamond and Heiner Mines were engulfed by the Book Cliffs mine. The Lila Canyon prospect refers to the old Lila Canyon mine fan portals used to ventilate the Geneva (Horse Canyon) mine. The Calkins prospect is believed to have been engulfed by the Geneva mine.

An outcrop fire has been detected in an area north of the exiting permit area ~~"A".~~"A." The fire is off the permit area and located in an area that has been sealed from the old horse canyon works. The outcrop fire is not anticipated to cause any problems with mining at the Lila Canyon Mine.

521.112 No surface mined areas are found within the permit area. Therefore, this section does not apply.

521.120 Three existing structures, a 48" and a 60" CMP culvert located near the new proposed sediment pond, and the Little Park Road can be found at the Lila Canyon Mine. The existing culverts are shown on plate 5-1A and the road on Plate 5-1. Existing Horse Canyon facilities are discussed in part "A" of this plan, and used for historical purposes only.

521.121 There are no buildings within 1000 feet of the proposed permit area ~~for~~, except those used as a part of the Lila Canyon ~~Mine, Part "B"~~mining operation.

521.122 There are no subsurface man-made features, other than the culverts discussed in 521.200, within, passing through, or passing over the proposed permit area ~~for Part "B"~~.

521.123 Plate 4-1, as well as others, shows the existing ~~c~~County ~~r~~Road 126 which is located partly within 100 feet of the proposed permit area. In ~~A~~addition, the Little Park road is located above the surface facilities within the permit area. The Little Park ~~r~~Road is also shown on plate 4-1

521.124 There are no known existing areas of spoil, waste, coal development waste, or non-coal waste disposal, dams, embankments, other impoundments, and water treatment and air pollution control facilities ~~within part "B" of the proposed permit area. This section is not Applicable~~, except those used as part of the mining operation.

521.125 There are no existing sedimentation ponds, permanent water impoundment, coal processing waste banks or coal processing waste dams near or within the permit area.

521.130 Landowner and right of entry maps are included in the permit application. These maps and cross sections show the following:

521.131 Plate 4-1 shows the surface ownership and Plate 5-4 shows the coal ownership of land included in or contiguous to the permit area.

521.132 The applicant has the legal right to enter and begin coal mining and reclamation operations on all areas shown within the permit area. The permit area is shown on Plates 5-3 and 5-4 as well as others.

521.133 Coal mining or reclamation operations are planned within 100 feet of a public road. There are no plans to relocate public roads.

521.133.1 Emery County has given permission to conduct coal mining or reclamation operations within 100 feet of the county road. (See Appendix 1-4)

521.133.2 The current permit does not propose any relocation of public roads. Therefore, this section is not applicable.

521.140 Mine maps and permit area maps and/or cross-sections will clearly indicate the following:

521.141 Plate 5-1 shows the permit boundary and Plate 5-2 shows the disturbed area boundary. Additional subareas that might require additional permits are addressed in Section 112.800 and 4-1B.

521.142 The underground workings are shown on Plate 5-5.

521.143 The proposed disposal site for placing the slope rock is shown on Plate 5-2 as well as other appropriate plates.

521.150 Plates 6-2, 6-3, and 6-4, show surface contours that represent the existing land surface configuration of the proposed permit area.

521.151 The Plates show the surface contours for all

areas to be disturbed as well as over the total permit area. The Plates showing the surface contours has~~s~~ve been prepared by or under the supervision of a registered engineer.

521.152 No previously mined areas are included within Part ~~"B".~~"B." Therefore, this section does not apply.

521.160 The maps, plates, and cross sections associated with this chapter clearly show:

521.161 Proposed buildings, utility corridors, and facilities are shown on Plates 5-2 and 8-1, as well as others.

521.162 ~~A~~The area of land affected according to the sequence of mining and reclamation is shown on the appropriate plates.

521.163 Land for which a performance bond will be posted is shown on the appropriate plate. Plates 5-2 and 8-1, as well as others, show the area for which the performance bond will be posted. All disturbed areas within the permit boundary has~~s~~ve been bonded.

521.164 ~~C~~Existing coal storage and loading areas are shown on Plates 5-2 and certified as required. Future coal storage and loading areas are shown on Plate ~~5-2~~8-1 and certified as required. Additional information can be found in Appendix 5-4.

521.165 Topsoil~~,~~ and waste piles are shown on Plate 5-2, as well as others.

521.166 The waste disposal areas are shown for non-coal waste and underground mine waste on Plate 5-2.

521.167 No explosives are expected to be stored on~~-~~-site. However, if explosives are stored, they will be stored as discussed in Section 520. on Plate 5-2.

521.168 Since Lila Canyon mine is an underground operation, this paragraph is not applicable.

521.169 The refuse pile is shown on Plate 5-2 and discussed in Appendix 5-7.

521.170 Transportation facility maps describing roads~~,~~ and conveyors maintained within the permit ~~is~~are shown with descriptions~~-~~ of roads, embankments, culverts, and drainage structures are presented in section 520 and are shown on Plates 5-2, 7-2, and 7-~~2~~5.

521.180 Support facilities are described in section 520 and are shown on Plate 5-2. Plate 5-2 is the official disturbed area boundary map.

521.190 Other relevant information required by the Division will be addressed.

521.200 Signs and markers will:

521.210 Signs and markers will be posted maintained, and removed by the person who conducts the coal mining and reclamation operations.

521.220 Signs and markers will be of uniform design that can be easily seen and read and be made of durable material and conform to local laws and regulations.

521.230 Signs and marker will be maintained during all activities to which they pertain.

521.240 Mine and Permit Identification Signs.

521.241 Mine and permit identification signs will be displayed at each point of access from public roads to areas of surface operations and facilities on permit areas.

521.242 Since Lila Canyon Mine is an underground operation, this section is not applicable.

521.243 Mine and permit identification signs, where required, will show the name, business address,

and telephone number of the permittee and the identification number of the permanent program permit authorizing coal mining and reclamation operations.

521.244 Mine and permit identification signs will be retained and maintained until after the release of all bonds for the permit area.

521.250 Perimeter Markers

521.251 The perimeter of all areas affected by surface operations or facilities before beginning mining activities will be clearly marked with perimeter markers.

521.252 Since Lila Canyon Mine is an underground operation, this section is not applicable.

521.260 Buffer Zone Markers

521.261 Signs will be erected to mark buffer zones as required and will be clearly marked to prevent disturbance by surface operations and facilities.

521.262 Since Lila Canyon Mine is an underground operation, this section is not applicable.

521.270 Topsoil Markers~~. Markers~~ will be erected to mark where topsoil or other vegetation-supporting material is physically segregated and stockpiled.

522. Coal Recovery

Additional Details can be found in the R2P2 on file at the BLM Office.

Effective barrier and pillar designs are essential for safe and productive underground mining. Barrier pillars will be sized according to accepted engineering practices. One or more of the following methods may be used to properly size barrier pillars: Dunn's Rule, the Old English Barrier Pillar Law, Pennsylvania Mine Inspector's Formula, Ash and Eaton Impoundment Formula, Pressure Arch Method, British Coal Rule of Thumb, North American Method, Holland Rule of Thumb, or Holland Convergent Method.

Regardless of the methods or care taken to properly size barrier pillars, the true effectiveness on any design can only be determined by conducting full-scale in-mine performance evaluations. Mine experience and history in the local area will have as much influence on pillar sizes as does the engineering formulas.

Barrier pillars will be utilized to isolate the abandoned Horse Canyon Mine from the new Lila Canyon Mine. Barrier pillars will also be used to simplify ventilation, to provide independent escape routes, and to possibly retain large quantities of mine water. Barrier pillars will be employed along the outcrop in order to maintain ventilation courses.

A barrier pillar, where no second mining will be allowed within the barrier, will be used to protect the escarpments. The width of the escarpment barrier will be determined by implementing a 21.5^{o} angle of draw projected, downward from the surface to the coal seam. Development mining, or first mining, will be allowed within the escarpment barrier.

For longwall mining applications, the abutment loading is of prime importance. Initial longwall pillars will be designed using the ALPS method. Again, mine experience and history in the local area will have as much influence on pillar sizes as does the engineering formulas.

Mine pillars will be sized taking into consideration the coal strength, depth of cover, width and height of pillars, using one or more of the following methodologies: Obert-Duvall, Holand-Graddy, Holland, Salamon-Munro, or Bieniawski. Again, mine experience and history in the local area will have as much influence on pillar sizes as does the engineering formulas.

523. Mining Methods:

Mining will begin in Section 15, T16S, R14E, in the Sunnyside seam. Development of the Sunnyside seam will be in a down dip direction toward the east. The seam will be accessed by two 1,200 foot slopes driven up at 12% from the base of the cliffs.

Production during the first year is estimated to be 200,000 tons~~, t~~. The second through the fifth year production should be between 1,000,000 and 1,500,000 using continuous mining methods. If and when tonnage demand increases to justify longwall mining, production could peak as high as

4,500,000 tons a year and continue at that level for the life of the mine.

Mine production will begin with the slope construction. Once the coal is encountered, development will continue using continuous miners and various haulage types. Battery, cable, or continuous haulage may be used in conjunction with continuous miners in development. Continuous miners will account for all the production during the first two to five years. Mining will consist of driving mains, developing room and pillar panels and gate entries for future longwall mining.

The majority of the second mining will be performed using longwall equipment. However, in isolated areas room and pillar type of mining may be used in areas not suitable for longwall mining. Longwall panels are sited approximately parallel lengthwise to the strike with a slight up dip orientation to provide drainage for the development faces. This practice will be applied to the continuous miner panels wherever possible. (See plate 5-5)

Roof control and ventilation plans will be submitted to MSHA and approved prior to any underground mining activities.

An air quality permit from the State Division of Air Quality has been obtained and will be modified as needed.

Ventilation of the mine will be by an exhaust and-/or blowing type system. It has been estimated that 900,000 cfm will be required at full production. Intake air will be supplied by slopes and- entries from the surface.

A water supply system will be installed. Potable water from an approved source will be hauled by truck and stored in a mine site storage tank located near the man and coal slope portals. Alternative sources for potable water are being considered. A treatment plant may be indicated. Process water will be hauled from the Price River or other approved source by truck and stored in another mine site storage tank. It is anticipated that once the old two entry development panel is encountered that, adequate process water may be obtained from the old works. This process water will provide for dust control, water to the mine and fire suppression. Mine water will be used with the process water. See Appendix 7-3 (PHC) for water usage calculations.

Dust suppression will be accomplished by the use of sprays on all underground equipment as required. Sprays will also be used along sections of the conveyors and at transfer points.

No major de-watering concerns are anticipated at this property. The workings are expected to produce some water with more water being produced as the depth of mining increases. Part of this water will be used for dust suppression. The remainder will be collected in sumps and pumped to mined out sections of the mine or to the surface and treated when necessary.

Underground mining equipment to be used at Lila Canyon is typical of most room-and-pillar and longwall mines. A list of major equipment which may be used underground is listed below~~ a~~. Additional equipment not on the list may be used as needed.

Continuous Miners
Roof Bolters
Battery Shuttle Cars
Electric Shuttle Cars
Diesel Ram Cars
Feeder Breakers
Continuous Haulage Units
Battery Scoops
Diesel Scoops
Diesel Service Vehicles
Diesel Material Haulers
Diesel
Belts and Terminal Groups
Battery and Diesel Man Trips
Longwall Shields
Longwall Pan-lines
Longwall Shears
Longwall Stage-loaders
Longwall Pumps
Various Water Pumps
Various Transformers and Switches
Rock Drills
Loaders

523.100 No Surface Coal Mining and Reclamation Activities are proposed to be conducted within the permit area within 500 feet of an underground mine~~, t~~. Therefore, this section is not applicable.

523.200 No Surface Coal Mining and Reclamation Activities are proposed with 500 feet of an underground mine~~, t~~. Therefore, this section is not applicable.

523.210 No Surface Coal Mining and Reclamation Activities are proposed to be conducted within the permit area within 500 feet of an underground mine~~, t~~. Therefore, this section is not applicable.

523.220 No Surface Coal Mining and Reclamation Activities are proposed to be conducted within the permit area within 500 feet of an underground mine~~, t~~. Therefore, this section is not applicable.

524. Blasting and Explosives: Surface blasting activities incident to underground coal mining ~~is~~are planned for the Lila Canyon mine during construction of the access slopes only.

524.100 Steps have been taken to achieve compliance with the blaster certification program and ~~is~~are described in this permit application.

524.110 Surface blasting involving 5 lbs. of explosives or more will be ~~conducted~~done under the direction of a certified blaster.

524.120 Blasting certificates will be carried by the blasters or will be on file at the permit area during blasting operations.

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

524.140 Persons responsible for blasting operations at a blasting site will be familiar with the blasting plan, if required, 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.

524.200 Since the planned blasting does not meet the requirements of 524.211 or 524.212, a blast design is not included in the permit

application. If, in the future, blasting falls under section 524.200, then a plan will be submitted to Division for approval.

524.210 Since the planned blasting does not meet the requirements of 524.211 or 524.212-, anticipated blast designs are not required.

524.300 Since planned blasting requires more than 5 lbs. of explosives, the preblasting survey is addressed where applicable in this permit application.

524.310 There are no dwellings or other structures located within one-half mile of the permit area owned by anyone but the operator. The operator will prepare the preblast survey if required. Notification procedures implied in this section are not applicable.

524.320 Since the operator is the only owner of structures and no dwelling exists within one-half mile of any part of the permit area, this section is not applicable.

524.330 Because the operator is the only owner of structures or dwellings within one-half mile of any part of the permit area, this section is not applicable.

524.340 Because the operator is the only owner of structures or dwellings within one-half mile of any part of the permit area, this section is not applicable.

524.350 Because the operator is the only owner of structures or dwellings within one-half mile of any part of the permit area, this section is not applicable.

524.400 The blast schedule is as follows:

524.410 Since there are no residents within one-half mile of the projected blasting site, this section does not apply.

524.420 All surface blasting will be conducted between sunrise and sunset, unless nighttime blasting is approved by the Division.

524.430 Since there are no residents within one-half mile of the projected blasting site, this section does not apply.

524.440 Since there are no residents within one-half mile of the projected blasting site, a flexible blasting schedule is allowable. Surface blasting may take place anytime during daylight hours, unless approved differently by the Division.

524.450 Because of the remote location of the Lila Canyon Mine, over six miles from the nearest locality (Columbia), this section does not apply.

524.460 Since the town of Columbia is the nearest locality~~,~~ and is over six miles distance from the permit area, this section does not apply.

524.500 The blasting signs, warnings and access control ~~is~~are described below.

524.510 Blasting signs will meet the specifications of R645-301-521.200. The following will apply.

524.511 Signs reading "Blasting Area" will be conspicuously place at the point where any road provides access to the blasting area.

524.512 The signs posted at all entrances to the permit area from public, roads, or highways will be placed in a conspicuous location and will state "Warning! Explosives in ~~Use"~~Use," and will clearly list and describe the meaning of the audible blast warning and all clear signals that are in use.

524.520 Audible warning and all-clear signals of different character or pattern will be given. Each person within the permit area will be trained in the meaning of the signals.

524.530 Access within the blasting area will be controlled until ~~an authorized until~~ the operator has reasonably determined the following:

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

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

524.600 Adverse blasting effects are described as follows:

524.610 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 availably of surface or ground water outside the permit area.

524.620 Airblast Limits

524.621 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.622 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.630 Monitoring: Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.640 Ground Vibration: Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance form the permit area, this section does not apply.

524.650 Since all structures are either owned by the permittee

and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.660 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.670 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.680 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.690 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, sections 524.620 through 524.632 and 524.640 through 524.680 do not apply.

524.700 Records of blasting operations will be maintained at the mine site for at least three years, and will be available for inspection by the Division or the public. ~~Blasting records will contain the following information.~~

524.710 Blasting records will include~~.~~:

524.711 The name of the operator will be on the blasting record.

524.712 The location, date, and time of the blast will be recorded on the blasting record.

524.713 The name, signature, and certification number of the blaster will be recorded on the blasting record.

524.720 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, this section does not apply.

524.730 Weather conditions will be recorded on the blasting record.

524.740 A record of the blast will include the following:

524.741 The type of material blasted will be recorded on the blasting records.

524.742 Sketches of the blast pattern including number of holes, spacing, burden, decks, and delay pattern will be recorded on the blasting record.

524.743 The diameter and depth of holes will be recorded on the blasting record.

524.744 The type of explosives used will be recorded on the blasting record.

524.745 The total weight of the explosives used per hole will be recorded on the blasting record.

524.746 The maximum weight of explosives detonated in an eight-millisecond period will be recorded on the blasting record.

524.747 Information on the initiation system will be recorded on the blasting record.

524.748 The type and length of the stemming will be recorded on the blasting record.

524.749 Mats or other protections used will be recorded on the blasting record.

524.750 Since all structures are either owned by the permittee and not leased to another person, or are located over six miles distance from the permit area, a record of

seismographic and airblast information is not required.

524.760 Since a blasting schedule is not required, this section does not apply.

524.800 The operator will comply with the various appropriate State and Federal laws and regulations in the use of explosives.

525. Subsidence: The permittee will comply with the appropriate R645-301-525 requirements.

525.100 Subsidence Control Plan

525.110 Plate 5-3 shows the location of State appropriated water and Plate 5-3 (Confidential) shows the eagle nests that potentially could be diminished or interrupted by subsidence.

525.120 SUBSIDENCE POTENTIAL ~~(See also Section 5.4 of Part "A")~~

A review of renewable resources in and adjacent to the permit area found resources consisting of ground water, grazing, timber, and recharge areas. Subsidence from underground coal mines has been believed to affect overlying forest and grazing resource lands in the following ways:

- Formation of surface fissures which intercept near surface soil moisture thus draining the water away from the root zone with deleterious effects.

- Alterations in ground slope and destabilization of critical slopes and cliffs.

- Modification of surface hydrology due to the general downward migration of surface water through vertical fractures.

- Modification of groundwater hydrology including connection of previously separated aquifers, reduction in flows of seeps and springs which rely upon tight aquitards for their

flow, and changes in recharge mechanisms.

- Emissions of methane originating from the coal seam through open fissures to the surface or at least the base of the surficial soil which has been known to have deleterious effects on woody plants.

Because these renewable resources exist with and adjacent to the permit area, a subsidence control plan is required. This plan is presented in Section 525.400.

A great deal of baseline data is available from many mining settings to develop subsidence damage criteria for surface structures (Bhattacharya et al. 1984). The formation of cracks and fissures are the general effects of subsidence and can have minor deleterious effects on groundwater resources without any fissuring to the surface. In the arid areas of Utah, impacts to and modification of the groundwater regime can be disruption of flow from natural seeps and springs which rely on the permeability contrast of interbedded sandstones and shale for their flows. These water resources are generally near surface occurrences and are essentially surface waters and subject to the same limiting damage criteria as surface water bodies. Subsidence damage to surface water bodies has been studied by a number of workers including Dunrud (1976), Wardell and Partners (1976), and U.S. Bureau of Mines (1977). The result~~s~~ of the Wardell and Partners studies of subsidence effects in a number of countries indicates that the limiting strain for the onset of minor impacts to surface waters is approximately 5×10^{-3}. The SME Mining Engineering Handbook also suggests a limiting extension strain value of 5×10^{-3} for pasture, woodland, range or wildlife food and cover.

Table 10.6.19 in the Mining Engineers Handbook suggests that the minimum safe cover required for total extraction of the coal resources under surface waters is approximately 60 times the seam thickness for coal beds at least 6 feet thick or approximately 450 feet. In their review of the foregoing, Singh and Bhattacharya (1984) recommended that the same limiting safe strain values and cover thickness ratios be used for protecting groundwater resources and recharge areas over coal mines. Where extension strain is greater than this

limiting value, it is likely that surface fissures and cracks may develop. As the strain value decreases below the limiting value, the potential for surface damage decreases.

Figure 1 in Appendix 7-3 shows a typical subsidence profile. As shown in Figure 1, the zones are: a caved zone that occurs in the ~~6~~six to 10 times the thickness of the coal seam, a fractured zone which occurs 10 to 30 times the thickness of the coal seam, and deformation zone which occurs 30 to 60 times the thickness of the coal seam, and finally, a soil zone which occurs on the ground surface. The cover thickness of 1,000 to over 2,000 feet, over most of the mine area is also much greater than the limiting thickness of 630 feet recommended by International Engineers Inc. (1979) (10.5' x 60).

The Lila Canyon mine will be a longwall operation. As projected, 15 longwall panels at various depths will be mined. The longwall panels are laid out with the gate roads running along the strike roughly north-south, which will result in the longwall shear cutting up and down the dip. The depth of cover over the longwall panels approaches but never gets less than 500 feet toward the southwest and increases to over 2500 feet in the northeast. Only three of the 13 planned longwall panels are under less than 1,000 feet of cover. The remaining 10 panels are under 1,000 plus feet of cover. Maximum subsidence is expected to be approximately 9.5 feet in the areas approaching 500 feet of cover and less than 3' in the deeper cover areas. Extension strain varies from 12.4×10^{-3} in the 500 foot cover areas to $.9 \times 10^{-3}$ in the 2,500 foot cover areas. Extension strain values of 5.0×10^{-3} and above occurs in areas of approximately 1000' of cover and less.

A typical longwall panel at the Lila Canyon Mine will have dimensions of approximately 950 feet wide and up to 7,000 feet long and 2,000 feet deep. Using the methods described in the National Coal Board's *Subsidence Engineers' Handbook,* the S/m ratio for this geometry would be 0.38 where "S" is the maximum subsidence and "m" is the seam extraction thickness. For an average seam extraction thickness of 10.5 feet, the total subsidence would be 4.0 feet. However, as described above, the major impacts of this subsidence are due to extension strains and not total vertical subsidence. The

prediction of average extension strain is accomplished with the use of the formula:

+E = 0.75 S/h where S=subsidence, and h=depth of cover

NOTE: The .75 factor is only an average. The factor changes with various w/h ratios. Figure 15 found in NCB's Subsidence Engineers Handbook takes into account the w/h ratio.

The solution of this equation for the Lila Canyon Mine configuration discussed above produces a predicted, average extension strain of 1.5×10^{-3} which is less than the limiting strain of 5×10^{-3} for protecting surface waters, groundwater sources, pasture, woodland, range or wildlife food and cover. Thus, it is unlikely that the gradual compression expected over much of the subsidence area will have any deleterious effects on the overlying renewable surface resources.

The table below shows the expected subsidence amounts and expected extension strain for longwall panels at various mining depths. These calculations were done for a flat multiple seam mining. There are adjustments for single seam mining and for dipping seams. However, these adjustments are minor and are not expected to result in significant changes in values.

Maximum Subsidence
& Expected Extensive
Strain (NCB 1975)

	Feet	Meters
Panel Width =	900	274
Seam Height =	10.5	3

Depth of Cover		Width to Depth (a)	Maximum Subsidence(S)		Factor NCB Fig. 15	Extension Strain (E)
Feet	Meters	Ratio	Feet	Meters	Factor	x 10^{-3}
500	152	0.9	9.5	2.9	.65	12.4
1000	305	0.75	7.9	2.4	.66	5.2
1100	335	0.71	7.5	2.3	.68	4.6
1200	366	0.68	7.1	2.2	.70	4.1
1300	396	0.65	6.8	2.1	.70	3.7
1400	427	0.59	6.2	1.9	.75	3.3
1500	457	0.54	5.7	1.7	.78	3.0
2000	610	0.38	4.0	1.2	.82	1.6
2500	762	0.28	2.9	0.9	.80	0.9

The most favored technique until recently has been the use of the empirical charts developed by the National Coal Board (NCB). The above calculations were obtained using the empirical charts developed by the National Coal Board (NCB). Comparisons, as stated in the SME handbook, of US subsidence data with NCB predictions highlight the following differences between coalfields in the US and UK: Most of the studies in the US are limited to the Eastern US coalfields with a very limited data base applicable to western conditions.

With the exception of Illinois, maximum subsidence factors observed in US coalfields are less than predicted by NCB.

The limit (draw angles in the US coalfields tend to be less then the 35 degree value generally accepted by NCB.

The points of inflection of the subsidence profiles over US coal mines are generally closer to the panel centerline compared to the NCB profile. This effect is dependent not only on the percentage of competent strata in the overburden but also on their locations relative to the ground surface and their

thickness.

Surface strains and curvatures observed over US longwall panels have been shown to be significantly higher then NCB predictions, almost four times larger in many cases.

The pace at which subsidence occurs depends on many controls including the type and speed of coal extraction, the width, length and thickness of the coal removed, and the strength and thickness of the overburden. Observations of subsidence by Dunrud over the Geneva and Somerset Mines indicate that subsidence effects on the surface occurred within months after mining was completed, and the maximum subsidence was essentially completed within 2 years of the completion of retreat mining.

Dr. Roy Sidle found in his study of Burnout Creek that subsidence impacts to streams are temporary and self healing.

The Sidle Study is representative of the conditions found in the Lila area because:

- the lithology is very similar between the Book Cliffs and the Wasatch Plateau

- the cover thickness ranges from 600 - 800 feet which falls within the rage expected at Lila, and

- the seam thickness of 8-10 feet is in the same range expect at Lila.

An Executive Summary of his study and published findings follows:

Title : Stream response to subsidence from underground coal mining in central Utah

5. Authors: Sidle-RC Kamil-I Sharma-A Yamashita-S

Short-term geomorphic and hydrologic effects of subsidence induced by longwall mining under Burnout Creek, Utah were evaluated. During the year

after longwall mining, 0.3-1.5 m of subsidence was measured near impacted reaches of the mountain stream channel. The major channel changes that occurred in a 700-m reach of Burnout Creek that was subsided from 1992 to 1993 were: extent glides; (2) increases in pool length, numbers and volumes; (3) increases in median particle diameter of bed sediment in pools; and (4) some constriction in channel geometry. Most of the changes appeared short-lived, with channel recovery approaching pre-mining conditions by 1994. In a 300-m reach of the South Fork drainage that was subsided from 1993 to 1994, only channel constriction was observed, although any impacts on pool morphology may have been confounded by heavy grazing in the riparian reaches during the dry summer of 1994. Similar near-channel sedimentation and loss of pool volume between 1993 and 1994 were noted throughout Burnout Creek and in adjacent, unmined James Creek. Subsidence during the 3-year period had no effect on baseflows or near- channel landslides.

No major impacts of subsidence to the surface, caused by the underground mining methods proposed during the permit term are anticipated.

The coal seam is approximately 12.5 feet thick with only about 10.5 feet being extracted, and the depth of cover ranges from 0' to approximately 2,500'. The rocks overlaying the coal seam are sandstones and mudstones with some thin bands of coal. Due to the strength of the overburden, and depth of workings, even with full seam extraction, only minimal subsidence, if any, is anticipated.

Some surface expressions of tension cracks, fissures, or sink holes may be experienced, but should be insignificant. The

chances of subsidence-related damage to any perceived renewable resource is minimal.

All dirt roads above the mine are in areas in excess of 1,000 feet of cover or in areas where mining will not take place. The chance of subsidence negatively effecting these dirt roads is minimal. However, in the unlikely event that cracks, fissures or sink holes are observed as a result of subsidence, the road will remain accessible by regrading and filling in the cracks, fissures or sinkholes.

The unnamed ephemeral channel in the southwest corner of the permit area is located in an area where no mining is planned or over the top of a bleeder system that will not be second mined. The chance of subsidence negatively effecting this ephemeral channel is minimal. However, in the unlikely event that cracks, fissures or sink holes are observed as a result of subsidence the channel will be regraded and the cracks, fissures or sinkholes will be filled in by hand methods due to its inaccessibility.

A small portion of Little Park Wash, which is ephemeral, has less than 1,000 feet of cover in the southwest corner of the permit area. The portion with less than 1,000 feet of cover runs diagonally across one longwall

panel and then parallel to the bleeder system in the second longwall panel. In the unlikely event that cracks, fissures or sink holes are observed as a result of subsidence the channel will be regraded and cracks, fissures or sinkholes will be filled in. Since this stream channel is accessible and is traversable by 4 wheel drive, access for repairs would not be a problem. If any subsidence repairs cannot be fixed using hand methods, small earth moving equipment could be used.

DWR and BLM Wildlife Biologists, in consultation with the Division, have determined that any loss of snake dens to subsidence would be random and a minor impact to the population of snakes.

525.130 A survey was conducted within the proposed permit area and adjacent area and it was determined that limited renewable resource lands exist within the area surveyed. Limited areas were found which contribute to the long-range productivity of water supply or fiber products. No structures exist within the permit area in which subsidence, if it occurred, could cause material damage or diminution for reasonably foreseeable use. See Plates 5-5 and 5-3 for areas of potential subsidence. Identification and data for the State appropriated water supplies can be found in chapter 7 section 727.

All State Appropriated water rights within the maximum limit of subsidence that could be affected, are either owned by the Operator or by the BLM. The BLM has been notified of the water rights survey by means of the submittal of the permit application.

According to Mark Page (State Water Rights), there is not a water conversation district associated with Lila Canyon Mine.

525.200. Protected Areas

525.210. Since there are no public buildings or other facilities such as churches, school or hospitals, and since there

are no impoundments with a storage capacity of more than 20 acre-feet, this section does not apply.

525.220. Since R645-301-525.210 does not apply, this section does not apply.

525.230. Since there are no planned operations under urbanized areas, cities, towns, and communities, or adjacent to industrial or commercial buildings, major impoundments, or perennial streams this section does not apply.

525.240. A detailed plan of the underground workings, including maps and descriptions of significant features of the underground mine, including the size, configuration, and approximate location of pillars and entries, extraction ratios, measures taken to prevent or minimize subsidence and related damage, and areas of full extraction can be found in the R^2P^2 on file with the BLM local and state offices.

525.300. Subsidence control.

525.310. Measures to prevent or minimize damage.

525.311 No attempt will be made to prevent subsidence in any area except where the escarpment near the outcrop is to be protected and to insure that subsidence remains within the permit area. The use of continuous miners in a pillar section as well as longwall technology provides for planning subsidence in a predictable and controlled manner. Some surface expressions of tension cracks, fissures, or sink holes may be experienced but should be insignificant. The chances of subsidence related damage to any perceived renewable resource is minimal. The value and foreseeable use of the surface lands will not be affected by potential subsidence.

525.312 Since there are no buildings or occupied residential dwellings or structures within the Lila Canyon project area this section does not apply.

525.313 Room-and-pillar mining in addition to longwall

methods will be used at the Lila Canyon Mine.

525.400. Since state-appropriated water supplies exist on the surface, 525.400 has been addressed.

525.410 Coal will be removed using a combination of continuous miner and long wall methods as described in sections 522 and 523. Sequence and timing for the development of underground workings are also discussed in sections 522 and 523.

525.420 Plate 5-5 shows the underground workings, and depicts areas where first mining or partial mining will be utilized to protect the escarpment and raptor nests that may exist on the escarpment, and to insure that subsidence remains within the permit area. State-appropriated water rights are shown on Plates 5-3, 5-5 as well as Plate 7-1.

525.430 No major impacts of subsidence to the surface caused by the underground mining methods proposed during the permit term are anticipated.

The coal seam is approximately 12.5 feet thick with only about 10.5 feet being extracted, and the depth of cover ranges from 0' to approximately 2,300'. The rocks overlaying the coal seam are sandstones and mudstones with some thin bands of coal. Due to the strength of the overburden and depth of workings, even with full seam extraction, only minimal subsidence, if any, is anticipated.

525.440 Aerial subsidence monitoring will be done annually while the significant subsidence is taking place. The subsidence monitoring will be initiated in an area prior to any 2nd mining being done within that area. Initially a 200 foot grid along with baseline photograph will be established prior to any 2nd mining. Approximately 12-16 control points will be needed to cover the total mining area. Six of these points will be located outside of the subsidence zone. The accuracy of this survey will be plus or minus 6" horizontally and vertically. From this data a map will be created that will show subsided areas. Once per year a follow up aerial will be

performed to determine the extent and degree of active subsidence. Subsidence monitoring will continue for a minimum of 5 years after the mining ceases. If at the end of the 5 year period the annual subsidence in any of the 3 prior years measures more than 10 percent of the highest annual subsidence amount, subsidence monitoring will continue until there are 3 consecutive years where the annual subsidence amount is less than 10 percent of the highest annual subsidence amount. If for three years in a row the subsidence is measured to be less than 10% of the highest subsidence year, subsidence will be determined to be complete, and no additional monitoring for that area will be required.

"A ground survey of the mine permit area 'where secondary extraction has occurred over the last year' will be conducted in conjunction with the quarterly water monitoring program." Identified features will be monitored until they are repaired or self-healed. The survey will be conducted on roads, adjacent to stock watering ponds, and in drainage channels where they cross tension areas relative to the underground extraction areas."

"The results of this survey will be documented quarterly in a written report which provides global positioning co-ordinates as well as the following information;

A) a description of the identified subsidence related feature,
B) length, and width measurements, and compass bearing,
C) dated photographic documentation,
D) located on a topographic overlay map of the underground disturbed area.
E) if the feature is determined as significant, the Division will be notified within a 48 hour period.
F) A written report, compiling the four quarterly reports for the monitoring year, will be submitted as part of the Annual Report required by the Division.
G) The commitment "to restore the land where subsidence damage has affected the use of the surface" must be revised to read "to restore the

land where subsidence damage has been determined as significant enough to require repair, as determined by the Division".

Two areas of the permit have stream reaches with less than 1,000 feet of cover over the coal seam. As discussed in Section 525.120, it is not envisioned that subsidence will negatively impact these areas. During periods of 2nd mining under areas of intermittent or perennial streams, a ground survey will be conducted of the stream channels every two weeks. These ground surveys will be continued for a period of 3 months following the 2nd mining.

The ground survey will consist of walking and photographing the various areas of the surface over the mine where subsidence might occur. If evidence of subsidence is identified, the area of subsidence will be surveyed and the extent of the disruption identified. Depending on the extent and location of the damage, mitigation measures will be reviewed and implemented. Due to the fact that mitigation options change with time as new technology and measures are developed, better options may be implemented in the future. However, UEI provides a commitment that where subsidence damage affects uses of the surface, the land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence. The surface effects will be repairs as described in Section 525.500.

525.450 Subsidence control measures.

525.451. No backstowing or backfilling of voids used as a subsidence control measure is planned at this time. Therefore, this section is not applicable.

525.452. Support pillars as a subsidence control measure is not anticipated at this time. However, an area of partial mining where an unmined coal block will be left for subsidence control is shown on Plate 5-5. First mining indicates an area where a block of coal is roomed leaving pillars for support with no mining of the remaining pillars. Partial mining as shown on Plate 5-5 indicates

an area where a block of coal has been isolated without the rooms being developed. Both first mining and partial mining will leave support that can be used to control subsidence. If the partially mined area shown on Plate 5-5 is ever roomed out, the area now defined as partially mined would become an area defined as being first mined.

525.453. An outcrop barrier of coal will be left to protect the escarpments at the outcrop. As per the R2P2, only first mining will be allowed within 200' of the outcrop. Mains, submains, and ventilation portals will be allowed within the outcrop.

525.454 No measures will be taken on the surface to prevent material damage or lessening of the value or reasonable foreseeable use of the surface.

525.460. Anticipated effects of planned subsidence may include tension cracks, fissures, or sink holes. Areas of minimal ground lowering may be anticipated. The chances of subsidence-related damage to any perceived renewable resource is minimal.

525.470. Since no urbanized areas, cities, towns, public buildings, facilities, churches, schools, or hospitals exist within the permit area this section does not apply.

525.480. There are no plans to change or modify the mining plan to protect any springs or seeps. Springs with water rights will be monitored for flow and quality as described in Chapter 7 Section 731.211. UEI has committed to provide for mitigation of any lost water rights as per Chapter 7 Section 727.

525.490. Other information specified by the Division as necessary to demonstrate that the operation will be conducted in accordance with R645-301-525.300 will be provided.

525.500. Repair of damage.

525.510. If effects of subsidence are confirmed, any material damage to the surface lands will be restored to the

extent technologically and economically feasible. The land will be restored to a condition capable of maintaining the value and reasonable foreseeable uses which it was capable of supporting before the subsidence.

525.520. Since no structures exist within or adjacent to the permit area which could be damaged by subsidence, should it occur, this section does not apply.

525.530. The Little Park Road exists in the subsidence zone. In the unlikely event the road is damaged by subsidence, UEI will repair the damage as per Section 525.120.

525.600. Public Notice.

At least six months prior to mining, or within that period if approved by the Division, the underground mine operator will mail a notification to all owners and occupants of surface property and structures above the underground workings. The notification oil include, at a minimum, identification of specific areas in which mining will take placee, dates that specific areas will be undermined, and the location or locations where the operator's subsidence control plan may be examined.

526. A narrative explaining the construction, modification, use, maintenance and removal of the mine facilities follows. Additional information can be found in Appendix 5-4 and Chapter 8.

526.100 Mine Structures and Facilities.

526.110 The only existing structures are found in Horse Canyon (Part "A" of this permit) and are the remains of the United States Steel operation. Horse Canyon has received phase II bond release, and the remaining structures have been left in place for future use. Only three existing structures, a 60" and a 48" CMP culverts located near the new proposed surface facilities, and the County road on top of Little Park, can be found within the Lila Canyon Permit. The existing culvert is shown on plate 5-1A. The existing road on Little Park can be found on Plate 5-1 as well as most other plates showing the surface area of the Lila Canyon Permit. Several vehicle ways will be used for water and

subsidence monitoring. These ways branch off the Little Park Road and generally follow the ephemeral drainages. The ways are shown on Plate 5-1 as well as most other plates showing the surface area of the Lila Canyon Permit. More detail of the existing Little Park Road can be found in Appendix 5-4.

526.111 The location of the existing culverts is shown on Plate 5-1A.

526.112 Most of the existing 48" culvert is outside the permit boundary and is ~~the~~Emery Count~~ie~~y's responsibility. UEI will grade the site so that during reclamation and operations surface flows will be directed away from the 48" culvert. The 60" culvert is in poor condition and will be replaced by the ~~c~~County. UEI will add on to the culvert during the operation and reclamation phase. The bottom 30' is the responsibility of the County, the upper portion is the responsibility of UEI.

526.113 It is believed that the existing culverts were installed with the road construction around 1940.

526.114 Since the existing culvert is going to be removed upon construction of the sediment pond, this section does not apply.

526.115 Since the existing culvert is going to be removed upon construction of the sediment pond, this section does not apply. The County road and the culvert within the disturbed area boundary will be modified or reconstructed by the County.

526.115.1. Since the existing culvert is going to be removed upon construction of the sediment pond, this section does not apply. See Appendix 5-4 for existing road details.

526.115.2. Since the existing culvert is going to be removed upon construction of the sediment pond, this section does not

apply. See Appendix 5-4 for existing road details.

526.115.3. Since the existing culvert is going to be removed upon construction of the sediment pond, this section does not apply. See Appendix 5-4 for existing road details.

526.115.4. Since the existing culvert is going to be removed upon construction of the sediment pond, this section does not apply. See Appendix 5-4 for existing road details.

526.116 The only coal mining and reclamation operations that are planned within 100 feet of the County Road are an office complex, sediment ponds, topsoil pile, and security shack. The permit area adjacent to the county road will be fenced to protect the public from the sediment pond and other mine associated buildings. Other than fencing, no additional measures are planned after the construction phase. During construction, measures to control traffic on the County Road will be taken to protect the public from construction related hazzards.

526.116.1. A cooperative agreement with Emery County ,as stated in Appendix 1-4, requires a six foot chain link fence to be constructed adjacent to the Lila Canyon Road to provide safety to the general public in the proximity to the mine site and mine related structures and activities.

526.116.2. At the current time, there are no plans to relocate any public road.

526.200 Utility Installation and Support Facilities.

526.210 All coal mining and reclamation operations will be

conducted in a manner which minimizes damage, destruction, or disruption of services provided by oil, gas, and water wells, oil, gas, and coal-slurry pipelines, railroads, electric and telephone lines, and water and sewage lines which may pass over, under, or through the permit area, unless otherwise approved by the owner of those facilities and the Division. Since no existing services are found within the projected disturbed area, no negative impact to any service is anticipated.

526.220 The new support facilities are described in section 520 and in Appendix 5-4 and shown on plate 5-2 and will be operated in accordance with the mine reclamation plan. Plans and drawings for each support facility to be constructed, used or maintained within the permit area are found in Appendix 5-4, Plates 5-7A, 5-7B, and 5-8.

526.221 The new facilities designs shown in Appendix 5-4 prevent~~s~~ or control~~s~~ erosion and siltation, water pollution, and damage to public or private property, and:

526.222 The new facilities designs shown in Appendix 5-4 minimize~~s~~ damage to fish, wildlife, and related environmental values; and minimize~~s~~ additional contributions of suspended solids to stream flow or runoff outside the permit area to the extent possible by using the best technology currently available.

Islands of undisturbed areas within the permit area will be visually monitored for coal fines deposition. If monitoring reveals coal fine deposition, then water sprays on the area from which the fines are originating will be warranted as per the August 27, 1999 Approval Order.

526.300 Water pollution control facilities consist of sedimentation control and properly designed sewage systems.

The sedimentation control is accomplished by containing all disturbed area runoff in a properly sized sedimentation pond. Complete designs are presented in Appendix 7-4

and on Plate 7-6.

The sewage system will consist of a septic tank and drainfield. ~~The system is shown on Plate 5-2.~~ Complete designs are presented in Appendix 5-4.

The drain field design and layout ~~is~~are shown on plate 5-2, and details are shown in Appendix 5-4.

526.400 Since Lila Canyon Mine is an underground operation, this section does not apply.

527. Transportation Facilities.

527.100 All new roads within the disturbed area have been classified as primary.

527.110 See Sections 527.120 and 527.130.

527.120 The Slope Access Road / Portal Access Road and the Mine Facilities Road / Truck Loadout Road will be used frequently for access for a period in excess of six months, and or will transport coal~~, t~~. They are classified as primary roads.

527.121 See 527.120 above.

527.122 See 527.120 above.

527.123 Since none of the new roads planned within the disturbed area will be retained for an approved postmining land use, this section does not apply.

527.130 There are no ancillary roads within the disturbed area.~~.~~

527.200 A detailed design and description for each road, and conveyor to be constructed used, and maintained within the proposed permit area is included in Appendix 5-4. The roads are show on Plate 5-2.

527.210 The specifications for each road width, road gradient, road surface, road cut, fills, embankments culverts, drainage ditches and drainage structures are shown on Plate 5-2 and in Appendixes 5-4 and 7-4.

527.220 Since no alteration or relocation of natural drainage ways is anticipated, this section is not applicable.

527.230 Roads shall be maintained in manner that allows them to meet their design standards throughout their use.

527.240 If any of the roads on the disturbed area is damaged by a catastrophic event, the road will be repaired as soon as practical after the damage has occurred.

527.250 Steep cut slopes or requests for alternative specifications are not anticipated at this time therefore this section does not apply.

528. Handling and Disposal of Coal, **Overburden, etc:**

A narrative explaining the construction modifications, use, maintenance and removal of coal, overburden, excess spoil and coal mine waste.

528.100 Coal will be mined using continuous miners and longwall equipment. The coal will be transported from the face and deposited on the underground mine belts using shuttle cars or continuous haulage equipment. The coal will be transported by a series of conveyor belts from the section to the run of mine stockpile. The coal will be removed from the run of mine stockpile by a reclaim belt to an enclosed crusher/screen. Once crushed the coal will be conveyed to a storage bin from which it will loaded in to coal haul trucks for transportation to a unit train loadout.

528.200 Overburden: Lila Canyon is an underground operation, and it is not anticipated that any material that overlays the coal seam, consolidated, or unconsolidated, other than topsoil, will be disturbed. Therefore, this section does not apply.

528.300 Spoil, coal processing waste, mine development waste, and noncoal waste removal, handling, storage, transportation, and disposal areas and structures are discussed below.

528.310 Excess Spoil: Since Lila Canyon is an underground operation, it is not anticipated tha~~n~~t any spoil will be generated. Therefore, this section does not apply.

528.320 Coal Mine Waste: All underground development waste brought to the surface will be placed in the temporary rock pile and then blended back into the ROM product for

sale. There will be no coal processing waste generated on the surface. Any oversized coal chunks from the screens will be crushed and put back into the ROM stream. Portions of the rock slope material, not containing coal, will be used as structural fill for the shop/warehouse pad. The temporary mine development waste pile and slope rock disposal area are shown on Plate 5-2 and in Appendix 5-7.

528.321 Coal processing waste produced from the screen will not be returned to any abandoned underground workings. Any and all of the coal processing waste from the screen will be crushed and reintroduced into the ROM stream for sale.

528.322 Refuse Piles. Each pile will meet the requirements of MSHA, 30 CFR 77.214 and 30 CFR 77.215, meet the design criteria of R645-301-210, R645-301-512.230, R645-301-513.400, R645-301-514.200, R645-301-515.200, R645-301-528.320, R645-301-536 through R645-301-536.200, R645-301-536.500, R645-301-536.900, R645-301-542.730, R645-301-553.250, R645-301-746.100, R645-301-746.200, and any other applicable requirements.

528.323 Burning and Burned Waste Utilization.

528.323.1. Coal mine waste fires will be extinguished by the person who conducts coal mining and reclamation operations, in accordance with a plan approved by the Division and MSHA. The plan will contain, at a minimum, provisions to ensure that only those persons authorized by the operator, and who have an understanding of the procedures to be used, will be involved in the extinguishing operations. The coal mine waste fire plan can be found in Appendix 5-3. MSHA approval is not required unless you have an actively burning fire. (Phone conversation with Billy Owens MSHA Denver 5/31/05)

528.323.2. No burning or burned coal mine waste will be removed from the permitted disposal area.

528.330 Noncoal Mine Waste.

528.331 Noncoal mine wastes including, but not limited to, grease, lubricants, paints, flammable liquids, garbage, abandoned mining machinery, lumber and other combustible materials generated during mining activities will be placed and stored in a controlled manner in a designated portion of the permit area. The noncoal mine waste will be placed in dumpsters and emptied on a as needed basis. The designated noncoal waste area (concrete trash chute) is shown on Plate 5-2.

528.332 It is anticipated that final disposal of noncoal mine wastes will be at the ECDC facility near East Carbon City. Concrete will be disposed of in a specified area, refer to Plate 5-6 for this location. The disposal site will be located under the reclaimed coal stockpile. This area will receive the maximum fill during reclamation. Placement of this fill around the concrete will help to eliminate runoff. This will ensure that leachate and drainage does not degrade surface or underground water. The noncoal mine waste will be placed in dumpsters and emptied on an as-needed basis.

528.333 The noncoal mine waste will be disposed of at the ECDC facility near East Carbon City.

528.334 Notwithstanding any other provision to the R645 Rules, any noncoal mine waste defined as "hazardous" under 3001 of the Resource Conservation and Recovery Act (RCRA) (Pub. L. 94-580, as amended) and 40 CFR Part 261 will be handled in accordance with the requirements of Subtitle C of RCRA and any implementing regulations.

528.340 A description of the disposal methods for placing underground waste and excess spoil generated at surface

areas according to R645-301-211, R645-301-212, R645-301-412.300, R645-301-512.210, R645-301-512.220, R645-301-514.100, R645-301-528.310, R645-301-535.100 through R645-301-535.130, R645-301-535.300 through R645-301-535.500, R645-536.300, R645-301-536.600, R645-301-542.720, R645-301-553.240, R645-301-745.100, R645-301-745.300, and R645-301-745.400 is covered in sections 535, and 536.

528.350 A description of measures to be employed to ensure that all debris, acid-forming and toxic-forming materials, and materials constituting a fire hazard are disposed of in accordance with R645-301-528.330, R645-301-537.200, R645-301-542.740, R645-301-553.100 through R645-301-553.600, R645-301-553.900, and R645-301-747 is included.

528.400 Dams, embankments and other impoundments.
See Section 700 and Appendix 7-4.

529. Management of Mine Openings:

The permit application includes a description of the measures to be used to seal or manage the openings within the proposed permit area. New slope or drift openings required to be sealed shall be sealed with solid, substantial, noncombustible material for a distance of at least 25 feet into such openings. The closure design for portals, slopes, and drifts, can be found in Appendix 5-6.

529.100 Shafts or other exposed underground opening when no longer in use will be cased, lined, or otherwise managed as approved by the Division. All openings exposed by mining operations within the permit area will be permanently closed unless approved for water monitoring.

529.200 For the purposes of Underground Coal Mining and Reclamation Activities:

529.210 Mine entries which are temporarily inactive, but have a further projected useful service under the approved permit application, will be protected by barricades or other covering devices, fenced, and posted with signs, to prevent access into the entry and to identify the

hazardous nature of the opening. These devices will be periodically inspected and maintained in good operating condition by the person who conducts the activity.

529.220 Since no portals are projected to return underground development waste, coal processing waste or water to the mine, this section does not apply. There is no current need to return any waste to the underground workings.

529.300 Section 529 does not apply to holes drilled and used for blasting.

529.400 No openings have been identified for use to return coal processing waste to underground workings. Therefore, this section is not applicable.

530. Operational Design Criteria and Plans.

531. General plans for the sediment pond and refuse pile are found within this section.

532. Sediment control measures can be found in Chapter 7.

532.100 The smallest practicable area will be disturbed during the life of the project. Progressive backfilling, grading, and prompt revegetation of applicable will be completed as per R645-301-353.200.

532.200 Backfilled material will be stabilized to promote a reduction of the rate and volume of runoff in accordance with R645-301-537.200, R645-301-552 through R645-301-553.230, R645-301-553.260 through R645-301-553.420, R645-301-553.600, and R645-301-553.900.

533. Impoundments.

533.100 Since no impoundments meeting the criteria of 30 CFR 77.216(a), this section does not apply.

533.200 T~~he only impoundment~~wo impoundments are planned for this site~~ is the sediment p~~: Pond #1 and Pond #2. The sediment ~~pond is~~ponds are temporary structures. A detailed design for the Sediment ponds can be found in

Appendix 7-4, Section 3.1; and on Plate 7-6s 7-6a and 7-6b.

533.210 The sediment ponds will be incised, except for the dam/road embankment. This embankment will be reconstructed and compacted to at least 95%. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1; and on Plate 7-6s 7-6a and 7-6b.

533.220 Where fill is to be placed, natural ground shall be removed 12" below the structure. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1; and on Plate 7-6s 7-6a and 7-6b.

533.300 Rip-rap or other protection (culverts, concrete) will be placed at all inlets and outlets to prevent scouring. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1. Also see Plate 7-6s 7-6a and 7-6b.

533.400 External slopes of the impoundment will be planted with an approved seed mix to help prevent erosion and promote stability. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1. A detailed design for the Sediment ponds can be found in Appendix 7-4, Section 3.1; and on Plate 7-6s 7-6a and 7-6b.

533.500 This section does not apply. There are no vertical highwalls associated with this impoundment.

533.600 Since no impoundments are planned that meet the criteria of MSHA, 30 CFR 77.216(a), this section does not apply.

533.700 Design and construction requirements, as well as operation and maintenance requirements, are detailed in Appendix 7-4, Section 3.1.

534. Roads. The designs for surface roads can be found in Appendix 5-4.

534.100 The roads have been designed, located, constructed and will be maintained to:

534.110 The roads have been designed, located, constructed and will be maintained to prevent or control damage to public or private property.

534.120 Non-acid or nontoxic-forming substances will be used in road surfacing.

534.130 The designs for the roads can be found in Appendix 5-4.

534.140 The reclamation plan for the roads can be found in section 542.600.

534.150 The roads have been designed to prevent or control erosion, siltation and air pollution.

534.200 Appropriate limits for grade, width, and surface materials have been used in the design of the roads.

534.300 Primary Roads. Primary roads will meet the requirements of R645-301-358, R645-301-527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-542.600, R645-301-542.600, and R645-301-762, and any necessary design criteria established by the Division, and the following requirements. Primary roads will:

534.310 The roads will be located insofar as practical, on the most stable available surfaces.

534.320 The roads will be surfaced with rock, crushed gravel, asphalt, or other material approved by the Division as being sufficiently durable for the anticipated volume of traffic and the weight and speed of vehicles using the road;

534.330 The roads will be routinely maintained to include repairs to the road surface, blading, filling potholes and adding replacement gravel or asphalt. It will also include revegetating, brush removal, and minor reconstruction of

road segments as necessary.

534.340 Culverts, if required, will be designed, installed, and maintained to sustain the vertical soil pressure, the passive resistance of the foundation, and the weight of vehicles using the road.

535. Spoil: It is anticipated that no spoil will be produced at the Lila Canyon Mine t. Therefore, this section is not applicable.

536. Coal Mine Waste: The proposed Lila Canyon Mine could produce 2 separate types of coal mine waste:

1. Normal coal processing waste or refuse and;
2. Underground development waste (rock slope material).

All underground development waste brought to the surface will be placed in the temporary rock pile and then blended back into the ROM product for sale. There will be no coal processing waste generated on the surface. The rock slope material / underground development waste will be examined and tested as necessary to determine acid- or toxic-forming potential.

536.100 All underground development waste, other than the rock slope material, will be brought to the surface and will be placed in the temporary rock pile and then blended back into the ROM product for sale. There will be no coal processing waste generated on the surface.

536.110 The refuse pile will be designed to attain a minimum long-term slope stability safety factor of 1.5. See Appendix 5-7.

536.200 Underground development waste brought to the surface will be deposited according to the plan described in Appendix 5-7.

536.300 Since no spoil fills will be generated this section does not apply.

536.400 Since there will not be any impounding structures constructed of coal mine waste this section does not apply.

536.500 As discussed in Section 536 and 536.300, it is proposed to

dispose of the rock slope material / underground development waste within the rock disposal area and be used as structural fill as shown on Plate 5-2.

536.510 It is not anticipated that coal mine waste materials from activities located outside the permit area be disposed of in the permit area. Therefore this section does not apply.

536.520 It is not anticipated that coal mine waste will be brought to the surface then taken back underground for disposal therefore this section does not apply.

536.600 In areas where slope rock or coal processing waste is deposited, the topsoil will be removed and stored in the topsoil stockpile area until reclamation.

536.700 It is not anticipated that coal processing waste will be returned to abandoned underground workings therefore this section does not apply

536.800 Since no coal processing waste banks, dams, or embankments are planned for the Lila Canyon Mine therefore, this section does not apply.

536.900 Refuse Piles. (See Appendix 5-7) The refuse pile is designed to meet the requirements of R645-301-210, R645-301-512.230, R645-301-513.400, R645-301-514.200, R645-301-515.200, R645-301-528.322, R645-301-528.320, R645-301-536 through R645-301-536.200, R645-301-536.500, R645-301-536.900, R645-301-542.730, R645-301-553.250, R645-301-746.100 through R645-301-746.200, and the requirements of MSHA, 30 CFR 77.214 and 30 CFR 77.215.

537. Regraded Slopes.

537.100 Each application will contain a report of appropriate geotechnical analysis, where approval of the Division is required for alternative specifications or for steep cut slopes under R645-301-358, R645-301-512.250, R645-301-527.100, R645-301-527.230, R645-301-534.100, R645-301-534.200, R645-301-534.300, R645-301-542.600, R645-301-742.410, R645-301-742.420, R645-301-752.200, and R645-301-762.

540. Reclamation Plan. (See Appendix 5-8 for reclamation plan.)

541. General.

541.100. The operator is committed to performing all reclamation as in accordance with R645 rules.

541.200. N/A. The operator is not involved in surface mining activities.

541.300. The operator is committed to the removal of all equipment facilities and structures upon cessation of mining activities.

541.400. The operator will address all reclamation activities as referenced in Chapter 5 of this document.

542 Narratives, Maps and Plans.

542.100. See Table 3-3 time table based on project reserves markets and life of mine.

542.200. The perimeter of the disturbed area contains approximately ~~42.6~~40.26 surface acres within the disturbed area but only 3~~3~~7.~~86~~02 acres will be disturbed leaving ~~8.74~~3.84 acres of undisturbed islands within the disturbed area.
The following R645 regulations will give detailed description and reclamation procedures to address these areas of disturbance. The reclamation plan for the sediment pond and drainage control structures can be found in Appendix 7-4.

Topsoil amounts can be found in Section 232.100 and are calculated from Plate 2~~0~~-3. Concrete amounts can be calculated from the text in Section 520. Coal Mine Waste volumes can be found in Appendix 5-7. Volumes were calculated using a Cad system.

542.300. Included.

542.310. Included. (See Plates 5-6 & 7-7)

542.320. There will not be any surface facilities left post mining.

542.400. Not applicable. No surface facilities will remain post bond liability period.

542.500. A reclamation time table is included as Table 3-3.

542.600. All roads within the disturbed area will be reclaimed immediately after they are no longer needed for mining and reclamation operations~~.~~, except for the upgraded portion of County Road #R.S. 2477. At the time of reclamation, the Bureau of Land Management (BLM) and Emery County will be given the option of keeping the upgrades to this portion of the roadway, reclaim the roadway to its original condition. The Division will be notified of the final decision.

542.610. The time table of reclamation activities will enable the roads to be removed concurrently with reclamation activities. So, no closures specific to traffic would be anticipated except for the upgraded portion of the Emery County Road #R.S. 2477. Minimal closures may be required for the upgraded portion, if it is reclaimed.

542.620. All bridges and culverts will be removed concurrent with reclamation.

542.630. All disturbed areas will be ripped and top soiled prior to revegetation activities in compliance with all applicable R645 regulations. (See Appendix 5-8)

542.640. Road surfacing materials such as sand and gravel, which are not suitable for revegetation establishment, will be buried on site and covered with a minimum of two feet of material that would support vegetation. Concrete will be disposed of in the designated area and covered with four feet of cover. Asphalt will be disposed of off site, either in

a landfill or sent to a recycling facility.

542.700. Final Abandonment of Mine Openings and Disposal Areas.

542.710. Appendix 5-6 depicts a typical seal that will be constructed at all mine openings.

542.720. No excess spoil is anticipated at this time.

542.730. All underground development waste brought to the surface will be placed in the temporary rock pile and then blended back into the ROM product for sale. There will be no coal processing waste generated on the surface.

542.740. Disposal of Noncoal Mine Wastes.

542.741. All non coal waste will be temporarily stored on site in approved waste bins and commercially picked up and transported to an approved disposal site. Non Coal waste generated during reclamation (such as concrete structure, buried culverts, utility lines, septic systems etc.) will be buried in the refuse disposal area and covered with a minimum of four feet of fill.

542.742. No noncoal waste will be stored on site or disposed of on site during the life of the mine.

542.800. A detailed cost break down is included in Chapter 8-1 Appendix 8-1 relative to bonding.

550 Reclamation Design Criteria and Plans. Each permit application will include site specific plans that incorporate the following design criteria for reclamation activities.

551. All underground openings will be sealed as detailed in Appendix 5-6.

552. Permanent Features.

552.100. In the course of reclamation, areas that have been recontoured and top soiled will be ~~"pock-marked"~~"pock-marked," creating small basins that will facilitate vegetation establishment as well as minimizing erosion.

552.200. No permanent impoundments will be left post reclamation.

553. The operator will comply with all regulations applicable to underground mining activities relative to backfilling and grading as required by R645 regulations.

Some minor cut slopes along the reclaimed road may be left after reclamation due to the difficulty and inability to reclaim all material pushed over the side while making the road cut. See plate 5-7B-2, cross section 16+00 for details. UEI will make reasonable efforts to minimize the cut slopes being left.

553.100. Disturbed Areas. Disturbed areas will be backfilled and graded to:

553.110 The operator will obtain a post mining topography similar in form as what existed premining.

553.120 Since Lila Canyon is an underground operation, no spoil piles will be created. Minor highwalls may be created with the development of the rock slope portals. Upon completion of mining these entries will be sealed as per Closure for Mine Openings Appendix 5-6 and all highwalls will be eliminated during the reclamation phase of the operation. Plate 5-9 shows the proposed portal plan. During reclamation, suitable material will be placed against the portals. This material will be shaped to eliminate the highwall and to bring the slope back to the approximate original contour.

553.130 All fill slope will have a static safety factor of 1.3 as shown in Appendix 5-5.

553.140 Erosion and water pollution will be minimized on site by the use of drainage control structures (b~~u~~erms, channels and silt fence) and the use of small depressions, soil tackifiers, mulch and sediment pond design. No water is anticipated leaving the reclaimed site prior to adequate treatment in the form of retention and/or filtration that does not meet and/or exceed UPDES standards.

553.150 The post mining land use of wildlife and domestic grazing should be enhanced to some degree with the revegetation of a more desirable seed mix and a vegetative cover in excess of what was present premining.

553.200 Spoil and Waste.

553.210 All underground development waste brought to the surface will be placed in the temporary rock pile and then blended back into the ROM product for sale. There will be no coal processing waste generated on the surface. Any oversized from the screens will be crushed and put back into the ROM stream.

553.220 Since no spoil will be produced this section does not apply.

553.221 All vegetation and /or organic material will be removed prior to any coal mine waste being stored.

553.222 All useable topsoil or topsoil substitute will be removed from the structural fill and refuse areas prior to use. Table 2-1 shows estimates of salvageable soil by soil type based on current NRCS soil inventories.

The location of the soil storage ~~are~~is shown on Plate 5-2. This material will be spread over the recontoured structural fill and refuse areas prior to seeding and mulching.

553.223 Since no spoil will be produced this section does not apply.

553.230 All recontoured areas will be compacted to minimize slippage. The area will then be over laid with topsoil and ripped. In addition the area will be "pock-marked" to minimize the potential for erosion, as well as enhance revegetation establishment. It is not anticipated that soil will be disturbed in areas too steep for equipment to operate.

553.240 The structural fill area will have slopes of less than 8% upon final recontouring~~-~~, and revegetated to enhance the post mining land use of grazing and wildlife habitat.

553.250 A need for a refuse pile at Lila Canyon is not anticipated.

553.260 The operator will commit to all applicable R645 regulations relative to disposal of coal processing waste.

553.300 All underground development waste brought to the surface will be placed in the temporary rock pile and then blended back into the ROM product for sale. There will be no coal processing waste generated on the surface. Any oversized from the screens will be crushed and put back into the ROM stream.

553.400 Cut-and-fill terraces may be allowed by the Division

553.410 No cut and fill terraces will be required.

553.420 No terraces will be required for post mining land use.

553.500-540 and 553.600-553.650.500

The only area that falls under these provisions are the reclaimed Horse Canyon mine which lies in the north west portion of the lease area and is addressed under approved MRP Act #0013 ~~(Part "A")~~.

553.700-553.900

This operation will only involve underground mining, and as such the above referenced regulations do not apply.

560. Performance Standards. Coal mining and reclamation operations will be conducted in accordance with the approved permit and requirements of R645-301-510 through R645-301-553.

WordPerfect Document Compare Summary

Original document: K:\Lila\Most Recently Approved MRP Chapters\Chapter 7.wpd
Revised document: K:\Lila\2016\L16-005 New Storage Pad\Originals\Chapter 7 Edits.wpd
Deletions are shown with the following attributes and color:
~~Strikeout~~, Blue RGB(0,0,255).
Deleted text is shown as full text.
Insertions are shown with the following attributes and color:
Double Underline, Redline, Red RGB(255,0,0).

The document was marked with 31 Deletions, 58 Insertions, 0 Moves.

Horse Canyon Extension
Lila Canyon Mine

Chapter 7
Hydrology
11-006

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Chapter 7

700. HYDROLOGY

710. Introduction

711. General Requirements

711.100 The existing hydrologic resources of the proposed Lila Canyon Mine area are detailed under section 720.

711.200 The proposed operations and potential impacts to the hydrologic balance are described in Sections 728 and 730.

711.300 All methods and calculations utilized to achieve compliance with hydrologic design criteria and plans are described in Section 740 and Appendix 7-4.

711.400 Applicable performance standards

711.500 Reclamation hydrology is described in Section 760 and in Appendix 7-4.

712. All cross sections, maps and plans required by R645-301-722 as appropriate, and R645-301-731.700 have been prepared and certified according to R645-301-512.

713. Impoundments will be inspected as described under Section 514.300:

A professional engineer or specialist experienced in the construction of impoundments will inspect the impoundment.

Inspections will be made regularly during construction, upon completion of the construction, and at least yearly until removal of the structure or release of the performance bond.

The qualified, registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of

any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. (See Appendix 5-2 for the inspection form).

A copy of the report will be retained at or near the mine site.

There are no impoundments at this site subject to MSHA, 30 CFR 77.216; therefore, weekly inspections are not required.

Impoundments not subject to MSHA, 30 CFR 77.216 will be examined at least quarterly by a qualified person designated by the operator for appearance of structural weakness and other hazardous conditions.

720. Environmental Description

721. General. The following information will present a description of the existing, pre-mining hydrologic resources within the proposed permit and adjacent areas. This information will be used to aid in determining if these areas will be affected or impacted by the proposed coal mining activities.

The proposed Lila Canyon Mine is located, in the southwestern portion of the Book Cliffs in Emery County, Utah, approximately 2 miles south of the old Horse Canyon Mine, formerly operated by Geneva Steel Company. The proposed mining will be in the Upper (and possibly Lower) Sunnyside Seam of the Blackhawk Formation.

Existing hydrologic resources of the area consist of: Surface water resources - intermittent by rule with ephemeral flow streams; and Groundwater resources - springs and seeps and perched, isolated aquifers. These resources have been evaluated using hydrologic data from the Horse Canyon Mine, water level piezometers, and seep/spring inventory data of the proposed mine and adjacent areas. Plates 7-1 and 7-1A show the locations of the surface drainages, springs and seeps, and piezometers.

722. Cross Sections and Maps

722.100 Subsurface Water. The locations where subsurface water, including springs and seeps, have been identified are presented on Plates 6-1 and 7-1 and data results are included in Appendix 7-1. Relevant cross sections of subsurface water, geology, and drill holes are shown on Plate 6-1. Where sufficient data are available, the seasonal head differences are presented on contour maps (see Figure 7-2A) and on a piezometer hydrograph plot (see Figure 7-2B).

722.200 Surface Water. Location of all streams and stockwatering ponds or tanks in the area of the mine are shown on Plate 7-1. There are no perennial streams, lakes or ponds known to exist within the proposed permit or adjacent areas.

A new diversion work was thought to have been constructed by the BLM in 2004 at the confluence of the Right Fork of Lila Canyon and Grassy Wash. Water from this diversion was directed to the stock pond located in Section 28, T. 16 S., R 14 E. Figure 1 in Appendix 7-9 shows the location of the diversion and the alignment of the diversion channel to the stock pond. Also, the location of the overflow channel back to Grassy Wash is also presented on the figure. However, the BLM was not involved in the pond improvements. Recent site investigation 2006 shows that the diversion structure described in Appendix 7-9 has been breached and no flow now reaches the pond from Grassy Wash. No other ditches or drains are known to have been constructed in the area of the mine.

722.300 Baseline Data Locations. Locations of all baseline data monitoring points are shown on Plate 7-1. Baseline water quality and quantity data is included in Appendix 7-1.

722.400 Water Wells. Three wells and three piezometers have been identified in the permit and adjacent areas. Two wells are located within the alluvium of lower Horse Canyon Creek. Three water piezometers were drilled in the area, IPA #1, IPA #2 and IPA #3, to monitor mine water levels. Drill hole S-32 was drilled and converted to a water monitoring hole by Kaiser in 1981. The details of these wells and piezometers are discussed in Section 724.100 of the application. The location of all these wells and piezometers is shown on Plate 7-1. No information on any other wells has been identified.

722.500 Contour Maps Contour Maps of the proposed disturbed area and mining areas are included as Plates 5-2~~A~~, 5-2~~B~~A, 7-1 and 7-2. These maps

use U.S.G.S. based contours and accurately represent the proposed permit and adjacent areas. Disturbed area maps present greater detail from low-level aerial photography, for greater detail, and are tied to relevant U.S.G.S. elevations to ensure correlation between the maps.

723. Sampling and Analysis

All water quality analyses performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Water quality sampling performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to either methodology listed above when feasible. "Standard Methods for the Examination of Water and Wastewater" is a joint publication of the American Water Works Association, and the Water Pollution Control Federation and is available from the American Public Health Association, 1015 Fifteenth Street, NW, Washington, D.C. 20036.

724. Baseline Information

This section presents a description of the groundwater and surface water hydrology, geology, and climatology resources to assist in determining the baseline hydrologic conditions which exist in the permit and adjacent areas. This information provides a basis to determine if mining operations can be expected to have a significant impact on the hydrologic balance of the area.

724.100 Ground Water Information. This section presents a discussion of baseline groundwater conditions in the permit and adjacent areas. The data set consists of piezometer, spring and seep inventory data, mine discharge, and mine inflow information from the abandoned Horse Canyon Mine. Appendices 7-1 and 7-6 provide data through the 2002 sampling period. All of these data and other recent data are available in the DOGM electronic database. The data, provided in Appendices 7-1 and 7-6 and the DOGM electronic data base, were obtained from multiple sources, including (but not limited to) on-site sampling efforts, the Horse Canyon Mine P.A.P. filed by Geneva Steel and annual reports, U.S. Geological Survey publications, and various consultant reports. Since not all monitoring parties were required to adhere to UDOGM or SMCRA rules, the laboratory parameters varied between reports. However, the data are still considered valid and appropriate for determining baseline conditions within the permit and

adjacent areas. The location of the sampling points are presented on Plates 7-1 and 7-1A.

History of Data Collection. The U.S. Geological Survey conducted a water quality study in Horse Canyon from August 1978 until September 1979 during the time that U.S. Steel operated the mine. Samples were taken monthly from the Horse Canyon Creek and analyzed for most major ions and cations and field parameters. Metals, eight nitrogen species and other minor chemical constituents were taken on a quarterly basis or less.

Between January 1981 and April 1983, baseline water quality data was collected for four surface water/spring sites B-1, HC-1, RF-1 and RS-2, and 3 UPDES Discharge Points, 001 (Mine Discharge), 002 (Mine Discharge) and 003 (Sewer Plant) , on the Horse Canyon permit area. Between 14 and 19 samples were taken and analyzed during the monitoring period depending on the site. The parameters that were analyzed were derived from Section 783.16 in the regulations. DOGM monitoring guidelines were not in force at that time.

Two other sites, RS-1, and RS-2, were sampled once a year during 1978, 1979, and 1980 and analyzed for most major chemical constituents. In addition, springs H-1, H-6, H-18, and H-21 were sampled once by JBR and analyzed for the major constituents in 1985. Third quarter data for 1989 were collected for B-1, HC-1, RF-1, and RS-2 and sampled for most of the parameters in DOGM's guidelines.

Sample sites B-1, HC-1, RF-1 and RS-2, along with the UPDES Discharge Points 001A and 001B, have been monitored quarterly since 1989 in accordance with the approved water monitoring plan for the Horse Canyon Mine (Part A). The results of this monitoring have been submitted to the Division each year with the Annual Report and or have been entered into the Divisions electronic data base.

Baseline monitoring was also conducted on the proposed Lila Canyon Mine extension area by Earthfax Engineering in 1993-1995. Some 60 sites were identified and monitored. This data is presented in Appendix 7-1.

The operational water monitoring program committed to the permit application was implemented in July, 2000. Data will be collected from new monitoring sites L-1-S through L-4-S. L-5-G has yet to be installed. These sites are typically dry and no quality data has been gathered as yet. Sites L-6-G through L-10-G have been monitored for baseline in 1993, 1994, and 1995. These sites, along with piezometers IPA-1, IPA-2 and IPA-3, were

monitored in December 2000 to determine if they were still viable and to establish a current baseline that will be continuous with operational monitoring.

Sites L-11-G and L-12-G were added in October 2001 to replace sites L-6-G and L-10-G. Sites L-13-S, L-14-S, L-15-S, and L-18-S are being used to determine flow characteristics of the Williams Draw Wash, Wash below L-12-G, Little Park Wash, and Stinky Springs Wash.

Sites L-6-G, L-10-G and L-15-S were determined to either provide no flow data or data that was less representative than the replacement sites and will be suspended from sampling in the 1st quarter of 2003.

Wells. The wells in the mine area consist of two water supply wells, three water level piezometers, and an exploration borehole converted to a monitoring well.

Two wells are located within the alluvium of lower Horse Canyon Creek, near the Horse Canyon Mine. These wells area completed in the aerially small, alluvial aquifer at the mouth of Horse Canyon which contains groundwater likely collect from infiltration of surface flows from the upper Horse Canyon area. As indicated in Section 722.400, the well located near the main Horse Canyon surface facilities, identified as Horse Canyon well on Plate 7-1A, is still open, although not operational at this time. The well was investigated and it was determined that it would not be useful as a piezometer. The pump is sitting on the top of a concrete cap encapsulating the top of the well. The site could not be used as a piezometer without removing the pump. This well will be donated to the College of Eastern Utah as part of the Post Mine Land Use Change. The well located near the road junction, identified as MDC well on Plate 7-1A, is an abandoned well owned by Minerals Development Corporation. This well has been sealed to the operator's best knowledge. No hydrologic data is presently available from either of these wells.

Three water level piezometers were drilled as part of plans to access the Kaiser South Lease by I.P.A. These piezometers were designated IPA-1, IPA-2 and IPA-3, and are located in the Lila Canyon Permit area (see Plate 7-1). IPA monitored these sites for water depth from 7/94 to 4/96. These monitoring results are included in Appendix 7-1 and monitoring points and measured water levels are shown on Plate 7-1. It should be noted that the monitoring of these holes was done over the 2 3/4 year period to provide baseline data for the South Lease by I.P.A. Monitoring of water depths at these points by UtahAmerican commenced in December 2000 and continued through present. As indicated by the data in Appendix 7-1, the water levels

in the holes show very little fluctuation. Levels change from less than 1.2' to a maximum of 21.2' over an eight year monitoring period. Figure 7-2A and 7-2B present the seasonal fluctuations of the water levels as contour maps and hydrographs. Using these water levels, an estimate of the projected water level assuming that the zones from the individual piezometers are connected is shown on Plate 7-1 and the monitoring results are included in Appendix 7-1 - Baseline Monitoring.

The piezometers were installed to provide depth of water only. It is impossible to drop a bailer 1000 feet and withdraw a water sample without contaminating the sample. It has been suggested that sampling pumps be installed on these wells. Appendix 7-11 discusses the difficulties of using pumps and bailers in these piezometers. Due to limited pump capabilities in a 2-inch diameter well such sampling is not feasible. Therefore the depth and diameter of the piezometers holes make it impossible to use them for baseline quality sampling.

Drill holes S-26, S-27, S-28, and S-31 were cased in 3" PVC pipe with bottom perforations for water monitoring; however, cement seals were faulty, allowing the PVC pipe to fill with cement. Drill hole S-26 was reported dry in the week prior to cementing.

It has been reported by Kaiser that holes within one and one-quarter miles east of the cliff face were drilled with air, mist and foam and did not detect any water in the subsurface with the exception of drill hole S-32. No apparent increase in fluid level could be attributed to groundwater inflow from these holes, some of which were open for two weeks. Exploration drill holes in the South Lease property south of Williams Draw did not encounter groundwater within 1 to 1.25 miles of the coal outcrop. Exploration drill holes in the South Lease property, south of Williams Draw, did not encounter groundwater within 1 to 1.25 miles of the coal outcrop.

S-32 is located approximately three miles south of Lila Canyon and is separated from Lila by at least two known fault systems. The drill log along with the Chronology of Development and Pump tests are included in Appendix 6-1. Water levels measured are shown in the `"Chronology of Development". Water quality analysis for S-32 is also included in Appendix 6-1. These water quality data are representative of the completion zone of the well (Upper Sunnyside Coal Seam and zone beneath the coal). The location of S-32 is shown on Plate 7-1. The Permittee visited S-32 in 2002 and attempted to measure water levels, but found that piezometer S-32 was unusable.

Spring and Seep Data. JBR Consultants Group (1986) conducted a spring and seep inventory of the Horse Canyon area during the fall of 1985. During the study, no springs or seeps were located within the disturbed area or near the proposed surface facilities. Within and adjacent to the permit area, 19 springs and seeps were found. Flows occurred from either sandstone beds located over shales or from alluvium. The flow rates from the springs varied from less than 1 gpm to about 10 gpm. Table 7-1 shows the flow rates and field data for each site. Sample results are listed in Appendix 7-6.

Based on the data, nine of the springs occurred from alluvial deposits in the stream channels or in colluvium. Nine of the remaining springs discharge from sandstone located above less permeable shale. Spring (H-92) was developed by excavating into bedrock. The discharge from this spring is through a pipe.

An additional spring and seep survey was conducted in the area, including the proposed Lila Canyon Mine area, by Earthfax Engineering in 1993 through 1995. Results of this survey are included in Appendix 7-1 of this permit. This is the most consistent and most recent data; therefore, this data has been used for baseline monitoring in Appendix 7-1.

All of the spring and seep sites identified from the various surveys are presented on Plate 7-1A. The geologic source for the springs can be determined by comparing Plates 6-1 and 7-1 and 7-1A. Additionally, the elevation of the sampling points can be estimated from the topographic base map. All groundwater use (seeps and springs) within the permit and adjacent areas is confined to wildlife and stock watering.

It should be noted that a number of sample sites and monitoring holes have been noted in previous submittals. Sites A-26 and A-31 were mentioned in the Horse Canyon Mine Plan; however, these sites were drilled in 1981, and no data is available as to location and/or water quality data. These sites are considered non-usable for this plan. Sites H-21A, H-21B, H-18A, H-18B, HC-1A and an unidentified spring 1000' southwest of HCSW-2 have been mentioned; however, no sample data or pertinent information is available for these sites, and they have been removed from Plates 7-1 and 7-1A. Plates 7-1 and 7-1A have therefore been revised to show only seep/spring and other pertinent hydrologic data points for which adequate, reliable data is available for the plan.

Water rights for the mine and adjacent areas are addressed in Section 722.200 of this P.A.P.

Table 7-1
1985 Spring and Seep Survey Results

Spring ID	Temp (C°)	pH	Conduct. (umhos.)	Flow (gpm)	Occurrence	Use	Sampled
H-1	7	8.1	950	2	SS over Shale	wildlife	yes
H-2	10	8.0	1111	2	Colluvium	wildlife	no
H-3	-	-	-	<<1	Alluvium	wildlife	no
H-4	9	7.7	1229	1	Colluvium	wildlife	no
H-5	10.5	7.7	1359	1	Alluvium	wildlife	no
H-6	9	7.9	1366	10	SS over Shale	cattle	yes
H-7	9.5	7.6	1985	<1	SS	cattle	no
H-8	12	7.8	1997	<1	SS	wildlife	no
H-9	11	7.7	1919	2	Alluvial	cattle	no
H-10	11	7.9	2150	1	Alluvial	cattle	no
H-11	9.5	7.8	1227	2.5	Alluvium	cattle	no
H-13	11	7.1	1596	4.5	Colluvium	cattle	no
H-14	7	7.5	2040	2	SS over Shale	cattle	no
H-18	7	7.9	1381	9	Alluvium	wildlife	yes
H-19	8	8.2	645	3.5	SS over Shale	developed	no
H-20	14	8.3	777	2.5	SS over Shale	none	no
H-21	14	8.3	968	6	SS over Shale	wildlife	yes
H-22	5	8.3	322	1	SS over Shale	none	no
H-92	-	-	-	<<<1	SS over Shale	none	no

Mine Inflow Information. Based on the historic record, water was encountered underground in the Horse Canyon Mine, resulting in outflows from portal areas of approximately 0.2 cfs or 90 gpm. The size of the flows from pumping or from old portal discharges is more the result of the large size of the mine (approx. 1500 ac), rather than the result of intercepting a localized high flowing aquifer. If the flow is distributed over the mine area, the average inflow is about 0.6 gpm per acre. The water encountered was likely discharge from perched aquifers or saturated sandstone lenses encountered during mining, not uncommon in mines in the Blackhawk Formation.

According to mining records of U.S. Steel (previous owner), groundwater was monitored within the Horse Canyon mine in several locations. Generally, the underground flows occurred from roof drips or areas where entries encountered sandstone lenses. As discussed in the Blackhawk Formation description, the inflows were similar to inflows found in other mines along the Book Cliffs. This is thought to represent an interception of an isolated saturated zone in the subsurface. Generally, a saturated, perched sandstone lense which overlies the coal seam is intersected by the mining operation. This provides a flow path for the isolated water in the sandstone lense to drain into the mine. Over time as the volume of water in the sandstone lense decreases, the rate of discharge also decreases. Eventually, the inflow ceases as the available water in the lense is fully drained. This drying up of the inflow is indicative of a very limited recharge to the deep strata in area, which is consistent with the known horizontal and vertical hydraulic conductivity of the Blackhawk Formation.

Flows which issued from rock slopes and gob areas, where roof collapse may have occurred, were also small. These area would have exposed numerous points for inflow from sand stone lenses, roof bolts, and fractures within the formation. Therefore, it would be likely that if there were large amounts of water stored within the formation, the inflows from these area would have been significantly greater. The lack of these flows from these areas of the mine are a further indication that limited water was stored in the formation and that the recharge to the formation from overlying strata was also limited.

During the period from 1957 to 1962, an exploration test entry was mined south from the Geneva Mine into the Lila Canyon Area. This entry encountered in-place water, which was allowed to collect in short cuts made into the down dip entry which was sufficient to keep excess water from working areas. The exploration entry was terminated when the Entry fault was encountered (see Plate 7-1). More than two months was spent drilling to ascertain the nature of the fault and locate the coal seam. During this

period, there is no mention in the records of excess water or that water was encountered in the Entry fault area.

There is no estimate of water quality retrieved while mining the exploration entry other than mentioned above. However, water flow and seeps were reported to be in the range of 1 to 24gpm.

Only when the mine neared the Sunnyside Fault was significant water encountered. The water was initially pumped for use in the water supply system for the mine. When inflows increased beyond in-mine needs, to keep the workings near the Sunnyside Fault from flooding, the mine pumped water collected from this area from the workings during the period 1980 through 1983, prior to suspending operations. The development plan for the mining within the Lila Canyon extension is planned to avoid the Sunnyside Fault. Therefore, the amount of water to be encountered underground will be limited.

The rate of inflow into the Horse Canyon Mine is not precisely known. In U.S. Steel's Permit Application Package (PAP) (1983) they estimated the average discharge from the mine to be 0.2 cfs. Lines and Plantz (1981, p. 32) also estimated the discharge from the mine to be 0.2 cfs and mentioned that the discharge was intermittent. It is not known, however, if this represents a constant average flow or the average flow rate during discharge periods. The mine was using an unknown volume of water within the mine for dust suppression and other operational needs.

According to the I.P.A. Mining and Reclamation Plan for Horse Canyon, Kaiser Coal re-entered the mine in 1986. They found that at the intersection of the Main Slope and 3rd level, at the rotary car dump, there was water in the bottom of the dump. The water level in the dump was described in the Horse Canyon P.A.P. as being "about 30 feet below the floor (personnel communication, 1990)". U.S. Steel monitoring site 2 Dip, a sump where water collected, is very near this location and has an elevation of 5,827 feet. Therefore, the water level in the rotary dump would be at a level of about 5,800 feet. No other water levels were obtained during 1986.

In 1993, BXG also re-entered the Horse Canyon Mine. They reported water levels at the rotary car dump at approximately 5870. It is not known if this reported level was for the same locations, but it is assumed to be the close to the same location. Due to the extended period without pumping, this water level is probably representative of the level of water collected in the rest of the mine. Therefore, to be conservative, it is assumed that the Geneva exploration entries driven south from the Horse Canyon Mine into the

proposed Lila Canyon mining area do contain water since the tunnels elevation is approximately 5855 feet.

The Horse Canyon Mine has been closed and the surface area reclaimed. With no significant inflow to the old workings, no discharges are occurring from any of the portal areas nor are expected in the future. It is known however, that water has collected in the old entries. As future mining activities, for the proposed Lila Canyon Mine, will be occurring near this area of collected water in the old exploration entry workings, it is likely that some of this water will be intercepted by the proposed Lila Canyon Mine (see Plate 7-1). Water may then have to be pumped from the mine. Because of undulating floor and unknown void areas, it is impossible to determine the amount of water that would be pumped. The rate of pumping, if any, would be determined by the water discharge system design. All water discharged from the mine would be discharged at UPDES Site # 002A which is Site L-5-G, and will meet all UPDES standards. DOGM has specified planning to include a mine discharge of 500 gpm maximum.

An inspection of the Horse Canyon area following mining has shown no diminution of reasonably foreseeable use of aquifers. Since mining ceased in 1983, subsidence should have occurred within two years. However, no deterioration of the aquifers in the area was identified. Mining has not yet begun on the Lila Canyon site; however, since the structure and groundwater regime is similar to the Horse Canyon area, no diminution or deterioration of groundwater resources is expected in this area.

As the mining in the Lila Canyon Mine will be from the same seam and the adjacent strata are the same and the over and underburden are the same, occurrences of ground water in the Lila Canyon Mine are expected to be similar to the Geneva Mine (Horse Canyon). The water quality is expected to be the same as the water encounter in the Horse Canyon Mine. Samples taken underground from the Horse Canyon Mine (MRP part “A” Appendix VI-1) to the north of the Lila Canyon Mine and from well S-32 (MRP part “B” Appendix 7-1) by Kaiser to the south of the Lila Canyon Mine show the water from the level of the coal seam to be a calcium, sodium-sulfate type water. Therefore, it is likely that the water from the strata between these two points from the same strata will be very similar.

Inflows of water encountered while mining are expected to reduce to seeps or dry up in a short period of time. If a significant water inflow is encountered, the water, which is not needed for underground operations, will be collected, treated as necessary, and pumped to the surface for discharge under the terms of the UPDES permit.

Groundwater Systems. In the Lila Canyon Lease area, the groundwater regime consists of two separate and distinct multilayered zones. The upper zone consists of the Wasatch Group which includes of the Colton Formation, the undifferentiated Flagstaff Limestone-North Horn Formation, and the Price River Formation. These formations contain groundwater in isolate, perched aquifers. These perched zones are classified as aquifers because they supply groundwater in sufficient quantities for a specific use (as specified by R645-100-200). The lower zone consists of the Blackhawk Formation (where the coal seams are located). This formation consist of low-permeable strata which contain groundwater in isolated saturated zones. Based on the definition in the State coal mine regulations (R645-100-200), there is no aquifer in the lower saturated zone, because the water is not developed for a specific use nor does the strata transmit sufficient water to supply water sources. Additionally, there is no discharge from this zone along any fault or fracture or in any adjacent canyons. The two zones are separated by the Castlegate Sandstone. This zone is a porous, fairly clean sandstone. According to Fisher, et.al. (1960), the Castlegate Sandstone does not have any shales, clays, siltstones, or mudstones. The lower zone is underlain by the Mancos Shale, a very impermeable marine shale.

Geologic conditions in the permit and adjacent areas are described in detail in Chapter 6 of this P.A.P. Though discussed in several publications for the general Book Cliffs area, formal aquifer names have not been applied to any groundwater system in the permit and adjacent areas because the geometry, continuity, boundary conditions, and flow paths of the groundwater systems in the area differ somewhat from the general published discussions. However, the data do suggest that groundwater systems in each of the bedrock groups are sufficiently different from each other to justify the informal designation of groundwater systems based on bedrock lithology. Thus, the informal designation of the Upper zone - Colton, Flagstaff/North Horn, and Price River and the Lower zone - Castlegate, Blackhawk, and Mancos groundwater systems is adopted herein.

The majority of groundwater in the permit and adjacent areas generally occurs within isolated, perched aquifers in the upper zone overlying the coal-bearing Blackhawk Formation. In the lower zone groundwater occurs in isolated saturated zones in the Blackhawk Formation. Hydrogeologic conditions within the permit and adjacent areas are summarized below:

Upper Groundwater Zone

Colton Formation. The Colton Formation outcrops in the northeast portion of the permit and adjacent areas. This formation consists predominantly of fine-grained calcareous sandstone with occasional basal beds of conglomerates and interbeds of mudstone and siltstone. Data presented in

Plates 7-1 and 7-1A and Appendices 7-1 and 7-6 indicate that 16 springs issue from the Colton Formation within the permit and adjacent areas. The elevations and location of these springs vary greatly within the formation, indicating that the springs are isolated from each other and that they are not part of one aquifer.

Waddell et al. (1986) evaluated the discharge of springs in the formation for the period of June to September 1980. The measured discharge rate generally declined during the 4-month period of evaluation. This suggests that the groundwater system has a good hydraulic connection with surface recharge and that most of the annual recharge quickly drains out of the system. The limited flow indicates that the recharge is limited to small areas above the spring and not to a deeper groundwater sy~~t~~stem.

Groundwater issuing from the Colton Formation has a total dissolved solids ("TDS") concentration of 300 to 600 mg/l (as measured by specific conductance and laboratory analyses of TDS). The pH of this water is slightly alkaline (7.5 to 8.1). Insufficient data are available to describe seasonal variations in these parameters.

The water is a calcium-magnesium-bicarbonate type (see Appendix 7-1). The data also indicated total iron concentrations of <0.04 to 4.89 mg/l. Total manganese concentrations ranged from <0.01 to 1.29 mg/l.

Undifferentiated Flagstaff-North Horn Formation. The Flagstaff-North Horn Formation outcrops across much of the northern and central portion of the permit area. This formation consists of an interbedded sequence of sandstone, mudstone, marlstone, and limestone. Most springs and a major portion of the volume of groundwater discharging from the permit and adjacent areas issue from the Flagstaff-North Horn Formation. According to Plates 7-1 and 7-1A and Appendices 7-1 and 7-6, 36 springs issue from the Flagstaff-North Horn Formation within the permit and adjacent areas.

Groundwater discharge rates for springs issuing from the Flagstaff-North Horn Formation are greatly influenced by seasonal variations in precipitation and snowmelt, with most discharge corresponding to the melting of the winter snow pack during the spring months. Discharge is highest following the spring snowmelt and decreases to a trickle by the fall (Appendices 7-1 and 7-6). Many springs issuing from the Flagstaff-North Horn Formation have been noted to dry up each year.

Waddell et al. (1986), found that most of the annual recharge to the Flagstaff-North Horn Formation drains out of the system within about two months,

while the remainder of the annual recharge drains out prior to the next snowmelt recharge event.

The groundwater regime in the Flagstaff-North Horn Formation appears to be influenced predominantly by the combined effects of lithology and topographic expression. Because the Flagstaff-North Horn Formation forms the upland plateau of the permit and adjacent areas, this formation is capable of receiving appreciable groundwater recharge from precipitation and snowmelt.

Waddell et al. (1986) concluded that the Flagstaff-North Horn groundwater system consists of isolated, perched water bearing lenses rather than a continuous perched aquifer. They indicate that approximately 9 percent of the average annual precipitation recharges the Flagstaff-North Horn groundwater system and that recharge water entering the Flagstaff-North Horn Formation moves downward until it encounters low permeability lenses of shale or claystone layers in the lower portion of the formation, where almost all of the water is forced to flow horizontally to springs.

Data presented in Appendices 7-1 and 7-6 indicate that groundwater issuing from the Flagstaff-North Horn Formation has a TDS concentration range of 400 to 700 mg/l. This water tends to be slightly alkaline and, similar to conditions encountered in the overlying Colton Formation, is of the calcium-magnesium-bicarbonate type.

The data presented in Appendices 7-1 and 7-6 indicate that the total iron concentration of groundwater discharging from springs in the Flagstaff-North Horn Formation is generally less than 0.04 to 0.15 mg/l. Total manganese concentrations in Flagstaff-North Horn groundwater are generally less than 0.03 mg/l. These data do not exhibit seasonal trends.

<u>Price River Formation.</u> The Price River Formation consists of interbedded mudstone and siltstone with some fine-grained sandstone and carbonaceous mudstone. Within the permit area, 17 springs have been found issuing from the Price River Formation as indicated based on data presented in Plates 7-1 and 7-1A and Appendices 7-1 and 7-6. Flows from these springs are limited in quantity and generally show a seasonal decrease with time, being high in the spring and reduce to very low or dry conditions in the summer. Such fluctuations indicate that these springs originate from limited recharge areas. Therefore, these springs are also part of a series of isolated, perched saturated zones or lenses and not part a regional aquifer system. Transmissivity in the Price River Formation is estimated by Waddell (1986) to be 0.07 ft^2/day or 0.00013 ft/day. Based on specific conductance

measurements collected from these springs, the TDS concentration of water issuing from the Price River Formation varies from about 750 to 850 mg/l. The water is slightly alkaline, with a pH of 7.9 to 8.9.

Lower Zone

Castlegate Sandstone. The Castlegate Sandstone consists of a fine- to medium-grained sandstone that is cemented with clay and calcium carbonate. The outcrops of this sandstone form prominent cliffs in the area. No springs were identified in this formation, suggesting that it is not a significant aquifer. The absence of springs is of great significance, since this formation is situated between the overlying Upper groundwater zone (in the Colton, Flagstaff/North Horn, and Price River Formations) and the underlying lower zone (in the Blackhawk Formation). This lack of springs indicates that there is separation between the upper and lower groundwater zones. Most likely this zone is the result of two factors: 1) clay horizons in overlying formations inhibit vertical recharge from groundwaters in the Flagstaff-North Horn Formations, and 2) the exposed recharge area of the Castlegate Sandstone is limited primarily to areas of steep cliff faces.

Blackhawk Formation. The Blackhawk Formation underlies the Castlegate Sandstone and consists of interbedded sandstone, siltstone, shale, and coal. The lower Sunnyside coal seam, to be mined by UtahAmerican, is located in the upper portion of the Blackhawk Formation.

Across the formation, with the exception of the Sunnyside Sandstone, most of the individual sandstone bodies are discontinuous. This results in areas that are saturated; i.e. sandstone lenses; and areas that are dry; i.e. siltstone and shale sections. This discontinuous nature results in the typical pattern found in the mines of the Wasatch Plateau and the Book Cliffs. For this upper portion of the Blackhawk Formation, no regional aquifer has been identified. As mining advances an isolated area of saturation (perched aquifer) is encountered by the entry or by roof bolting or fractures due to subsidence. As the water from these isolated saturated zone drains into the mine it starts at an initially high rate and over time as the limited extent of the zone is emptied, the rate of flow decreases. Some zones which are laterally connected are able to reach a consistent inflow which is a balance for the recharge to the system with the outflow to the mine entry.

The hydraulic conductivity of the lower zone is believed to be about 0.01 to 0.02 ft/day, similar to values reported by Lines (1985) from the Wasatch Plateau for similar lithologies. Structural dip in the Lila Canyon area is about 6 to 7 degrees to the east. The gradient of the lower zone in the Horse Canyon/Lila Canyon area is probably less than 2 degrees.

The IPA water level piezometers (Plate 7-1) were completed within the first formation with identifiable water below the coal seam, the Sunnyside Sandstone of the Blackhawk Formation. EarthFax Engineering supervised the drilling of the monitoring bore holes for IPA. In all three piezometers, immediately below the coal seam, a mudstone layer was encountered. Above the mudstone layer no significant water had been identified. Below the mudstone layer, a sharp transition to a sandstone layer was encountered. This sandstone layer was identified as the Sunnyside Sandstone. Water was identified as occurring from the sandstone layer in each of the piezometers. According to the EarthFax completion logs, the screened zones in the piezometers were located within the Sunnyside Sandstone layer and a cement-bentonite seal was placed from the top of the sandstone layer to the ground surface of the piezometer. Thus, the water level measured in the piezometers is indicative of the conditions found within the sandstone layer.

Data collected from the piezometers (Appendix 7-1) indicate that the water in the sandstone is under pressure. In IPA 1, the water level is approximately 590 feet above the completion zone. In IPA 2, the water level is about 810 feet above the screened level. While, IPA 3 has a water level approximately 250 feet above the completion level.

Additionally, water levels in IPA 2 and 3 varied by approximately 2 feet during the period of July 1994 through April 1996, but showed no consistent trend. IPA 1 showed a rise of 5.6 feet over the same period. Measurements collected in 2001 indicated that the water levels in IPA 2 and 3 were 1 to 2 feet higher than the last time it was measured nearly 5 years earlier, while IPA 1 showed a rise of 16 feet. For the period since 2001, no trend has been identified for IPA 2 and 3, while IPA 1 has continued a slow increase. Although an increase in water levels has occurred during the period of record, this increase is not considered significant.

As the piezometers are completed in the same saturated zone, the piezometric surface shows that groundwater in the Sunnyside Sandstone to be moving to the northeast, into the Book Cliffs (see Plate 7-1). The gradient of the piezometric surface is approximately 0.011 ft/ft. The seasonal fluctuations between fall and spring are almost undistinguishable. Based on the tabulated data (Appendix 7-1), the fluctuation range is less than 0.5 feet between summer and fall readings. Figures 7-1 and 7-2 attempt to show these variations in contour map and piezometer hydrographs.

The water level piezometers show water levels above the lower zone containing the coal seam in area of the mine. However, as reported in the Castlegate Sandstone section, no springs or water bearing zones were

identified in the spring and seep inventories or in the drilling of the water level piezometers in the formation. Therefore, indicating that the piezometer monitored zones are under pressure and that the water identified in the upper zone is perched and isolated from the lower groundwater zone.

While the water in the Sunnyside Sandstone is under pressure, there was no indication during drilling that the coal seam was saturated. Similar conditions have been identified in other mines in the Wasatch Plateau and the Book Cliffs. It is likely that the water within the Sunnyside Sandstone will not affect mining unless the confining mudstone layer is breached.

It is possible that mining will intercept some water as it progresses down dip. However, as discussed previously regarding mine water inflows to the Horse Canyon Mine, it is expected that water quantities and quality will be similar to that encountered in the Horse Canyon Mine. While some pumping is likely for water from the isolated saturated zones within the lower groundwater zone; since the water in the upper groundwater zone appears to be perched aquifers 200 to 500 feet above the coal seams, no adverse effects on usable surface sources are expected.

No springs have been identified as issuing from the Blackhawk Formation (see Appendices 7-1 and 7-6 and Plates 7-1 and 7-1A).

The quality of groundwater in the Blackhawk Formation is characterized by the water quality of data collected from inflows to the Horse Canyon Mine, which is completed in the lower portion of the Blackhawk Formation. Both mines will be completed in the same coal zone. Therefore, the quality of the water encountered in the Lila Expansion is expected to be similar to the water encountered in the Horse Canyon Mine. These data indicate that Blackhawk Formation groundwater has a mean TDS concentration range of 1400 to 2400 mg/l and is of the calcium, sodium-sulfate type. These waters are chemically distinct from groundwater in overlying groundwater systems.

Quality and quantity of underground water is the most difficult to ascertain due to geologic variables such as faults, fractures, channel sands and isolation of these particular features when water is encountered in order to gain reliable samples. Underground water tends to be co-mingled with water from other places in the mine and water pumped through the mines for mine equipment and dust suppression. Thus, care needs to be taken to obtain representative samples. Specific undisturbed water samples of the subsurface inflows are not known to have been collected. However, the quality results reported in the Horse Canyon records are consistent with in-mine samples from adjacent mines.

The dissolved iron concentration of groundwater flowing into the Horse Canyon Mine has historically been less than 0.5 mg/l and is generally less than 0.1 mg/l (see Appendices 7-1 and 7-6). The total iron concentration of this water has historically been less than 0.7 mg/l and generally less than 0.1 mg/l. The total manganese concentration of Blackhawk Formation water (as measured in the Horse Canyon Mine) has historically been less than 0.05 mg/l and is typically less than 0.03 mg/l (see Appendices 7-1 and 7-6).

Mancos Shale. The Mancos Shale is exposed south and west of the permit area. This formation is a relatively impermeable marine shale and is not considered to be a regional or local aquifer. Groundwater samples collected from two monitoring sites located in Stinky Spring Canyon approximately 2 miles southeast of Lila Canyon Mine have a TDS concentration in the range of 2200 to 4200 mg/l and are of the sodium-sulfate-chloride type (Appendix 7-1). The flow rate for these two springs is less than 1 gpm, indicating the impermeable nature of the source formation. In the 1981 baseline study for the Kaiser Steel south lease permit document, Kaiser indicated that no springs were identified below the coal seam along the face of the Book Cliffs. Therefore, at that time, these springs were not flowing. Total iron concentrations ranged from 0.35 to 11.8 mg/l. Total manganese concentrations ranged from 0.05 to 0.29 mg/l. Chemical compositions of other parameters are consistent with waters from the Mancos Shale in the Book Cliffs area. The change in water type, from sodium-bicarbonate in the overlying Blackhawk Formation to sodium-sulfate-chloride in the Mancos, and the increased iron and manganese concentrations indicate that the Big and Little Stink spring waters are not from the same source, but are isolated waters from different recharge sources.

The two springs, which are located stratigraphically near the top of the Mancos Shale, appear to be fault related. As shown on Plate 7-1a, there is an east-west trending fault zone that is located within the canyon where Big and Little Stink Springs are located, referred to as the Central Graben. These two springs are located on the southern side of the northern fault of the graben. Due to the isolated nature of this graben block, being down dropped relative to the surrounding strata, within the highly impermeable Mancos Shale, it is unlikely that these springs are connected to any other water sources within the permit area. Further, the water quality and flow of the these springs, as discussed above, also indicate an isolated nature of the waters. Based on these results, the waters from Big and Little Stinky Springs are considered are from a localized, isolated saturated zone, but not part of a regional aquifer or an extensive saturated zone.

Recharge and Discharge Relations

Recharge in the permit and adjacent areas occurs from precipitation to the exposed strata. Plate 7-1a shows the major zone of recharge. This recharge area corresponds to the outcrop and exposure of the Colton/Flagstaff-North Horn Formations. No perennial surface water streams or surface water bodies exist within the permit or adjacent areas which contribute water to the groundwater systems. The majority of infiltration is a near surface occurrence into the alluvial fills within the drainages. The deeper sediments underlying the drainages (Blackhawk and Mancos) consist of low transmissivity strata which would prohibit the vertical movement of groundwater.

Recharge rates were calculated by Waddell and others (1986, p. 43) for an area in the Book Cliffs. Waddell estimated recharge at about 9 percent of annual precipitation. Lines and others (1984) indicate the mean annual precipitation along the Book Cliffs in the area of the Horse Canyon Mines is about 12 inches, indicating a recharge rate of just over 1 inch per year.

The recharge and discharge areas for local isolated, perched aquifers in the upper zone (Colton, Flagstaff-North Horn and Price River Formations) generally lie within the drainage areas of Horse and Lila Canyons. These local systems are complex in that they are discontinuous and lenticular in nature and highly dependent on topography. Recharge water from precipitation or snowmelt enters the Colton or Flagstaff-North Horn Formations and moves downward until it encounters low permeability shale or claystone layers or lenses in the formations, where almost all of the water is forced to flow horizontally to springs. The springs exhibits substantial variability in discharge in response both to spring snowmelt events and to drought and wet years. Discharge rates as great as 20 gpm have been recorded from the springs during the high-flow season, and discharge rates as low as 1 gpm are not uncommon during late summer. The effects of the drought occurring in the late 1980s and early 1990s are clearly evident in the flow records.

Recharge to the lower zone including the Castlegate Sandstone, Blackhawk Formation, and Mancos Shale is of limited magnitude, due to the limited area of exposure of the formations to steep outcrops and the presence of low-permeability units in overlying North Horn and Price River Formations. Additionally, the clay layers in the upper Blackhawk, which contain approximately 80 percent clays, siltstones, mudstones, and shales, are all highly restrictive to vertical groundwater movement (Fisher and others, 1960). Further, no surface water bodies are present to act a supply sources to the deep ground water system.

Recharge to the lower zone probably occurs primarily from vertical movement of water through the overlying formations and is probably greatest

where surface fractures intersect the topographic highs where the upper zone formations outcrop. The rate of recharge to the lower zone is very slow. The lack of a significant recharge source results in limited discharge areas. The largest portion of recharge to the lower zone is in the Castlegate Sandstone and upper member of the Blackhawk Formation with some leakage from the upper zone where the greatest number of springs are identified.

The Sunnyside fault zone is the major feature throughout much of the ~~Sunnysdie~~Sunnyside Mining District. Having a north-northwest strike, the fault zone extends from West Ridge to the Horse Canyon Mine. South of the Horse Canyon Mine the faults are not mapped at the surface. South of Horse Canyon, the faults are believed to be east of the Lila Canyon extension.

At the south end of the Lila Canyon Extension, a series of east-west trending faults have been mapped. These faults form the structure known as the Central Graben. The graben is a down dropped block relative to the adjacent strata.

Faults may effect flow, direction and magnitude of both lateral and vertical flows. However, the area is abundant with plastic or swelling clays that can seal faults and fractures inhibiting both lateral and vertical flows. As discussed in the mine inflow section, significant groundwater was only encountered in the Horse Canyon Mine as mining approached the Sunnyside fault zone. To prevent such inflows at the Lila Canyon extension, the mining plan attempts to avoid the fault zone. Also, exploratory mining by U.S. Steel, during the period 1952 to 1960, encountered the east-west trending Entry fault in the proposed Lila Canyon area. After extensive exploration, no significant water was encountered from the east-west trending fault.

Assuming mass-balance and stable hydrologic conditions, recharge will equal discharge over the long term. The relatively rapid groundwater discharge from the upper zone formations as compared with the underlying lower zone formations suggest that the stratigraphically-higher water discharges are local and are not hydraulically connected with the lower zone. Waddell et al. (1986) conclude that the perched nature of the upper zone formations protect them from the influence of dewatering of the coal-bearing zone unless the upper zone is influenced by subsidence.

Groundwater resources in the permit area are limited due to the small surface area and low recharge rates. There is not enough base flow from groundwater discharge to maintain a perennial flow in Horse Canyon Creek or Lila Canyon.

The upper groundwater zone produces low volume spring flows from up-dip exposures of bedrock and overlying alluvium. Some spring discharges from this zone have been developed and are used for livestock and wildlife. The lower groundwater zone has very limited discharges that are used for wildlife, generally during the early spring. Based on the location of these lower zone points and the vertical separation (500 feet) between the coal seam and the points, there is no possibility of mining impacting the springs.

Due to the lenticular, discontinuous, and vertically separated water bearing zones in the upper zone, it is not possible to develop a potentiometric surface or to show water level variations within these discontinuous aquifers. As described above, the nature of the discharge from the springs with time has been identified. Also, it is not possible, due to the discontinuous nature, to map the extent of the upper water bearing zones.

724.200 Regional Surface Water Resources. The permit area exists entirely within the Horse Canyon, Lila Canyon, and Little Park Wash watersheds. The regional drainage patterns are generally north-south with steep canyons which are incised in the Book Cliffs escarpment. Stream flows within the region, generally, are the result of snowmelt runoff or summer thunderstorms. Water is not abundant as evapotranspiration exceeds precipitation.

Permit Area Surface Water Resources

Within the permit area, the surface water resources consist of three main drainages: Horse Canyon Creek, Little Park Wash, and Lila Canyon. Horse Canyon flows to Icelander Wash which, in turn, flows to Grassy Trail Creek and the Price River. Little Park Wash flows southward to Trail Canyon and the Price River. Lila Canyon flows southwest to Grassy Wash, then south to the Marsh Flat Wash and the Price River (see Plate 7-1).

Surface water sampling data are available in Appendix 7-2 and in the DOGM electronic database. The data were obtained from multiple sources, including (but not limited to) on-site sampling efforts, the Horse Canyon Mine P.A.P. filed by Geneva Steel and annual reports, U.S. Geological Survey publications, and various consultant reports. Since not all monitoring parties were required to adhere to UDOGM or SMCRA rules, the laboratory parameters varied between reports. However, the data are still considered valid and appropriate for determining baseline conditions within the permit and adjacent areas. The location of the sampling points are presented on Plates 7-1 and 7-1A.

Based on field observations (described in Appendix 7-7) and flow data obtained during the collection of water-quality samples within the permit and adjacent areas, Horse Canyon Creek is considered intermittent by rule with ephemeral flow within the permit area. Lila Canyon and Little Park Wash, based on the size of the drainage area (greater than 1 sq. mi.), are defined by regulation as intermittent but have been shown to be intermittent by rule with ephemeral flow (see Appendix 7-7). Several smaller tributaries of these streams within the permit and adjacent areas are ephemeral by flow pattern and by rule.

Horse Canyon, Little Park and Lila Canyon flow during the spring snowmelt runoff period and also as a result of isolated summer thunderstorms. Due to the limited drainage area and elevation of Lila Canyon, the duration of the snowmelt flows is quite short and is limited to the very early spring. Flows in Horse Canyon, generally, are limited to the early spring period (Lines and Plantz, 1981). By mid to late spring, usually no flow is evident in Horse Canyon Creek, below the minesite or Lila Canyon.

Over the period of record, 1981 through present, there have been both wet and dry periods. From 1983 through 1984, the area had high precipitation. In the late 1990's through the present, a drought has been evident in the area. Over this period of record, the flows in the streams have increased and decreased based on the available water. Also, during both of these periods, flows in Horse Canyon Creek during the summer and fall are generally not evident below the mine site. Only flows from summer thunderstorms upstream of the site have resulted in flows below the mine. This indicates that while surface water resources may fluctuate, the fluctuations are not great enough to change the response of the stream to overcome the hydraulic and geologic characteristics of the area.

During most years, the snowmelt peak is the highest peak flow for the drainages. Under certain circumstances, when a significant summer thunderstorm occurs over the drainages, the runoff event can be quite large. In the area of the springs, there are sections with continuous flow, where the channel has cut into the perching layer of the spring. The flows from the springs continue a short distance downstream of the spring location; however, there is no base flow contribution within the channel itself. The only flow is a result of the spring discharge and this is absorbed by the channel fill indicating a losing stream reach. There are no indications that any other reaches of Lila Canyon or Little Park Wash are perennial. Since the spring of 2000, both areas have been observed numerous times (at least quarterly) and no flow has even been noted in either drainage. Normally, this would indicate an ephemeral drainage, however, since the drainage areas are

greater than one square mile and exhibit no consistent flows, they are classified by regulation as intermittent.

The ephemeral nature of the streams make it difficult to document the high and low flow periods. Generally, the seasonal flow pattern for the drainages consists of dry channels until a thunderstorm or rapid snowmelt occurs. Then there is a short duration of flow within a portion of the channel. Following the passing of the storm or melting of the snow the runoff quickly decreases and the channel is again dry until the next event.

Such an event was documented in March 05 near the monitoring station L-11-G reported in the DOGM database 05/06/05. This was flow from a snowmelt event. An attempt was made to get to the monitoring point, but the access to the site was inaccessible due to deep snow across the road up Lila Canyon. Access was available only a short distance (couple of hundred feet above the Horse Canyon Access road). A water sample was taken at the upper most point that could be accessed. This was an area that typically would have been dry with no flow. The flow recorded was 7.5 gpm and a water quality sample was taken. The data are presented in the DOGM database.

A number of perched springs do exist in the tributaries of the upper reaches of the Little Park Wash drainage; however, the flows from the springs dry-up or infiltrate into the alluvial fill of the canyons within 50 to 200 feet of the source, before reaching the main drainage channel. The springs and seeps in the area have been sampled, as indicated in this application, as part of the baseline and spring/seep inventories. Therefore, they provide an estimate of the quality of the flow within the drainages.

Precipitation in the area generally consists of either high-intensity, localized thunderstorms or area wide, frontal storms. Table 7-1A presents rainfall-runoff model simulation results of both the 6-hour and 24-hour rainfall events of the drainages in the site area, to simulate each kind of storm. Appendix 7-10, Figure 1 presents the location of the drainages for the simulation results in Table 7-1A. Appendix 7-10 also presents the simulation calculation results. These peak flow results show that for short duration events with small return periods (5 years or less), there is little or no runoff from the watersheds. Additionally, due to the localized character of the thunderstorms, the storms affect only a part of the watershed and the limited runoff that does occur is lost to channel losses (infiltration, evaporation, transpiration) within the portion of the watershed that is not affected by the rainfall event. As the return period of the storm increases, storms have greater intensity and tend to cover larger areas, which likely affects most if

not all of the watershed. Therefore, flows tend to increase. Intense rainfall may cause heavy flooding, but likely only affect small areas and do not result in large volumes of runoff.

For the long duration, frontal type storms, the entire watershed is covered for each event. The frontal precipitation events tend to produce only limited amounts of flow in the local ephemeral washes for the short return periods. With the increase in the return period, the flow events tend to be larger. This is due to the contribution from the entire watershed.

Each flow event in an ephemeral channel is separate and distinct. The stream flow is directly proportional to the amount of precipitation or snow-melt runoff, and the water quality varies greatly depending on the amount of flow. The duration of these runoff events is generally short. For thunderstorm events, the flow is generally less than a few hours. Duration of runoff from the frontal runoff events is moderate in length, generally on the order of 11 to 14 hours. Based on the end of rainfall from the watershed model simulations, the runoff would generally end within 3 to 5 hours. Therefore, if a sampler were not on-site during the event, it is unlikely that any flow would be observed.

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
WS1.1	6 hr	0	0	1.39	5.54	9.98	17.18
	24 hr	0.65	3.22	9.31	22.68	39.50	59.77
WS1.2	6 hr	0	0	1.21	6.43	12.77	22.18
	24 hr	0.86	3.82	9.45	20.66	33.99	49.70
WS1 Total	6 hr	0	0	2.37	11.78	22.68	38.79
	24 hr	1.50	6.62	16.96	39.59	67.46	100.70
WS7 Total	6 hr	0	0	2.23	10.43	19.63	33.75
	24 hr	1.29	6.04	15.85	36.15	60.94	90.24

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
WS8 Total	6 hr	0	0	0.85	3.60	6.59	11.34
	24 hr	0.43	2.09	5.76	13.64	23.46	35.09
WS9 Total	6 hr	0	0	3.46	16.17	30.46	52.36
	24 hr	2.01	9.38	24.59	56.08	94.53	139.99

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 6.1	6 hr	0	0	1.63	6.48	11.66	20.08
	24 hr	0.76	3.76	10.88	26.5	46.16	69.84
Little Park 6.2	6 hr	0	0	0.93	3.70	6.66	11.47
	24 hr	0.44	2.15	6.21	15.14	26.36	39.89
Little Park 6 Cumulative	6 hr	0	0	2.56	10.18	18.33	31.54
	24 hr	1.20	5.91	17.09	41.63	72.52	109.74
Little Park 6.3	6 hr	0	0	0.32	1.21	2.15	3.70
	24 hr	0.14	0.70	2.17	5.47	9.75	14.92
Little Park 5.1	6 hr	0	0	0.31	1.00	1.73	2.93
	24 hr	0.11	0.59	2.41	7.85	15.16	23.59
Little Park 5.2	6 hr	0	0	0.73	2.75	4.87	8.38
	24 hr	0.32	1.59	4.92	12.40	22.10	33.82
Little Park 5 Cumulative	6 hr	0	0	2.82	11.34	20.41	35.22
	24 hr	1.77	8.54	24.80	61.16	107.32	163.42
Little Park 4.1	6 hr	0	0	0.75	2.58	4.47	7.65
	24 hr	0.29	1.49	5.31	14.72	28.04	43.72
Little Park 4.2	6 hr	0	0	0.76	3.01	5.42	9.33
	24 hr	0.36	1.75	5.06	12.32	21.46	32.47
Little Park 6.4	6 hr	0	0	0.23	0.86	1.53	2.64
	24 hr	0.10	0.50	1.55	3.90	6.95	10.64

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 6.5	6 hr	0	0	0.90	3.58	6.45	11.10
	24 hr	0.42	2.08	6.02	14.66	25.53	38.63
Little Park 4 Cumulative	6 hr	0	0	6.17	24.81	44.74	77.12
	24 hr	2.93	14.01	40.73	101.08	178.91	269.04
Little Park 6.6	6 hr	0	0	0.87	4.44	8.64	14.92
	24 hr	0.58	2.60	6.58	14.58	24.18	35.52
Little Park 3.1	6 hr	0	0	2.35	8.86	15.72	27.03
	24 hr	1.03	5.13	15.87	40.00	71.27	109.07
Little Park 3.2	6 hr	0	0	1.00	4.65	8.76	15.07
	24 hr	0.58	2.70	7.08	16.14	27.20	40.29
Little Park 3 Cumulative	6 hr	0	0	9.73	42.29	77.65	133.01
	24 hr	5.08	23.46	65.66	162.22	284.24	430.10
Little Park 6.7	6 hr	0	0	0.76	4.53	9.00	15.63
	24 hr	0.60	2.69	6.66	14.57	23.96	35.04
Little Park 2.1	6 hr	0	0	0	1.84	4.30	7.79
	24 hr	0.17	0.81	2.54	7.96	14.23	24.90
Little Park 2.2	6 hr	0	0	0.64	3.68	7.15	12.35
	24 hr	0.48	2.16	5.45	12.07	20.02	29.40

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 2 Cumulative	6 hr	0	0	11.07	54.40	100.57	168.92
	24 hr	6.59	29.31	80.68	192.12	329.11	493.91
Little Park Total	6 hr	0	0	11.56	58.64	110.02	183.99
	24 hr	7.24	31.45	84.30	199.12	340.37	508.74

To determine the extent of the protection of these runoff waters, the downstream state appropriated waters were evaluated. As listed in Table 7-2 and shown on Plate 7-3, the downstream water rights are held by the BLM and consist of 91-2617, -2618, -2619, -2620, -2621, -2646, -2665, -4516, -4646, -4648, and -4649. As reported in Table 7-2, most of these rights have no flow and no use associated with them. According to the State Engineers web site, these rights have not yet been evaluated to determine if there is sufficient water to meet the right. Many of these rights are located on the stream and some are for stock ponds to be located off stream. However, in reviewing these locations, except for 91-2621, no stock ponds have been located in these areas. The BLM pond located at the location of water right 91-2621 had some improvement work conducted in 2004 (see Appendix 7-9). However, the BLM was not involved in the pond improvements. Recent site investigation shows that the diversion structure described in Appendix 7-9 has been breached and no flow now reaches the pond from Grassy Wash.

There are two water rights for isolated stock ponds in the head waters of Stinky Spring Canyon, 91-4648 for Dryden Reservoir located in the SE/4, SW/4, Section 14, T16S, R14E and 91-4649 for Sams Pond located in the NW/4, NE/4, Section 23, T16S, R14E (see Plates 7-1 and 7-3). Both of the water rights are owned by the BLM and have a maximum capacity of 3 ac-ft. No records have been found that these ponds were constructed. Based on the maximum capacity of the ponds, it is expected that these ponds would be about one half acre in size, assuming a depth of 5 feet. Field inspection of the quarter sections found no ponds along the ephemeral drainages and review of aerial photos of the area also did not reveal any ponds in the area. Based on the locations for

the water rights, the area for water right 91-4648 is shown in a photograph presented in Attachment 1 of Appendix 7-7 (Photo 93 - Page 28). As can be seen, there is no stock pond in this area. The area for water right 91-4649 is shown in photographs taken in the area (see Figure 7-5) indicated in the water right of the pond. No pond has been found. The only thing found in the designated area is an area of grass in the pinyon juniper.

Based on water rights flow values and the lack of a specified use, it is assumed that the State Engineer and the BLM had planned to develop range improvements in the area, but the lack of water made this effort unsuccessful. Given the lack of use for these downstream channels, it does not appear that a significant concern exists for the downstream waters.

Surface waters in this part of the Book Cliffs drain to the Price River. The Price River flows to the Green River which, in turn, flows to the Colorado River. It is anticipated that only during extremely long duration, high-intensity thunderstorms that flow from the ephemeral and intermittent drainages within the permit area would reach the Price River. Due to the length of channel and the limited volume of runoff, the majority of flow is lost to channel losses, as indicated in Appendix 7-9.

Lines and Plantz (1981, p. 33) conducted three seepage surveys of Horse Canyon Creek in 1978 and 1979. The results of the surveys show no consistent trends through time. Mine discharges created difficulties in interpretation of the data because there was no indication of whether the mine was or was not discharging water at the time of the surveys. However, Horse Canyon Creek below the mine is a losing stream, due to the visual observation of low flows decreasing downstream of the mine (professional observations, Thomas Suchoski, 1979-1980 & 1984-86). Flow in the channel adjacent to the mine facility entry portal on several occasions during mine inspections during the spring period were approximately 4 to 6 inches deep, with a flow width of 15 to 20 feet. Downstream of the mine in the area of the roadside refuse pile, the flow would be 2 to 3 inches deep with a flow width of 10 to 12 feet. Channel slopes in both areas were similar. No diversions are present along this reach of the channel to reduce the flow. Therefore, the channel flow decrease is the result of infiltration and evaporation of the water within the channel.

The Lila Canyon drainage is normally dry, flowing only in response to precipitation runoff or rapid snowmelt. The mine facilities will be located in the Right Fork of Lila Canyon.

In January 2004, an assessment of the geomorphic character of the Lila Canyon channel, downstream of the proposed mine site, was conducted to address

DOGM comments. A series of channel cross-section measurements were taken and the bed and bank materials visually observed. During this evaluation, it was discovered that a diversion structure had been installed just above the confluence of the Right Fork of Lila Canyon and Grassy Wash (see Appendix 7-9 and Figure 7-3). This diversion structure diverted all flow from the drainage and conveyed it by diversion channel to a stock pond located in the SW/4, SW/4 of Section 28, T. 16 S., R. 14 E. Subsequently, it was thought that the improvements were part of a BLM range improvement project. This structure significantly modified the drainage pattern for this area. Flows that previously would have flowed into Grassy Wash would now be detained in the stock pond. However, in discussions with BLM personnel, it was discovered that the BLM was not involved in the pond improvements. Recent site investigation shows that the diversion structure described in Appendix 7-9 has been breached and no flow now reaches the pond from Grassy Wash.

The closest perennial stream to the permit area is Range Creek. The drainage is located approximately 6 miles east of the proposed Lila Canyon permit area boundary (see Plate 7-1a).

Range Creek is in a broad, south-southeast oriented drainage that has been eroded into the Roan Cliffs. A western extension of the Roan Cliffs (Patmos Ridge) lies between Range Creek and the Book Cliffs. The proposed Lila Canyon operation is on the west side of Patmos Ridge. The Colton Formation is exposed at the surface from Patmos Ridge east to the main body of the Roan Cliffs, and between these two escarpments Range Creek has eroded into but not through the Colton Formation. Approximately eleven miles southeast of the permit area, just upstream of Turtle Canyon, Range Creek has eroded through the Colton, Flagstaff, and North Horn Formations, but it reaches the Green River without having eroded through the Upper Price River Formation. The nearest Blackhawk outcrop is 10 miles further south, along the Price River.

Argument has been made that Range Creek receives recharge from a regional aquifer which is likely from the lower saturated zone that the Lila Canyon Mine will be mining or that the overlying perched upper zone might be drained by the mining activities and affect the flows contributing to and in Range Creek.

To address these concerns, the following issues were evaluated. An evaluation of the elevation difference between the saturated ground-water zone in the Blackhawk Formation and stream flows in the Range Creek drainage was conducted, especially for the reaches nearest the permit area. Also, the thickness and composition of the strata between the coal seam and the creek was conducted. Further, the potential for diminishment of spring and tributary

flows to the Range Creek drainage resulting from subsidence impacts within the recharge area to the overlying strata was evaluated.

If the deeper ground water in the Blackhawk Formation were to flow following either the gradient indicated by the piezometers (see Figure 7-1) or geologic dip (see Plate 7-1B), the water would flow well below Range Creek (800 to 1,200 feet) in the reaches nearest the Lila Canyon Mine and for many miles downstream.

Additionally, the thick section of strata between Range Creek and the Blackhawk Formation would impede hydraulic interaction between any deep ground water and the surface (Plates 7-1A and 7-1B). It is estimated that the vertical separation between the Blackhawk and Range Creek at the base of the Colton would be about 1,200 feet.

A review of U.S. Geological Professional Paper by D.J. Fisher, C.E. Reeside and J.B. Erdman, 1960, **Cretaceous and Tertiary Formation of the Book Cliffs, Carbon and Emery Counties, Utah,** which evaluates the composite stratigraphy in the Horse Canyon area, was conducted. The lithology descriptions were reviewed and a total of the percentage of shale, siltstone and mudstone (less permeable layers), for each strata identified by the authors, was generated to get an idea of the ability of each strata to restrict flow throughout the stratigraphic column.

Colton Formation		
Upper Sandstone Unit	1,300 ft.	
% Shale		23.1
Shale Unit	960 ft.	
% Mudstone	82.9	
Lower Sandstone Unit	1,128 ft.	
% Shale and Mudstone		34.8
North Horn–Flagstaff, Undifferentiated		
Shale beds	237 ft.	
Mudstone	181 ft.	
Limestone	21 ft.	
Siltstone	25 ft.	
Clay	7 ft.	
Sandstone beds	99 ft.	
%Shale, Clay, Siltstone, and Mudstone		79.0
Price River Formation		
Upper Unit	299 ft.	

% Shale		43.8
Lower Unit	234 ft.	
% Shale and Siltstone		43.8
Castlegate Sandstone	160 ft.	
% Shales, Clays, Siltstones or Mudstones		0
Blackhawk Formation		
Upper Shale Unit	170 ft.	
Middle Sandstone Unit	0 ft.	
Middle Shale Unit	102 ft.	
Lower Sandstone Unit	200 ft.	
% Shale		52.5

Based on the stratigraphic column in the area, the overall percentage of less permeable strata is 47 percent. Looking at the distribution of the less permeable strata, the majority is in the upper lithographic units. The Colton and North Horn-Flagstaff contain about 1940 feet of less permeable units, while the Price River and Blackhawk contain about 480 feet. Therefore, there is little potential for water to move vertically between the upper and lower zones. The main direction of water movement will be horizontally within the strata.

Further, the elevation of Range Creek in the area of concern ranges from 6890 to 5740 feet (see Plate 7-1A). The coal seam exposure along the Book Cliffs ranges from 5,500 to 6,000 feet. Therefore, for water to flow from the coal seam to Range Creek the flow would need to overcome a hydraulic head difference of 200 plus feet, just based on the initial elevation and not accounting for dip of the formations. There is insufficient head and no source of water to provide the driving head for such conditions.

In regard to subsidence affecting the potential recharge to the springs and tributaries to Range Creek, as described in Chapter 5, Section 525, the subsidence limits from the proposed mining are required to be limited to the area of the permit boundary. Therefore, the recharge area to Range Creek that the mine might affect is limited to that portion of the recharge area within the permit boundary.

To determine the recharge area to Range Creek, a review of the relationship of the proposed permit area, location of Range Creek and the geology in the area, as shown on Plate 7-1A, in the reach nearest to the proposed mine, was conducted. As is evident on Plate 7-1A, the Little Park drainage has eroded through the Colton and North Horn Formations and into the Price River Formation, while the Range Creek drainage has not eroded through the Colton

Formation. Based on this and the previous discussion of the high percentage of low permeable strata within the Lower Colton and North Horn-Flagstaff formations, there is limited potential for recharge to the springs and tributaries from areas below the bottom of the Colton Formation. Figure 7-3 presents a representation of the likely characterization of the method of recharge to these springs. The potential impact area from the mine is, therefore, that portion of the permit area that is east of the Horse Canyon and Little Park drainages which is above the Colton - North Horn-Flagstaff contact within the area of maximum subsidence.

Based on a projection of the direction of dip (N68^{o}E), the recharge area of the Range Creek drainage that might be affected by the mine would be from just north of Little Horse Canyon south to Cherry Meadow Canyon. Figure 7-4 presents a localized view of this area with recharge potential along the west side of the Range Creek drainage. The total recharge area to this portion of the Range Creek drainage is approximately 18,150 acres.

Based on a review of Figure 7-4, the portion of the permit boundary that meets the potential impact area criteria is approximately 183 acres. Therefore, the percentage of the recharge area that might be intercepted by catastrophic subsidence is 1.0 percent. As catastrophic subsidence is unlikely due to the cover over the coal seam for most of this area (2,000ft +) (see Figure 7-4), this percentage is conservatively high. Such a small percentage would not be measurable within the Range Creek drainage.

If such an occurrence were to happen, based on the hydraulic conductivity (0.1gpd/ft^2) and porosity (0.25) of the formation and the anticipated gradient (0.1ft/ft), the average linear velocity of flow through the formation would be about 0.006ft/day. This results in an estimated duration, for the reduced recharge to move laterally through the Colton Formation and reach the Range Creek drainage, to be about 8,700 to 11,300 years.

As a result of the five to six miles horizontal distance from proposed permit area to Range Creek (see Plate 7-1a) and the isolating effects of the over 1,000 feet of low-permeability, isolating strata between the coal seam and the creek elevation (see Plate 7-1B and Table above) and the limited potential impact of subsidence damage to the recharge area, it is not likely that the Lila Canyon Mine will adversely effect Range Creek. Due to these conditions, no baseline or other sampling has been gathered nor is anticipated on Range Creek.

Additional concerns have been raised regarding the potential impact that water extracted from the Blackhawk Formation as a result of the mining activities would have on the downstream drainages, specifically the Price and Green Rivers.

Initial evaluation indicates that the distance within the Blackhawk Formation between the mine and the Price River is over 12 miles. This distance alone would preclude any significant impact.

As further evidence, as discussed in Appendix 7-3, it is difficult to determine the amount of water that will be extracted by the mining activities. For design purposes, DOGM has required that a value of 500 gpm be used. This is thought to be very conservative. If this volume were extracted, the yearly total would be about 800 ac-ft per year. As there are no significant springs that discharge from the Blackhawk Formation, the loss of this flow would be minimal. Also, as discussed in Appendix 7-3, the addition or loss of this flow would result in a 0.9% flow change to the Price River and a 0.02% flow change to the Green River. In both cases, this flow change would be less than could be measured by standard methods.

The Horse Canyon drainage is monitored in accordance with the approved monitoring plan for the permit. There has been only one sample taken in the Lila Canyon and no samples taken in Little Park Wash because only limited flow has been observed during the monitoring activities. Factors that contribute to the lack of data are: accessibility to the sites during the winter period and immediately after summer rain storm events is generally not possible, due to safety issues and a physical lack of flow. Concerns have been raised that evidence of flow has been seen in the drainages over the course of the year, therefore, why hasn't a water quality sample been collected. The following sections address the concerns of access and safety, physical lack of flow, and monitoring methods.

Access and Safety. Safety issues have hampered field work on several projects in the area. When the soils in the area get wet from a light rain, that would not generate a flow event, they become very slick and pose access and safety issues. During the IPA drilling, EarthFax had significant difficulty in getting equipment and vehicles up and down the access road following several small rain storms. In one case, they had one of their vehicles slide into the embankment rocks along the Horse Canyon access road (drop in the area was about 400 feet).

In the conditions of heavier rains, access during rainstorms through the channels in the area is dangerous. During the avian study for the Westridge mine, Mel Coonrod (EIS) and Frank Howe (DWR) were caught in a channel during a rainstorm and lost their vehicle to flooding. This occurred on Nine Mile Creek at the Dry Canyon crossing in March or April of 2000. Conditions in this drainages are similar to drainages within the Lila Canyon Permit Area.

During winter and early spring periods, there have been times when the access road has been blocked with several feet of snow making access with the field equipment impossible.

UAE's position is that collection of environmental data is not worth of the loss of life or limb. Therefore, when the conditions are unsafe, the site is labeled inaccessible. At all other times, the sites are visited and if no flow is encountered it is reported as such.

Physical Lack of Flow. The lack of flow data in the sampling effort is not a failure of the sampling effort. The lack of flow at these sample sites is data which documents the normal conditions in the site area. If the streams were flowing 50 percent of the time, it is likely that the sampling efforts would encounter flow on an infrequent basis. However, if the flow for the short return periods is extremely small or none existence, it will be difficult to obtain and provide samples of these events. This lack of flow shows that the drainages do not have a base flow component and there is no regional aquifer discharging to the deeply incised canyons and drainages in the area. The sequence of sampling efforts have demonstrated further, that there are no long-term flow events occurring in the mine permit area or adjacent areas. Also, spring photographs show disturbances in the stream channels from the previous fall period sampling efforts, indicating that for some years no flow occurred from the fall to spring measurement events. Additionally, the peak flow simulation results presented in Table 7-1A show that for small return periods, 2 to 5 year events, runoff flows are not expected and that the duration of any flow events would be of extremely limited duration.

Therefore, a pattern has been identified of a set of drainages that only flow in direct response to precipitation or rapid snow melt. The flow events are localized, sporadic events with no consistent sequence and timing and are extremely limited in duration. For ephemeral drainages in the area, these are the variations and distributions in flow that can be expected and are seen at other mines. Under the definitions in the rules, the seasonal variation would then be the isolated snowmelt in various reaches of the channels in the spring period, and the isolated peak flow from a thunder storm that would have enough intensity to result in a runoff event. Based on the runoff simulations in Table 7-1A, for the larger precipitation events, the flows can be significant.

U.S. Steel conducted water quality monitoring of the Horse Canyon drainage. These monitoring efforts were conducted prior to the development of DOGM's present Water Monitoring Guidelines, and as a result the data is quite limited. The most recent results of these water monitoring efforts are presented in Appendix 7-2 and historic results are included in the DOGM electronic database.

The data collected from Horse Canyon follows the same pattern documented by Waddell, et.al. (1986). The pattern shows that the TDS concentrations for surface waters on the lower Blackhawk and out onto the Mancos Shale range from 1000 mg/l and increase to 2,000 to 2,500 mg/l. Additionally, the highest concentrations of suspended sediment will occur during high-intensity runoff from thunderstorms, and the lowest concentrations will occur during low flow or snow melt events.

Therefore, because of the similarity of the water quality data, the water quality expected from the drainages in the area of the proposed mine will be similar to the water quality found in the Horse Canyon drainage.

Monitoring Methods. Monitoring efforts did not include remote or automatic sampling efforts because of inherent problems attempting to implement these methods for this application. It has been suggested that crest-staff gauges, single-stage samplers, ISCO instruments, etc. could be used to collect samples. These are methods that the USGS uses for developed remote sampling sites. However, none of the UEI sampling sites are developed. In the case of crest gauges, for these methods to be reliable and feasible, the sites need to be developed with concrete or bedrock lined channel sections. For the channel configurations at the UEI sites, the channel bottoms generally consist of movable beds. These are channels that change configuration from storm to storm. As a result of channel erosion and deposition, the stage discharge relationship of the channel changes with each storm event. Therefore, while the crest gauge would indicate that a flow event may have occurred, the ability to determine what the flow rate was is greatly compromised. To be able to overcome this, it would be necessary to construct lined channel sections in remote channel areas. In some cases, this would require the construction of access ways and cement trucks to haul in the materials necessary. This would likely cause more damage than it is worth.

Single stage and automatic samplers have problems with holding time on many water samples being exceeded, routine clogging of the inlets to the sampler, and acceptability or reliability of the data. Holding time exceedence would occur when a storm event occurred immediately after a prior sampling visit and resulted in a sample being collected. As a result, the sample would remain in an unpreserved and unrefrigerated state for the duration of the period until the site was next visited. In the hot summer conditions, common in the area, the water quality of unpreserved and unrefrigerated samples would not be representative of the water in the drainage during the flow event. Changes to water quality parameters would be expected with changes in temperature of the sample, concentration due to evaporation of the sample, and extended contact of the water with the sediment collected in the sample bottle. Therefore, for the

majority of parameters in the monitoring guidance list, the water quality data would not be usable for determining the baseline or impact conditions.

Maintenance problems have been common problems with the use of remote samplers. Generally, these samplers work fairly well in perennial sampling environments. However, in ephemeral environments where the flows tend to be “flashy” - short duration events which carry a heavy sediment and debris load, these samplers encounter significant problems with plugging of the inlets or sampler damage or destruction.

The use of stage or automatic samplers on ephemeral streams does not meet the USGS sampling protocols and are not a depth integrated sample. According to the Shelton (1994), there are no protocols for adequately sampling an ephemeral stream and ephemeral streams are not included in the national water-quality assessment program. Australian water quality monitoring guidelines suggest that automatic samplers are not appropriate for sampling parameters that change with time (A-NZECC, 2000). ADOT (2005) removed all automatic samplers from there monitoring program. Only grab samples are allowed and ADOT will not accept any data collected by any automatic samplers. Recent information provided to ADOT indicates that automatic samplers are unreliable and impractical in arid climate conditions in Arizona. As the conditions in the arid climate in Southeastern Utah are similar to the Arizona conditions, similar difficulties and problems will be encountered and the data will have the same difficulties.

Several samplers were installed as apart of the Westridge Mine sampling efforts. The samplers have problems with plugging and malfunctions on a regular basis and need constant maintenance. They are still in use, because they were required, however, the data are of limited value (Karla Knoop, personal communication, 2006). Single stage and automatic samplers were also installed as part of the Smoky Hollow baseline data collection efforts. Similar maintenance and malfunction problems were identified as part of the Smoky Hollow sampling efforts (Richard White, personal communication, 2006).

Radio Frequency telemetry (RF) sensing equipment has also been considered. However, as most of the monitoring sensors require line of sight and these sites are in remote, incised canyons or drainages, that was not considered a viable option.

As a result of these difficulties, it was determined that these methods would not provide any better data than was already being collected. The concerns with what conclusions erroneous or questionable data would generate versus limited good data lead to the decision that these methods would not be used.

724.300 Geologic Information Detailed geologic information of the permit and adjacent areas is included in Section 600, with specific strata analyses, as required, in Section 624.

724.310 Probable Hydrologic Consequences. The geologic data indicate that no toxic- or acid-forming materials are known to exist in the coal or rock strata immediately below or above the seam (see Section 624.300). The probable hydrologic consequences of the proposed operation will be discussed in Section 728 and Appendix 7-3 of this application.

724.320 Feasibility of Reclamation. The geologic data in Section 600 provides sufficient detail to allow: the evaluation of whether toxic- or acid-forming materials are expected to be encountered in mining; subsidence impacts; whether surface disturbed areas are designed to be constructed in a manner that will allow for reclamation to approximate original contour; and whether the operation plans have been design to ensure that material damage to the hydrologic balance does not occur outside of the permit area. These issues are evaluated in the R645 rules and discussed in Section 728 of this application.

724.400 Climatological Information

724.410 Climatological Factors

724.411 Precipitation The closest weather recording station to the Lila Canyon Mine is located at Sunnyside, Utah. Based on the relatively close proximity and similar locations (west exposure of the Book Cliffs) the data from this station is representative of the type, intensity and duration of the precipitation at the site area and will be used to verify precipitation amounts and other weather conditions for the Lila Canyon Mine.

Precipitation data from the Sunnyside station has been gathered from 1971 to 2005, showing an average annual precipitation of 14.74 inches. The information was downloaded from the Western Regional Climate Center, as shown on Table 7-1B. The distribution of precipitation shows that September and October average the highest totals. Based on a 1-day precipitation event or less, the probability of precipitation is generally less than 20 percent for an event with 0.01" and less than 5 percent for an event with greater than 0.50" (see Table 7-1C). This indicates that the precipitation events are generally light and consist of infrequent small storms.

A rain gauge will be installed at the site, once construction and operations start, to comply with the reporting requirements of the air quality permit.

724.412 Winds. The average direction of the prevailing winds is West to East, and the average velocity is 2.74 knots.

Table 7-1B

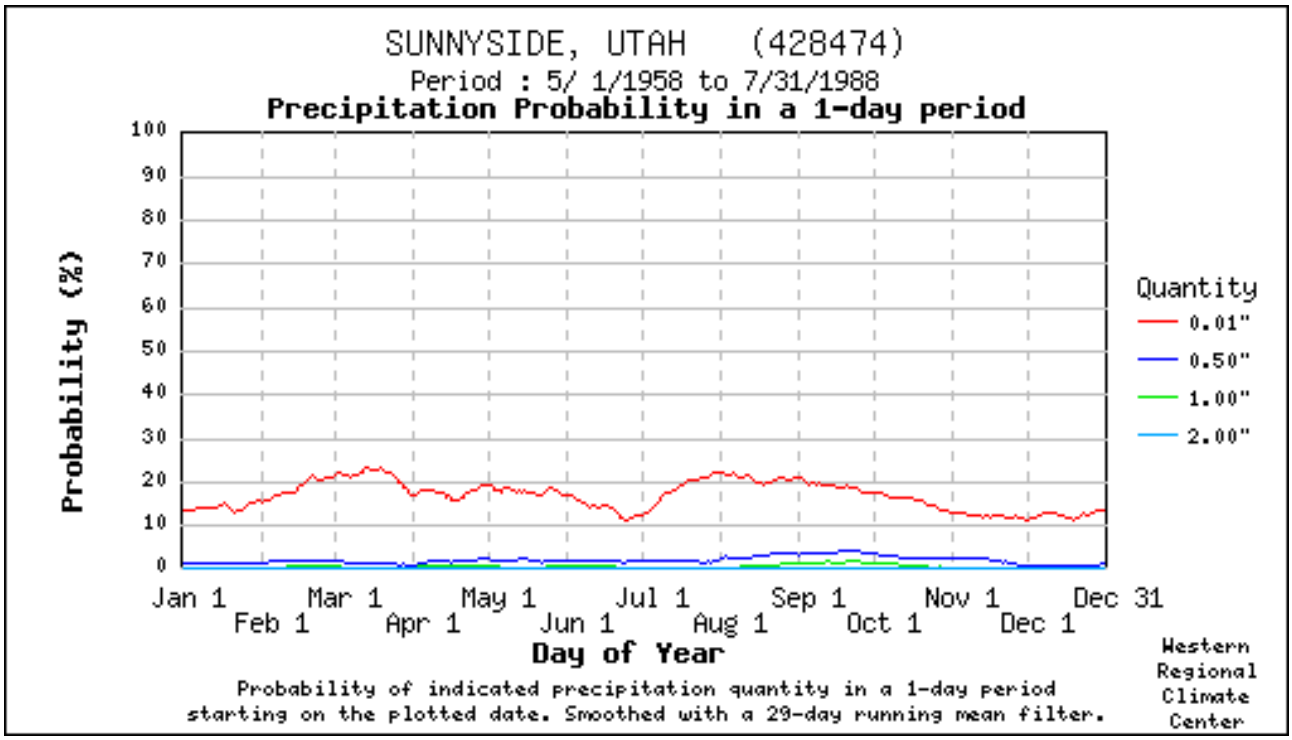
Sunnyside, Utah (428474)
Period of Record Monthly Climate Summary

Period of Record: 1971 - 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Average Max. Temp(F)	33.7	38.4	44.1	54.0	63.5	76.2	82.4	80.3	71.3	58.3	42.8	34.9	56.8
Average Min. Temp(F)	13.9	17.5	21.8	30.0	38.3	47.2	53.6	52.2	44.7	34.6	22.8	15.3	32.8
Average Total Precip (in.)	0.80	1.01	1.30	1.22	1.22	0.85	1.46	1.50	1.80	1.67	1.14	0.78	14.74

Unofficial values based on averages/sums of smoothed daily data, Information is computed from available daily data during the 1971-2000 period. Smoothing, missing data and observation-time changes may cause these 1971-2000 values to differ from official NCDC values. This table is presented for use at locations that don't have official NCDC data. No adjustments are made for missing data or time of observation. Check NCDC normals table for official data.

TABLE 7-1C



724.413 Temperature. Mean temperatures in the proposed mine area range from a high of 58.0 degrees F to a low of 33.4 degrees F. See Table 7-1B.

724.420 Additional Data. Additional data will be supplied if requested by the Division to ensure compliance with the requirements of R645-301 and R645-302.

724.500 Supplemental Information N/A - The determination of the PHC in Section 728 does not indicate that adverse impacts on or off the proposed permit area may occur to the hydrologic balance, or that acid-forming or toxic-forming material is present that may result in the contamination of ground-water or surface-water supplies.

724.700 Valley/Stream N/A - The proposed plan does not include mining or reclamation operations within a valley holding a stream or in a location where the permit area or adjacent area includes a stream which meets the requirements of R645-302-320.

725. Baseline Cumulative Impact Area Information

725.100 Hydrologic and Geologic Information Hydrologic and geologic information for the mine area is provided in Sections 600, 724 and in the PHC Determination in Appendix 7-3. This information includes the available information gathered by the applicant. Additional information is available for the areas adjacent to the proposed mining and adjacent areas from state and federal agencies.

725.200 Other Data Sources As indicated above, additional information is available for the cumulative impact area. In addition to the base line data for the proposed mining, additional pertinent hydrologic data is available from adjacent mines and permits and government reports.

725.300 Available Data Necessary hydrologic and geologic information is assumed to be available to the Division in this P.A.P.

726. Modeling Where ever possible actual surface and ground water information is supplied in this application. However, the following models were used to supplement the data.

Storm 6.2, a program to calculate runoff flows was used to calculate runoff from some disturbed area drainage areas.

Hydroflow Hydrograph program by Intelisolve was used to simulate the runoff and routing from the undisturbed drainages above the proposed mine. As discussed in Section 724.200 of the MRP, the flow simulations provide an understanding of the types and kinds of flow responses that can be expected from the watersheds of the proposed mine area.

A simulation of transmission losses to determine potential impacts from mine water discharge to the Price River and fishery was completed using a spreadsheet based on the NRCS channel loss evaluation.

727. Alternate Water Source Information A search was conducted of the State of Utah Water Rights files for all rights occurring within, and adjacent to, the permit area for a distance of one mile. The location of those rights are shown on Plate 7-3, based on the location provided for the water right. A description of each of the rights, including the name of the water right owner, point of diversion, source of the water, along with the allotted flow and the designated use of the water is tabulated in Table 7-2. Due to the limited volume of water available, the condition of most of the spring and stock pond facilities is very poor. Based on the water rights, for the area

of the mine, the use is limited to stockwatering of less than 250 animal units.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-557 Eardley, Joseph K.	0	-	0	So. Fork Horse Canyon Creek	Stockwatering	SW 34, T. 15 S, R. 14 E.
91-557 Eardley Joseph K.	0	-	0	So. Fork Horse Canyon Creek	Stockwatering	NE 34, T. 15 S, R. 14 E.
91-1903 State of Utah	0.08	36	0	Spring	Stockwatering	SE 35, T. 15 S, R. 14 E.
*91-148 IPA	0.30	135	0	U. G. Tunnel	Other	NW 3, T. 16 S., R. 14 E.
*91-149 IPA	0.10	45	0	U. G. Tunnel	Other	NW 3, T. 16 S., R. 14 E.
*91-150 IPA	0.10	45	0	U. G. Tunnel	Other	NW 3, T. 16 S., R. 14 E.
*91-4959 CEUF	0.00	-	5.00	Redden Spring	Mining	NE 3, T. 16 S., R. 14 E.
91-2616 BLM	0	-	0	Stream	Stockwatering	NW 3, T. 16 S., R. 14 E.
*91-183 CEUF	0.8	359	0	Horse Canyon Creek	Domestic, Other	SE 1/4 3, T.. 16 S., R. 14 E.
91-185 Minerals Devel. Co.	0.0190	9	0	Well	Domestic, Other	NW 9, T. 16 S., R. 14 E.
91-618 Mont Blackburn	0.0110	5	0	Mont Spring	Stockwatering	NE 11, T. 16 S., R. 14 E.
91-2615 BLM	0	-	0	Stream	Stockwatering	NW 10, T. 16 S., R. 14 E.
91-617 Mont Blackburn	0.0110	5	0	Leslie Spring	Stockwatering	NW 11, T. 16 S., R. 14 E.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-4650 BLM	0	-	0	Tributary to Flat Wash	Stockwatering, Other	SW 9, T. 16 S., R. 14 E.
*91-399 IPA	0.050	22	0	Unnamed Spring	Mining, Other	SE 12, T. 16 S., R. 14 E.
91-2537 BLM	0.0120	5	0	Spring	Stockwatering	SE 12, T. 16 S., R. 14 E.
91-2521 BLM	0.0110	5	0	Cottonwood Spring	Stockwatering	NE 13, T. 16 S., R. 14 E.
91-4648 BLM	0.00	-	0	Unnamed Wash	Stockwatering, Other	SW 14, T. 16 S., R. 14 E.
91-4649 BLM	0	-	0	Unnamed Wash	Stockwatering, Other	NE 23, T. 16 S., R. 14 E.
*91-810 IPA	0.050	22	0	Unnamed Spring	Mining, Other	SE 24, T. 16 S., R. 14 E.
91-2517 BLM	0.0110	5	0	Pine Spring	Stockwatering	SE 24, T. 16 S., R. 14 E.
91-2618 BLM	0	-	0	Stream	Stockwatering	NW 27, T. 16 S., R. 14 E.
91-2619 BLM	0	-	0	Stream	Stockwatering	SE 28, T. 16 S., R. 14 E.
91-2620 BLM	0	-	0	Stream	Stockwatering	SE 28, T. 16 S., R. 14 E.
91-2621 BLM	0	-	0	Stream	Stockwatering	SW 28, T. 16 S., R. 14 E.
91-2617 BLM	0	-	0	Stream	Stockwatering	SE 27, T. 16 S., R. 14 E.
91-4646 BLM	0	-	0	Wash	Stockwatering, Other	SW 33, T. 16 S., R. 14 E.
91-2518 BLM	0.110	5	0	Williams Spring	Stockwatering	SE 8, T. 17 S., R. 15 E.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-4516 BLM	0	-	0	Little Park Wash	Stockwatering, Other	SW 7, T. 17 S., R. 15 E.
91-4705 BLM	0	-	0	Bear Canyon	Stockwatering, Other	NW 7, T. 16 S., R. 15 E.
91-4621 BLM	0.0150	7	0	Kenna Spring	Stockwatering, Other	NE 8, T. 16 S., R. 15 E.
91-4701 BLM	0	--	0	Nelson Canyon	Stockwatering, Other	NW 17, T. 16 S., R. 15 E.
91-2519 BLM	0.0110	5	0	Unnamed Spring	Stockwatering, Other	SE 18, T. 16 S., R. 15 E.
*91-808 IPA	0.050	22	0	Unnamed Spring	Mining, Other	SW 18, T. 16 S., R. 15 E.
91-2538 State of Utah	0.0120	5	0	Unnamed Spring	Stockwatering	SW 18, T. 16 S., R. 15 E.
91-4701 BLM	0	-	0	Nelson Canyon	Stockwatering, Other	SE 17, T. 16 S., R. 15 E.
91-2539 BLM	0.0120	5	0	Pine Spring	Stockwatering	SW 19, T. 16 S., R. 15 E.
91-4703 BLM	0	-	0	Nelson Canyon	Stockwatering, Other	NW 21, T. 16 S., R. 15 E.
91-4703 BLM	0	-	0	Trib. to Nelson	Stockwatering, Other	NE 29, T. 16 S., R. 15 E.
91-4381 State of Utah	0.0150	7	0	Spring	Stockwatering,	NW 32, T. 16 S., R. 15 E.
91-2520 BLM	0.0110	5	0	Unnamed Spring	Stockwatering	NW 32, T. 16 S., R. 15 E.
*91-809 IPA	0.0500	22	0	Unnamed Spring	Mining, Other	SE 31, T. 16 S., R. 15 E.
91-2535 BLM	0.0120	5	0	Unnamed Spring	Stockwatering	SE 31, T. 16 S., R. 15 E.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-2646 (Cove #1)	0	0	0	Wash	Stock Watering	NE 06, T.16S., R. 14E.
91-2665 ((Big Pond)	0	0	0	Wash	Stock Watering	NE4 05, T.17S., R. 14E.

Any State-Appropriated water supply that may be damaged by mining operations will either be repaired or replaced. As soon as practical, after proof of damage by mining in Lila Canyon, of any State-Appropriated water supply, UEI will replace the water. Water replacement may include sealing surface fractures, piping, trucking water, transferring water rights, or construction of wells. The preferable method of replacement will be sealing of surface fractures effecting the water supply. As a last resort UEI will replace the water by transferring water rights or construction of wells.

As noted in the table, the majority of rights are owned by UEI for industrial use. Other rights owned by the B.L.M. or individuals are primarily for stockwatering.

UEI owns the rights to approximately 1.50 cfs in this area. Although the PHC (Appendix 7-3) indicates little, if any, adverse effects on water resources resulting from the operation, if such effects should become evident, lost water sources would be replaced from the rights owned by the company.

728. Probable Hydrologic Consequences (PHC) Determination

728.100 PHC The Probable Hydrologic Consequences (PHC) Determination is provided as a separate document in Appendix 7-3. This determination indicates minimal (or no) negative impacts of the mining or reclamation operation on the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas.

728.200 Basis for Determination The PHC is based on baseline hydrologic, geologic and other information such as public records and adjacent mine plan data statistically representative of the site (see Appendix 7-3).

With underground mining, there always exists a potential for impacting surface or ground water resources; however, as indicated in Section 525, subsidence effects are expected to be minimal due to the amount of cover and massive rock stratas between the mining and the surface. Effects on underground water are also expected to be minimal, since this water is not presently issuing to the surface, and any necessary discharges of the water would be in accordance with U.P.D.E.S. requirements.

Water in this area is primarily used for stock or wildlife watering. Any impacts to the small surface springs or seeps as a result of mining would likely be offset by the emergence of new seeps or springs due to fracturing, mine water discharge or replacement of water rights as described under Sections 525, and 731.800.

728.300 Findings

728.310 Adverse Impacts. Potential adverse impacts of the operation on the hydrologic balance include:

(1) Increased sediment loading;

(2) Diminution or interruption of water supplies on water rights;

(3) Discharge (pumping) of contaminated ground water;

(4) Erosion and streamflow alteration;

(5) Deterioration of water quality.

Each of the above potential impacts has been evaluated in the PHC (Appendix 7-3). Based on information provided in this plan to mitigate or otherwise control these impacts, the Probable Hydrologic Consequences determination is that of minimal (or no) negative impacts. (see Appendix 7-3)

728.320 Acid/Toxic Forming Materials (see Appendix 7-3)

728.330 Impacts On:

728.331 Sediment Yield (see Appendix 7-3)

728.332 Water Quality Parameters (see Appendix 7-3)

728.333 Flooding and Streamflow Alteration In the event that sufficient volumes of water are encountered underground that necessitate pumping, the applicant will take the following steps:

(1) Water will be held in sumps as long as possible to promote settling;

(2) Water will be sampled prior to discharge to ensure compliance with UPDES standards;

(3) Prior to mining receiving channel morphology parameters and erosion impacts will be evaluated prior to discharging to any drainage and at least quarterly during pumping to determine what, if any, streamflow alteration is occurring;

(4) If adverse impacts to the receiving stream are noted, steps will be taken, with Division input and approval, to minimize or eliminate those impacts.

(Also see Appendix 7-3)

728.334 Water Availability (see Appendix 7-3)

728.335 Other Characteristics (see Appendix 7-3)

728.340 Surface Mining Activity N/A - Underground Mine

728.400 Permit Revision To be reviewed by the Division.

729. Cumulative Hydrologic Impact Assessment (CHIA)

729.100 CHIA Assessment provided by Division.

729.200 Permit Revision To be reviewed by the Division.

730. Operation Plan

731. General Requirements This will be an underground mine with approximately ~~42.6~~40.26 acres of surface disturbance for mine site facilities and roads. Runoff from the disturbed minesite area is proposed to be controlled by a system of ditches and culverts which will convey all

disturbed area runoff to ~~a~~ sediment ponds for final treatment prior to discharge.

This permit application includes a plan, with maps and descriptions, indicating how the relevant requirements of R645-301-730, R645-301-740, R645-301-750 and R645-301-760 will be met. Each of these sections are addressed in this Chapter, along with relevant Maps and Appendices.

731.100 Hydrologic-Balance Protection

731.110 Ground-Water Protection In order to protect the hydrologic balance, coal mining and reclamation operations will be conducted according to the plan approved under R645-301-731 and the following:

731.111 Ground-Water Quality Ground-water quality will be protected by the plan described in Section 731 and the following:

(1) Minimizing surface disturbance and proper handling of earth materials to minimize acidic, toxic or other harmful infiltration to ground-water systems. Appendix 6-2 of the MRP presents acid and toxic results from a series of roof and floor samples from the areas north and south of the proposed mine. The samples of the S-24 and S-25 drillholes show the quality of the roof and floor strata located to the south of the proposed operation, while the Lila Fan Portal roof and floor samples show the quality of the strata north of the proposed mine. These samples identified only minor issues with one or two samples for revegetation issues. The recommendations were that these samples would not be a problem when mixed with the surrounding rock. No acid conditions were identified in any of the rock samples. As these samples bracket the mine property and the quality is similar to quality found at other mines along the Book Cliffs and none of these mines have an acid or toxic issue, then it is likely that the rock in the proposed mine area will have the same characteristics.;

(2) Testing (as-necessary) to ensure stockpiled materials are non-acid and non-toxic;

(3) Controlling and treating disturbed area runoff to prevent discharge of pollutants into ground-water, by the use of diversions, culverts, silt fences, sediment ponds and by chemical treatment if necessary;

(4) Minimizing and/or treating mine water discharge to comply with U.P.D.E.S. discharge standards;

(5) Establishing where ground-water resources exist within or adjacent to the permit area through a Baseline Study (done) and monitoring quality and quantity of significant sources through impletation of a Water Monitoring Plan (proposed);

(6) Proper handling of potentially harmful materials (such as fuels, grease, oil, etc.) in accordance with an approved Spill Prevention Control and Countermeasure Plan (SPCC).

731.120 Surface-Water Protection In order to protect the hydrologic balance, coal mining and reclamation operations will be conducted according to the plan approved under 731 and the following:

731.121 Surface-Water Quality Surface-water quality will be protected by handling earth materials, ground-water discharges and runoff in a manner that minimizes the formation of acid or toxic drainage; prevents, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow outside the permit area; and, otherwise prevent water pollution.

Surface-water quality protection is proposed to be accomplished by the plan described in Section 731 and the following methods:

(1) Minimizing surface disturbance and proper handling of earth materials to minimize acidic, toxic or other harmful infiltration to ground-water systems. Appendix 6-2 of the MRP presents acid and toxic results from a series of roof and floor samples from the areas north and south of the proposed mine. The

samples of the S-24 and S-25 drillholes show the quality of the roof and floor strata located to the south of the proposed operation, while the Lila Fan Portal roof and floor samples show the quality of the strata north of the proposed mine. These samples identified only minor issues with one or two samples for revegetation issues. The recommendations were that these samples would not be a problem when mixed with the surrounding rock. No acid conditions were identified in any of the rock samples. As these samples bracket the mine property and the quality is similar to quality found at other mines along the Book Cliffs and none of these mines have an acid or toxic issue, then it is likely that the rock in the proposed mine area will have the same characteristics. Also, the rock from the access tunnels will be similar to the rock samples for the floor;

(2) Testing (as-necessary) to ensure stockpiled materials are non-acid and non-toxic;

(3) Controlling and treating disturbed area runoff to prevent discharge of pollutants into surface-water, by the use of diversions, culverts, silt fences, sediment ponds, and by chemical treatment if necessary;

(4) Minimizing and/or treating mine water discharge to comply with U.P.D.E.S. discharge standards;

(5) Establishing where surface-water resources exist within or adjacent to the permit area through a Baseline Study (done) and monitoring quality and quantity of significant sources through impletation of a Water Monitoring Plan (proposed);

(6) Proper handling of potentially harmful materials (such as fuels, grease, oil, etc.) in accordance with an approved Spill Prevention Control and Countermeasure Plan (SPCC).

731.122 Surface-Water Quantity Surface water quantity and flow rates will be protected as described in Section 731.

731.200 Water Monitoring The water monitoring program has been implemented since July, 2000. Baseline data has been collected from both surface and groundwater monitoring sites. These sites established the current baseline data set that has been approved by the Division as representing the current surface and groundwater conditions.

Preceding each five year permit renewal, ground (springs) and surface waters will be sampled for baseline parameters, same as listed in Tables 7-4 and 7-5. Sampling of ground and surface waters will be conducted according to the operational monitoring plan, even if the monitoring has been temporarily suspended. It has been determined that minimal monitoring is required based on the anticipated impacts and no appropriated surface water use downstream.

731.210 Ground-Water Monitoring The ground-water monitoring plan is based on results of the Baseline Study and PHC determination. Based on results of these studies, the only ground water expected to be affected in the permit area is that which has been identified as springs or seeps and that which may be expected from perched aquifers encountered by the planned mining. Since no portals are presently discharging on or adjacent to the permit area and since current mining has not encountered water, no underground water is presently available for sampling. Therefore, selected springs are sampled under the Ground Water Monitoring Plan.

If ground water is encountered in future mining, of a quantity which requires discharge, the water will be monitored in accordance with requirements of this section and a monitoring plan will be proposed at that time.

For purposes of the water monitoring program, springs and seeps are considered ground water and will be monitored as such.

731.211 Ground-Water Monitoring Plan Based on information in the PHC determination (Appendix 7-3), and as indicated above, the only ground water resources on or adjacent to the permit area that can be monitored at this time are springs and seeps. See Appendix 7-6 for a detailed description of the water monitoring locations.

There are a total of 11 ground water monitoring sites proposed for this property (see Table 7-3). Station L-5-G is

the potential mine discharge point, and will be monitored at least monthly, or as discharge occurs, in accordance with U.P.D.E.S. Permit requirements (see Table 7-4).

Stations L-7-G, L-8-G, L-9-G, L-11-G, and L-12-G are significant springs or seeps located over the area of proposed mining. These springs will be monitored on a quarterly basis for parameters listed in Table 7-5.

Station L-6-G is in the vicinity of two listed water right springs, Mont Spring and Leslie Spring. These springs are within the same small drainage, and may in fact be the same spring. Close examination of spring/seep and baseline monitoring stations show only one site in this drainage with any consistent flows - site H-18; therefore, this site was originally chosen to monitor the Mont and Leslie Springs area. However in recent years L-6-G has been dry and a new wet area upstream of L-6-G, Location L-11-G, has been added to replace site L-6-G. Sampling at L-6-G was suspended as of the First Quarter of 2003.

Monitoring site L-7-G is intended to monitor a listed site known as Cottonwood Spring. Once again, a close examination of water rights information along with spring/seep and baseline monitoring has shown only one site in this area with any consistency - site #9; therefore, this is the site chosen for monitoring of Cottonwood Spring.

L-8-G is an unnamed spring that matches Earthfax sample site 10.

L-9-G is known as Pine Spring. There are two locations that are identified as Pine Spring. These are water rights 91-2517 and 91-2539, which are part of the same water right filing. In the spring and seep inventories there has never been any flow identified in the area of 91-2517 as the site is located off of the stream channel. It is assumed that the filing for 91-2517 is a duplicate but the location is wrong. There have been numerous seep/spring notations in the local area, but the only consistent flowing site is 91-2539; this is the site that will be monitored for Pine Spring. (In a recent archeological study, the location of the site that has been monitored as L-9-G was determined using GPS coordinates. The location for this site was determined to be

different than what was plotted on the Plates 7-1, 7-1A, and 7-3. Based on this new data, the location of the spring has been updated.)

L-10-G is also an unnamed spring that matches Earthfax sample site 14. Since this site is located over 1 mile south of the permit area, it has been replaced with L-12-G which is a more appropriate site to monitor. Monitoring of site L-10-G was suspended as of the First Quarter of 2003.

L-11-G is located in the bottom of the upper reaches of Lila Canyon. This is in the same drainage as the Mont and Leslie Springs water right locations. In recent years L-6-G (H-18) has been dry. However, there has been some minimum flow observed approximately one hundred yards above L-6-G where L-11-G was established.

L-12-G is an unnamed spring which had been developed but is now abandoned.

L-13-S, L-14-S, L-15-S, and L-18-S are sites being monitored to assist in characterization of the various drainages.

L-16-G and L-17-G are seeps being monitored in Stinky Spring Canyon. These sites were not identified during baseline surveys and are believed to exist intermittently and are not always evident. These two seeps appear to be an important source of water for Bighorn sheep specifically in the early spring.

L-20-G is a seep located north of the permit boundary along a tributary to Little Park Wash. It was identified in the original spring and seep survey and will now be monitored.

It should be noted that data has been gathered on the various seeps/springs as part of the original baseline inventory for the South Lease by I.P.A. The data was gathered over the years 1993, 1994 and 1995 and was stopped. In the second quarter of 2001 water monitoring continued.

The seep/spring inventory data is shown in Appendix 7-1 and locations are shown on Plate 7-1. Proposed water monitoring sites are shown on Plate 7-4.

IPA-1, -2 and -3 are groundwater piezometers in the Little Park Wash area. These holes will be checked quarterly for water depth only. Monitoring of these sites will continue until the mining or subsidence renders them unusable.

At a minimum, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron, total manganese and water levels will be monitored, on all points except IPA-1, -2 and -3.

731.212 Monitoring Reports During periods of active monitoring, ground water will be monitored and data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the approved reporting period. When the analysis of any ground-water sample indicates noncompliance with the permit conditions, then the operator will promptly notify the Division and immediately take the actions provided for in 145 and 731.

731.213 Waiver of Monitoring N/A - No waiver is requested.

731.214 Ground-Water Monitoring Duration Ground-water monitoring will continue through mining and reclamation until bond release.

The Division may approved modifications to the monitoring plan if, based on the monitoring data, it finds:

> **731.214.1** "The coal mining and reclamation operation has minimized disturbance to the prevailing hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses"; or,

> **731.214.2** until "Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under R645-301-731.211."

Therefore, UEI requests that the ground water monitoring plan be modified as follows:

One spring to the north of the northern edge of the permit boundary named Quaker Spring, will be monitored for two years to develop a baseline data set. It will be designated as L-20-G. Following the baseline data collection its monitoring will follow the operational monitoring schedule for the upper springs (shown on Table 7-3).

As baseline for the ground water conditions has been described by the monitoring to date for the Lila Canyon permit area, UEI will discontinue monitoring of the monitoring well water levels until mining intercepts the projected regional piezometric surface, as shown on Plate 7-1, and the springs and seeps until just before second mining takes place within the mine permit area. If mining encounters the regional piezometric surface, then water level monitoring will be resumed. Two years before second mining is anticipated to enter into an area that could affect the surface waters, then monitoring of the wells and springs and seeps will resume and the data compared with the baseline. All surface water monitoring will not start at the same time. Monitoring will resume as the second mining enters an area where the mining could affect the surface waters.

UEI recognizes the Division's concerns for springs, L-G-16 and L-G-17, located at the top of the Mancos Shale, below the escarpment. While concerns of the use of these springs for wildlife have been suggested, UEI does not believe that the wildlife are using these waters. The TDS values have been excessive which are believed to limit or preclude the use of this water by wildlife. At the Division's request, these sampling sites will continue to be monitored, while additional evaluation of wildlife use is made.

The existing baseline data shows the current ground water conditions for the permit area. No significant groundwater impacts have been identified from current first mining activities. Continuous additional monitoring will only

unnecessarily duplicate costs for data that has already been collected.

Also, it is desired that the monitoring during the first quarter not be continued. During the data collection period, there have been few first quarter periods when it was feasible to gain access to the upper elevations of the Book Cliffs and when access was available to the top during these periods, the snow cover in the canyons prevented access to the spring locations and the springs which were accessed were frozen. Therefore, it would be realistic to recognize the existing field conditions and adjust the monitoring plan accordingly.

The monitoring plan would be modified to require monitoring during the spring, summer and fall quarters.

731.215 Monitoring Equipment equipment, structures and other devices used in conjunction with monitoring the quality of ground water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

731.220 Surface Water Monitoring Surface water monitoring will be conducted in accordance with the plan described in this section.

Based on results of the PHC determination, baseline study and other available information, numerous small springs and seeps exist within, and adjacent to, the permit area. In addition, ephemeral drainages in the area flow in response to snow melt and precipitation events. The proposed surface water monitoring program will monitor the significant surface water sources, including drainages above and below the disturbed mine site area, and all point-source discharges (i.e. sediment pond). Seeps, springs and potential mine water discharge will be monitored in accordance with the Ground Water Monitoring Plan in the previous section.

It should be noted that field sheets in Appendix 7-2 refer to a point HC-2, while Bar Graphs and Spreadsheets refer to a station B-1. It has been determined that these are the same point. The site is designated B-1 on Plate 7-1, with a red HC-2 in parenthesis. The electronic data inventory (EDI) also shows both B-1 and HC-2 designations for this site.

Another HC-2 site is listed in the seep/spring inventories in Appendix 7-6 and in the baseline data in Appendix 7-1. This station is also occasionally referred to as H-2 in the seep/spring inventories (Appendix 7-6). It has been determined that the H-2 and HC-2 sites referred to in these two appendices are the same station. The station location is shown on Plate 7-1, where it is designated H-2 with a green (HC-2) in parentheses.

There is one other station with confusing designations in the data from Appendix 7-2 and 7-6 - station HCSW-1. This station has 3 different designations in the data - HCSW-1, HSW-1, and HC-1. The point is shown as HC-1 on Plates 7-1 and 7-4; however, a note has been added to Plate 7-1 to show the station is also called (HCSW-1), to eliminate confusion. It should also be noted that there is a seep/spring site designated as H-1 on Plate 7-1. This is not to be confused with any of the above listed HC, HSW or HCSW sites.

These are the only known duplication or wrong designation of sample site numbers. It appears that different samplers or companies conducting seep/spring inventories occasionally used different designations for the same sites - the main problem being the use of H-# or HC-# for the same location, in some instances. Every effort has been made to refine the station identifications and locations on Plate 7-1 to reflect the sampling data provided in Appendices 7-1, 7-2 and 7-6. Wherever a site has 2 different designations, both are shown with one in parentheses.

Table 7-3 presents a list of proposed surface water monitoring sites. Based on the two years of surface water sampling at locations CG-2, CG-3, CG-4, CG-5, CG-6, and CG-7 which characterized the drainages as Intermittent by rule with ephemeral flow or ephemeral, which matched the description of these drainages provided in the PAP, these sampling locations will no longer be sampled. Additionally, the surface water sites for these drainages are also requested to be discontinued as explained below in Section 731.224.2.

Locations of all monitoring sites are shown on Plate 7-4 , “Water Monitoring Location Map”.

Proposed monitoring methods, parameters and frequencies are described in Table 7-3, “Water Monitoring Stations”, Table 7-4,

"Surface Water Monitoring Parameters", and Table 7-5 "Ground Water Monitoring Parameters".

In any active quarter, a minimum of three unsuccessful attempts will be made by using either 4 wheel drive vehicles or ATV's to access all water monitoring sites prior to reporting any site as "No Access". However, safety and common sense will prevail while making these attempts.

Monitoring reports will be submitted to the Division at least every 3 months, within 30 days following the end of each quarter.

731.221 Surface-Water Monitoring Plan The proposed surface-water monitoring plan is detailed in Section 731.220. This plan is based on PHC determination and analysis of all baseline hydrologic, geologic and other information in this permit application. The plan provides for monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance as set forth in 751 (see Table 7-4).

731.222 Surface-Water Monitoring Parameters The surface-water monitoring parameters are shown in Table 7-4. Water monitoring locations and sample frequencies are described in Table 7-3 and on Plate 7-4 .

The plan will provide data to show impacts to potentially affected springs, seeps, impoundments and drainages within and adjacent to the permit area, by comparison with relevant baseline data and with applicable effluent limitations.

731.222.1 Non-point Source Locations The parameter list in Table 7-4 provides monitoring for all parameters required by this section. The monitoring locations and frequencies described in Table 7-3 show that all significant springs, seeps, impoundments and drainages that could potentially be impacted by the mining and reclamation operations will be monitored on a regular basis.

731.222.2 Point-source Discharges Point-source discharge monitoring will be conducted in accordance

with 40 CFR Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for Utah Pollutant Discharge Elimination System (U.P.D.E.S.) permits. A U.P.D.E.S. discharge permit application has been submitted to the Division of Environmental Health for the proposed sediment pond and mine water for the Lila Canyon operation. Existing U.P.D.E.S. permit applications for the Lila Canyon Mine are provided in Appendix 7-5.

731.223 Reporting As indicated in Section 731.220, surface-water monitoring data will be submitted at least every 3 months during active monitoring for each monitoring location. When analysis of any surface water sample indicates non-compliance with the permit conditions, the company will promptly notify the Division and immediately take actions to identify the source of the problem, correct the problem and, if necessary, to provide warning to any person whose health and safety is in imminent danger due to the non-compliance.

731.224 Duration Surface-water monitoring will continue through mining and reclamation until bond release. Locations, parameters and/or sampling frequency (other than U.P.D.E.S. discharge points) may be modified by the Division if:

731.224.1 "The operator has minimized disturbance to the hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses"; or,

731.224.2 "Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under 731.221.

Therefore, UEI requests that the surface water monitoring plan be modified as follows:

As baseline for the surface water conditions have been described by the monitoring to date for the Lila Canyon

permit area, UEI will discontinue monitoring of the surface water sites away from the surface facilities until just before second mining takes place within the mine permit area. Two years before second mining is anticipated to start, then monitoring will commence again and the data compared with the baseline.

The existing baseline data shows the current surface water conditions for the permit area. No significant surface water impacts have been identified from current first mining activities. Continuous additional monitoring will only unnecessarily duplicate costs for data that has already been collected.

As the two years of ephemeral wash characterization data have been collected and the data reflects the flow conditions as described in the surface water hydrology sections of the PAP, the sites CG-1 through CG-7 will be suspended and discontinued. Also, the upper rain gauge RS-2 will be suspended. These sites were installed and data were collected, as part of a Board Order settlement, to demonstrate that the upper drainages were ephemeral in nature and that the flow characteristics had been correctly described in the PAP.

Additionally, the sampling frequency for sites L-1-S, L-2-S, and L-3-S be changed from monthly to quarterly. As the baseline for these sites have been determined and there is no impact from the mining, reduction of the sampling frequency is justified. These sites will be sampled quarterly and flows will be recorded when they occur.

Also, it is desired that the monitoring during the first quarter not be continued. During the data collection period, there have been few first quarter periods when it was feasible to gain access to the upper elevations of the Book Cliffs and when access was available to the top during these periods, the snow cover in the canyons prevented access to the sampling locations and the sites which were accessed were either dry or frozen. Therefore, it would be realistic to recognize the existing field conditions and adjust the monitoring plan accordingly.

The monitoring plan would be modified to require monitoring during the 2nd, 3rd, and 4th quarters.

See Table 7-3 for the surface water monitoring schedule.

731.225 Monitoring Equipment Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of surface water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

731.300 Acid- and Toxic-Forming Materials Drainage from acid- and toxic-forming materials and underground development waste into surface water and ground water will be avoided by implementation of a Spill Prevention Control and Countermeasure (SPCC) Plan and by the following:

731.311 Identification/Burial of Acid- or Toxic-Forming Materials
Potentially acid- or toxic-forming materials will be identified by use of Material Safety Data Sheets (MSDS), or by direct sampling and analysis in the case of underground development waste.

Any material which exhibits acid- or toxic-forming characteristics will be properly stored, protected from runoff, removed to an approved disposal site or buried on site beneath a minimum of 4' of non-acid, non-toxic material.

731.312 Storage of Acid- or Toxic-Forming Materials Storage of potentially acid- or toxic-forming materials, such as fuel, oils, solvents and non-coal waste will be in a controlled manner, designed to contain spillage and prevent runoff to surface or ground water resources.

All oils and solvents will be stored in proper containers within enclosed structures. Fuels will be stored in appropriate tanks, enclosed within concrete or earthen bermed areas designed to contain any spillage.

Non-coal waste (garbage) will be stored in a designated location, in dumpsters, and removed to an approved landfill (East Carbon Development Contractors - ECDC) on a regular, as-needed basis.

Unused or obsolete equipment or supplies will be stored in a designated area. Drainage from the storage area will be directed to the sediment pond as shown on the Sediment Control Map, Plate 7-5.

Underground development waste (if any) will also be stored in a designated area. Such waste will be tested for acid- or toxic-forming potential, and if found to be acid- or toxic-forming, the waste site will be protected from surface runoff by the use of earthen berms.

731.320 Storage, Burial, Treatment All storage, burial and treatment practices will be as described in this permit, and consistent with applicable material handling and disposal provisions of the R645-Rules.

731.400 Transfer of Wells There are presently three piezometers on this permit. When these piezometers are no longer required, they will be sealed in a safe, environmentally sound manner in accordance with regulations (see Section 631.200). The Horse Canyon Well has been donated to the College of Eastern Utah as part of the Post Mine Land Use Change.

731.500 Discharges The only proposed discharges from this operation will be from the sediment pond and/or underground mine water. Each of these potential discharges would be monitored and controlled within requirements of approved U.P.D.E.S. Discharge Permits.

731.510 Discharges into an Underground Mine There are no plans to discharge any water into an underground mine. This section is not applicable.

731.512 Types of Discharge The only planned discharges from this site are water, in the form of sediment pond discharge or underground mine water discharge.

731.512.1 Water See Section 731.512.

731.512.2 Coal Processing Waste N/A - There are no plans to process coal or discharge coal processing waste from this site.

731.512.3 Fly Ash from a Coal-Fired Facility N/A - There are no plans for a coal-fired facility at this time.

731.512.4 Sludge from Acid-Mine-Drainage Treatment N/A There are no plans for an acid-mine-drainage treatment facility at this time.

Table 7-3
Lila Canyon Mine
Water Monitoring Stations

Station	Location	Type	Frequency	Remarks
L-1-S	Lila Canyon	Int. Stream	**Quarterly**	At mine Site
L-2-S	Rt. Fork Lila (above mine)	Ephemeral Stream	**Quarterly**	RF Above Mine Site
L-3-S	Lila Canyon (below mine)	Int. Stream	**Quarterly**	RF Below Mine Site
L-4-S	Sediment Pond	Discharge	Monthly or as occurs	Per UPDES Permit
L-5-G	Mine Water	Discharge	Monthly or as occurs	Per UPDES Permit
L-6-G	Lila Canyon	Spring	**Sampling Permanently Suspended 1Qtr 2003**	Replaced by L-11-G Water Right 91-617
L-7-G	Little Park	Spring	**Quarterly**	Cottonwood Spring Sample Site 9 Water Right 91-2521
L-8-G	Little Park	Spring	**Quarterly**	Unnamed Spring Sample Site 10 Water Right 91-2538
L-9-G	Little Park	Spring	**Quarterly**	Pine Spring Sample Site 16Z Water Right 91-2539
L-10-G	Williams Draw	Spring	**Sampling Permanently Suspended 1Qtr 2003**	Replaced by L-12-G Water Right 91-809

Table 7-3
Lila Canyon Mine
Water Monitoring Stations

Station	Location	Type	Frequency	Remarks
L-11-G	Lila Canyon	Spring	**Quarterly**	Mont/Leslie Spring Replaces L-6-G Water Right 91-618
L-12-G	Section 25 Spring	Spring	**Quarterly**	Replaces L-10-G
L-13-S	Little Park Wash	Dry Wash	**Sampling Permanently Suspended 3Qtr 2011**	At Road Crossing
L-14-S	Section 25 Noname Wash	Dry Wash	**Sampling Permanently Suspended 3Qtr 2011**	At Road Crossing
L-15-S	Williams Draw Wash	Dry Wash	**Sampling Permanently Suspended 1Qtr of 2003**	At Road Crossing
L-16-G	Stinky Spring Wash	Seep	Quarterly 2-3-4	Top of Mancos
L-17-G	Stinky Spring Wash	Seep	Quarterly 2-3-4	Top of Mancos
L-18-S	Stinky Springs Wash	Dry Wash	**Sampling Temporarily Suspended 3Qtr 2011**	Adjacent to Access Road
L-19-S	Little Park Wash	Dry Wash	**Quarterly**	At Permit Boundary

Table 7-3
Lila Canyon Mine
Water Monitoring Stations

Station	Location	Type	Frequency	Remarks
L-20-G	Quaker Spring	Seep	**Sampling Permanently Suspended 3Qtr 2012**	North of Permit Boundary
IPA-1	Little Park	Borehole	**Quarterly**	Water Level Only
IPA-2	Little Park	Borehole	**Quarterly**	Water Level Only
IPA-3	Little Park	Borehole	**Quarterly**	Water Level Only

NOTE: Sites L-13-S, L-14-S, L-15-S, L18-S, CG-2, CG-3, CG-4, CG-5, CG-6, and CG-7 were suspended following completion of wash characterization study.

Other sites temporarily suspended until two year prior to second mining influence.

Due to access concerns only the 2nd, 3rd and 4th quarters will be sampled. First quarter has been no access.

Table 7-4
Lila Canyon Mine
Surface Water Monitoring Parameters
Operational and Post-Mining

Field Measurements	Reported As
Water Level or Flow	Depth, Flow
pH	Standard Units
Specific Conductivity (ohms/cm)	umhos/cm @ 25° C
Temperature	^{o} C
Dissolved Oxygen	mg/l
Laboratory Measurements	**Reported As**
Total Dissolved Solids	mg/l
Total Settleable Solids	(UPDES)
Total Suspended Solids	mg/l
Total Hardness ($CACO_3$)	mg/l
Total Alkalinity	mg/l
Carbonate (CO_3^{-2})	mg/l
Bicarbonate $(HC)_3^{-1}$)	mg/l
Calcium (Ca) (Dissolved)	mg/l
Chloride (Cl^-)	mg/l
Iron (Fe) (Dissolved)	mg/l
Iron (Fe) (Total)	mg/l
Magnesium (Mg) (Dissolved)	mg/l
Manganese (Mn) (Dissolved)	mg/l
Manganese (Mn) (Total)	mg/l
Potassium (K) (Dissolved)	mg/l
Sodium (Na) (Dissolved)	mg/l
Sulfate (SO_4^{-2})	mg/l
Oil and Grease (As required)	mg/l
Cations	meq/l
Anions	meq/l

Table 7-5
Lila Canyon Mine
Ground Water Monitoring Parameters
Operational and Post-Mining

Field Measurements	Reported As
Water Level or Flow	Depth, Flow
pH	Standard Units
Specific Conductivity	umhos/cm @ 25° C
Temperature	^{o} C
Laboratory Measurements	**Reported As**
Total Dissolved Solids	mg/l
Total Hardness ($CACO_3$)	mg/l
Total Alkalinity	mg/l
Carbonate (CO_3^{-2})	mg/l
Bicarbonate $(HC)_3^{-1}$)	mg/l
Calcium (Ca) (Dissolved)	mg/l
Chloride (Cl^-)	mg/l
Iron (Fe) (Dissolved)	mg/l
Iron (Fe) (Total)	mg/l
Magnesium (Mg) (Dissolved)	mg/l
Manganese (Mn) (Dissolved)	mg/l
Manganese (Mn) (Total)	mg/l
Potassium (K) (Dissolved)	mg/l
Sodium (Na) (Dissolved)	mg/l
Sulfate (SO_4^{-2})	mg/l
Oil and Grease (As required)	mg/l
Cations	meq/l
Anions	meq/l

731.512.5 Flue-gas Desulfurization Sludge N/A - There are no plans for flue-gas desulfurization at this site.

731.512.6 Inert Materials N/A - There are no plans to use or discharge inert materials used for stabilizing underground mines.

731.512.7 Any underground mine development wastes that cannot be left and permanently stored underground will be brought to the surface and stored in a controlled, designated location. Final disposal of such material will depend on its volume, physical and chemical characteristics and potential for use in reclamation. There are presently no plans to return such material underground; however, if this does become necessary in the future, complete plans will be submitted for disposal at that time.

731.513 Water from Underground Workings Based on historical data from other mines in the area, some mine water can be expected to be encountered during the mining operation. Typically, such water is stored in “sumps” or designated areas in the mine and used for mining operations or discharged to the surface. A sump is an underground storage area that is used to temporarily store water before it is used underground or pumped to the surface for discharge. The main purpose of a sump is to remove sediments. The sump will also remove oil/grease if they were to get into the water. The size of a sump can vary from a few hundred gallons to several thousand gallons. The size normally depends on the space available and the amount of water needed for mining operations.

In order to more accurately define the potential impact of the mine on ground water, underground usage discharge amounts, if they were to occur, would be documented. This information along with the surface monitoring program will provide the best information available as to the potential impact of the mine on ground water.

IPA piezometers 1-3 will still be monitored quarterly if possible. The three piezometers were monitored on December 22, 2000. The water level probe during this period was unable to reach the depth required to measure the water level of IPA-1 and IPA -3. Another attempt will be

made to enter these piezometers when the sites are accessible.

The water level of IPA-2 was very consistent with the last reading taken on April 29, 1996. This piezometer (IPA-2) is the farthest west of the three piezometers and is up dip from the other two. Any impact to ground water would be noticed very quickly at IPA-2. This information from IPA-2 along with the past baseline data on the three piezometers and the in mine water monitoring program mentioned above, would provide an accurate evaluation of potential ground water impacts.

At the present time, there are no plans to divert water from the underground workings of this operation to any other underground workings.

If it became necessary to discharge water from the mine, this water would be discharged in accordance with the UPDES permit application in Appendix 7-5. The water would be discharged into the Right Fork of Lila Canyon. Refer to Plate 7-5.

731.520 Gravity Discharges Location of the proposed portal slopes are below the western (upper) exposure of the easterly dipping coal bed. In the area immediately around the proposed portals, no water is presently issuing from the strata above or below the coal outcrop; therefore, it is assumed any water encountered in the underground mining will not be under artesian pressure or with sufficient hydrostatic head to raise it to the portal site.

The coal seam to be mined dips away from the portal site at approximately 10%. If water is encountered in the mining, it will likely be at a static level far below the exposed outcrop or rock slopes. This may result in some possible mine discharge from pumping, but not from gravity.

731.521 Portal Location The proposed access portals are below the coal outcrop, as shown on Figure 7-1, Plates 5-5 and 7-5. The ventilation breakout locations are shown on Plate 5-2 and 5-2a. The rock slopes will slope up to the east at approximately 12% to contact the coal seam; however, the coal seam is dipping down to the east in this area. The

approximate point of contact between the rock slopes and the coal seam will be 1227' from the surface at an elevation of 6300'. Ground water levels in the mining area, based on the 3 water monitoring holes and other geologic data, appear to be nearly static at elevation 5990 in this area (see Figure 7-1).

Water level in the mine would have to raise approximately 310' to reach the rock slope/coal seam contact and result in a gravity discharge. Water monitoring results and other historical data in the area do not indicate this is likely to occur.

731.522 Surface Entries after January 21, 1981 This is not known to be an acid-producing or iron-producing coal seam; however, proposed portals are located to prevent gravity discharge from the mine (see Section 731.521).

731.600 Buffer Zones All streams within the permit area are either ephemeral or intermittent by rule with ephemeral flow. In the area of the surface facilities along the intermittent by definition Lila Wash, the Operator will install stream buffer zone signs in locations shown on Plate 5-2 and maintain the buffer zones during the operation.

731.700 Cross Sections and Maps The following is a list of cross-sections and maps provided in this section of the P.A.P.

Plate 7-1	Permit Area Hydrology Map
Plate 7-2	Disturbed Area Hydrology/Watershed
Plate 7-3	Water Rights Locations
Plate 7-4	Water Monitoring Location Map
Plate 7-5	Proposed Sediment Control Map
Plate 7-6a	Proposed Sediment Pond #1
Plate 7-6b	Proposed Sediment Pond #2
Plate 7-7	Post-Mining Hydrology

All required maps and cross-sections have been prepared by, or under the supervision of, and certified by a Registered Professional Engineer, State of Utah.

731.710 General Area Hydrology Plate 7-1.

731.720 Plate 7-2.

731.730 Water Monitoring Map Plate 7-4.

731.740 Sediment Pond Map Plates 7-6a and 7-6b.

731.750 Plate 7-6a & b.

731.760 Other Maps (See Section 731.700 for a complete list of maps provided in this section).

731.800 Water Rights and Replacement (See Section 727)

732. Sediment Control Measures

732.100 Siltation Structures The only proposed siltation structures for this site ~~is~~are the sediment ponds. All disturbed area runoff is proposed to be directed to ~~this~~these ponds for final treatment prior to discharge.

The sediment ponds will be constructed and maintained in compliance with applicable regulations. Details of the proposed ponds are discussed in the following section and in Appendix 7-4.

732.200 Sedimentation Ponds As discussed above, all disturbed area runoff is proposed to be directed to a sediment pond for final treatment prior to any discharge. The proposed sediment ponds will be located at the low points of the disturbed area, as shown on Plate 7-5.

732.210 Sediment Pond Details The proposed sediment pond~~ is~~s are considered temporary, and will be removed during final reclamation. The pond~~ is~~s are designed in compliance with the requirements of the following sections, as required:

356.300 - The ponds will be maintained until the disturbed area has been stabilized and revegetated. Removal shall not be any sooner than 2 years after the last augmented seeding;

356.400 - Upon removal, the ponds' areas will be reclaimed and reseeded according to the reclamation plan;

513.200 - N/A - The proposed sediment ponds does not meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a);

763 - Refer to this regulation addressed later in this chapter.

Design details for the sediment ponds and site drainage controls are addressed in Appendix 7-4 of this P.A.P.

732.220 MSHA Requirements This section does not apply since there are no plans for construction of coal processing waste dams or embankments at this site. The proposed ponds does not meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a).

732.300 Diversions There is one undisturbed diversion planned for this site. This diversion consists of a bypass culvert beneath the sediment pond, which will allow undisturbed runoff to bypass the site without mixing with disturbed area runoff.

Other diversions planned consist of disturbed area ditches and culverts, as shown on Plate 7-5. Design details for all diversions are provided in Appendix 7-4.

All diversions will be constructed and maintained to comply with the requirements of R645-301-742.100 and R645-301-742.300. Details are described under those respective sections of this chapter.

732.400 Road Drainage All roads will be constructed, maintained and reconstructed to comply with R645-301-742.400. Specific information to road drainage is provided under that section of this chapter.

732.410 Alteration or Relocation of Natural Drainages There are no plans to construct roads which will require alteration or relocation of natural drainageways, other than by providing

culverted crossings over ephemeral drainages. There are no plans to alter or relocate any intermittent or perennial drainages in conjunction with road construction.

Road construction and design details are provided in Chapter 5 of this P.A.P. Road drainage and culvert design details are provided in Appendix 7-4.

732.420 Culverts Culvert details are provided in Appendix 7-4. All undisturbed culvert inlets will be provided with headwall protection, consisting of inlet sections, rock or concrete.

733. Impoundments The only water impoundments proposed for this site ~~is~~are the sediment ponds. Design details for the pond are provided in Appendix 7-4 and on Plates 7-6a &b.

733.100 General Plans The general plan for this site is to drain runoff from the disturbed area into ~~a single~~two sedimentation ponds for treatment prior to discharge. Site drainage and design details are described in Appendix 7-4. The general plan includes the following, at a minimum:

733.110 Certification The sediment control plan and proposed sediment pond designs have been prepared and certified by a Registered Professional Engineer, State of Utah.

733.120 Maps and Cross Sections Sediment pond locations, design plans and cross sections are provided on Plates 7-5 and 7-6a & b, respectively.

733.130 Narrative A complete description of the proposed sediment pond along with volumes and design/construction details in provided in Appendix 7-4.

733.140 Survey The proposed sediment pond ~~is~~s are not located within a potential subsidence area from past underground mining operations.

733.150 Hydrologic and Geologic Information Relevant hydrologic and geologic information for the sediment pond ~~is~~s are provided in Appendix 7-4.

733.160 Certification Statement All proposed sediment pond structures are provided with this submittal. The structure will be constructed prior to construction of the mine site area, but not before receiving Division approval.

733.200 Permanent and Temporary Impoundments As indicated earlier, the proposed sediment pond ~~is~~s are classed as temporary.

733.210 Design Requirements The proposed sediment pond ~~is~~s are temporary; therefore, the pond ~~is~~s are not designed to meet requirements of MSHA 30 CFR 77.216.

The proposed pond ~~is~~s are not located where failure would expect to cause loss of life or serious property damage. As shown in Appendix 7-4, the proposed pond embankments will have a minimum of 3H : 1V on the inside slope and 2H : 1V on the outside. These slopes, along with the 95% compaction requirement, will ensure a static safety factor in excess of 1.3, as required.

733.220 Permanent Impoundment Section 733.220 is not applicable since the impoundment will be temporary.

733.230 Temporary Impoundment The proposed sediment ~~pond is~~ponds are temporary impoundments, and will be removed when reclamation sediment control and revegetation criteria are met, in accordance with Phase II Bond Release criteria.

733.240 Inspections/Potential Hazards As indicated under Section 515.200, if any examination or inspection shows a potential hazard exists, the person who examined the impoundment will promptly notify the Division of the finding and emergency procedures formatted for public protection and remedial action.

734. Discharge Structure All discharges from sedimentation ponds, diversions and culverts will be protected from erosion by the use of adequately sized rip-rap, concrete or other approved protection. Details for outlet protection for all drainage control structures are provided in appendix 7-4. All discharge structures have been designed according to standard engineering design procedures.

735. Disposal of Excess Spoil No excess spoil production is anticipated.

736. Coal Mine Waste Any areas designated for the disposal of coal mine waste will be constructed and maintained to comply with R645-301-746. Details are described under that section.

737. Noncoal Mine Waste Storage and final disposal of noncoal mine waste are described under section 747.

738. Temporary Casing and Sealing of Wells There are no wells proposed to be used to monitor ground water conditions associated with this permit or operation. The three Piezometers will be reclaimed according to the requirements of the Divisions's Performance Standards.

740. Design Criteria and Plans Design criteria and plans for this permit are detailed in Appendix 7-4. The following section will describe the general drainage and sediment control plan.

741. General Requirements The proposed operation is an underground mine with a relatively small surface disturbance for transportation, support and coal handling facilities. The proposed surface facilities will comprise a disturbed perimeter of approximately ~~42.6~~40.26 acres. Access roads and utility lines will consist of approximately 10 acres of additional disturbance along a BLM Right-of-Way designated as a "Transportation Corridor".

The majority of undisturbed runoff from areas above the proposed mine site will be diverted beneath the site via an undisturbed diversion culvert. Runoff from the disturbed mine site area will be directed to ~~a~~ sediment ponds, designed to contain and treat the runoff from a 10 year - 24 hour precipitation event for the contributing watershed. Disturbed area runoff will be directed to the sediment ponds via a combination of properly sized ditches and culverts. The general drainage control plan for the mine site is shown on Plate 7-5. The complete Drainage Design and Control Plan is provided in Appendix 7-4 of this P.A.P.

742. Sediment Control Measures See Appendix 7-4 for Sediment Control Measure details.

742.100 General Requirements

742.110 Designed/Constructed/Maintained Appropriate sediment control measures will be designed, constructed and maintained using the best technology currently available to:

742.111 "Prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area;"

This will be accomplished by the construction of undisturbed diversions to allow most undisturbed runoff to by-pass the site and by routing all disturbed runoff to sediment ponds for treatment prior to discharge.

742.112 "Meet the effluent limitations under R645-301-751;"

Any discharge from the sediment ponds will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

742.113 "Minimize erosion to the extent possible:" This will be accomplished by proper routing of drainage, and by the use of energy dissipators and/or erosion protection at all sediment pond, ditch and culvert outlets and in ditches where erosive velocities are expected.

742.120 Sediment Control Measure Sediment control measures within and adjacent to the disturbed areas are detailed in Appendix 7-4. These measures include, but are not limited to:

742.121 As discussed in Appendix 7-4, runoff from the disturbed area will be captured in sediment ponds and/or treated as necessary to meet effluent limitations prior to discharge.

742.122 As discussed in Appendix 7-4, the majority of undisturbed drainage from above the mine site will be diverted via designed undisturbed diversions.

742.123 Undisturbed diversions will consist of properly designed and protected channels and/or culverts as described in Appendix 7-4.

742.124 The primary means of velocity reduction is planned to be the use of rip-rap; however, other methods such as straw dikes, check dams and/or vegetative filters may be employed during the operational or reclamation phases as determined necessary, and with Diversion approval.

742.125 There are no plans to treat runoff with chemicals. Based on extensive experience with runoff in this area, effluent requirements for discharge can normally be met by containment and settling in a sediment pond.

742.126 It is expected that water will be encountered in the underground mining; however, this water will be used for mining needs and only discharged when no further storage is available underground. Any discharge of mine water will meet applicable effluent limitations. Such water will be sampled (and treated if necessary) prior to discharge.

742.200 Siltation Structures As described in Appendix 7-4, the sediment ponds will provide for sediment removal for most of the surface facility disturbance. An alternate sediment control methods of berms and silt fences will be used at the ventilation breakouts, around the topsoil stockpile area, and on the slopes below the water treatment area and portal access road. The description of this alternate sediment control method is also described in Appendix 7-4. In the case of the ventilation breakouts, this is necessary due to its remote location and rough terrain. In the case of the water treatment slope, due to topography, there is no way to direct the runoff to the sediment basins. Other sediment structures that might be used around the surface facilities are temporary sediment traps such as straw dikes and/or catch basins.

742.210 General Requirements Siltation structures will be designed, constructed and maintained in accordance with the following regulations.

742.211 Siltation structures will be constructed using the best technology currently available to prevent additional

contributions of suspended solids and sediment to streamflow outside the permit area to the extent possible. Sediment control structures and details are discussed in Appendix 7-4.

742.212 The siltation structures (i.e. sediment ponds) will be constructed prior to any coal mining and reclamation operations. Upon construction, the ponds and any other siltation structures will be certified by a qualified registered professional engineer to be constructed as designed and approved in the reclamation plan.

742.213 The sediment ponds will be designed, constructed and maintained in accordance with all applicable regulations. See 732.200, 733.200 and Appendix 7-4 for details.

742.214 Any discharge of water from underground workings to surface waters will meet applicable effluent limitations of 751. If such water is found not to meet those requirements, the water will be treated underground prior to discharge, or passed through a siltation structure prior to leaving the permit area.

742.220 Sedimentation Ponds The sedimentation ponds will meet the following criteria:

742.221.1 The ponds will be used individually;

742.221.2 The ponds are located at the lower end of the disturbed area and out of any perennial stream (See Plate 7-5);

742.221.3 The sediment ponds will be designed, constructed and maintained to:

742.221.31 The ponds are designed to contain the runoff from a 10 year - 24 hour precipitation event for the area in addition to a minimum of 2 years of sediment storage.

742.221.32 The ponds are designed to provide a minimum of 24 hour retention of the runoff from a 10 year - 24 hour precipitation event.

742.221.33 The ponds are designed to contain the runoff from a 10 year - 24 hour precipitation event plus a minimum of 2 years of sediment storage.

742.221.34 A nonclogging dewatering devices are proved as described in Appendix 7-4.

742.221.35 This will be accomplished by proper design, construction and maintenance of the ponds as described in Appendix 7-4.

742.221.36 As discussed in Appendix 7-4, sediment will be removed when the level reaches the 2 year storage level. Since the pond ~~is~~s are oversized, this leaves adequate room for storage of the design event.

742.221.37 The sediment ponds' construction ensures against excessive settlement. See "Sediment Pond Construction Requirements" in Appendix 7-4.

742.221.38 Sediment ponds will be free of sod, large roots, frozen soil, and acid- or toxic-forming coal processing waste. See "Sediment Pond Construction Requirements" in Appendix 7-4.

742.221.39 The sediment ponds will be compacted properly. See "Sediment Pond Construction Requirements" in Appendix 7-4.

742.222 Sediment Ponds Meeting MSHA Criteria The proposed ponds do not meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a). Therefore, this section is not applicable.

742.223 Sediment Ponds Not Meeting MSHA Criteria As discussed in Appendix 7-4, the ponds will be equipped with principle spillway and emergency spillway culverts each

sized to safely discharge runoff from a 25 year - 6 hour precipitation event.

742.223.1 The Principle Spillway culverts and the Emergency Spillway culverts will be corrugated, metal pipe. Each one designed to carry sustained flows.

742.223.2 N/A - See 742.223.1

742.224 N/A - See 742.223.1

742.225 N/A - No exception requested.

742.225.1 N/A

742.225.2 N/A

742.230 Other Treatment Facilities No other treatment facilities are planned for this operation. Therefore, Section 742.230 is not applicable.

742.240 Exemptions No exemptions are requested at this time; however, since this is a new proposed operation, the need for Small Area Exemptions and/or Alternate Sediment Control Areas may arise in the future.

742.300 Diversions

742.310 General Requirements

742.311 All diversions are considered temporary, and will be removed upon final reclamation.

Diversions are designed to minimize adverse impacts to the hydrologic balance within the permit and adjacent areas, to prevent material damage outside the permit area and to assure the safety of the public detailed diversion designs are presented in Appendix 7-4 of this P.A.P.

742.312 See Appendix 7-4 for diversion designs.

742.313 As indicated, all diversions for the Lila Canyon Mine are temporary, and will be removed when no longer needed. Land disturbed by removal will be reclaimed in accordance with R645-301 and R645-302. Prior to diversion removal, downstream water treatment facilities will be modified or removed. See Reclamation Hydrology Section of Appendix 7-4.

742.320 Diversion of Perennial and Intermittent Steams
Section 742.320 is not applicable since there are no diversions planned for perennial or intermittent streams within the permit area.

742.330 Diversion of Miscellaneous Flows All diversions within the permit area are of miscellaneous flows.

742.331 Certain miscellaneous undisturbed flows are proposed to be diverted around the disturbed area. Other flows are diverted within the disturbed area and to the sediment ponds, as described in Appendix 7-4.

742.332 See Appendix 7-4.

742.333 All temporary diversions are designed to safely pass the peak runoff of a 10-year 6-hour event resulting in a more robust design that the required 2-year 6-hour precipitation event. See Appendix 7-4 for details.

742.400 Road Drainage

742.410 All Roads All roads are designed in accordance with requirements of 534. Drainage control for all roads is discussed in detail in Appendix 7-4. No part of any road is planned to be located in the channel of an intermittent or perennial stream. As shown on Plate 7-2, roads are located to minimize downstream sedimentation and flooding.

742.420 Primary Roads Primary road design is discussed under 534.

742.421 As described in Section 534, all primary roads are to be located, insofar as practical, on the most stable available surfaces.

742.422 There are no stream fords planned for this operation.

742.423 Drainage Control Road drainage control is discussed in Appendix 7-4.

742.423.1 Primary roads will be equipped with adequate drainage control, including ditches, culverts and relief drains. The drainage control system is designed, and will be constructed and maintained, to pass the peak runoff safely from a 10 year - 6 hour precipitation event, as described in Appendix 7-4.

742.423.2 Culvert design and installation details are described in Appendix 7-4. Inlets and outlets are protected from erosion. Undisturbed culvert inlets are to be equipped with trash racks.

742.423.3 Drainage ditch design details are provided in Appendix 7-4.

742.423.4 There are plans to alter the drainage channel on the south boundary of the disturbed area. This drainage is an ephemeral channel with no riparian habitat. A stream alteration permit will not be required for this channel. A 60 inch culvert and a sedimentation pond will be placed in this channel. Installation of this culvert and sedimentation control plans are described in Appendix 7-4. To ensure that state of the art technology is incorporated, the final reclamation plans for the sedimentation pond area will be submitted prior to commencement of final reclamation of this area.

742.423.5 Stream channel crossings will be provided by culverts designed, constructed and maintained using current, prudent engineering practice, as described in Appendix 7-4.

743. Impoundments

743.100 General Requirements All impoundments associated with this operation are considered temporary.

743.110 Not applicable there are no impoundments planned that meet the criteria of MSHA, 30 CFR 77.216 (a).

743.120 The design of impoundments have been prepared and certified by a qualified, registered professional engineer. As described in Appendix 7-4, the proposed sediment ponds will have at least 2' of freeboard above the highest flow level in the emergency spillway, which is adequate to resist overtopping by waves and by sudden increases in storage volumes.

743.130 As described in Appendix 7-4, the sediment ponds will be equipped with a culvert riser principal spillway and a culvert riser emergency overflow sized to safely pass the runoff from a 25 year - 6 hour precipitation event.

743.131 The principal spillway design is discussed below.

743.131.1 The principle spillway will be constructed of corrugated metal pipe. The emergency spillway will also be constructed of corrugated metal pipe.

744. Discharge Structures

744.100 The sediment ponds' emergency spillways will be a vertical corrugated metal pipe. For Sediment Pond 1, it will flow into the UC-1* C.M.P. beneath the pond and discharge onto an engineered rip-rap apron to prevent scouring or erosion. For Sediment Pond 2, the discharge will be via C.M.P. (See Appendix 7-4).

Diversions and culvert outlets that are expected to have flow velocities in excess of 5 fps will also be equipped with erosion and velocity controls as described in Appendix 7-4.

744.200 Discharge structures have been designed and certified according to standard engineering design procedures. (See Appendix 7-4).

745. Disposal of Excess Spoil Section 745 is not applicable since there are no plans for disposal of excess spoil at the Lila Canyon operation.

746. Coal Mine Waste The area designated for coal mine waste disposal is within an existing depression area which is located beneath and around the proposed coal storage pile area as shown on Plates 5-2, 7-2 and 7-5. This disposal area will be used for disposal of the rock slope material, reject from coal processing, coal contaminated waste from the mine (i.e. roof falls, etc.) and/or sediment pond waste.

The designated waste area will be within the disturbed area and drained to the sediment pond, and will be constructed according to Division and MSHA requirements. Coal mine waste disposal is discussed in detail under Section 536 of this permit.

746.100 General Requirements

746.110 All coal mine waste will be placed in a new disposal area within the permit area as discussed in Section 536 and 746.

746.120 The area selected for coal mine waste disposal will drain to the sediment pond for final treatment to minimize adverse effects on the surface and ground water quality and quantity. (See Plates 7-2 and 7-5).

746.200 Refuse Piles. The refuse area is described under Coal Mine Waste in Section 746 and detailed in Section 536. Rock slope material will be used as fill and is referred to as refuse. No coal refuse pile is anticipated. Other than described in Section 536.

746.210 In the event a refuse pile is needed for future operations the refuse piles would be designed to meet the requirements of the above listed Division regulations as well as applicable MSHA regulations. See Section 536 for details.

746.211 The coal mine waste disposal areas will not be located in an area containing springs, seeps or water

courses. As shown on Plates 5-2 and 7-5 and described in Appendix 7-4, runoff from the areas will be drained to the sediment pond.

746.212 As described in Sections 536 and 746, the coal refuse will be placed within the mine workings, rock slope material will be placed in existing depression areas. These areas are below grade and will drain to the sediment pond. Due to the location (below grade) no berms or diversion ditches are planned for the Coal Mine Waste Area. See Appendix 7-4 for hydrologic details.

746.213 Not applicable since there are no underdrains planned for this pile.

746.220 Surface Area Stabilization

746.221 The plan for revegetation of the area is discussed in Section 536.

746.222 There are no plans for any permanent impoundments on the refuse or Coal mine waste area. Small depressions may exist for a short time until regrading is completed. These depressions are normally less than one foot in depth and not left for more than 30 days.

746.300 This section is not applicable since there are no plans to construct any impounding structures of coal mine waste or to impound coal mine waste.

746.400 This section is not applicable since there are no plans to return coal processing waste to abandoned underground workings.

747. Disposal of Noncoal Waste. Disposal of non-coal mine waste is discussed under Section 528.330 of this permit.

747.100 As indicated in Section 528.330, non-coal mine waste will be stored in a controlled manner in a designated area on site. Final disposal of all noncoal mine waste , except concrete during

reclamation, will be in a state-approved solid waste disposal area (E.C.D.C.).

747.200 As shown on Plates 5-2~~B~~ and 7-5, the proposed noncoal mine waste storage area is in a designated site, free of springs or seeps, and drained to the sediment pond.

747.300 There are no plans to dispose of noncoal mine waste within the permit area, except concrete during reclamation. The concrete will be buried beneath a minimum of 2' of non-acid, non-toxic material, and will not degrade surface or ground water.

748. Casing and Sealing of Wells There are only three ground water piezometers on the site IPA-1, IPA-2 and IPA-3. They will be reclaimed according to the requirements of the Division's Performance Standards. If any additional wells are required in the future, requirements of this section will be met.

750. Performance Standards

751. Water Quality Discharges of water from this operation will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U. S. Environmental Protection Agency set forth in 40 CFR Part 434. See Sections 731 and 742.

The current General UPDES Permit allows one million gallons of discharge (total) from Sediment Pond #1 and from the Mine Portal into Grassy Wash. UtahAmerican Energy is considering an individual permit for the potential of increased volume of mine portal water discharge. UtahAmerican Energy will inform the Division if/when an individual permit is issued.

752. Sediment Control Measures Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs described under Sections 732, 742, 760 and Appendix 7-4.

752.100 Siltation Structures Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs described under Sections 732, 742, 763 and Appendix 7-4.

752.200 Road Drainage Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed as described under Sections 732.400, 742.400 and 762.

752.210 Control or Prevent Erosion See Section 742.400 and Appendix 7-4.

752.220 Control or Prevent Additional Disturbance See Section 742.400 and Appendix 7-4.

752.230 Effluent Standards See Section 742.400 and Appendix 7-4.

752.240 Degradation of Ground Water Systems See Section 742.400 and Appendix 7-4.

752.250 Altering Normal Flow of Water See Section 742.400 and Appendix 7-4.

753. Impoundments and Discharge Structures Impoundments and discharge structures will be located, maintained, constructed and reclaimed as described in Sections 733, 734, 743, 745, 760 and Appendix 7-4.

754. Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste Disposal areas for excess spoil, coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed to comply with Sections 735, 736, 745, 746, 747 and 760.

755. Casing and Sealing of Wells Not applicable since no wells are planned for this site. The three Piezometers will be reclaimed according to the requirements of the Divisions's Performance Standards.

760. Reclamation Reclamation hydrology is detailed in Appendix 7-4.

761. General Requirements Upon completion of operations, the disturbed area will be reclaimed. All drainage and sediment controls are considered temporary and will be removed when no longer required. The sediment ponds will remain in place until Phase II Bond Release requirements have been met. At that time, the ponds will be removed and the areas will be reclaimed in accordance with the approved plan.

762. Roads All roads within the disturbed area are temporary, and will be removed and reclaimed upon completion of operations. ~~An access~~The County road will be left in place to reach the sediment pond~~; however, t~~ and for public use. This road will ~~also~~ be removed and reclaimed when the sediment pond is removed or remain according to the recommendations of the Bureau of Land Management (BLM).

762.100 Upon removal of roads, culverts and diversions will also be removed and the natural drainage patterns will be restored.

762.200 Cut and fill slopes will be reshaped according to the approved reclamation plan. This reshaping will be compatible with the postmining land use and will complement the drainage pattern of the surround terrain. Road reclamation is described in Section 550.

763. Siltation Structures. See Appendix 7-4 for details on removal of siltation structures.

763.100 Siltation Structures will be Maintained. As indicated in Section 761, the sediment ponds will remain in place until the stability and vegetation requirements for Phase II Bond Release are met. This will be a minimum of 2 years after the last augmented seeding. At this time, the ponds will be removed and the area reclaimed.

763.200 Structure is Removed Upon removal of the sediment ponds, the area will be regraded and revegetated in accordance with the approved reclamation plan and Sections 358, 356 and 357.

764. Structure Removal A timetable for reclamation activities is provided in Section 542.100.

765. Permanent Casing and Sealing of Wells There are only three ground water piezometers on the site IPA-1, IPA-2 and IPA-3. They will be reclaimed according to the requirements of the Division's Performance Standards. If any additional wells are required in the future, requirements of this section will be met.

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Lila Canyon Extension

Appendix 1-7
BLM Rights-of-Way

(PDF files only. No other digital files exist.)

FORM 2800-14
(August 1985)

Issuing Office
Moab District
Price Field Office

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
RIGHT-OF-WAY
SERIAL NUMBER UTU-77122

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1. A right-of-way is hereby granted pursuant to Title V of the Federal Land Policy and Management Act of October 21, 1976 (90 Stat. 2776; 43 U.S.C. 1761).

2. Nature of Interest:

   a. By this instrument, the holder:

      Utah American Energy Inc
      P. O. Box 986
      Price, Utah 84501

      receives a right to construct, operate, maintain and terminate a mine facility right-of-way on public lands described as follows:

      Salt Lake Meridian, Utah,

      T.16 S., R.14 E.,
      Section 15, NW4SE4,S2SE4, E2SW4.

b. The right-of-way granted herein is for mine site facilities and encompasses 40.0 acres, more or less within the described subdivisions.

   c. This instrument shall terminate thirty (30) years from its effective date unless, prior thereto, it is relinquished, abandoned, terminated, or modified pursuant to the terms and conditions of this instrument or of any applicable Federal law or regulation.

   d. This instrument may be renewed. If renewed, the right-of-way or permit shall be subject to the regulations existing at the time of renewal and any other terms and conditions that the authorized officer deems necessary to protect the public interest.

e. Notwithstanding the expiration of this instrument or any renewal thereof, early relinquishment, abandonment, or termination, the provisions of this instrument, to the extent applicable, shall continue in effect and shall be binding on the holder, its successors, or assigns, until they have fully satisfied the obligations and/or liabilities accruing herein before or on account of the expiration or prior termination of the grant.

3. Rental:

For and in consideration of the rights granted, the holder agrees to pay the Bureau of Land Management fair market value rental as determined by the authorized officer, unless specifically exempted from such payment by regulation. Provided, however, the rental may be adjusted by the authorized officer, whenever necessary, to reflect changes in the fair market rental value as determined by the application of sound business management principles, and so far as practicable and feasible, in accordance with comparable commercial practices.

4. Terms and Conditions:

a. This grant or permit is issued subject to the holder's compliance with all applicable regulations contained in Title 43 Code of Federal Regulations, part 2800.

b. Upon grant termination by the authorized officer, all improvements shall be removed from the public lands within 90 days, or otherwise disposed of as provided in paragraph (4)(d), or as directed by the authorized officer.

c. Each grant issued for a term of 20 years or more shall, at a minimum, be reviewed by the authorized officer at the end of the 20th year and at regular intervals thereafter not to exceed 10 years. Provided, however, a right-of-way or permit granted herein may be reviewed at any time deemed necessary by the authorized officer.

d. The stipulations, plans, maps, or designs set forth in Exhibit A and Exhibit B, dated July 23, 2001, attached hereto are incorporated into and made a part of this grant instrument as fully and effectively as if they were set forth herein in their entirety. All commitments referenced in Chapter 2, Alternative B, all mitigation outlined in Chapter IV and all other applicable sections of the environmental assessment for the project entitled *Development of the Lila Canyon Project, Emery County, Utah* (EA NO. UT-070-99-22, July 2000) are incorporated into and made a part of this grant instrument as fully and effectively as if they were set forth herein in their entirety.

e. Failure of the holder to comply with applicable law or any provision of this right-of-way grant or permit shall constitute grounds for suspension or termination thereof.

f. The holder shall perform all operations in a good and workmanlike manner so as to ensure protection of the environment and the health and safety of the public.

g. Ninety (90) days prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a joint inspection of the right-of-way area. This inspection will be held to agree to an acceptable termination (and rehabilitation) plan. This plan shall include, but is not limited to, removal of facilities, drainage structures or surface material, recontouring, topsoiling, or seeding. The authorized officer must approve the plan in writing prior to the holder's commencement of any termination activities.

IN WITNESS WHEREOF, The undersigned agrees to the terms and conditions of this right-of-way grant or permit.

(Signature of Holder)	(Signature of Authorized Officer)
President	Field Manager
(Title)	(Title)
7/25/01	7/27/01
(Date)	(Effective Date of Grant)

JUL 2 8 2001

2890
UTU-77122
(UT-070)

Exhibit A

1. The holder shall operate, and maintain the facilities, improvements, and structures within this right-of-way in strict conformity with its mine permit plan (Utah Division of Oil Gas and Mining No. ACT/007/013). When approved this grant is made part of the permit. Any relocation, additional construction, or use that is not in accord with the approved mine plan shall not be initiated without the prior written approval of the authorized officer. A copy of the complete right-of-way grant, including all stipulations and mine plan, shall be made available on the right-of-way area during construction, operation, and termination to the authorized officer. Noncompliance with the above will be grounds for an immediate temporary suspension of activities if it constitutes a threat to public health and safety or the environment.

2. The holder shall contact the authorized officer at least fourteen (14) days prior to the anticipated start of construction and/or any surface disturbing activities. The authorized officer will require and schedule a preconstruction conference with the holder prior to the holder's commencing construction and/or surface disturbing activities on the right-of-way. The holder and/or his representative shall attend this conference. The holder's contractor, or agents involved with construction and/or any surface disturbing activities associated with the right-of-way, shall also attend this conference to review the stipulations of the grant including the plans(s) of development.

3. The holder shall not initiate any construction or other surface disturbing activities on the right-of-way without the prior written authorization of the authorized officer. Such authorization shall be a written notice to proceed issued by the authorized officer. Any notice to proceed shall authorize construction or use only as therein expressly stated and only for the particular location or use therein described. A notice to proceed shall not be issued until the mine plan is approved by the Office of Surface Mining Reclamation and Enforcement.

4. The authorized officer may suspend or terminate in whole, or in part, any notice to proceed which has been issued when, in his judgement, unforeseen conditions arise which result in the approved terms and conditions being inadequate to protect the public health and safety or to protect the environment.

5. The holder shall designate a representative who shall have the authority to act upon and to implement instructions from the authorized officer. The holder's representative shall be available for communication with the authorized officer within a reasonable time when construction or other surface-disturbing activities are underway.

6. The holder hall conduct all activities associated with the construction, operation and maintenance of the right-of-way within the authorized limits of the right-of-way.

7. The holder shall survey and clearly mark the centerline and or exterior limits of the right-of-way, as determined by the authorized officer.

8. No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of six (6) inches deep, the soil shall be deemed to be too wet to adequately support construction equipment.

9. Construction sites shall be maintained in a sanitary condition at all times: waster material at the site shall be disposed of promptly at an appropriate waste disposal facility. "Waste" means all discarded matter including human waste, trash, garbage, refuse, oil drums, petroleum products, ashes, and equipment.

10. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the authorized officer after consulting with the holder.

11. The Holder shall retain a contractor for third party compliance. The compliance contractor shall be separate, independent from, and not subcontracted by anyone preparing the engineering plans, design, construction or operation of the holder's project.

    All costs incurred by the compliance contractor in connection with this project shall be the sole responsibility of the holder, and the holder agrees to hold harmless and indemnify BLM with respect to any and all claims, demands, cause(s) or action and the like which may arise from the performance of the compliance contractor or any services utilized in the compliance of the project.

12. Thirty (30) days prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a joint inspection of the right-of-way. This inspection will be held to agree to an acceptable termination and rehabilitation plan. This plan shall include, but is not limited to, removal of facilities, recontouring, topsoiling, or seeding. The authorized officer must approve the plan in writing prior to the holder's commencement of any termination activities.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Green River District
Price Field Office
125 South 600 West
Price, UT 84501
http://www.blm.gov/ut/st/en/fo/price.html

NOV 0 3 2016

IN REPLY REFER TO:
UTU-91789
2800 (UTG020)

CERTIFIED MAIL-RETURN RECEIPT REQUESTED:
No. 7016 1370 0000 0863 1803

PJ Jenson
UtahAmerican Energy Inc.
P.O. Box 910
East Carbon, Utah 84520

Re: New Right-of-Way UTU-91789

DECISION
:
:
Right-of-Way Grant UTU-91789 Issued

Enclosed is a copy of a right-of-way grant (serial number UTU-91789) which has been approved by the Bureau of Land Management and issued under authority of Title V of the Federal Land Policy and Management Act of October 21, 1976, as amended through September 1999, (90 Stat. 2776; 43 U.S.C. 1761). The issuance of this right-of-way grant constitutes a final decision by the Bureau of Land Management in this matter.

This decision may be appealed to the Interior Board of Land Appeals, Office of the Secretary, in accordance with the regulations contained in 43 CFR, Part 4, and the enclosed Form 1842-1. If an appeal is taken, your notice of appeal must be filed in this office (at the above address) within 30 days from receipt of this decision. The appellant has the burden of showing that the decision appealed from is in error.

If you wish to file a petition pursuant to regulation 43 CFR 4.21 (58 FR 4939, January 19, 1993) or 43 CFR 2801.10 for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal. A petition for a stay is required to show sufficient justification based on the standards listed below. Copies of the notice of appeal and petition for a stay must also be submitted to each party named in this decision and to the Interior Board of Land Appeals and to the appropriate Office of the Solicitor (see 43 CFR 4.413) at the same time the original documents

are filed with this office. If you request a stay, you have the burden of proof to demonstrate that a stay should be granted.

Standards for Obtaining a Stay

Except as otherwise provided by law or other pertinent regulation, a petition for a stay of a decision pending appeal shall show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied;

(2) The likelihood of the appellant's success on the merits;

(3) The likelihood of immediate and irreparable harm if the stay is not granted; and

(4) Whether the public interest favors granting the stay.

Please note that under the regulations in 43 CFR Group 2800, this decision is effective even if an appeal is filed. If you have any questions, please contact Jaydon Mead, Realty Specialist, at the above address, by e-mail jmead@blm.gov, or by phone (435) 636-3646.

Sincerely,

Don Stephens

Don Stephens
Assistant Field Manager

Enclosure:
Right-of-Way Grant UTU-91789

FORM 2800-14
(August 1985)

Issuing Office
Price Field Office

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
RIGHT-OF-WAY GRANT

SERIAL NUMBER UTU-91789

RECEIVED
OCT 25 2016
BLM
Price, UT

1. A right-of-way is hereby granted pursuant to Title V of the Federal Land Policy and Management Act of October 21, 1976 (90 Stat. 2776; 43 U.S.C. 1761).

2. Nature of Interest:

   a. By this instrument, the holder:

      UtahAmerican Energy Inc.
      P.O. Box 910
      East Carbon, Utah 84520

      Receives a right to construct, operate, maintain, and terminate an access road within portions of the public lands described as follows:

      T.16 S., R. 14 E., Salt Lake Meridian, Emery County, Utah
      Section 15: SE¼SW¼.

   b. The right-of-way or permit area granted herein is 60 feet wide, 1,300 feet long plus an additional 150 feet by 200 feet area to improve an existing damn, and contains 2.5 acres, more or less.

   c. This instrument shall expire on December 31, 2046. This grant is authorized for 30 years unless, prior thereto, it is relinquished, abandoned, terminated, or modified pursuant to the terms and conditions of this instrument or of any applicable Federal law or regulation.

   d. This instrument may be renewed. If renewed, the right-of-way or permit shall be subject to the regulations existing at the time of renewal and any other terms and conditions that the Field Manager or other authorized officer deems necessary to protect the public interest.

   e. Notwithstanding the expiration of this instrument or any renewal thereof, early relinquishment, abandonment, or termination, the provisions of this instrument, to the extent applicable, shall continue in effect and shall be binding on the holder, its successors, or assigns, until they have fully satisfied the obligations and/or liabilities accruing herein before or on account of the expiration, or prior termination, of the grant.

3. Rental:

   For and in consideration of the rights granted, the holder agrees to pay the Bureau of Land Management fair market value rental as determined by the authorized officer unless specifically exempted from such payment by regulation. Provided, however, that the rental may be adjusted by the authorized officer, whenever necessary, to reflect changes in the fair market rental value as determined by the application of sound business management principles, and so far as practicable and feasible, in accordance with comparable commercial practices.

Terms and Conditions:

4. Standard

   a. This grant or permit is issued subject to the holder's compliance with all applicable regulations contained in

Title 43 Code of Federal Regulations part 2800.

b. Each grant issued for a term of 10 years or more shall, at a minimum, be reviewed by the authorized officer at the end of the 10th year and at regular intervals thereafter not to exceed 10 years. Provided, however, that a right-of-way or permit granted herein may be reviewed at any time deemed necessary by the authorized officer.

c. The maps set forth in exhibit A attached hereto, are incorporated into and made a part of this grant instrument as fully and effectively as if they were set forth herein in their entirety.

d. BLM may suspend or terminate your grant if you do not comply with applicable laws and regulations or any terms, conditions, or stipulations of the grant (such as rent payments), or if you abandon the right-of-way. Your failure to use your right-of-way for its authorized purpose for any continuous 5-year period creates a presumption of abandonment.

e. In the event that the public land underlying the right-of-way (ROW) encompassed in this grant, or a portion thereof, is conveyed out of Federal ownership and administration of the ROW or the land underlying the ROW is not being reserved to the United States in the patent/deed and/or the ROW is not within a ROW corridor being reserved to the United States in the patent/deed, the United States waives any right it has to administer the right-of-way, or portion thereof, within the conveyed land under Federal laws, statutes, and regulations, including the regulations at 43 CFR Part [2800][2880], including any rights to have the holder apply to BLM for amendments, modifications, or assignments and for BLM to approve or recognize such amendments, modifications, or assignments. At the time of conveyance, the patentee/grantee, and their successors and assigns, shall succeed to the interests of the United States in all matters relating to the right-of-way, or portion thereof, within the conveyed land and shall be subject to applicable State and local government laws, statutes, and ordinances. After conveyance, any disputes concerning compliance with the use and the terms and conditions of the ROW shall be considered a civil matter between the patentee/grantee and the ROW Holder.

5. Applicable Laws

a. The holder shall comply with all Federal, State, and local regulations whether or not specifically mentioned within this grant.

b. Use of pesticides shall comply with the applicable Federal and state laws. Pesticides shall be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides, the holder shall obtain from the Field Manager or other authorized officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer. Emergency use of pesticides shall be approved in writing by the authorized officer prior to such use.

c. The holder of this right-of-way grant or the holder's successor in interest shall comply with Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d et seq.) and the regulations of the Secretary of the Interior issued pursuant thereto.

d. The holder shall meet Federal, State, and local emission standards for air quality.

e. The holder shall comply with all applicable Federal laws and regulations existing or hereafter enacted or promulgated. In any event, the holder(s) shall comply with the Toxic Substances Control Act of 1976, as amended (15 U.S.C. 2601, et seq.) with regard to any toxic substances that are used, generated by or stored on the right-of-way or on facilities authorized under this right-of-way grant. (See 40 CFR, Part 702-799 and especially, provisions on polychlorinated biphenyls, 40 CFR 761.1-761.193.) Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117 shall be reported as required by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, Section 102b. A copy of any report required or requested by any Federal agency or State government as a result of a reportable release or spill of any toxic substances shall be furnished to the authorized officer concurrent with the filing of the reports to the involved Federal agency or State government.

f. The holder shall comply with the construction practices and mitigating measures established by 33 CFR 323.4, which sets forth the parameters of the "nationwide permit" required by Section 404 of the Clean Water Act. If the proposed action exceeds the parameters of the nationwide permit, the holder shall obtain an individual permit from the appropriate office of the Army Corps of Engineers and provide the authorized

officer with a copy of same. Failure to comply with this requirement shall be cause for suspension or termination of this right-of-way grant.

g. The holder of Right-of-Way No. UTU- 91789 agrees to indemnify the United States against any liability arising from the release of any hazardous substance or hazardous waste (as these terms are defined in the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. 9601, et seq. or the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901 et seq.) on the right-of-way (unless the release or threatened release is wholly unrelated to the right-of-way holder's activity on the right-of-way. This agreement applies without regard to whether a release is caused by the holder, its agent, or unrelated third parties.

h. The holder is prohibited from discharging oil or other pollutants into or upon the navigable waters of the United States, adjoining shorelines, or the waters of the contiguous zone in violation of Section 311 of the Clean Water Act as amended, 33 U.S.C. 1321, and the regulations issued there under, or applicable laws of the State and regulations issued there under. Holder shall give immediate notice of any such discharge to the authorized officer and such other Federal and State officials as are required by law to be given such notice.

6. Miscellaneous

a. The holder shall perform all operations in a good and workmanlike manner so as to ensure protection of the environment and the health and safety of the public. All design, material, and construction, operation, maintenance, and termination practices shall be in accordance with safe and proven engineering practices.

b. The holder shall designate a representative who shall have the authority to act upon and to implement instructions from the authorized officer. The holder's representative shall be available for communication with the authorized officer within a reasonable time when construction or other surface disturbing activities are underway.

c. The holder shall permit free and unrestricted public access to and upon the right-of-way for all lawful purposes except for those specific areas designated as restricted by the Field Manager or other authorized officer to protect the public, wildlife, livestock or facilities constructed within the right-of-way.

d. The holder shall inform the Field Manager at (435) 636-3600 within 48 hours of any accidents on federal lands.

e. All surface disturbing activities will have a cultural survey completed (if one has not been previously completed) and submitted to the BLM before activities begin and may be monitored by a BLM permitted archaeologist if determined necessary by the BLM. If any cultural materials are discovered during construction, work in the area will halt immediately and the authorized official notified.

f. Any cultural and/or paleontological resource (historic or prehistoric site or object) discovered by the holder, or any person working on his behalf, on public or Federal land shall be immediately reported to the authorized officer. Holder shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer to determine appropriate actions to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation and any decision as to proper mitigation measures will be made by the authorized officer after consulting with the holder.

g. The holder shall protect all survey monuments found within the right-of-way. Survey monuments include, but are not limited to, General Land Office and Bureau of Land Management Cadastral Survey Corners, reference corners, witness points, U.S. Coastal and Geodetic benchmarks and triangulation stations, military control monuments, and recognizable civil (both public and private) survey monuments. In the event of obliteration or disturbance of any of the above, the holder shall immediately report the incident, in writing, to the authorized officer and the respective installing authority if known. Where General Land Office or Bureau of Land Management right-of-way monuments or references are obliterated during operations, the holder shall secure the services of a registered land surveyor or a Bureau cadastral surveyor to restore the disturbed monuments and references using surveying procedures found in the Manual of Surveying Instructions for the Survey of the Public Lands in the United States, latest edition. The holder shall record such survey in the appropriate county and send a copy to the authorized officer. If the Bureau cadastral surveyors or other Federal surveyors are used to restore the disturbed survey monument, the holder shall be responsible for the survey cost.

7. Construction / Maintenance

a. The holder shall conduct all activities associated with the construction, operation, and termination of the right-of-way within the authorized limits of the right-of-way.

b. Equipment and vehicles shall be inspected and cleaned for vegetation matter and seeds prior to entering BLM administered lands. Clothing and animals should also be inspected for vegetation matter and seeds. Vehicles and equipment should be power washed at a commercial facility or other applicable site where invasive species/noxious weeds seeds can be flushed through a waste treatment plant, where seeds will become inert.

c. The holder shall construct, operate, and maintain the facilities, improvements, and structures within this right-of-way in strict conformity with the plan of development which was approved and made part of this grant. Any relocation, additional construction, or use that is not in accord with the approved plan of development, shall not be initiated without the prior written approval of the authorized officer. A copy of the complete right-of-way grant, including all stipulations and approved plan of development, shall be made available on the right-of-way area during construction, operation, and termination to the authorized officer. Noncompliance with the above will be grounds for an immediate temporary suspension of activities if it constitutes a threat to public health and safety or the environment.

d. The map and site plan drawings submitted with the original proposal shall be made a part of this right-of-way grant. All construction must conform to these drawings and maps.

e. The holder shall provide for the safety of the public entering the right-of-way. This includes, but is not limited to barricades for open trenches, flagmen/women with communication systems for single-lane roads without intervisible turnouts, and attended gates for blasting operations.

f. If any clearing is needed, the right-of-way will be brush-hogged to prevent unnecessary disturbance. Only those areas where safety, absolute need for construction or other regulations may warrant the use of topsoil removal by blading or scalping. This right-of-way clearing shall be limited to the limits of the right-of-way. Suitable topsoil material removed in conjunction with clearing and stripping shall be conserved in stockpiles within the right-of-way.

g. Holder shall remove only the minimum amount of vegetation necessary for the construction of structures and facilities. Topsoil shall be conserved during excavation and reused as cover on disturbed areas to facilitate regrowth of vegetation.

h. Prior to fill construction, the existing surface shall be sloped to avoid sharp banks and allow equipment operations. No fills shall be made with frozen or water saturated soils. Construction equipment shall be routed evenly over the entire width of the fill to obtain a thorough compaction.

i. Construction holes left open overnight shall be covered. Covers shall be secured in place and shall be strong enough to prevent livestock or wildlife from falling through and into a hole.

j. Holder shall limit excavation to the areas of construction. No borrow areas for fill material will be permitted on the site. All off-site borrow areas must be approved in writing by the authorized officer in advance of excavation. All waste material resulting from construction or use of the site by holder shall be removed from the site. All waste disposal sites on public land must be approved in writing by the authorized officer in advance of use.

k. All roads and parking areas shall be constructed to provide drainage and minimize erosion. Culverts shall be installed if necessary to maintain drainage. All areas to be used for roads and parking can be surfaced with gravel.

l. Construction sites shall be maintained in a sanitary condition at all times; waste materials at those sites shall be disposed of promptly at an appropriate waste disposal site. "Waste" means all discarded matter including, but not limited to, human waste, trash, garbage, refuse, oil drums, petroleum products, ashes, and equipment.

m. If during any phase of the construction, operation, or termination any oil or other pollutant should be discharged from containers or vehicles and impact Federal lands, the control and total removal, disposal, and cleanup of such oil or other pollutant, wherever found, shall be the responsibility of the holder, regardless of fault. Upon failure of holder to control, cleanup, or dispose of such discharge on or affecting Federal lands, or to repair all damages to Federal lands resulting therefrom, the authorized officer may take such measures as he deems necessary to control and cleanup the discharge and restore the area, including, where appropriate, the aquatic environment and fish and wildlife habitats, at the full expense of the holder. Such action by the authorized officer shall not relieve the holder of any liability or responsibility.

n. Fences, gates, brace panels and any other range improvements shall be reconstructed to appropriate Bureau standards and/or specifications as determined by the authorized officer.

o. When construction activity in connection with the right-of-way breaks or destroys a natural barrier used for livestock control, the gap, thus opened, shall be fenced to prevent the drift of livestock. The subject natural barrier shall be identified by the authorized officer and fenced by the holder as per instruction of the authorized officer.

p. Construction-related traffic shall be restricted to routes approved by the authorized officer. New access roads or cross-country vehicle travel will not be permitted unless prior written approval is given by the authorized officer. Authorized roads used by the holder shall be rehabilitated or maintained when construction activities are complete as approved by the authorized officer.

q. Existing roads and trails on public lands that are blocked as the result of the construction project shall be rerouted or rebuilt as directed by the authorized officer.

r. No construction or routine maintenance activities shall be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of four inches deep, the soil shall be deemed too wet to adequately support construction equipment.

s. The holder shall construct waterbars on all disturbed areas as needed. Waterbars are to be constructed to: (1) simulate the imaginary contour lines of the slope (ideally with a grade of one or two percent); (2) drain away from the disturbed area; and (3) begin and end in vegetation or rock whenever possible.

t. A litter policing program shall be implemented by the holder, if requested and approved of in writing by the authorized officer, which covers all roads and sites associated with the right-of-way.

a. The holder is responsible for consultation with the authorized officer and/or local authorities for acceptable weed control methods (within limits imposed in the grant stipulations). The holder shall be responsible for annual surveys, reporting the results of the surveys to the BLM, and weed control on disturbed areas within the limits of the right-of-way.

b. Holder shall maintain the right-of-way in a safe, usable condition, as directed by the authorized officer.

8. Reclamation / Rehabilitation / Termination

a. Upon grant termination by the Field Manager or other authorized officer, all improvements shall be removed from the public lands within 90 days, or otherwise disposed of as provided in paragraph (4)(d) or as directed by the authorized officer.

b. The holder shall restore drainages, to the greatest extent possible, to the original bank configuration, stream bottom width, and channel gradient. Loose soil, fill, and culverts shall be removed from drainage channels as directed by the authorized officer.

c. The holder shall re-contour the disturbed area and obliterate all earthwork by removing embankments, backfilling excavations, and grading to re-establish the approximate original contours of the land in the right-of-way.

d. The holder shall prepare a seedbed by scarifying the disturbed area, distributing topsoil uniformly, or disking the topsoil.

e. The holder shall seed all disturbed areas that have been or are being reclaimed with a seed mixture(s) submitted to and approved by the authorized officer.

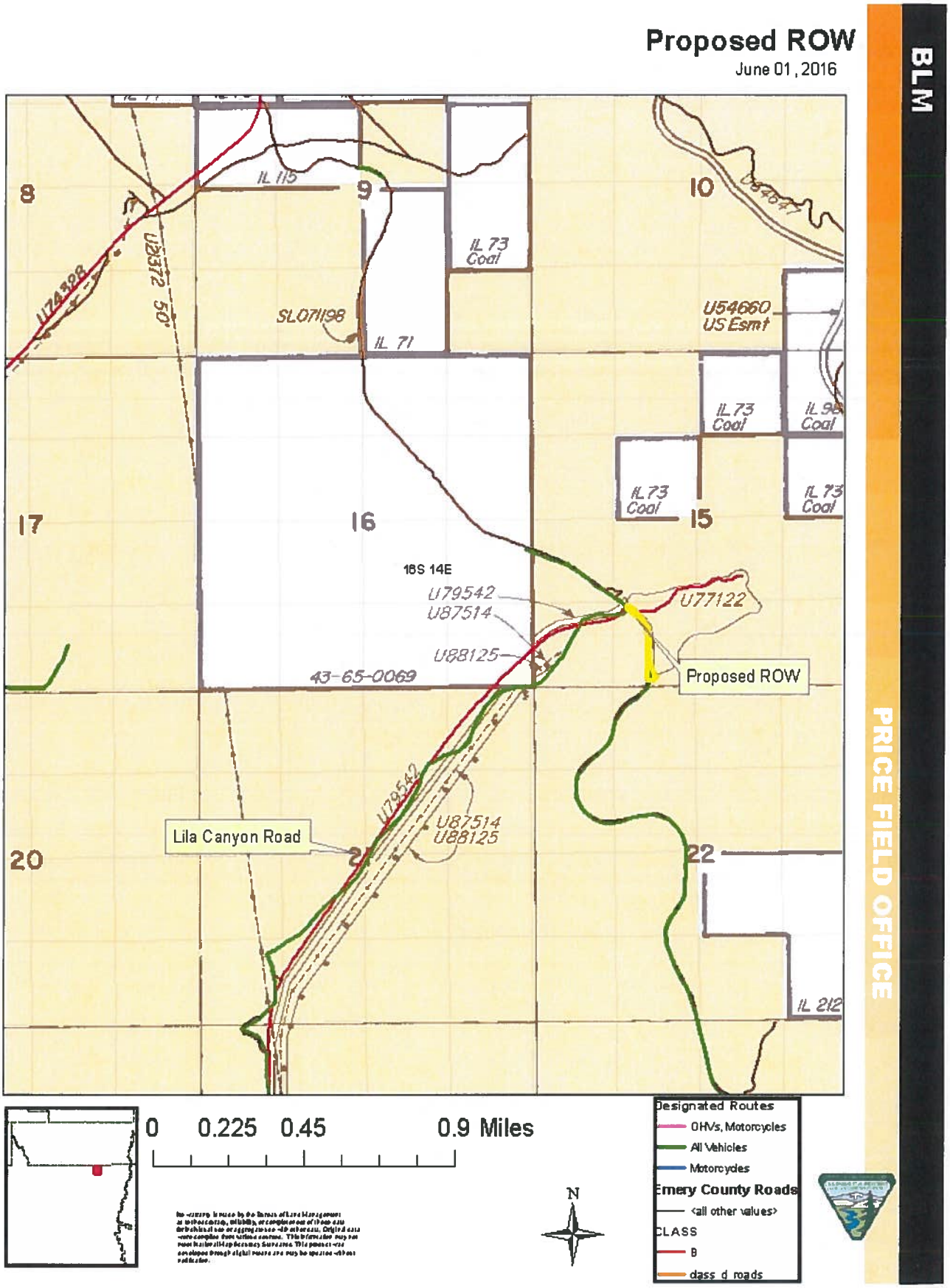
f. Ninety (90) days prior to termination of the right-of-way, the holder shall contact the authorized officer to arrange a pre-termination conference. This conference will be held to review the termination provisions of the grant.

IN WITNESS WHEREOF, The undersigned agrees to the terms and conditions of this right-of-way grant or permit.

Dail Hollis	
(Signature of Holder)	**(Signature of BLM Authorized Officer)**
President	**Assistant Field Manager, Price Field Office**
(Title)	**(Title)**
10/11/16	10-25-16
(Date)	**(Effective Date of Grant)**

Exhibit A (Map1)

Exhibit A (Map 2)



Appendix 7-4
Lila Canyon Mine
Sedimentation and Drainage Control Plan

Revised

January 2001
October 2002 RJM
February 2007 TJS
April 2008 TJS
July 2008 TJS
June 2009 TJS
January 2010 TJS
January 2012 TJS
October 2014 TJS
December 2015 KM-PJ
November 2016 PJ/KM

SEDIMENTATION AND DRAINAGE CONTROL PLAN

TABLE OF CONTENTS

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1- Introduction: . . . . . Page -1-

2- Design of Drainage Control Structures: . . . . . Page -3-

3- Design of Sediment Control Structures: . . . . . Page -41-

4- Design of Drainage Control Structures for Reclamation: . . . . . Page -54-

5- Alternate Sediment Control for Fan, Water Treatment, and Topsoil Sites. . . . . Page -59-

SEDIMENTATION AND DRAINAGE CONTROL PLAN

1- Introduction

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

This plan has been divided into the following three sections:

1) Design of Drainage Control Structures for the Proposed Construction

2) Design of Sediment Control Structures

3) Design of Drainage Control Structures for Reclamation

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

(a) This is a new site construction. All areas proposed for disturbance will be sloped to drain to surface ditches and/or culverts where runoff will be carried to two sediment ponds. All minesite drainage controls and watersheds are shown on Plate 7-5 "Proposed Sediment Control Map" and Plate 7-2 "Disturbed Area Hydrology and Watershed Map," respectively.

(b) The majority of undisturbed runoff will be diverted around the minesite and/or beneath the Sediment Pond #1 by properly sized culverts. Undisturbed diversion culvert UC-1, is located on the southwest end of the site. This diversion will allow the majority of undisturbed runoff from the Right Fork of Lila Canyon to bypass the mine area beneath Sediment Pond #1. All undisturbed diversions are designed to carry runoff from a 100 year - 6 hour precipitation event. UC-1 is oversized at 60" diameter.

(a) <u>NOTE:</u> In the fall of 2016, a massive storm event caused a large portion of culvert UC-1 to become plugged. Blockage in the culvert is so extensive that removing the debris blocking the culvert would be an enormous undertaking. The Operator has determined that replacing a large portion of the UC-1 culvert will be a safer and more cost-effective solution than clearing the debris from the existing culvert. Therefore, a new 60" culvert (UC-1a) will be constructed from the inlet location of UC-1 and extending

below Sediment Pond #1, then attaching to UC-1 near the spillway structures. The plugged portion of UC-1 will be cut and removed as required for the installation of the new section of culvert. The remaining section of existing culvert will be abandoned and sealed in place. All sections of the culvert will remain until final reclamation. During final reclamation, all sections (including the abandoned portions) of UC-1 and UC-1a will be removed in accordance with the approved reclamation plan.

(c) Two adequately sized sediment ponds will be constructed at the lower end of the site. These ponds are sized to contain and treat the runoff from all of the disturbed area and any contributing undisturbed areas for a 10 year - 24 hour precipitation event. The ponds will be equipped with C.M.P. culvert principle spillway and decant and CMP culvert emergency spillway sized to safely pass runoff from a 25 year - 6 hour precipitation event. The spillways from Sediment Pond #1 will discharge into the UC-1 CMP culvert running beneath the pond. This culvert will discharge onto an engineered discharge structure and into the Right Fork of Lila Canyon channel below the minesite. The spillways from Sediment Pond #2 will discharge onto an engineered discharge structure and into the Middle Fork of Lila Canyon channel, below the minesite.

DESIGN OF DRAINAGE CONTROL STRUCTURES

Design Parameters:

2.1 Precipitation
2.2 Flow
2.3 Velocity
2.4 Drainage Areas
2.5 Slope Lengths
2.6 Runoff
2.7 Runoff Curve Numbers
2.8 Culvert Sizing
2.9 Culverts
2.10 Main Canyon Culvert - Outlet Structure
2.11 Ditches

Tables:

Table 1 Undisturbed Watershed Summary
Table 2 Disturbed Watershed Summary
Table 3 Watershed Parameters
Table 4 Runoff Summary - Undisturbed Watershed (Not Draining to Pond)
Table 5 Runoff Summary - Watersheds Draining to Sediment Pond
Table 6 Runoff Control Structure - Watershed Summary
Table 7 Runoff Control Structure - Flow Summary
Table 8 Disturbed Ditch Design Summary
Table 9 Disturbed Culvert Design Summary
Table 10 Undisturbed Culvert Design Summary

Figures:

Figure 1 Culvert Nomograph
Figure 2 Rip-Rap Chart
Figure 3 Disturbed Ditch Typical Section
Figure 4 Trash Rack - Culvert Inlet - Typical Section
Figure 4A UC-1 Culvert Outlet
Figure 7.26 Design of Outlet Protection - Barfield et al.

Design Parameters

2.1 Precipitation

The precipitation-frequency values for the area were taken from the approved Mining and Reclamation Plan, Horse Canyon Mine, Emery County, Utah, Volume III, submitted by I.P.A.

Frequency - Duration	Precipitation
10 year - 6 hour	1.30"
10 year - 24 hour	1.90"
25 year - 6 hour	1.50"
100 year - 6 hour	1.90"

2.2 Flow

Peak flows were determined from rainfall depths, drainage areas, and curve numbers and were calculated using the computer program "Triangular Hydrograph Calculations", based on SCSHYDRO Program developed by Hawkins and Marshall (1979) prepared for the Division of Oil, Gas, and Mining.. All flows are based on the SCS Curve Number Method for both SCS 6-hour and NOAA Type II, 24-hour storms.

Time of concentration of storm events were calculated for each drainage area using SCS Lane's Formula. (U.S. Soil Conservation Service, 1972):

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

and

$$Tc = 1.67 * L$$

where L = watershed lag (hours)
l = hydraulic length of the watershed, or distance along the main channel to the watershed divide (feet)
S = watershed storage factor defined in Equation (2-2)
Y = average watershed slope (percent)
Tc = time of concentration (hours)

2.3 Velocity

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

where:

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

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

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

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

Structure	Manning's n
Culverts (cmp)	0.024
Culverts (HDPE)	0.013
Unlined Disturbed Area Ditches	0.030
Lined Disturbed Area Ditches	0.032 - 0.040

2.4 Drainage Areas

All drainage areas were determined directly from Plate 7-1, "Permit Area Hydrology Map", Plate 7-2, "Disturbed Area Hydrology/Watershed", or Plate 7-5 "Proposed Sediment Control".

2.5 Slopes, Lengths

All slopes and lengths were measured directly from the topography on Plates 7-1, 7-2, and/or 7-5.

2.6 Runoff Volume

Runoff was calculated using the SCS Curve Number formula for both NOAA Type II, 24-hour and SCS 6-hour storms; using the SCSHYDRO computer program:

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

where:

Q = Runoff in inches

P = Precipitation in inches

$$S = \frac{1000}{CN} - 10$$

CN = Runoff Curve Number

2.7 Runoff Curve Numbers

Two curve numbers were utilized for the undisturbed areas. Areas with milder slopes (less than 30%) were given a runoff curve number of 75. All other undisturbed areas (30% slope or greater) were given a runoff curve number of 83. These numbers were taken directly from the approved "Mining and Reclamation Plan, Horse Canyon Mine, Emery County, Utah, Volume III", submitted by I.P.A. The numbers in that plan were based on vegetation and soils data from on-site.

A runoff CN of 90 is used for all disturbed areas. This value is based on commonly used and approved values and from Table 2.20, (p. 82, Barfield, et al, 1983).

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

Watershed	Runoff CN
Undisturbed (<30% slopes):	75
Undisturbed (>30% slopes):	83
Disturbed:	90

2.8 Culvert Sizing

Minimum culvert sizing is based on the either the inlet control nomograph or Manning's Equation. Culverts were evaluated for inlet control conditions to determine the minimum pipe size using the Culvert Nomograph included as Figure 1 of this Appendix. If the pipe had a HW/D ratio equal to or greater than 1.0 or the slope were less than 2% the Hydraulic Toolbox, Version 4.0 or later version computer program was used to determine the pipe flow diameter using:

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

where:	D	=	Required Diameter (feet)
	Q	=	QP = Peak Discharge (cfs)
	n	=	Roughness Factor (0.025 for CMP)
	S	=	Slope (ft. per ft.)

2.9 Culverts

Culverts have been sized according to the calculations previously described, and are shown on Plate 7-5, "Proposed Sediment Control". Culverts carrying undisturbed drainages are designated with UC- Letters (i.e. UC-1). All undisturbed area drainage culverts will be fitted with trash racks to minimize plugging by rocks or other debris.

Trash racks will be provided at the inlet for all undisturbed drainage culverts. These will consist of 3/4" steel bars welded on 6" centers across the flared inlet structures of each culvert. Bars will be sloped from the front of the inlet structure up to the top of the culvert. This ramp configuration will allow trash, branches and other potential obstructions to be swept up and away from the inlet rather than being impinged against the grates during a flow event. Rip rap will be placed around the flared inlet structure and above it to a height of at least 6" above the required headwall for each culvert. (See Figure 4 for details). Trash racks will be checked on a routine schedule and following precipitation events and all trash, branches and other obstructions will be removed.

It should be noted that all undisturbed area culverts are adequately sized to handle the expected runoff from a 100 year - 6 hour event for maximum protection of the mine area, sediment pond and undisturbed drainage. This is well in excess of the 10 year - 6 hour event required by the regulations and is proposed as an extra measure of safety.

Disturbed area culverts and ditches are shown on the "Proposed Sediment Control", Plate 7-5. Culverts carrying disturbed drainage are designated with a DC-number (i.e. DC-1). Calculations for all disturbed area culverts and ditches are also included with this report, along with design criteria. Disturbed drainage areas draining to culverts and ditches are marked with a DA-number (i.e. DA-1).

Culverts will be inspected regularly, and cleaned as necessary to provide for passage of drainage flows. Inlets and outlets shall also be maintained so as to prevent plugging or undue restriction of water flow.

All disturbed area culverts are temporary, and will be removed upon final reclamation.

2.10 Main Canyon Culvert - Outlet Structure

The outlet of culvert UC-1 has been designed to flow onto a rip-rap apron to protect against scouring and to allow for energy dissipation. The rip-rap apron is designed to fit the natural channel configuration as closely as possible, and will allow runoff to re-enter the natural channel at a reduced velocity which is no greater than natural flow conditions. Runoff from the 100 year - 6 hour precipitation event in the canyon below the minesite has been calculated at 55.60 cfs, including sediment pond overflow.

The rip-rap apron design is based on Figure 7-26, Design of Outlet Protection - Maximum Tailwater Condition, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983. Based on the figure, the apron should be a minimum of 15' in length, widening from 5' to 9', with a 0.1% slope. The proposed length has been increased to 20', to ensure adequate time for velocity reduction. The apron slope is kept at 0.1%. Rip-rap size is conservatively placed at 12" D_{50}. Rip-rap will be placed to a depth of 1.5 D_{50} and will be placed on a 6" layer of 2" drain rock filter. Rip-rap will also be placed on the 2H:1V side slopes to the height of the culvert (5') at the culvert outlet tapering to 3' at the outlet of the apron. This rip-rap apron has been sized and designed to adequately dissipate energy from flow velocities of a 100 year - 6 hour precipitation event and resist dislodgement. The drain rock filter bed will also serve to secure the rip-rap boulders firmly in place, to add an additional element of stability, and prevent scouring underneath the armored apron. (See Figure 4A for construction details). The natural channel below the culvert has a gradient of approximately 7.76%. When the flow is routed from the culvert across the apron to the natural channel, the velocity is reduced from 6.31 fps at the culvert outlet to 1.54 fps at the outlet of the apron. (See Culvert Outlet Rip-Rap Apron Flow Velocity Calculations in Appendix 1.)

It should be noted that these calculations are based on a 100 year - 6 hour event.

Please see Part (a) of Section (b) on Page 1 regarding changes to UC-1 due to a massive storm event in 2016.

2.11 Ditches

All ditches will carry disturbed area drainage to the ponds. Ditches are shown on the "Proposed Sediment Control", Plate 7-5, and are designated with a DD-number (i.e. DD-1 for Disturbed Area Ditches) or UD-number (i.e. UD-1 for Undisturbed Area Ditches).

All ditches are designed to carry the expected runoff from a 10 year - 6 hour event with a minimum freeboard of 0.5' (See Table 8 and Figure 3). It should be noted that at ditch DD-11a, there is accommodation for the introduction of discharge of mine water at a rate of 1.5 cfs (690 gpm).

Ditches which exhibit expected flow velocities of 5 fps or greater will be lined with rip-rap. A typical cross-section is shown on Figure 3 and flow depths and areas for all lined and unlined ditches are presented in Table 8 of this report.

Ditch slopes have been determined from Plates 7-2 and 7-5.

All ditches will be inspected regularly, and maintained to the minimum dimensions to provide adequate capacity for the design flow. All ditches are temporary and will be removed as described under the reclamation hydrology section. (Section 4)

TABLE 1

Undisturbed Watershed Summary		
Watershed	Drains To	Final
UA-1	UC-1/UC-1a	Right Fork Lila Canyon
UA-2	DD-1	Sediment Pond
UA-3	DD-1	Sediment Pond
UA-4	Sediment Pond	Sediment Pond
UA-5a	Removed	
UA-5b	Removed	
UA-6a	DD-2	Sediment Pond
UA-6b	DD-2	Sediment Pond
UA-7	ASCA Area	Left Fork Lila Canyon
UA-8	County Road Culvert	Right Fork Lila Canyon

TABLE 2

Disturbed Watershed Summary		
Watershed	Drains To	Final
DA-1	DD-1	Sediment Pond
DA-2	DD-2	Sediment Pond
DA-3	DD-3	Sediment Pond
DA-4	DD-4	Sediment Pond
DA-5	DD-5a	Sediment Pond
DA-6a	DC-6a	Sediment Pond
DA-6b	DC-6b	Sediment Pond
DA-7	DC-7	Sediment Pond
DA-8	DC-8	Sediment Pond
DA-9	DC-9	Sediment Pond
DA-10	DD-7	Sediment Pond
DA-11	DD-7	Sediment Pond
DA-12	DD-8	Sediment Pond
DA-13	DD-9	Sediment Pond
DA-14a	DD-10	Sediment Pond
DA-14b	DD-15	Sediment Pond
DA-15	DD-11a	Sediment Pond
DA-15b	DD-11b	Sediment Pond
DA-16a	DD-12b	Sediment Pond
DA-16b	DD-12a	Sediment Pond
DA-16c	DD-12c	Sediment Pond
DA-18	DD-17	Sediment Pond
DA-19	DD-18	Sediment Pond
DA-20	DD-21	Sediment Pond
DA-21a	DD-14a	Sediment Pond
DA-21b	DD-14a	Sediment Pond
DA-22	DD-22	Sediment Pond
Fan Portal	ASCA Area	Right Fork Lila Canyon
TS-1	Topsoil Berm	Sediment Pond
POND 1	Sediment Pond	Sediment Pond
POND 2	Sediment Pond	Sediment Pond

TABLE 3

Watershed Parameters					
Watershed	Area (Acre)	Hydraulic Length (ft.)	Elevation Change (ft.)	% Slope	CN
Undisturbed Watersheds					
UA-1	258.29	9475	2020	21.32	75
UA-2	1.63	1360	1000	74.26	83
UA-3	2.40	660	410	62.12	83
UA-4	14.08	1950	595	30.51	83
UA-5a	Removed				
UA-5b	Removed				
UA-6a	0.54	230	80	34.78	83
UA-6b	0.46	90	30	33.33	83
UA-7	0.90	100	30	30.00	75
UA-8	0.17	160	16	10.00	75
Disturbed Watersheds					
DA-1	1.25	650	79	12.15	90
DA-2	0.30	380	47	12.37	90
DA-3	0.25	240	10	4.17	90
DA-4	0.38	275	51	14.55	90
DA-5	2.87	580	103	17.93	90
DA-6a	0.12	155	26	16.77	90
DA-6b	0.74	220	28	25.91	90
DA-6c	0.81	410	61	14.88	90
DA-7	0.22	170	33	19.41	90
DA-8	0.41	400	50	12.50	90
DA-9	0.30	290	32	11.03	90
DA-10	0.13	250	35	14.00	90
DA-11	0.25	230	20	8.70	90
DA-12	4.38	875	85	9.71	90
DA-13a	Removed				
DA-13	1.49	490	40	9.18	90
DA-14a	0.59	630	43	6.83	90
DA-14b	0.51	490	43	8.57	90
DA-15a	1.15	497	77	15.49	90
DA-15b	3.50	885	72	8.14	90
DA-16	Removed				
DA-16a	0.20	251	19	15.54	90
DA-16b	0.26	275	48	14.18	90
DA-16c	0.54	221	38	13.57	90

TABLE 3 (Continued)

Watershed Parameters					
Watershed	Area (Acre)	Hydraulic Length (ft.)	Elevation Change (ft.)	% Slope	CN
DA-20	0.49	410	38	9.27	90
DA-21a	1.12	385	55	14.29	90
DA-21b	0.18	120	61	50.83	90
DA-21c	1.91	758	61	8.05	90
DA-23a	11.65	2155	1187	55.08	75
TS-01	1.87	310	53	17.10	75
POND 1	1.92	815	30	3.68	100
Disturbed Watersheds					
DA-17	1.12	240	11	4.58	90
DA-18	0.48	490	37	7.55	90
DA-19	0.55	764	63	8.25	90
DA-22	0.79	610	28	4.59	90
Fan Portal	0.60	195	25	12.82	90
POND 2	0.47				100

TABLE 4

Runoff Summary Undisturbed Watersheds (Not Draining to Ponds)					
Watershed	10 yr. / 6 hr. Peak Flow - cfs	25 yr. / 6 hr. Peak Flow - cfs	100 yr. / 6 hr. Peak Flow - cfs	10 yr. / 24 hr. Peak Flow - cfs	10 yr. / 24 hr. Volume - ac.ft.
UA-1	7.99	13.69	30.52	35.07	7.17
UA-7	0.05	0.12	0.29	0.36	0.03
UA-8	0.01	0.02	0.05	0.07	0.01

TABLE 5

Runoff Summary Watershed Drainage to Sediment Pond				
Watershed	10 yr. / 6 hr. Peak Flow-cfs	25 yr. / 6 hr. Peak Flow-cfs	10 yr. / 24 hr. Peak Flow-cfs	10 yr. / 24 hr. Volume-ac-ft
Undisturbed Watersheds draining to Pond #1				
UA-2	0.40	0.58	1.12	0.09
UA-3	0.62	0.89	1.70	0.13
UA-4	3.00	4.48	9.00	0.74
UA-5a	Removed			
UA-5b	Removed			
UA-6a	0.14	0.20	0.39	0.03
UA-6b	0.12	0.18	0.33	0.02
Disturbed Watersheds				
DA-1	0.64	0.82	1.29	0.11
DA-2	0.16	0.20	0.32	0.03
DA-3	0.13	0.17	0.26	0.02
DA-4	0.20	0.26	0.40	0.03
DA-5	1.48	1.90	3.00	0.24
DA-6a	0.06	0.08	0.13	0.01
DA-6b	0.39	0.50	0.78	0.06
DA-6c	0.42	0.54	0.85	0.07
DA-7	0.12	0.15	0.23	0.02
DA-8	0.21	0.27	0.43	0.03
DA-9	0.16	0.20	0.32	0.03
DA-10	0.07	0.09	0.14	0.01
DA-11	0.13	0.17	0.26	0.02
DA-12	2.16	2.79	4.46	0.37
DA-13a	Removed			
DA-13b	Removed			
DA-13	0.76	0.98	1.54	0.13
DA-14a	0.29	0.38	0.60	0.05
DA-14b	0.26	0.34	0.53	0.04
DA-15a	0.79	1.02	1.60	0.10
DA-15b	1.56	2.01	3.20	0.29
DA-16	Removed			
DA-16a	0.10	0.13	0.21	0.02
DA-16b	0.14	0.18	0.27	0.02
DA-16c	0.29	0.37	0.57	0.05
DA-20	0.25	0.32	0.51	0.04
DA-21a	0.58	0.75	1.17	0.09
DA-21b	0.10	0.12	0.19	0.02
DA-21c	0.94	1.22	1.95	0.16
DA-23a	0.36	1.24	1.68	0.32

Runoff Summary Watershed Drainage to Sediment Pond				
Watershed	10 yr. / 6 hr. Peak Flow-cfs	25 yr. / 6 hr. Peak Flow-cfs	10 yr. / 24 hr. Peak Flow-cfs	10 yr. / 24 hr. Volume-ac-ft
TS-1	0.96	1.24	1.95	0.05
POND 1				3.73

TABLE 5 (Continued)

Runoff Summary Watershed Drainage to Sediment Pond				
Watershed	10 yr. / 6 hr. Peak Flow-cfs	25 yr. / 6 hr. Peak Flow-cfs	10 yr. / 24 hr. Peak Flow-cfs	10 yr. / 24 hr. Volume-ac-ft
Disturbed Watersheds				
Fan Portal	0.21	0.27	0.40	0.03
DA-17	0.58	0.74	1.17	0.09
DA-18	0.25	0.32	0.50	0.04
DA-19	0.27	0.35	0.56	0.05
DA-22	0.39	0.50	0.80	0.07
POND 2				0.32

TABLE 6

Runoff Control Structure Watershed Summary		
Structure	Type	Contributing Watersheds/Structures
UC-1	Culvert	UA-1, Fan Portal, Sediment Pond Overflow (Partially abandoned in Fall of 2016 due to plugging from massive storm event)
UC-1a	Culvert	UA-1, Fan Portal, Sediment Pond Overflow (Replaces abandoned portions of UC-1)
DD-1	Ditch	DA-1, UA-2, UA-3
DC-1	Culvert	DD-1
DD-2	Ditch	DC-1, DA-2, UA-6a, UA-6b
DC-2	Culvert	DD-2
DD-3	Ditch	DA-3
DC-3	Culvert	DD-3
DD-4	Ditch	DA-4, DC-2
DC-4	Culvert	DD-4, DC-3
DD-5a	Ditch	DA-5
DD-5b	Ditch	DD-5a
DD-6a	Ditch	DA-6a
DD-6b	Ditch	DD-6a, DA-6b
DC-5	Culvert	DD-5b, DD-6b
DC-6	Culvert	DC-4, DC-5, DA-6c
DC-7	Culvert	DC-6, DA-7
DC-8	Culvert	DC-7, DA-8
DC-9	Culvert	DC-8, DA-9
DD-7	Ditch	DC-9, DA-10, DA-11
DC-10	Culvert	DD-7
DD-8	Ditch	DC-10, DA-12
DD-21	Ditch	DA-20

TABLE 6

Runoff Control Structure Watershed Summary		
Structure	Type	Contributing Watersheds/Structures
DC-11	Culvert	DD-8, DD-21
DD-9	Ditch	DC-11, DA-13

TABLE 6

Runoff Control Structure Watershed Summary		
Structure	Type	Contributing Watersheds/Structures
DC-12a	Culvert	DD-9
DC-12b	Culvert	DC-12a
DC-12c	Culvert	DC-12b
DC-12d	Culvert	DC-12c
DD-10	Ditch	DA-14a
DD-15	Ditch	DA-14b
DD-11a	Ditch	DA-15a, DA-23a, Mine Water
DD-11b	Ditch	DA-15b
DC-13	Culvert	DD-12
DD-12a	Ditch	DC-13, DD-11b, DA-16b
DD-12b	Ditch	DA-16a
DD-12c	Ditch	DD-12a, DD-12b, DA-16c
DD-13	Ditch	DA-21c
DC-14	Culvert	DD-12c
DD-14a	Ditch	DC-14, DA-21a, DA-21b
DD-14b	Ditch	DD-13, DD-14a
DD-16	Ditch	DC-12d, DD-10, DD-15
DD-17	Ditch	DA-18
DD-18	Ditch	DA-19
DD-22	Ditch	DA-22
DC-15	Culvert	DD-18
DC-16	Culvert	DC-15, DD-17
DC-17	Culvert	DA-17
DC-18	Culvert	DD-22

TABLE 7

Runoff Control Structure Flow Summary				
Structure	Type	10yr. / 6hr. Peak Flow-cfs	10yr. / 24hr. Peak Flow-cfs	100yr. / 6hr. Peak Flow-cfs
UC-1*	Culvert	33.07	60.15	55.60
UC-1a*	Culvert	33.07	60.15	55.60
DD-1	Ditch	1.66	4.11	- -
DC-1	Culvert	1.66	4.11	- -
DD-2	Ditch	2.08	5.15	- -
DC-2	Culvert	2.08	5.15	- -
DD-3	Ditch	0.13	0.26	- -
DC-3	Culvert	0.13	0.26	- -
DD-4	Ditch	2.28	5.55	- -
DC-4	Culvert	2.41	5.81	- -
DD-5a	Ditch	1.48	3.00	- -
DD-5b	Ditch	1.48	3.00	- -
DD-6a	Ditch	0.06	0.13	- -
DD-6b	Ditch	0.45	0.91	- -
DC-5	Culvert	1.93	3.91	- -
DC-6	Culvert	4.76	10.57	- -
DC-7	Culvert	4.88	10.80	- -
DC-8	Culvert	5.09	11.23	- -
DC-9	Culvert	5.25	11.55	- -
DD-7	Ditch	5.45	11.95	- -
DC-10	Culvert	5.45	11.95	- -
DD-8	Ditch	7.61	16.41	- -
DD-21	Ditch	0.25	0.51	- -
DC-11	Culvert	7.86	16.92	- -
DD-9	Ditch	8.62	18.46	- -

TABLE 7

Runoff Control Structure Flow Summary				
Structure	Type	10yr. / 6hr. Peak Flow-cfs	10yr. / 24hr. Peak Flow-cfs	100yr. / 6hr. Peak Flow-cfs
DC-12a	Culvert	8.62	18.46	- -
DC-12b	Culvert	8.62	18.46	- -
DC-12c	Culvert	8.62	18.46	- -
DC-12d	Culvert	8.62	18.46	- -
DD-10	Ditch	0.29	0.60	- -
DD-11a	Ditch	2.75	1.60	- -
DC-13	Culvert	2.75	1.60	- -
DD-11b	Ditch	1.56	3.20	- -
DD-12a	Ditch	4.45	10.36	- -
DD-12b	Ditch	0.10	0.21	- -
DD-12c	Ditch	4.84	11.14	- -
DC-14	Culvert	4.84	11.14	- -
DD-14a	Ditch	5.52	12.50	- -
DD-13	Ditch	0.94	1.95	- -
DD-14b	Ditch	6.46	14.45	- -
DD-15	Ditch	0.26	0.53	- -
DD-16	Ditch	9.17	19.59	- -
DD-17	Ditch	0.25	0.50	- -
DD-18	Ditch	0.27	0.56	- -
DA-22	Ditch	0.39	0.80	- -
DC-15	Culvert	0.27	0.56	- -
DC-16	Culvert	0.52	1.06	- -
DC-17	Culvert	0.58	1.17	- -
DC-18	Culvert	0.39	0.80	- -

* UC-1 and UC-1a flow values includes sum of 25yr-6hr peak flows for UA-1 13.69 cfs from Table 4 and 25yr-6hr Sediment Pond 1 peak flow of 26.33 cfs & Fan Portal flow from Table 5- 0.27cfs.

TABLE 8						
Disturbed Ditch Design Summary						
Ditch	DD-1	DD-2	DD-3	DD-4	DD-5a	DD-5b
Slope (%)	13.01	11.98	1.11	11.76	3.33	55.45
Length (ft.)	607	334	180	170	390	110
Manning's No.	0.035	0.035	0.03	0.035	0.03	0.04
Side Slope (H:V)	3:1	3:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	2.00	2.00	0.00	2.00	2.00	2.00
Peak Flow 10/6 (cfs)	1.66	2.08	0.13	2.28	1.48	1.48
Peak Flow 10/24 (cfs)	4.11	5.15	0.26	5.55	3.00	3.00
Flow Depth (ft.) 10/6	0.17	0.19	0.24	0.21	0.21	0.11
Flow Depth (ft.) 10/24	0.27	0.31	0.31	0.35	0.32	0.17
Flow Area ($ft.^2$) 10/6	0.41	0.49	0.11	0.51	0.52	0.25
Flow Area ($ft.^2$) 10/24	0.77	0.93	0.19	0.93	0.84	0.40
Velocity (fps) 10/6	4.03	4.22	1.17	4.52	2.86	5.93
Velocity (fps) 10/24	5.35	5.55	1.39	5.96	3.55	7.58
Rip-Rap Req'd (Y/N)	N	N	N	N	N	Y
Rip-Rap D_{50}	-	-	-	-	-	3"
Note: Slope/Lengths from Plate 7-2.						

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-6a	DD-6b	DD-7	DD-8	DD-9	DD-10	DD-11a
Slope (%)	11.76	5.38	8.11	2.22	2.31	7.46	7.31
Length (ft.)	170	130	148	142	190	630	260
Manning's No.	0.030	0.030	0.035	0.030	0.035	0.030	0.035
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	0.00	0.00	2.00	2.00	2.00	0.00	0.00
Peak Flow 10/6 (cfs)	0.06	0.45	5.45	7.61	8.62	0.29	2.70
Peak Flow 10/24 (cfs)	0.13	0.91	11.95	16.41	18.46	0.60	4.83
Flow Depth (ft.) 10/6	0.11	0.28	0.38	0.59	0.68	0.22	0.55
Flow Depth (ft.) 10/24	0.15	0.36	0.58	0.88	0.99	0.29	0.68
Flow Area ($ft.^2$) 10/6	0.03	0.16	1.05	1.88	2.27	0.10	0.60
Flow Area ($ft.^2$) 10/24	0.05	0.27	1.83	3.29	3.96	0.17	0.93
Velocity (fps) 10/6	2.33	2.87	5.21	4.04	3.80	2.91	4.50
Velocity (fps) 10/24	2.83	3.43	6.55	4.99	4.67	3.49	5.20
Rip-Rap Req'd (Y/N)	N	N	Y	N	N	N	N
Rip-Rap D_{50}	-	-	3"	-	-	-	-
Note: Slope/Lengths from Plate 7-2.							

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-11b	DD-12a	DD-12b	DD-12c	DD-13	DD-14a	DD-14b
Slope (%)	0.93	15.32	14.29	11.05	9.05	3.24	7.88
Length (ft.)	540	235	70	190	475	340	140
Manning's No.	0.030	0.035	0.030	0.035	0.030	0.035	0.035
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	2.00	2.0	0.0	2.0	2.0	2.0	2.0
Peak Flow 10/6 (cfs)	1.56	4.40	0.10	4.79	0.94	5.47	6.41
Peak Flow 10/24 (cfs)	3.20	8.30	0.21	9.08	1.95	10.44	12.39
Flow Depth (ft.) 10/6	0.32	0.28	0.13	0.32	0.12	0.49	0.42
Flow Depth (ft.) 10/24	0.47	0.40	0.18	0.46	0.19	0.68	0.59
Flow Area ($ft.^2$) 10/6	0.83	0.72	0.04	0.86	0.28	1.45	1.18
Flow Area ($ft.^2$) 10/24	1.38	1.12	0.06	1.34	0.45	2.31	1.89
Velocity (fps) 10/6	1.87	6.09	2.85	5.58	3.39	3.77	5.42
Velocity (fps) 10/24	2.31	7.39	3.43	6.75	4.36	4.52	6.54
Rip-Rap Req'd (Y/N)	N	Y	N	Y	N	N	Y
Rip-Rap D_{50}	-	3"	-	3"	-	-	3"
Note: Slope/Lengths from Plate 7-2.							

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-15	DD-16	DD-17	DD-18	DD-21	DD-22	
Slope (%)	6.94	1.52	8.43	7.75	8.61	5.00	
Length (ft.)	490	260	415	710	360	480	
Manning's No.	0.030	0.030	0.030	0.030	0.030	0.030	
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	
*Bottom Width (ft.)	0.0	4.0	0.0	0.0	0.0	0.0	
Peak Flow 10/6 (cfs)	0.26	9.17	0.25	0.27	0.25	0.39	
Peak Flow 10/24 (cfs)	0.53	19.59	0.50	0.56	0.51	0.80	
Flow Depth (ft.) 10/6	0.22	0.53	0.21	0.22	0.21	0.27	
Flow Depth (ft.) 10/24	0.28	0.81	0.27	0.28	0.27	0.35	
Flow Area ($ft.^2$) 10/6	0.09	2.68	0.09	0.09	0.08	0.14	
Flow Area ($ft.^2$) 10/24	0.16	4.53	0.14	0.16	0.14	0.25	
Velocity (fps) 10/6	2.76	3.42	2.94	2.90	2.96	2.70	
Velocity (fps) 10/24	3.29	4.32	3.49	3.48	3.54	3.23	
Rip-Rap Req'd (Y/N)	N	N	N	N	N	N	
Rip-Rap D_{50}	-	-	-	-	-	-	
Note: Slope/Lengths from Plate 7-2.							

TABLE 9

Disturbed Culvert Design Summary						
Culvert	DC-1	DC-2	DC-3	DC-4	DC-5	DC-6
Slope (%)	11.67	10.00	53.85	9.81	4.71	28.04
Length (ft.)	60	60	65	400	350	107
Manning's No.	0.024	0.024	0.024	0.024	0.024	0.024
Peak Flow 10/6 (cfs)	1.66	2.08	0.13	2.41	1.93	4.76
Peak Flow 10/24 (cfs)	2.85	3.37	0.21	5.81	3.91	10.57
Diam. Proposed (ft.)	1.5	1.5	1.5	2.0	2.0	2.0
Velocity (fps) 10/6	6.72	6.79	5.32	6.20	4.93	12.06
Rip-Rap D_{50}	3"	3"	3"	3"	-*	-*
Note: Slope/Lengths from Plate 7-5. Velocity: (Hydraulic Toolbox Program)						

* Discharge is into manhole - no riprap needed

TABLE 9 (Continued)

Disturbed Culvert Design Summary						
Culvert	DC-7	DC-8	DC-9	DC-10	DC-11	DC-12a
Slope (%)	7.74	5.99	5.91	2.27	4.95	0.48
Length (ft.)	155	167	186	60	101	140
Manning's No.	0.024	0.024	0.024	0.024	0.024	0.015
Peak Flow 10/6 (cfs)	4.88	5.09	5.25	5.45	7.86	8.62
Peak Flow 10/24 (cfs)	10.80	11.23	11.55	11.95	16.25	18.46
Diam. Proposed (ft.)	2.0	2.0	2.0	2.0	2.0	2.0
Velocity (fps) 10/6	7.70	7.11	7.14	5.11	7.5	4.64
Rip-Rap D_{50}	-*	-*	3"	3"	3"	-*
Note: Slope/Lengths from Plate 7-5. Velocity: (Hydraulic Toolbox Program)						

* Discharge is into manhole - no riprap needed

TABLE 9 (Continued)

Disturbed Culvert Design Summary						
Culvert	DC-12b**	DC-12c**	DC-12d	DC-13	DC-14	DC-15
Slope (%)	1.55	2.46	-0.12	3.33	5.00	2.22
Length (ft.)	79	357	9	60	40	45
Manning's No.	0.015	0.015	0.015	0.024	0.024	0.024
Peak Flow 10/6 (cfs)	8.62	8.62	8.62	2.75	4.84	0.27
Peak Flow 10/24 (cfs)	18.46	18.46	18.46	6.89	11.14	0.56
Diam. Proposed (ft.)	2.0	2.0	2.0	2.0	2.0	1.50
Velocity (fps) 10/6	7.10	8.40	4.03	4.94	6.71	2.72
Rip-Rap D_{50}	-	-	-	-	3"	-
Note: Slope/Lengths from Plate 7-5. Velocity: (Hydraulic Toolbox Program)						

** Discharge is into a manhole - no riprap required

TABLE 9 (Continued)

Disturbed Culvert Design Summary						
Culvert	DC-16	DC-17	DC-18	SP2-1*		
Slope (%)	11.20	5.00	3.73	0.50		
Length (ft.)	25	120	27	165		
Manning's No.	0.024	0.024	0.024	0.024		
Peak Flow 10/6 (cfs)	0.52	0.58	0.39	-		
Peak Flow 10/24 (cfs)	1.06	1.17	0.80	2.72*		
Diam. Proposed (ft.)	1.50	1.50	1.50	1.50		
Velocity (fps) 10/6	5.80	2.93	2.93	2.45		
Rip-Rap D_{50}	3"	-	-	-		
Note: Slope/Lengths from Plate 7-5. Velocity: (Hydraulic Toolbox Program)						

* SP2-1 Peak Flow is a 25/6 event

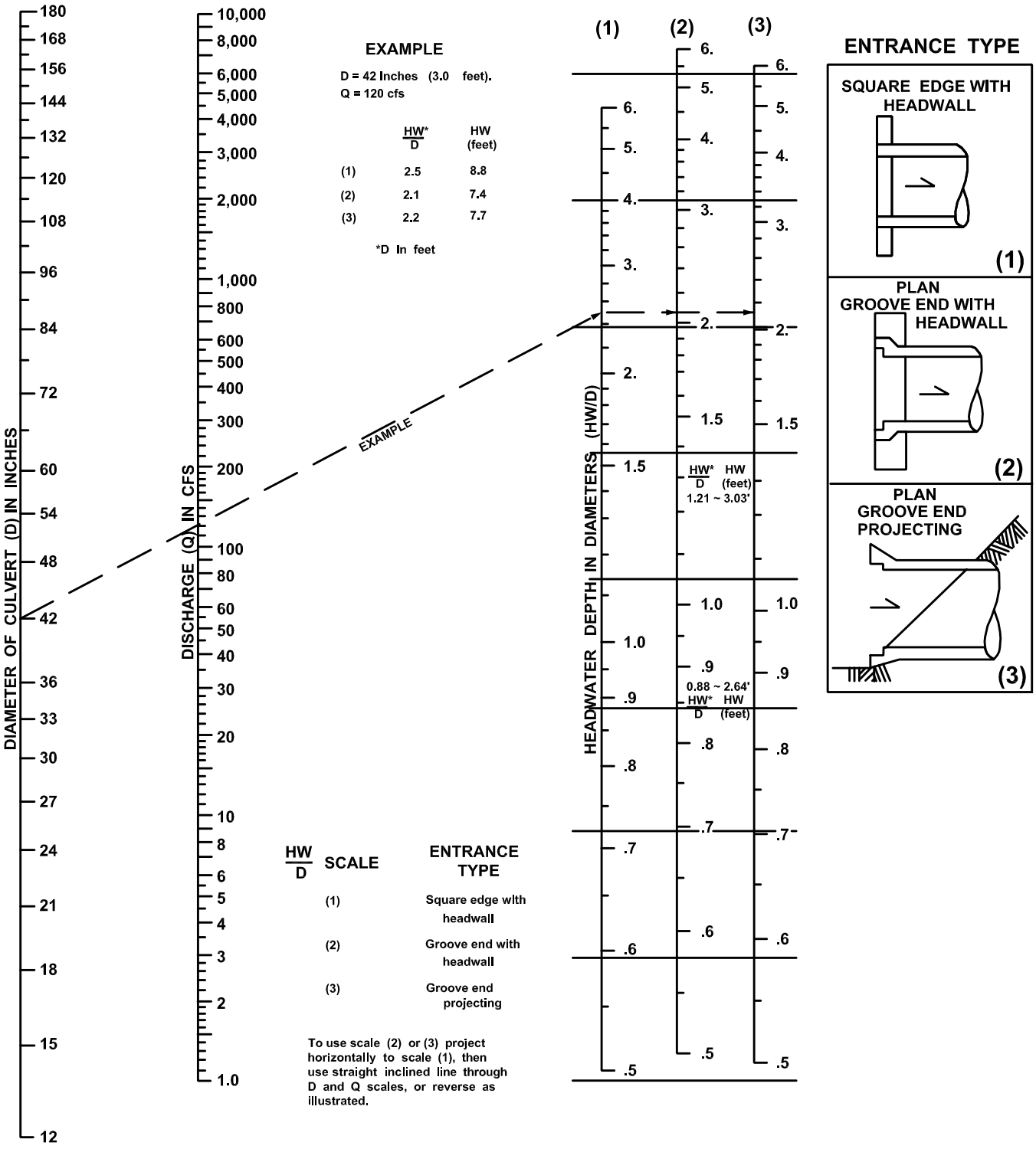
TABLE 10

Undisturbed Culvert Design Summary		
Culvert	UC-1	UC-1a
Min. Slope (%)**	0.50	0.50
Length (ft.)	120	360
Manning's No.	0.025	0.025
Peak Flow 10/6 (cfs)*	33.07	33.07
Peak Flow 100/6 (cfs)*	55.60	55.60
Diam. Proposed (ft.)	5.00	5.00
Velocity (fps) 100/6	5.22	5.22

* Note: Peak flow values include 25 year-6 hour flow from Sediment Pond 1 (see Tables 4 and 7).
** Pipe slope from Plate 7-6a.
***Note: A large portion of culvert UC-1 was abandoned and replaced with UC-1a in the fall of 2016. See Part (a) of Section (b) on Page 1 regarding changes to UC-1.

References:

Hawkins, R.H. and K.A. Marshall. 1979. Storm Hydrograph Program. Final Report to the Utah Division of Oil, Gas and Mining. Utah State University. Logan, Utah.

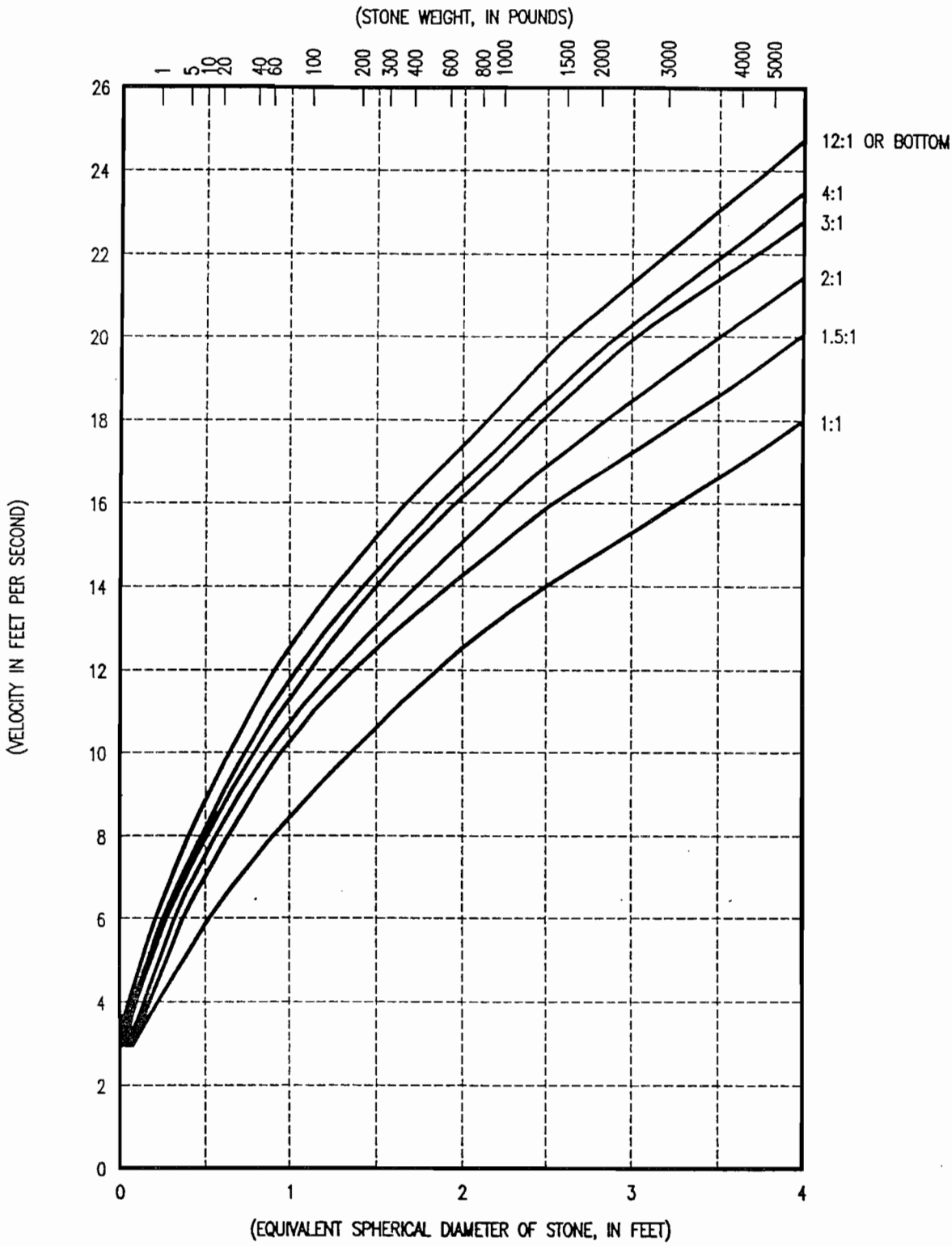


Headwater Depth for Smooth Interior Pipe Culverts with Inlet Control

0' NTS

FIGURE 1. HEADWATER DEPTH NOMOGRAPH

RIP-RAP CHART

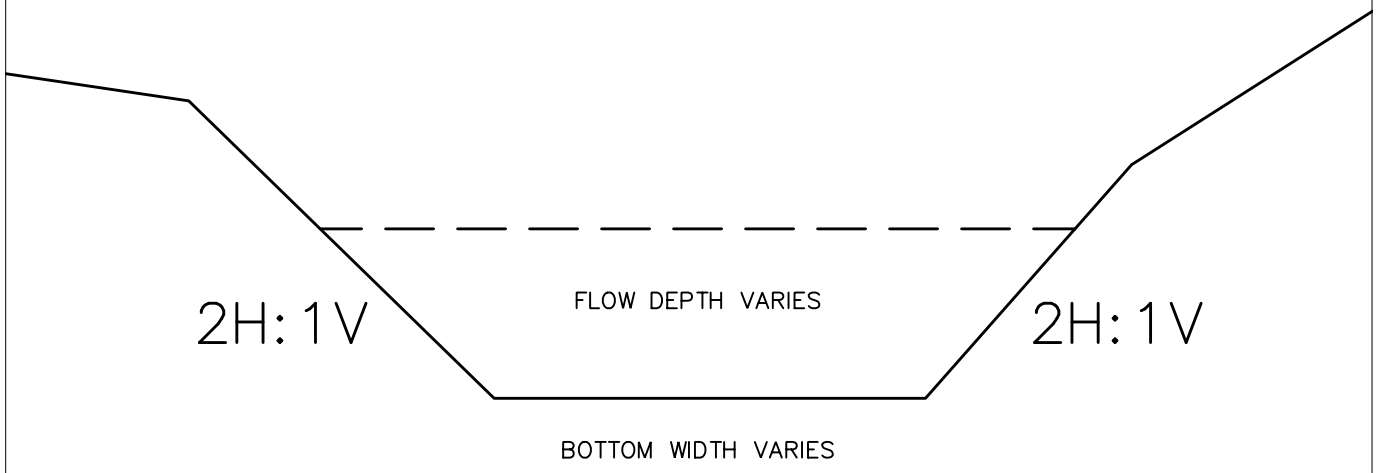


SIZE OF STONE THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND SIDE SLOPES

NOTE:

ADAPTED FROM REPORT OF SUBCOMMITTE ON SLOPE PROTECTION, AM. SOC. CIVIL ENGINEERS PROC. JUNE 1948.
FOR STONE WEIGHING 165 LBS. PER CUBIC FEET.

Figure 2



APPENDIX 7–4, TABLE 8 PRESENTS THE SPECIFIC DETAILS OF DITCH SIZING

0' NTS

FIGURE 3. DISTURBED DITCH TYPICAL SECTION

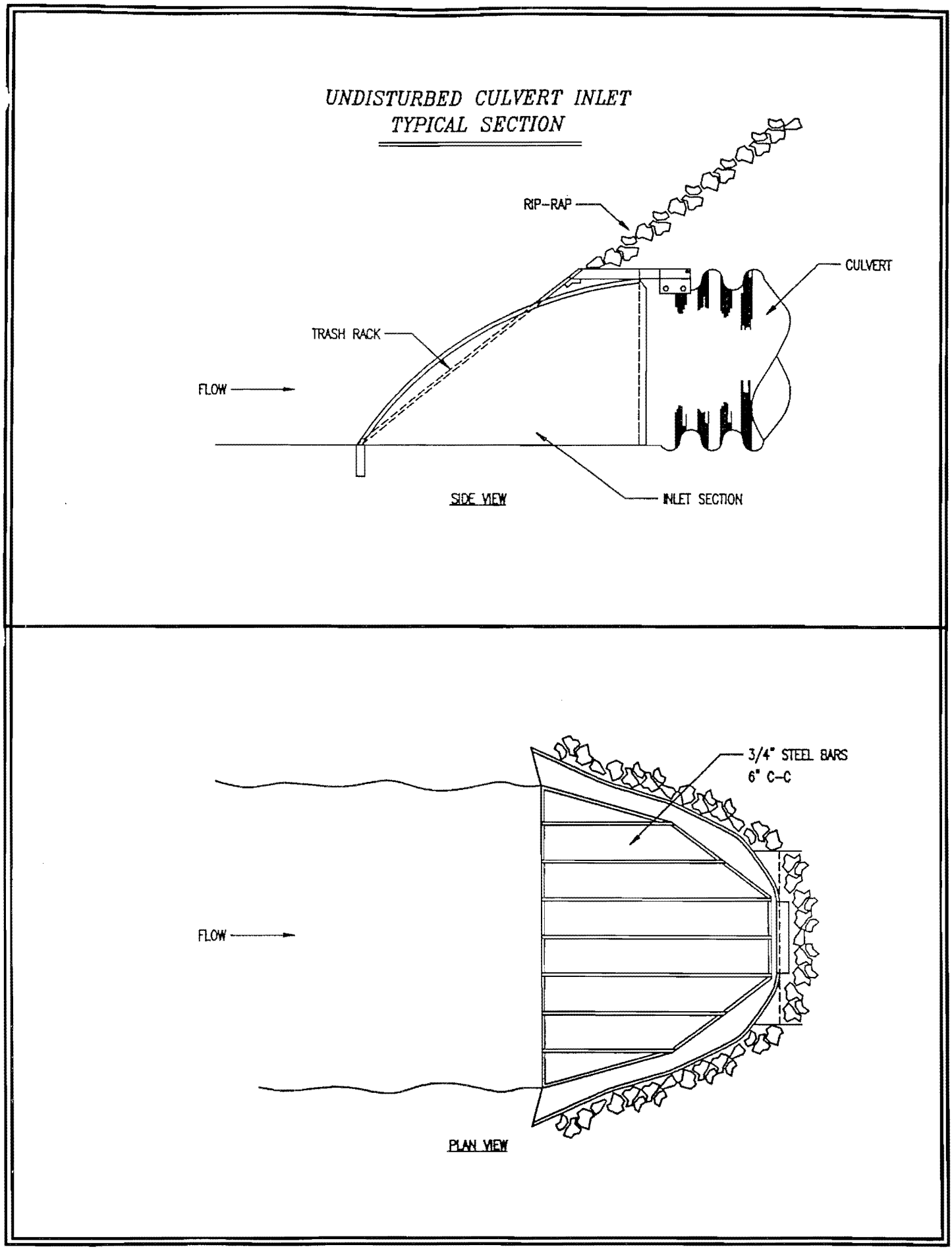
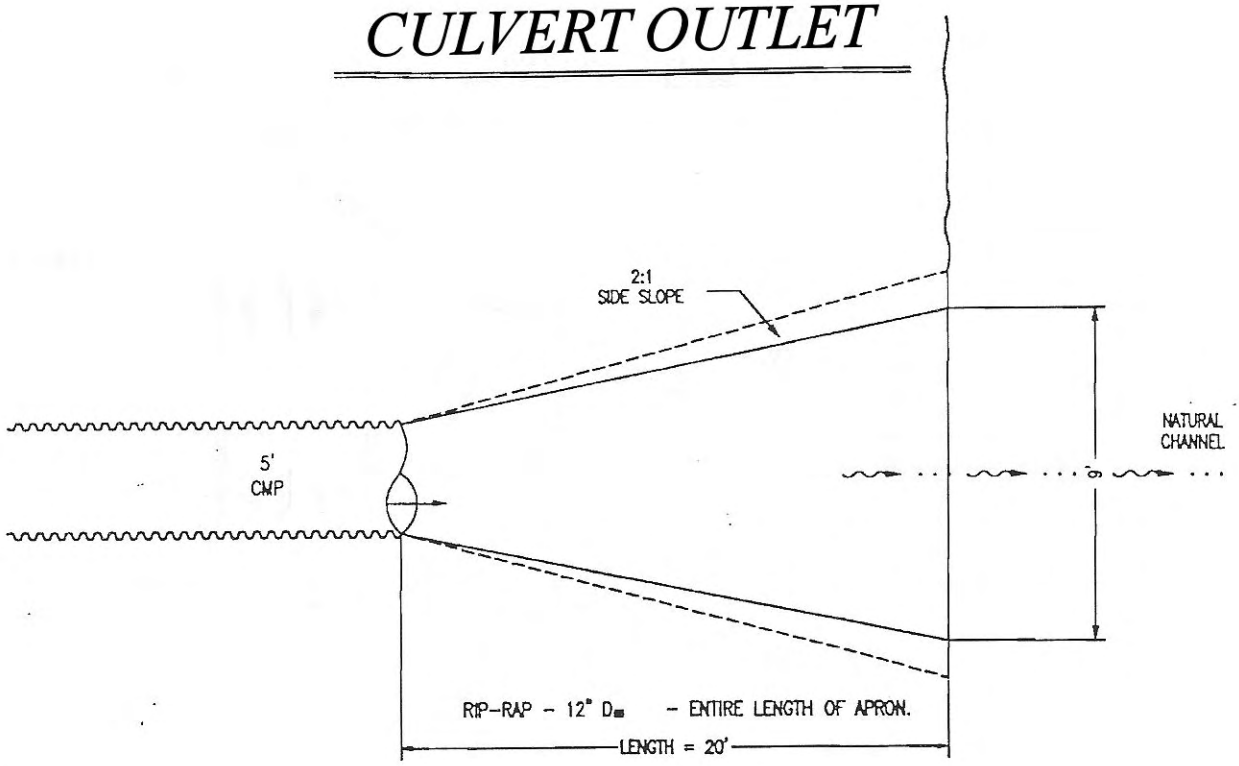
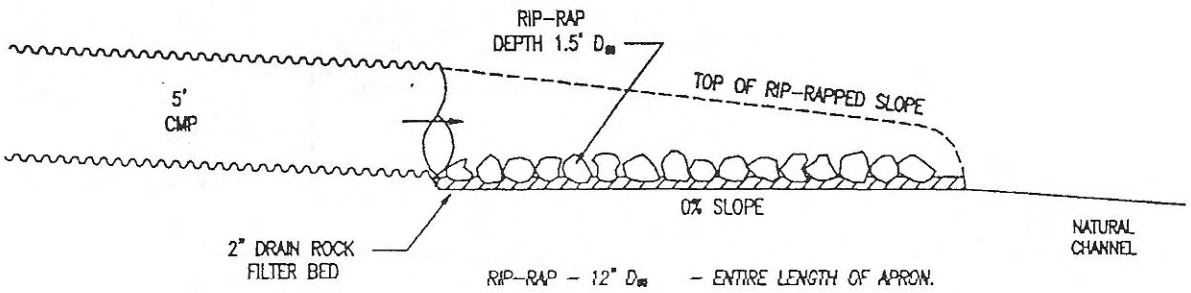

UNDISTURBED CULVERT INLET
TYPICAL SECTION
RIP-RAP
CULVERT
TRASH RACK
FLOW
SIDE VIEW
INLET SECTION
3/4" STEEL BARS
6" C-C
FLOW
PLAN VIEW

Figure 4

UC-1
CULVERT OUTLET





* DESIGN BASED ON FIGURE 7-26, DESIGN OF OUTLET PROTECTION - MAXIMUM TAILWATER CONDITION, "APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS", BARFIELD, WARNER & HAAN, 1983.

Figure 4A

DESIGN OF SEDIMENT CONTROL STRUCTURES

Design Specifications:

3.1 Design and Construction Specifications for Sedimentation Pond
3.2 Sediment Yield
3.3 Sediment Pond Volume
3.4 Sediment Pond Summary

Tables:

Table 11 Sediment Pond Design
Table 12a Sediment Pond #1 - Stage Volume Data
Table 12b Sediment Pond #2 - Stage Volume Data
Table 13a Sediment Pond #1 - Stage Discharge Data
Table 13b Sediment Pond #2 - Stage Discharge Data

Figures:

Figure 5.4 Depth of 2-year, 6-hour rainfall - Barfield et al.
Figure 5.15 Slope-effect Chart - Barfield et al.

3.1 Design and Construction Specifications for Sedimentation Pond

- All construction of sedimentation ponds will be performed under the direction of a qualified, registered professional engineer.

- The Sediment Pond #1 will be located in an existing low area where the Right Fork of Lila Canyon passes beneath the existing road. The existing road fill and culvert will be removed, and the pond embankment (road fill) will be reconstructed and compacted. The existing culvert will be replaced with UC-1/UC-1a which will extend approximately 400' up the Right Fork of Lila Canyon. This culvert will be equipped with an inlet section and trash rack, and will allow undisturbed runoff and treated access road drainage to pass beneath the sediment pond. The majority of the pond will be in an existing channel area, and is therefore considered incised. The pond will be equipped with a culvert riser principal spillway with an oil skimmer, a decant, and a second culvert riser emergency spillway with an oil skimmer. Both spillways will discharge to the oversized (60") CMP culvert running beneath the pond.

- The area of pond constructed shall be examined for topsoil, and where present in removable quantities, such soil shall be removed separately and stored in an approved topsoil storage location.

- In areas where fill is to be placed for the pond impoundment structures, natural ground shall be removed to at least 12" below the base of the structure.

- Native materials shall be used where practical. Fill will be placed in lifts not to exceed 6" and compacted prior to placement of next lift. Compaction of all fill materials shall be at least 95%.

- Rip-rap or other protection (culverts, concrete, etc.) will be placed at all pond inlets to prevent scouring. Rip-rap will consist of substantial, angular (non-slaking) rock material of adequate size.

- Decanting of the pond, as required, will be accomplished by use of a decant pipe with an inverted inlet as shown on Plate 7-6a. Samples will be collected prior to decanting of the pond. If the quality of the water meets the requirements of the U.P.D.E.S. Permit, decanting will proceed. Discharge samples will be collected as per the approved U.P.D.E.S. Discharge Permit.

- Slopes of the embankments shall not be steeper than 2h:1v, inside or outside, with a total of the inslope and outslope not less than 5h:1v, except where areas of the pond are incised.

- External slopes of the impoundment will be planted with an approved seed mix to help prevent erosion and promote stability.

- Top width of the embankment shall be not less than (H+35)/5, where H = Height of Dam in feet from the upstream toe.

3.2 Sediment Yield

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

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

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

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

Variable "R" is the rainfall factor which can be estimated from $R = 27P^{2.2}$; where P is the 2-year, 6-hour precipitation value. P for the Lila Canyon area is 0.75" as shown in Figure 5.4, page 315, Barfield, et.al. 1983. Therefore, the estimated value of "R" for this area is 14.34.

Variable "K" is the soil erodibility factor. For disturbed areas, the "K" value is conservatively estimated to be 0.5. For disturbed runoff, but uncompacted and ungraded areas, "K" is estimated at 0.320. "K" is estimated to be 0.035 for undisturbed areas.

Variable "LS" is the length-slope factor. This figure was determined by applying the slope length and percentage for each sub-drainage area to the chart in Figure 5.15, p. 334, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

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

Site	CP Factor
Compacted Areas	1.20
Disturbed/Uncompacted Areas	0.20
Undisturbed Areas	0.15

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

SEDIMENT YIELD CALCULATIONS - USLE - Drainages to Sediment Ponds

Drainage	R	K	Area (ac)	Slope Length (Ft)	Slope (%)	LS	CP	A (T/ac)	Yield (ac-ft)
Draining to Sediment Pond 1									
DA-1	14.34	0.500	1.25	650	12.15	4.67	1.20	40.14	0.0230
DA-2	14.34	0.500	0.30	380	12.37	3.67	1.20	31.55	0.0043
DA-3	14.34	0.500	0.25	240	4.17	0.59	1.20	5.10	0.0006
DA-4	14.34	0.500	0.38	275	18.55	5.95	1.20	51.20	0.0089
DA-5	14.34	0.500	2.87	580	17.76	8.05	1.20	69.26	0.0913
DA-6a	14.34	0.500	0.12	155	16.77	3.79	1.20	32.63	0.0018
DA-6b	14.34	0.500	0.74	220	12.73	2.92	1.20	25.10	0.0085
DA-6c	14.34	0.500	0.81	410	14.88	5.09	1.20	43.81	0.0163
DA-7	14.34	0.500	0.22	170	19.41	5.04	1.20	43.35	0.0044
DA-8	14.34	0.500	0.41	400	12.50	3.82	1.20	32.90	0.0062
DA-9	14.34	0.500	0.30	290	11.03	2.69	1.20	23.14	0.0032
DA-10	14.34	0.500	0.13	250	14.00	3.61	1.20	31.06	0.0019
DA-11	14.34	0.500	0.25	230	8.70	1.68	1.20	14.50	0.0017
DA-12	14.34	0.500	4.38	875	9.71	3.86	1.20	33.22	0.0668
DA-13a	Remo								
DA-13b	Remo								
DA-13	14.34	0.500	1.49	490	8.16	2.25	1.20	19.33	0.0132
DA-14a	14.34	0.500	0.59	630	6.83	1.99	1.20	17.13	0.0046
DA-14b	14.34	0.500	0.51	490	8.78	2.49	1.20	21.46	0.0050
DA-15a	14.34	0.500	1.55	497	15.49	5.98	1.20	51.43	0.0272
DA-15b	14.34	0.500	3.50	885	8.02	2.95	1.20	25.35	0.0407
DA-16	Remo								
DA-16a	14.34	0.500	0.20	251	15.54	4.27	1.20	36.74	0.0034
DA-16b	14.34	0.500	0.26	275	14.18	3.86	1.20	33.24	0.0040
DA-16c	14.34	0.500	0.54	221	13.57	3.23	1.20	27.80	0.0069
DA-20	14.34	0.500	0.49	410	8.54	2.19	1.20	18.86	0.0042
DA-21a	14.34	0.500	1.12	385	14.03	4.49	1.20	38.67	0.0199
DA-21b	14.34	0.500	0.18	120	8.33	1.14	1.20	9.85	0.0008
DA-21c	14.34	0.500	1.91	758	5.54	1.66	1.20	14.33	0.0126
UA-2	14.34	0.500	1.63	1360	73.53	110.75	0.15	119.11	0.0891
UA-3	14.34	0.500	2.40	540	75.93	72.56	0.15	78.04	0.0860
UA-4	14.34	0.500	14.08	1540	38.64	46.77	0.15	50.30	0.3252
UA-5a	Remo								
UA-5b	Remo								
UA-6a	14.34	0.500	0.54	370	21.62	8.87	0.15	9.54	0.0024
UA-6b	14.34	0.500	0.46	130	23.08	5.86	0.15	6.3	0.0013
TS-01*	14.34	0.500	1.87	660	17.10	8.08	0.20	11.58	0.0099
POND 1	14.34	0.500	1.92	340	3.68	0.59	1.20	5.11	0.0045
TOTAL									0.8998

Draining to Sediment Pond 2									
DA-17	14.34	0.500	1.12	240	4.58	0.66	1.20	5.68	0.0029
DA-18	14.34	0.500	0.48	490	7.55	2.02	1.20	17.34	0.0038
DA-19	14.34	0.500	0.55	764	8.25	2.85	1.20	24.51	0.0062
DA-22	14.34	0.500	0.79	610	4.59	0.96	1.20	8.26	0.0030
POND 2	14.34	0.500	0.47	45	12.82	1.33	1.20	11.48	0.0025
TOTAL									0.0184

* Disturbed Runoff / Uncompacted Area
** Paved Areas

3.3 Sediment Pond Volume

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

TABLE 11a

Sediment Pond #1 Design	
1. Use 1.90" for 10 year - 24 hour event.	
2. Runoff Volume - (3.34 ac-ft, from Table 5, 10yr/24hr Vol) =	3.38 ac-ft
3. Sediment Storage Volume USLE 0.8998 ac-ft./yr. x 3.0 yrs. =	2.70 ac-ft
4. Total Required Pond Volume 3.38 + 2.70 =	6.08 ac-ft
5. Peak Flow (25 yr. - 6 hr. event) =	24.81 cfs
6. Pond Design Volume @ Principle Spillway = (See Table 12a)	13.04 ac-ft
7. Mine water storage [1]	6.96 ac-ft

[1] difference in storage between the top of the require storm water storage and the spillway elevation

TABLE 12a

Sediment Pond #1 Stage/Volume Data				
Elevation	Area (sq. ft.)	Volume (cu. ft.)	Acc. Volume (ac. ft.)	Remarks
5839	26870	0	0.00	Bottom of Pond
5830	28640	27755	0.64	
5831	30480	29560	1.32	Sediment Storage - 2.70 ac-ft
5842	32320	31400	2.04	
5843	34210	33265	2.80	Sediment Cleanout Level 5843.6
5844	36140	35175	3.61	Decant 5844.6 - 4.21 ac-ft
5845	38110	37125	4.46	Runoff Storage - 3.38 ac-ft
5846	40120	39115	5.36	
5847	42160	41140	6.30	Runoff + Sed Storage - 6.08 ac-ft
5848	44260	43210	7.29	
5849	46390	45325	8.33	
5850	48550	47470	9.42	Mine Water Storage - 6.96 ac-ft
5851	50970	49760	10.57	
5852	53490	52230	11.77	
5853	55010	54250	13.01	Principal Spillway - 5853
5854	56590	55800	14.29	Emergency Spillway - 5854
5855	58380	57485	15.61	Top of Embankment

TABLE 11b

Sediment Pond #2 Design	
1. Use 1.90" for 10 year - 24 hour event.	
2. Runoff Volume - (from Table 5, 10yr/24hr) =	0.32 ac-ft.
3. Sediment Storage Volume USLE 0.0184 ac-ft./yr. x 3 yrs. =	0.06 ac-ft
4. Total Required Pond Volume 0.32 + 0.06 =	0.38 ac-ft
5. Peak Flow (25 yr. - 6 hr. event)* =	1.41 cfs
6. Pond Design Volume @ Principle Spillway = (See Table 12b)	1.36 ac-ft
* Peak Flow values from Table 5, sum of all contributing watersheds.	

TABLE 12b

Sediment Pond #2 Stage/Volume Data				
Elevation	Area (sq. ft.)	Volume (cu. ft.)	Acc. Volume (ac. ft.)	Remarks
5845	0	0	0	Bottom of Pond 5845.0
5846	312	156	0.00	
5847	6935	3623.5	0.08	Sediment Cleanout Level 5847.0
5848	8045	7490	0.26	Decant 5847.9
5849	8650	8348	0.45	
5850	9270	8960	0.65	Principal Spillway 5849.61
5851	9910	9590	0.87	
5852	10560	10235	1.11	Emergency Spillway 5851.25
5853	11230	10895	1.36	
5854	11920	11575	1.62	
5855	12890	12406	1.91	
5855.5	14120	6753	2.06	Top of Embankment

TABLE 13a

Sediment Pond #1 Stage/Discharge Data			
Head above Spillway(ft.)	Q (cfs) Weir Controlled	Q (cfs) Orfice Controlled	Q (cfs) Pipe Flow Controlled
0.0	-	-	-
0.2	2.53	15.22	95.68
0.4	7.15	21.53	96.23
0.6	13.14	26.36	96.77
0.8	20.23	30.44	97.31
1.0	28.27	34.04	97.85
1.2	37.17	37.28	98.38
1.4	46.84	40.27	98.91
1.6	57.22	43.05	98.91
1.8	68.28	45.66	99.44
2.0	79.97	48.13	99.97

Note: 1- 25 year - 6 hour flow = 24.81 cfs.
2- Flow will be weir controlled at a head of 0.91' over riser inlet.

Weir Controlled

$Q = CLH^{1.5}$; where: C= 3.0, L= Circumference of Riser = 9.4248', R=1.5'

Orfice Controlled

$Q = C'a\ (2gH)^{0.5}$; where: C= 0.6, a= Area of Riser = 7.0686 ft^2, R=1.5', g= 32.2 ft/sec^2

Pipe Flow Controlled

$Q = \frac{a\ (2gH')^{0.5}}{(1+Ke+Kb+KcL)^{0.5}}$; where a = Area of Pipe = 7.07 ft^2, R = 1.5'

H' = Head = H + 14.5 (Riser) + 0.35 (Slope) + 0.6*4 (barrel height)

Ke = 1.0

Kb = 0.5

Kc = 0.043

L = 70'

TABLE 13b

Sediment Pond #2 Stage/Discharge Data			
Head above Spillway (ft.)	Q (cfs) Weir Controlled	Q (cfs) Orfice Controlled	Q (cfs) Pipe Flow Controlled
0.0	-	-	-
0.2	0.84	1.69	5.81
0.4	2.38	2.39	5.88
0.6	4.38	2.93	5.95
0.8	6.74	3.38	6.02
1.0	9.42	3.78	6.09
1.2	12.39	4.14	6.16
1.4	15.61	4.47	6.22
1.6	19.07	4.78	6.29
1.8	22.76	5.07	6.36
2.0	26.66	5.35	6.42

Note: 1- 25 year - 6 hour flow =1.41 cfs.
2- Flow will be Weir controlled at a head of 0.36' over riser inlet.

Weir Controlled

$Q = CLH^{1.5}$; where: C= 3.0, L= Circumference of Riser =3.14', R=0.5'

Orfice Controlled

$Q = C'a\ (2gH)^{0.5}$; where: C= 0.6, a= Area of Riser = 0.79 ft^2, R=0.5', g= 32.2 ft/sec^2

Pipe Flow Controlled

$Q = \frac{a\ (2gH')^{0.5}}{(1+Ke+Kb+KcL)^{0.5}}$; where a = Area of Pipe = 0.79 ft^2, R = 0.5'

H' = Head = H + 6.0 (Riser) + 0.8 (Slope) + 0.6*2 (barrel height)

Ke = 1.0

Kb = 0.5

Kc = 0.043

L = 160'

3.4 Sediment Pond Summary

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

b) The required volume for Sediment Pond #1 is calculated at 6.08 acre feet, including 3.0 years of sediment storage. The proposed sediment pond size will have a volume of approximately 13.04 acre feet (at the principal spillway), which is more than adequate. The extra storage 6.96 acre-foot in Pond 1 will be used for optional mine water handling. The required volume for Sediment Pond #2 is calculated at 0.38 acre feet, including 3 years of sediment storage. The proposed sediment pond size will have a volume of approximately 1.36 acre feet (at the principal spillway), which is more than adequate.

c) The ponds will meet a theoretical detention time of 24 hours. Both are equipped with a decant, a culvert principal spillway and a culvert emergency spillway. Any discharge from the ponds will be in accordance with the approved UPDES Permit.

d) The pond inlets will be protected from erosion, and the spillways will discharge into the natural drainages in a controlled manner.

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

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

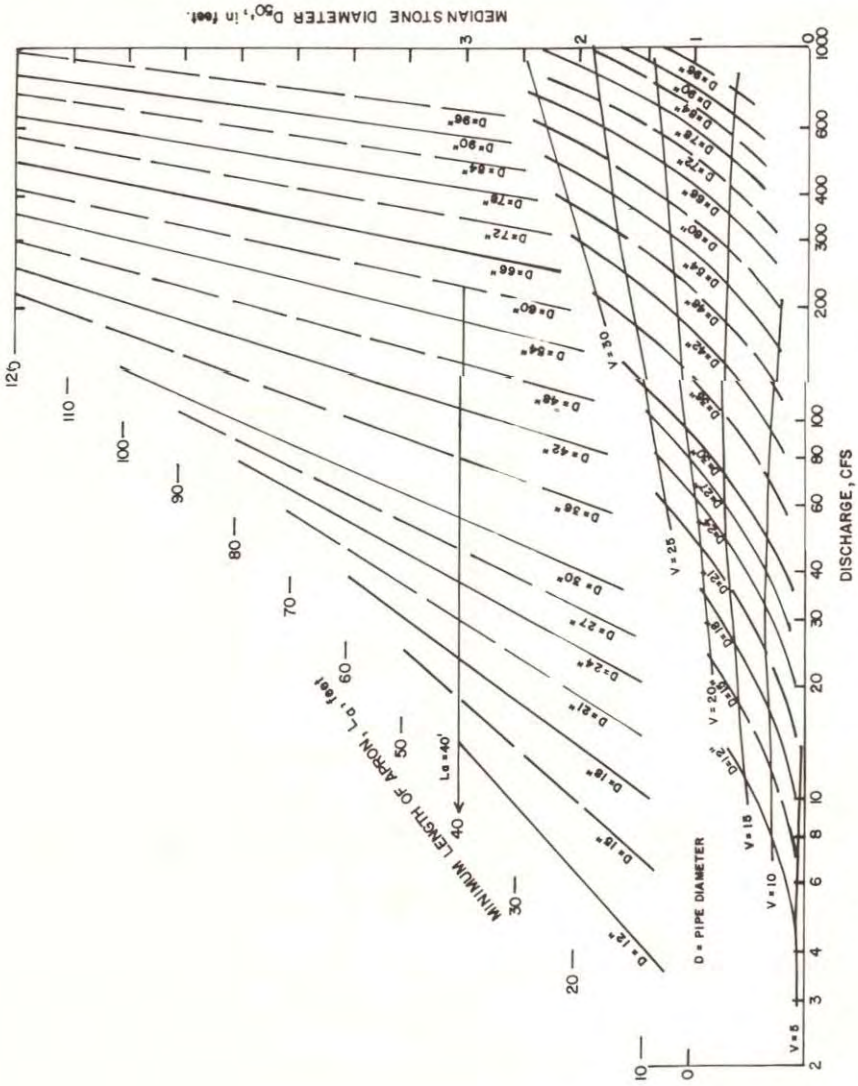


Figure 7.26. Design of outlet protection - maximum tailwater condition, $T_W \geqslant 0.5$.D. (U.S. EPA, 1976)

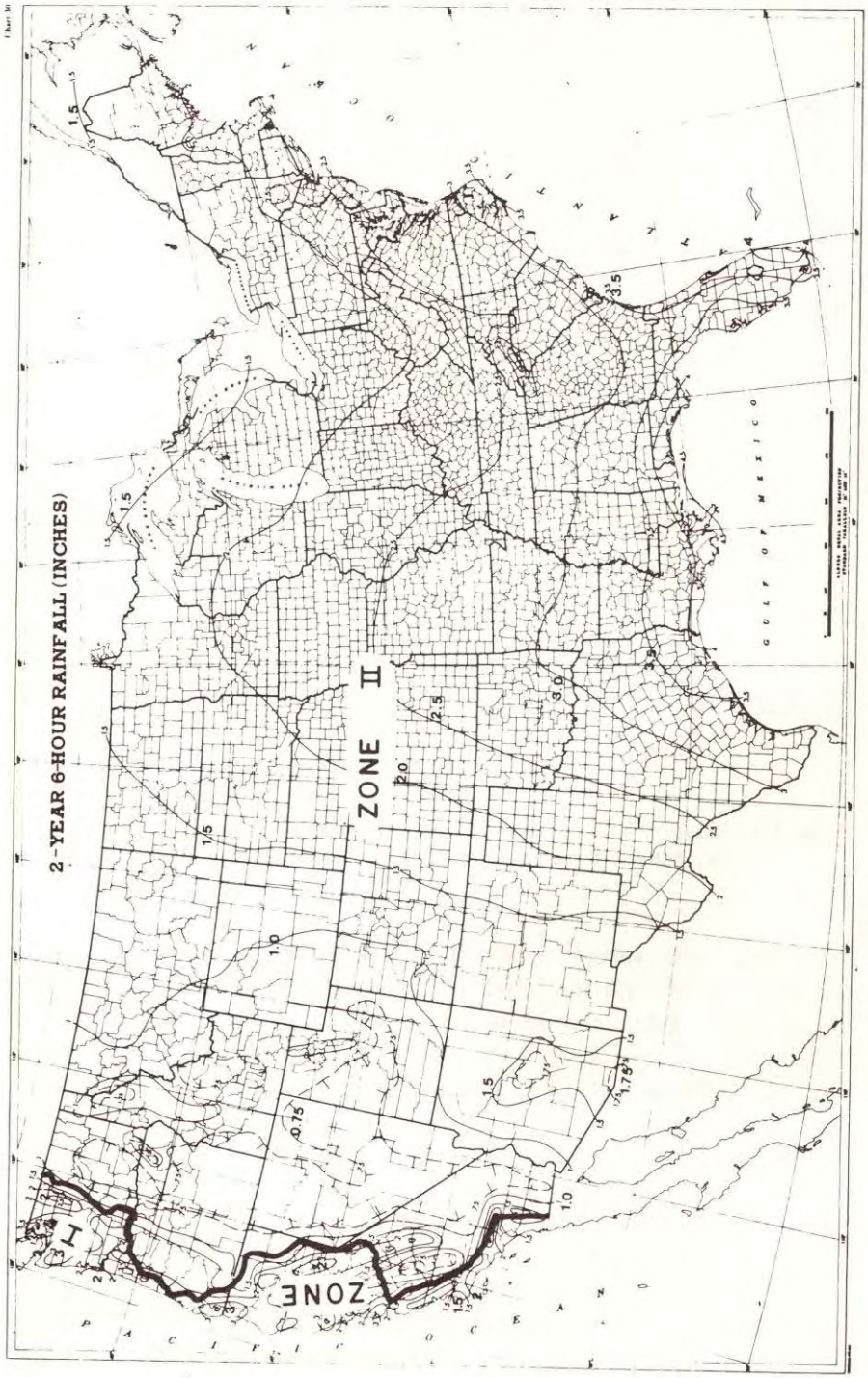
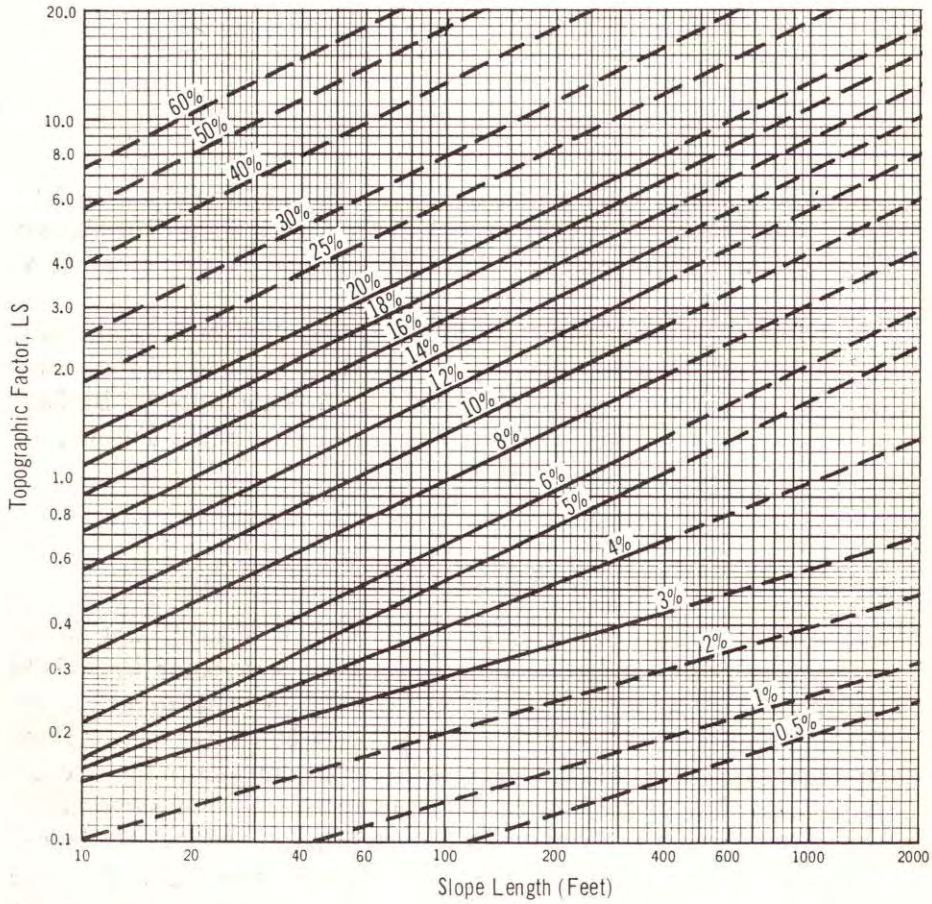


Figure 5.4. Depths of the 2-year, 6-hour rainfall, inches. (Hotes et al., 1973)

where S_j is the slope factor S for the jth segment of the slope given by

$$S_j = \frac{0.43 + 30x_j + 430x_j^2}{6.613} \tag{5.12}$$



*The dashed lines represent estimates for slope dimensions beyond the range of lengths and steepnesses for which data are available. The curves were derived by the formula:

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

where λ = field slope length in feet and m = 0.5 if s = 5% or greater, 0.4 if s = 4%, and 0.3 if s = 3% or less; and $x = \sin\theta$. θ is the angle of slope in degrees.

Figure 5.15. Slope-effect chart (topographic factor, LS). (SCS, 1977)

DESIGN OF DRAINAGE CONTROL STRUCTURES FOR RECLAMATION

Reclamation Hydrology:

4.1 General
4.2 Reclamation Area Drainage Control

Tables:

Table 14 Final Reclamation - Drainage Areas Contributing to Structures
Table 15 Final Reclamation - Drainage Structure Flow Summary
Table 16 Final Reclamation - Reclamation Structure Design Parameters
Table 17 Final Reclamation - Reclamation Structure Flow Calculations

Figures:

Figures 5 Filter Fence Construction

Reclamation Hydrology

4.1 General

Upon completion of operations at the Lila Canyon Minesite, the portals will be sealed and backfilled, and all structures will be removed except for the sediment ponds, bypass culvert UC-1/UC-1a, reclamation ditches and temporary sediment controls such as silt fences or straw bales.

Any refuse or mine development waste previously deposited under the approved plan will also be left in place. Concrete will be buried beneath at least 2' of non-toxic, non-acid material. Any potentially toxic or acid-forming material buried on site will be covered with a minimum of 4' of material.

The sediment ponds, and all remaining drainage controls will be removed upon completion of Phase II Bond Release.

4.2 Reclamation Area Drainage Control

During the initial phase of reclamation, all drainage controls will be removed with the exception of the two sediment ponds, bypass culvert UC-1/UC-1a, reclaimed ditches RD-1 and RD-2, and temporary sediment controls such as straw bales or silt fences installed in the undisturbed drainages.

As undisturbed drainage culverts are removed, a minimum of two straw bale or silt fence barriers will be installed downstream of each location for sediment control purposes.

Disturbed areas will be regraded and reclaimed ditches RD-1 and RD-2 will be installed to collect the runoff from the site area and direct it to the outlet structures (see Plate 7-7).

When the vegetation and sediment contribution levels meet requirements for Phase II Bond Release, a series of at least three straw bale or silt fence barriers will be placed downstream of the sediment pond outlets. All upstream sediment controls will be removed. Reclaimed ditches RD-1 and RD-2 will also be removed, regraded and reseeded. Culvert UC-1/UC-1a will be cut off at the location of the principal pond spillway.

The portion of culvert UC-1 remaining beneath the road will be left as a permanent drainage control. The culvert will be equipped with an inlet section and rip-rapped headwall. The culvert is adequately sized to safely pass runoff from a 100 year - 6 hour event, as shown in Table 10. To ensure that state of the art technology is incorporated, the final reclamation plans for the sedimentation pond areas will be submitted prior to commencement of final reclamation of this area.

The remainder of culvert UC-1/UC-1a will be removed, and the natural channel restored through the sediment pond #1 area. The sediment pond structures will also be removed, the pond areas regraded as necessary and reseeded. The Sediment Pond #1 embankment will remain as a permanent feature, since the existing (and proposed future) road through the area passes over the embankment.

Following the successful establishment of vegetation, and when effluent standards are met, the sediment ponds will be removed. The same methodologies relative to recontouring, top soil application and seeding will be utilized in grading and revegetating the pond areas as outlined in Chapters 2, 5, and Appendix 5-8.

The pond embankment will be narrowed to facilitate the even character of the Lila Canyon Road. The 60 inch bypass culvert (UC-1) will be removed to within six feet of the road embankment. A newly formed channel will be constructed at an approximate four percent grade to intercept the inlet of the culvert at its intersection of the road. The road embankment and associated new channel will be armored by the Operator

with an underlayment of filter gravel, with D_{50} -30 inch rip-rap. The new area of disturbance including the newly formed channel will have top soil spread in and around the rip-rap. The Operator will use the same seeding and mulching methods described in Appendix 5-8 will be used on this area as well. See Figure 4 for a detailed design.

TABLE 14

Final Reclamation Drainage Areas Contributing to Structures	
Channel	Contributing Watershed/Structure
RD-1	RW-1
RD-2	RW-2
UC-1/UC-1a	UA-1, UA-4, RD-1

TABLE 15

Final Reclamation Drainage Structure Flow Summary	
Channel	*100/6 Flow (cfs)
RD-1	13.26
RD-2	10.89
UC-1/UC-1a	**72.62

* CN = 83.
** Combined flow for watersheds UA-1, UA-4, and RW-2.

TABLE 16

Final Reclamation Reclamation Structure Design Parameters					
Channel	Bottom Width (ft.)	Side Slope H:V	Slope %	Reclaimed Depth (ft.)	Manning's No.
RD-1	3	2:1	5.00	1.5	0.035
RD-2	3	2:1	10.00	1.5	0.035
UC-1/UC-1a	60" Diam.	-	0.90*	60" Diam.	0.025

* Pipe slope for Plate 7-6

TABLE 17

Final Reclamation Reclamation Structure Flow Calculations			
Channel	RD-1	RD-2	UC-1/UC-1a
100 year - 6 hour event (in.)	1.90	1.90	1.90
Peak Flow (cfs)	13.26	10.89	72.62
Velocity (fps)	5.44	6.52	6.74
Required Area ($ft.^2$)	2.44	1.67	10.80
Flow Depth (ft.)	0.58	0.43	2.69

Alternate Sediment Control for Fan Site and Topsoil Storage Area

5.1 ASCA Areas

Sediment Control at the slope below water treatment area, and topsoil storage area sites will be accomplished with a combination of one or more of the following: berms, silt fences, and straw bales.
The ventilation breakouts are just punch outs and will have insignificant disturbance associated with them. (Plate 5-2 and 5-2a) However, they are addressed as ASCA's and are addressed here even though there will be only insignificant surface disturbance. The ASCA's will be seeded upon final reclamation.

The topsoil collected from the topsoil storage area sites will be located downslope from the sites and will be used in the construction of the berm. The berm will be constructed a minimum of two feet high and have 2:1 side slopes. The berm will control the flow from a 10 year-24 hour precipitation event. Silt fence will be selectively placed to help control run-off. The berm will be stabilized with vegetation to prevent erosion. As much as practical, the vegetation techniques used on the main topsoil pile will be utilized on the fan topsoil berm.

The outside of the berm will be protected with a silt fence or gravel. The gravel, if used, would help augment the revegetation. Construction details of the silt fence/filter fence are shown if Figure 5.

The outslope of the portal access road, outslope of the water treatment pad, and ventilation break outs will have a silt fence located along the disturbed area boundary to treat the runoff from the slope. While some portions of this area will be disturbed as a result of the fill material placed for the pad and road construction, the major portion of this area is expected to remain undisturbed. As an added protection, the portions of the area that are disturbed by the fill placement will be covered with a erosion control mat to minimize the erosion from this slope and that area seeded to aid in the establishment of a vegetative cover.

Due to lack of final engineering details, the exact location of the berms, silt fences, and subsequent erosion techniques will be determined in field with the approval of UDOGM. The final determination will be made prior to the start of topsoil removal.

Run-off Calculations

5.2 Ventilation Break Outs

Insignificant surface disturbance.

5.3 Topsoil Storage Area

Acreage: 2.61 acres
Design Storm:10 year/24 hour: 1.90"
CN: 90
S: 1.111

$$Q = \frac{(P-0.25S)^2}{P+0.8S} = 1.01'' \text{ of runoff}$$

Total run-off = 0.22 acre feet

5.4 Water Treatment Area

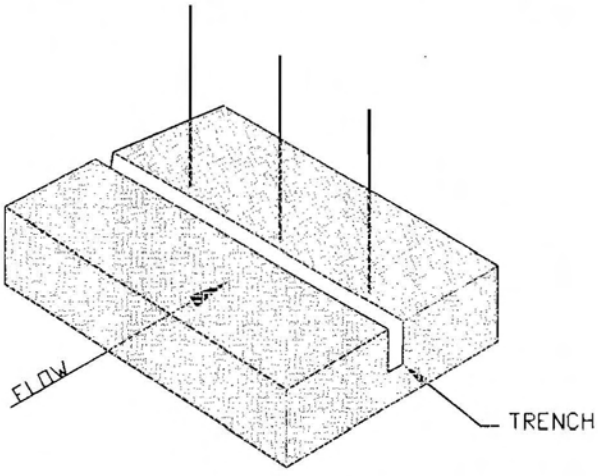
Acreage: 0.37 acres
Design Storm:10 year/24 hour: 1.90"
CN: 90
S: 1.111

$$Q = \frac{(P-0.2S)^2}{P+0.8S} = 1.01'' \text{ of runoff}$$

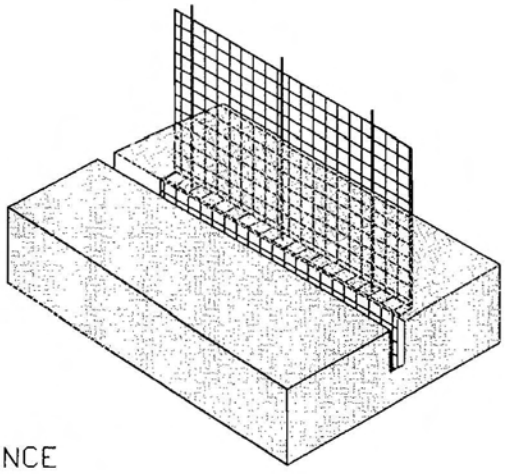
Total run-off = 0.03 acre feet

FILTER FENCE CONSTRUCTION

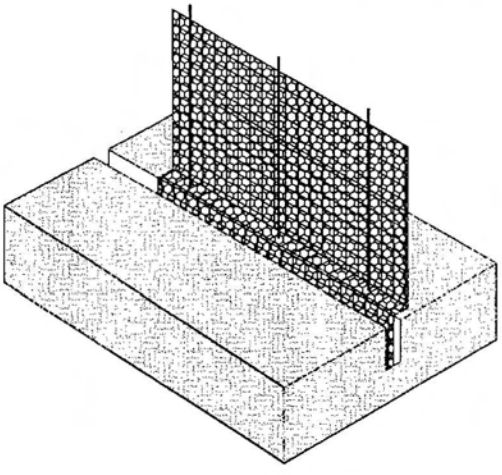
1. SET POSTS, EXCAVATE TRENCH



2. TIE WIRE FENCING TO POST



3. ATTACH FILTER FABRIC TO WIRE FENCE
WIRE AND FABRIC EXTENDS INTO TRENCH



4. BACKFILL AND COMPACT SOIL

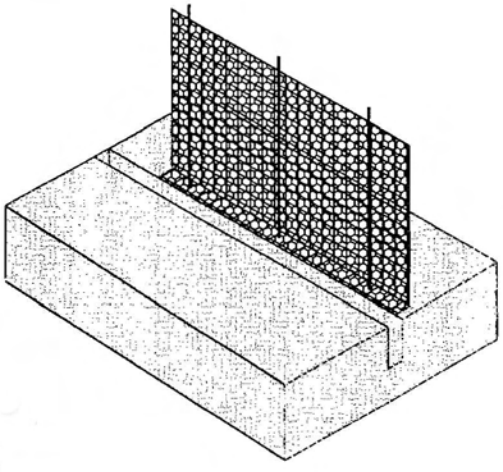


FIGURE 5

Lila Canyon Mine
Watershed Peakflow Calculations

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-1 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.25 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.20 cfs (0.951 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-1 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.25 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.82 cfs (0.652 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-1 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.25 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.29 cfs (1.027 iph)
at time:	12.003 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-1 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.25 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.64 cfs (0.508 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-2 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.30 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.29 cfs (0.965 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-2 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.30 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.20 cfs (0.664 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-2 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.30 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.32 cfs (1.044 iph)
at time:	12.005 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-2 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.30 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.16 cfs (0.519 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-3 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.25 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.24 cfs (0.956 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-3 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.25 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.17 cfs (0.655 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-3 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.25 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.26 cfs (1.035 iph)
at time:	12.008 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-3 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.25 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.13 cfs (0.511 iph)
at time:	2.504 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-4-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.38 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.37 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-4-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.38 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.26 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-4-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.38 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.40 cfs
at time 12.00 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-4-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.38 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.20 cfs
at time 2.50 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-5 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.87 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	2.77 cfs (0.956 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-5 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.87 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	1.90 cfs (0.655 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-5 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 2.87 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	3.00 cfs (1.035 iph)
at time:	12.008 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-5 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.87 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	1.48 cfs (0.511 iph)
at time:	2.504 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6a-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.12 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.020 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.12 cfs
   at time        2.50 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6a-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.12 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.020 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.68 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.08 cfs
   at time        2.50 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6a-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.12 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.020 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.13 cfs
   at time        12.00 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6a-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.12 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.020 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.06 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6b-100yr-6hr

```
-----------------------------------------------------------------------------
 STORM :                                        WATERSHED :
   Dist. = SCS Type 'b' - 6 Hour                      Area =   0.74 acres
   Depth =     1.90  inches                           CN =       90.00
   Duration = 6.00  hrs                               Time conc.= 0.030  hrs
-----------------------------------------------------------------------------
```

OUTPUT SUMMARY

```
-------------------------------------------------------------
         Runoff depth    = 1.01 inches
         Initial abstr.  = 0.22 inches
         Peak flow =      0.73 cfs
            at time        2.50 hrs
-------------------------------------------------------------
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6b-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.74 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.50 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6b-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.74 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.78 cfs
at time 12.00 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6b-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.74 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.53 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.39 cfs
   at time        2.50 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6c-100yr-6hr

```
-----------------------------------------------------------------------------
 STORM :                                        WATERSHED :
   Dist. = SCS Type 'b' - 6 Hour                      Area =   0.81 acres
   Depth =     1.90  inches                           CN =       90.00
   Duration = 6.00  hrs                               Time conc.= 0.050  hrs
-----------------------------------------------------------------------------
```

OUTPUT SUMMARY

```
-------------------------------------------------------------
         Runoff depth    = 1.01 inches
         Initial abstr.  = 0.22 inches
         Peak flow =      0.79 cfs
            at time        2.51 hrs
-------------------------------------------------------------
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6c-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.81 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.68 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.54 cfs
   at time        2.51 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6c-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.81 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.85 cfs
   at time        12.01 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-6c-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.81 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.42 cfs
at time 2.51 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-7 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.22 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.22 cfs (0.976 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-7 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.22 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.15 cfs (0.674 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-7 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.22 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.23 cfs (1.052 iph)
at time:	12.003 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-7 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.22 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.12 cfs (0.528 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-8 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.41 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.40 cfs (0.963 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-8 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.41 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.27 cfs (0.662 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-8 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.41 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.43 cfs (1.039 iph)
at time:	12.007 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-8 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.41 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.21 cfs (0.517 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-9 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.30 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.29 cfs (0.965 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-9 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.30 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.20 cfs (0.664 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-9 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.30 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.32 cfs (1.044 iph)
at time:	12.005 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-9 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.30 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.16 cfs (0.519 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-10 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.13 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.13 cfs (0.973 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-10 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.13 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.09 cfs (0.671 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-10 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.13 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.14 cfs (1.048 iph)
at time:	12.004 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-10 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.13 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.07 cfs (0.525 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-11 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.25 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.24 cfs (0.965 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-11 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.25 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.17 cfs (0.664 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-11 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.25 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.26 cfs (1.044 iph)
at time:	12.005 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-11 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.25 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.13 cfs (0.519 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-12 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 4.38 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	4.10 cfs (0.927 iph)
at time:	2.508 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-12 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 4.38 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	2.79 cfs (0.631 iph)
at time:	2.523 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-12 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 4.38 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	4.46 cfs (1.010 iph)
at time:	12.012 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-12 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 4.38 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.11 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	2.16 cfs (0.490 iph)
at time:	2.523 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-13-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 1.49 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 1.43 cfs
at time 2.51 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-13-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 1.49 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.98 cfs
at time 2.51 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-13-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 1.49 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 1.54 cfs
at time 12.00 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-13-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 1.49 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.76 cfs
at time 2.51 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-14a - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.59 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.56 cfs (0.933 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-14a - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.59 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.38 cfs (0.636 iph)
at time:	2.520 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-14a - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.59 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.60 cfs (1.017 iph)
at time:	12.013 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-14a - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.59 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.29 cfs (0.494 iph)
at time:	2.520 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-14b-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.51 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.49 cfs
   at time        2.51 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-14b-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.51 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.34 cfs
at time 2.51 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-14b-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.51 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.53 cfs
   at time        12.00 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-14b-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.51 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.070 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.53 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.26 cfs
   at time        2.51 hrs
```

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15a - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.55 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.49 cfs (0.951 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15a - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.55 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	1.02 cfs (0.652 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15a - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.55 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.60 cfs (1.027 iph)
at time:	12.003 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15a - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.55 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.79 cfs (0.508 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15b - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 3.11 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.09 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	2.95 cfs (0.940 iph)
at time:	2.508 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15b - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 3.11 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.09 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	2.01 cfs (0.642 iph)
at time:	2.508 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15b - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 3.11 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.09 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	3.20 cfs (1.022 iph)
at time:	12.012 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-15b - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 3.11 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.09 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	1.56 cfs (0.499 iph)
at time:	2.508 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16a-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.20 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.040 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.19 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16a-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.20 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.040 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.13 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16a-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.20 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.040 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.21 cfs
   at time        12.01 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16a-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.20 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.040 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.53 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.10 cfs
   at time        2.50 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16b-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.26 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.25 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16b-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.26 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.18 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16b-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.26 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.27 cfs
at time 12.00 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16b-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.26 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.14 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16c-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.54 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.53 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16c-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.54 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.37 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16c-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.54 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.57 cfs
at time 12.00 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-16c-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.54 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.29 cfs
at time 2.50 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-17 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.12 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.08 cfs (0.956 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-17 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.12 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.74 cfs (0.655 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-17 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.12 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.17 cfs (1.035 iph)
at time:	12.008 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-17 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.12 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.58 cfs (0.511 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-18 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.48 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.47 cfs (0.963 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-18 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.48 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.32 cfs (0.662 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-18 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.48 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.50 cfs (1.039 iph)
at time:	12.007 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-18 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.48 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.05 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.25 cfs (0.517 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-19 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.55 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.52 cfs (0.933 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-19 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.55 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	0.35 cfs (0.636 iph)
at time:	2.520 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-19 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.55 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	0.56 cfs (1.017 iph)
at time:	12.013 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
DA-19 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.55 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.10 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.27 cfs (0.494 iph)
at time:	2.520 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-20-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.49 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.060 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.47 cfs
   at time        2.50 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-20-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.49 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.060 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.32 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-20-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.49 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.060 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.51 cfs
at time 12.01 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-20-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.49 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.060 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.25 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21a-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 1.12 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 1.09 cfs
at time 2.51 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21a-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 1.12 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.75 cfs
at time 2.51 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21a-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 1.12 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      1.17 cfs
   at time        12.01 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21a-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 1.12 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.050 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.58 cfs
at time 2.51 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21b-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.18 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.010 hrs

OUTPUT SUMMARY

Runoff depth = 1.01 inches
Initial abstr. = 0.22 inches
Peak flow = 0.18 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21b-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.18 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.010 hrs

OUTPUT SUMMARY

Runoff depth = 0.68 inches
Initial abstr. = 0.22 inches
Peak flow = 0.12 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21b-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.18 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.010 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.19 cfs
   at time        12.00 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-21b-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.18 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.010 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.10 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-22-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.79 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.120 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.74 cfs
   at time        2.51 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-22-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.79 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.120 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.68 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.50 cfs
   at time        2.51 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-22-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.79 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.00 hrs	Time conc.= 0.120 hrs

OUTPUT SUMMARY

```
Runoff depth    = 1.01 inches
Initial abstr.  = 0.22 inches
Peak flow =      0.80 cfs
   at time        12.02 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-22-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.79 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.00 hrs	Time conc.= 0.120 hrs

OUTPUT SUMMARY

Runoff depth = 0.53 inches
Initial abstr. = 0.22 inches
Peak flow = 0.39 cfs
at time 2.53 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-23a-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 11.65 acres
Depth = 1.90 inches	CN = 75.00
Duration = 6.00 hrs	Time conc.= 0.150 hrs

OUTPUT SUMMARY

Runoff depth = 0.33 inches
Initial abstr. = 0.67 inches
Peak flow = 2.87 cfs
at time 2.56 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-23a-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 11.65 acres
Depth = 1.50 inches	CN = 75.00
Duration = 6.00 hrs	Time conc.= 0.150 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.17 inches
Initial abstr.  = 0.67 inches
Peak flow =      1.02 cfs
   at time        2.58 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-23a-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 11.65 acres
Depth = 1.90 inches	CN = 75.00
Duration = 24.00 hrs	Time conc.= 0.150 hrs

OUTPUT SUMMARY

Runoff depth = 0.33 inches
Initial abstr. = 0.67 inches
Peak flow = 3.74 cfs
at time 12.04 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: DA-23a-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 11.65 acres
Depth = 1.30 inches	CN = 75.00
Duration = 6.00 hrs	Time conc.= 0.150 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.10 inches
Initial abstr.  = 0.67 inches
Peak flow =      0.41 cfs
   at time        3.54 hrs
```

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
TS-01 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.87 acres
Depth = 1.90 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.80 cfs (0.956 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
TS-01 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.87 acres
Depth = 1.50 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.683 inches
Initial abstr:	0.222 inches
Peak flow:	1.24 cfs (0.655 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
TS-01 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.87 acres
Depth = 1.90 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	1.009 inches
Initial abstr:	0.222 inches
Peak flow:	1.95 cfs (1.035 iph)
at time:	12.008 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
TS-01 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.87 acres
Depth = 1.30 inches	CN = 90.00
Duration = 6.0 hrs	Time conc.= 0.06 hrs

OUTPUT SUMMARY

Runoff depth:	0.531 inches
Initial abstr:	0.222 inches
Peak flow:	0.96 cfs (0.511 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-1 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 258.29 acres
Depth = 1.90 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.81 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	30.52 cfs (0.117 iph)
at time:	3.456 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-1 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 258.29 acres
Depth = 1.50 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.81 hrs

OUTPUT SUMMARY

Runoff depth:	0.167 inches
Initial abstr:	0.667 inches
Peak flow:	13.69 cfs (0.053 iph)
at time:	3.672 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-1 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 258.29 acres
Depth = 1.90 inches	CN = 75.00
Duration = 24.0 hrs	Time conc.= 0.81 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	35.07 cfs (0.135 iph)
at time:	12.528 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-1 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 258.29 acres
Depth = 1.30 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.81 hrs

OUTPUT SUMMARY

Runoff depth:	0.101 inches
Initial abstr:	0.667 inches
Peak flow:	7.99 cfs (0.031 iph)
at time:	3.996 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-2 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.63 acres
Depth = 1.90 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	0.99 cfs (0.600 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-2 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.63 acres
Depth = 1.50 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.379 inches
Initial abstr:	0.410 inches
Peak flow:	0.58 cfs (0.353 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-2 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.63 acres
Depth = 1.90 inches	CN = 83.00
Duration = 24.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	1.12 cfs (0.682 iph)
at time:	12.012 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-2 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.63 acres
Depth = 1.30 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.270 inches
Initial abstr:	0.410 inches
Peak flow:	0.40 cfs (0.242 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-3 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.40 acres
Depth = 1.90 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	1.49 cfs (0.617 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-3 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.40 acres
Depth = 1.50 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.379 inches
Initial abstr:	0.410 inches
Peak flow:	0.89 cfs (0.367 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-3 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 2.40 acres
Depth = 1.90 inches	CN = 83.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	1.70 cfs (0.702 iph)
at time:	12.005 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-3 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 2.40 acres
Depth = 1.30 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth:	0.270 inches
Initial abstr:	0.410 inches
Peak flow:	0.62 cfs (0.255 iph)
at time:	2.507 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-4 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 14.08 acres
Depth = 1.90 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.15 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	7.81 cfs (0.550 iph)
at time:	2.540 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-4 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 14.08 acres
Depth = 1.50 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.15 hrs

OUTPUT SUMMARY

Runoff depth:	0.379 inches
Initial abstr:	0.410 inches
Peak flow:	4.48 cfs (0.316 iph)
at time:	2.540 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-4 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 14.08 acres
Depth = 1.90 inches	CN = 83.00
Duration = 24.0 hrs	Time conc.= 0.15 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	9.00 cfs (0.634 iph)
at time:	12.020 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-4 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 14.08 acres
Depth = 1.30 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.15 hrs

OUTPUT SUMMARY

Runoff depth:	0.270 inches
Initial abstr:	0.410 inches
Peak flow:	3.00 cfs (0.211 iph)
at time:	2.540 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5a - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.05 acres
Depth = 1.90 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	0.30 cfs (0.285 iph)
at time:	2.511 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5a - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.05 acres
Depth = 1.50 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.167 inches
Initial abstr:	0.667 inches
Peak flow:	0.12 cfs (0.111 iph)
at time:	2.520 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5a - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.05 acres
Depth = 1.90 inches	CN = 75.00
Duration = 24.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	0.38 cfs (0.362 iph)
at time:	12.012 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5a - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.05 acres
Depth = 1.30 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.07 hrs

OUTPUT SUMMARY

Runoff depth:	0.101 inches
Initial abstr:	0.667 inches
Peak flow:	0.04 cfs (0.041 iph)
at time:	2.529 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5b - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.63 acres
Depth = 1.90 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.12 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	0.42 cfs (0.258 iph)
at time:	2.544 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5b - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.63 acres
Depth = 1.50 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.12 hrs

OUTPUT SUMMARY

Runoff depth:	0.167 inches
Initial abstr:	0.667 inches
Peak flow:	0.15 cfs (0.094 iph)
at time:	2.560 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5b - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 1.63 acres
Depth = 1.90 inches	CN = 75.00
Duration = 24.0 hrs	Time conc.= 0.12 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	0.55 cfs (0.334 iph)
at time:	12.032 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-5b - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 1.63 acres
Depth = 1.30 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.12 hrs

OUTPUT SUMMARY

Runoff depth:	0.101 inches
Initial abstr:	0.667 inches
Peak flow:	0.06 cfs (0.036 iph)
at time:	3.520 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6a - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.54 acres
Depth = 1.90 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	0.34 cfs (0.625 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6a - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.54 acres
Depth = 1.50 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	0.379 inches
Initial abstr:	0.410 inches
Peak flow:	0.20 cfs (0.374 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6a - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.54 acres
Depth = 1.90 inches	CN = 83.00
Duration = 24.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	0.39 cfs (0.708 iph)
at time:	12.004 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6a - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.54 acres
Depth = 1.30 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth:	0.270 inches
Initial abstr:	0.410 inches
Peak flow:	0.14 cfs (0.260 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6b - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.46 acres
Depth = 1.90 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.01 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	0.30 cfs (0.637 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6b - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.46 acres
Depth = 1.50 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.01 hrs

OUTPUT SUMMARY

Runoff depth:	0.379 inches
Initial abstr:	0.410 inches
Peak flow:	0.18 cfs (0.383 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6b - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.46 acres
Depth = 1.90 inches	CN = 83.00
Duration = 24.0 hrs	Time conc.= 0.01 hrs

OUTPUT SUMMARY

Runoff depth:	0.628 inches
Initial abstr:	0.410 inches
Peak flow:	0.33 cfs (0.719 iph)
at time:	12.001 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-6b - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.46 acres
Depth = 1.30 inches	CN = 83.00
Duration = 6.0 hrs	Time conc.= 0.01 hrs

OUTPUT SUMMARY

Runoff depth:	0.270 inches
Initial abstr:	0.410 inches
Peak flow:	0.12 cfs (0.268 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-7 - 100yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.90 acres
Depth = 1.90 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	0.29 cfs (0.315 iph)
at time:	2.501 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-7 - 25yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.90 acres
Depth = 1.50 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	0.167 inches
Initial abstr:	0.667 inches
Peak flow:	0.12 cfs (0.131 iph)
at time:	2.504 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-7 - 10yr-24hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.90 acres
Depth = 1.90 inches	CN = 75.00
Duration = 24.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	0.333 inches
Initial abstr:	0.667 inches
Peak flow:	0.36 cfs (0.393 iph)
at time:	12.003 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:
UA-7 - 10yr-6hr

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type `b'	Area = 0.90 acres
Depth = 1.30 inches	CN = 75.00
Duration = 6.0 hrs	Time conc.= 0.02 hrs

OUTPUT SUMMARY

Runoff depth:	0.101 inches
Initial abstr:	0.667 inches
Peak flow:	0.05 cfs (0.055 iph)
at time:	2.504 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: UA-8-100yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.17 acres
Depth = 1.90 inches	CN = 75.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

```
Runoff depth    = 0.33 inches
Initial abstr.  = 0.67 inches
Peak flow =      0.05 cfs
   at time        2.50 hrs
```

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: UA-8-25yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.17 acres
Depth = 1.50 inches	CN = 75.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.17 inches
Initial abstr. = 0.67 inches
Peak flow = 0.02 cfs
at time 2.50 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: UA-8-10yr-24hr

STORM :	WATERSHED :
Dist. = SCS Type II - 24 Hour	Area = 0.17 acres
Depth = 1.90 inches	CN = 75.00
Duration = 24.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.33 inches
Initial abstr. = 0.67 inches
Peak flow = 0.07 cfs
at time 12.00 hrs

SCS HYDRO, Ver. 3.1
HYDROGRAPH GENERATION PROGRAM OUTPUT
BASED ON SCS CURVE NUMBER METHODOLOGY

INPUT FOR: UA-8-10yr-6hr

STORM :	WATERSHED :
Dist. = SCS Type 'b' - 6 Hour	Area = 0.17 acres
Depth = 1.30 inches	CN = 75.00
Duration = 6.00 hrs	Time conc.= 0.030 hrs

OUTPUT SUMMARY

Runoff depth = 0.10 inches
Initial abstr. = 0.67 inches
Peak flow = 0.01 cfs
at time 2.51 hrs

Lila Canyon Mine
Ditch And Culvert Calculations

Hydraulic Analysis Report

Project Data

Project Title: Project - Lila Canyon Operations

Designer:

Project Date: Monday, September 14, 2015

Project Units: U.S. Customary Units

Channel Analysis: DD-1

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1301 ft/ft

Manning's n: 0.0350

Flow: 1.6600 cfs

Result Parameters

Depth: 0.1652 ft

Area of Flow: 0.4124 ft^2

Wetted Perimeter: 3.0450 ft

Hydraulic Radius: 0.1354 ft

Average Velocity: 4.0257 ft/s

Top Width: 2.9914 ft

Froude Number: 1.9108

Critical Depth: 0.2441 ft

Critical Velocity: 2.4886 ft/s

Critical Slope: 0.0318 ft/ft

Critical Top Width: 3.46 ft

Calculated Max Shear Stress: 1.3414 lb/ft^2

Calculated Avg Shear Stress: 1.0994 lb/ft^2

Channel Analysis: DD-2

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1198 ft/ft

Manning's n: 0.0350

Flow: 2.0800 cfs

Result Parameters

Depth: 0.1913 ft

Area of Flow: 0.4925 ft^2

Wetted Perimeter: 3.2101 ft

Hydraulic Radius: 0.1534 ft

Average Velocity: 4.2233 ft/s

Top Width: 3.1480 ft

Froude Number: 1.8816

Critical Depth: 0.2787 ft

Critical Velocity: 2.6317 ft/s

Critical Slope: 0.0308 ft/ft

Critical Top Width: 3.67 ft

Calculated Max Shear Stress: 1.4304 lb/ft^2

Calculated Avg Shear Stress: 1.1469 lb/ft^2

Channel Analysis: DD-3

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0111 ft/ft

Manning's n: 0.0300

Flow: 0.1300 cfs

Result Parameters

Depth: 0.2361 ft

Area of Flow: 0.1115 ft^2

Wetted Perimeter: 1.0560 ft

Hydraulic Radius: 0.1056 ft

Average Velocity: 1.1659 ft/s

Top Width: 0.9445 ft

Froude Number: 0.5980

Critical Depth: 0.1922 ft

Critical Velocity: 1.7592 ft/s

Critical Slope: 0.0332 ft/ft

Critical Top Width: 0.77 ft

Calculated Max Shear Stress: 0.1635 lb/ft^2

Calculated Avg Shear Stress: 0.0731 lb/ft^2

Channel Analysis: DD-4

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1176 ft/ft

Manning's n: 0.0350

Flow: 2.2800 cfs

Result Parameters

Depth: 0.2088 ft

Area of Flow: 0.5049 ft^2

Wetted Perimeter: 2.9339 ft

Hydraulic Radius: 0.1721 ft

Average Velocity: 4.5160 ft/s

Top Width: 2.8353 ft

Froude Number: 1.8860

Critical Depth: 0.3079 ft

Critical Velocity: 2.8314 ft/s

Critical Slope: 0.0301 ft/ft

Critical Top Width: 3.23 ft

Calculated Max Shear Stress: 1.5324 lb/ft^2

Calculated Avg Shear Stress: 1.2628 lb/ft^2

Channel Analysis: DD-5a

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0333 ft/ft

Manning's n: 0.0300

Flow: 1.4800 cfs

Result Parameters

Depth: 0.2144 ft

Area of Flow: 0.5207 ft^2

Wetted Perimeter: 2.9588 ft

Hydraulic Radius: 0.1760 ft

Average Velocity: 2.8423 ft/s

Top Width: 2.8576 ft

Froude Number: 1.1734

Critical Depth: 0.2367 ft

Critical Velocity: 2.5281 ft/s

Critical Slope: 0.0236 ft/ft

Critical Top Width: 2.95 ft

Calculated Max Shear Stress: 0.4455 lb/ft^2

Calculated Avg Shear Stress: 0.3657 lb/ft^2

Channel Analysis: DD-5b

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.5545 ft/ft

Manning's n: 0.0400

Flow: 1.4800 cfs

Result Parameters

Depth: 0.1122 ft

Area of Flow: 0.2496 ft^2

Wetted Perimeter: 2.5019 ft

Hydraulic Radius: 0.0998 ft

Average Velocity: 5.9290 ft/s

Top Width: 2.4489 ft

Froude Number: 3.2726

Critical Depth: 0.2367 ft

Critical Velocity: 2.5284 ft/s

Critical Slope: 0.0420 ft/ft

Critical Top Width: 2.95 ft

Calculated Max Shear Stress: 3.8828 lb/ft^2

Calculated Avg Shear Stress: 3.4523 lb/ft^2

Channel Analysis: DD-6a

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.1176 ft/ft

Manning's n: 0.0300

Flow: 0.0600 cfs

Result Parameters

Depth: 0.1135 ft

Area of Flow: 0.0258 ft^2

Wetted Perimeter: 0.5076 ft

Hydraulic Radius: 0.0508 ft

Average Velocity: 2.3287 ft/s

Top Width: 0.4540 ft

Froude Number: 1.7227

Critical Depth: 0.1411 ft

Critical Velocity: 1.5071 ft/s

Critical Slope: 0.0369 ft/ft

Critical Top Width: 0.56 ft

Calculated Max Shear Stress: 0.8329 lb/ft^2

Calculated Avg Shear Stress: 0.3725 lb/ft^2

Channel Analysis: DD-6b

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0538 ft/ft

Manning's n: 0.0300

Flow: 0.4500 cfs

Result Parameters

Depth: 0.2798 ft

Area of Flow: 0.1566 ft^2

Wetted Perimeter: 1.2513 ft

Hydraulic Radius: 0.1251 ft

Average Velocity: 2.8742 ft/s

Top Width: 1.1192 ft

Froude Number: 1.3542

Critical Depth: 0.3159 ft

Critical Velocity: 2.2551 ft/s

Critical Slope: 0.0282 ft/ft

Critical Top Width: 1.26 ft

Calculated Max Shear Stress: 0.9393 lb/ft^2

Calculated Avg Shear Stress: 0.4201 lb/ft^2

Channel Analysis: DD-7

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0811 ft/ft

Manning's n: 0.0350

Flow: 5.4500 cfs

Result Parameters

Depth: 0.3792 ft

Area of Flow: 1.0459 ft^2

Wetted Perimeter: 3.6958 ft

Hydraulic Radius: 0.2830 ft

Average Velocity: 5.2106 ft/s

Top Width: 3.5167 ft

Froude Number: 1.6838

Critical Depth: 0.5130 ft

Critical Velocity: 3.5106 ft/s

Critical Slope: 0.0265 ft/ft

Critical Top Width: 4.05 ft

Calculated Max Shear Stress: 1.9189 lb/ft^2

Calculated Avg Shear Stress: 1.4322 lb/ft^2

Channel Analysis: DD-8

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0222 ft/ft

Manning's n: 0.0300

Flow: 7.6100 cfs

Result Parameters

Depth: 0.5915 ft

Area of Flow: 1.8829 ft^2

Wetted Perimeter: 4.6454 ft

Hydraulic Radius: 0.4053 ft

Average Velocity: 4.0416 ft/s

Top Width: 4.3661 ft

Froude Number: 1.0846

Critical Depth: 0.6192 ft

Critical Velocity: 3.7953 ft/s

Critical Slope: 0.0186 ft/ft

Critical Top Width: 4.48 ft

Calculated Max Shear Stress: 0.8194 lb/ft^2

Calculated Avg Shear Stress: 0.5615 lb/ft^2

Channel Analysis: DD-9

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0231 ft/ft

Manning's n: 0.0350

Flow: 8.6200 cfs

Result Parameters

Depth: 0.6768 ft

Area of Flow: 2.2698 ft^2

Wetted Perimeter: 5.0268 ft

Hydraulic Radius: 0.4515 ft

Average Velocity: 3.7978 ft/s

Top Width: 4.7072 ft

Froude Number: 0.9638

Critical Depth: 0.6634 ft

Critical Velocity: 3.9057 ft/s

Critical Slope: 0.0250 ft/ft

Critical Top Width: 4.65 ft

Calculated Max Shear Stress: 0.9756 lb/ft^2

Calculated Avg Shear Stress: 0.6509 lb/ft^2

Channel Analysis: DD-10

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0746 ft/ft

Manning's n: 0.0300

Flow: 0.2900 cfs

Result Parameters

Depth: 0.2232 ft

Area of Flow: 0.0996 ft^2

Wetted Perimeter: 0.9981 ft

Hydraulic Radius: 0.0998 ft

Average Velocity: 2.9111 ft/s

Top Width: 0.8927 ft

Froude Number: 1.5357

Critical Depth: 0.2650 ft

Critical Velocity: 2.0654 ft/s

Critical Slope: 0.0299 ft/ft

Critical Top Width: 1.06 ft

Calculated Max Shear Stress: 1.0389 lb/ft^2

Calculated Avg Shear Stress: 0.4646 lb/ft^2

Channel Analysis: DD-11a

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0731 ft/ft

Manning's n: 0.0350

Flow: 2.7000 cfs

Result Parameters

Depth: 0.5480 ft

Area of Flow: 0.6006 ft^2

Wetted Perimeter: 2.4507 ft

Hydraulic Radius: 0.2451 ft

Average Velocity: 4.4954 ft/s

Top Width: 2.1920 ft

Froude Number: 1.5135

Critical Depth: 0.6468 ft

Critical Velocity: 3.2270 ft/s

Critical Slope: 0.0302 ft/ft

Critical Top Width: 2.59 ft

Calculated Max Shear Stress: 2.4997 lb/ft^2

Calculated Avg Shear Stress: 1.1179 lb/ft^2

Channel Analysis: DD-11b

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0093 ft/ft

Manning's n: 0.0300

Flow: 1.5600 cfs

Result Parameters

Depth: 0.3168 ft

Area of Flow: 0.8345 ft^2

Wetted Perimeter: 3.4170 ft

Hydraulic Radius: 0.2442 ft

Average Velocity: 1.8695 ft/s

Top Width: 3.2674 ft

Froude Number: 0.6519

Critical Depth: 0.2445 ft

Critical Velocity: 2.5636 ft/s

Critical Slope: 0.0234 ft/ft

Critical Top Width: 2.98 ft

Calculated Max Shear Stress: 0.1839 lb/ft^2

Calculated Avg Shear Stress: 0.1417 lb/ft^2

Channel Analysis: DD-12a

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1532 ft/ft

Manning's n: 0.0350

Flow: 4.4000 cfs

Result Parameters

Depth: 0.2817 ft

Area of Flow: 0.7222 ft^2

Wetted Perimeter: 3.2600 ft

Hydraulic Radius: 0.2215 ft

Average Velocity: 6.0923 ft/s

Top Width: 3.1269 ft

Froude Number: 2.2340

Critical Depth: 0.4537 ft

Critical Velocity: 3.3361 ft/s

Critical Slope: 0.0274 ft/ft

Critical Top Width: 3.81 ft

Calculated Max Shear Stress: 2.6933 lb/ft^2

Calculated Avg Shear Stress: 2.1179 lb/ft^2

Channel Analysis: DD-12b

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.1429 ft/ft

Manning's n: 0.0300

Flow: 0.1000 cfs

Result Parameters

Depth: 0.1325 ft

Area of Flow: 0.0351 ft^2

Wetted Perimeter: 0.5927 ft

Hydraulic Radius: 0.0593 ft

Average Velocity: 2.8465 ft/s

Top Width: 0.5301 ft

Froude Number: 1.9486

Critical Depth: 0.1731 ft

Critical Velocity: 1.6693 ft/s

Critical Slope: 0.0344 ft/ft

Critical Top Width: 0.69 ft

Calculated Max Shear Stress: 1.1818 lb/ft^2

Calculated Avg Shear Stress: 0.5285 lb/ft^2

Channel Analysis: DD-12c

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1105 ft/ft

Manning's n: 0.0350

Flow: 4.7900 cfs

Result Parameters

Depth: 0.3241 ft

Area of Flow: 0.8583 ft^2

Wetted Perimeter: 3.4494 ft

Hydraulic Radius: 0.2488 ft

Average Velocity: 5.5808 ft/s

Top Width: 3.2964 ft

Froude Number: 1.9274

Critical Depth: 0.4766 ft

Critical Velocity: 3.4032 ft/s

Critical Slope: 0.0270 ft/ft

Critical Top Width: 3.91 ft

Calculated Max Shear Stress: 2.2348 lb/ft^2

Calculated Avg Shear Stress: 1.7157 lb/ft^2

Channel Analysis: DD-13

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0905 ft/ft

Manning's n: 0.0300

Flow: 0.9400 cfs

Result Parameters

Depth: 0.1235 ft

Area of Flow: 0.2776 ft^2

Wetted Perimeter: 2.5525 ft

Hydraulic Radius: 0.1088 ft

Average Velocity: 3.3862 ft/s

Top Width: 2.4941 ft

Froude Number: 1.7887

Critical Depth: 0.1785 ft

Critical Velocity: 2.2337 ft/s

Critical Slope: 0.0254 ft/ft

Critical Top Width: 2.71 ft

Calculated Max Shear Stress: 0.6976 lb/ft^2

Calculated Avg Shear Stress: 0.6142 lb/ft^2

Channel Analysis: DD-14a

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0324 ft/ft

Manning's n: 0.0350

Flow: 5.4700 cfs

Result Parameters

Depth: 0.4875 ft

Area of Flow: 1.4504 ft^2

Wetted Perimeter: 4.1803 ft

Hydraulic Radius: 0.3470 ft

Average Velocity: 3.7713 ft/s

Top Width: 3.9501 ft

Froude Number: 1.0968

Critical Depth: 0.5140 ft

Critical Velocity: 3.5146 ft/s

Critical Slope: 0.0266 ft/ft

Critical Top Width: 4.06 ft

Calculated Max Shear Stress: 0.9857 lb/ft^2

Calculated Avg Shear Stress: 0.7015 lb/ft^2

Channel Analysis: DD-14b

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0788 ft/ft

Manning's n: 0.0350

Flow: 6.4100 cfs

Result Parameters

Depth: 0.4173 ft

Area of Flow: 1.1829 ft^2

Wetted Perimeter: 3.8663 ft

Hydraulic Radius: 0.3060 ft

Average Velocity: 5.4187 ft/s

Top Width: 3.6693 ft

Froude Number: 1.6818

Critical Depth: 0.5624 ft

Critical Velocity: 3.6478 ft/s

Critical Slope: 0.0260 ft/ft

Critical Top Width: 4.25 ft

Calculated Max Shear Stress: 2.0520 lb/ft^2

Calculated Avg Shear Stress: 1.5045 lb/ft^2

Channel Analysis: DD-15

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0694 ft/ft

Manning's n: 0.0300

Flow: 0.2600 cfs

Result Parameters

Depth: 0.2171 ft

Area of Flow: 0.0943 ft^2

Wetted Perimeter: 0.9711 ft

Hydraulic Radius: 0.0971 ft

Average Velocity: 2.7569 ft/s

Top Width: 0.8686 ft

Froude Number: 1.4745

Critical Depth: 0.2536 ft

Critical Velocity: 2.0208 ft/s

Critical Slope: 0.0303 ft/ft

Critical Top Width: 1.01 ft

Calculated Max Shear Stress: 0.9404 lb/ft^2

Calculated Avg Shear Stress: 0.4205 lb/ft^2

Channel Analysis: DD-16

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 4.0000 ft

Longitudinal Slope: 0.0152 ft/ft

Manning's n: 0.0300

Flow: 9.1700 cfs

Result Parameters

Depth: 0.5293 ft

Area of Flow: 2.6778 ft^2

Wetted Perimeter: 6.3673 ft

Hydraulic Radius: 0.4206 ft

Average Velocity: 3.4245 ft/s

Top Width: 6.1174 ft

Froude Number: 0.9121

Critical Depth: 0.5004 ft

Critical Velocity: 3.6649 ft/s

Critical Slope: 0.0185 ft/ft

Critical Top Width: 6.00 ft

Calculated Max Shear Stress: 0.5021 lb/ft^2

Calculated Avg Shear Stress: 0.3989 lb/ft^2

Channel Analysis: DD-17

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0843 ft/ft

Manning's n: 0.0300

Flow: 0.2500 cfs

Result Parameters

Depth: 0.2063 ft

Area of Flow: 0.0851 ft^2

Wetted Perimeter: 0.9227 ft

Hydraulic Radius: 0.0923 ft

Average Velocity: 2.9366 ft/s

Top Width: 0.8253 ft

Froude Number: 1.6113

Critical Depth: 0.2497 ft

Critical Velocity: 2.0050 ft/s

Critical Slope: 0.0305 ft/ft

Critical Top Width: 1.00 ft

Calculated Max Shear Stress: 1.0853 lb/ft^2

Calculated Avg Shear Stress: 0.4854 lb/ft^2

Channel Analysis: DD-18

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0775 ft/ft

Manning's n: 0.0300

Flow: 0.2700 cfs

Result Parameters

Depth: 0.2157 ft

Area of Flow: 0.0931 ft^2

Wetted Perimeter: 0.9648 ft

Hydraulic Radius: 0.0965 ft

Average Velocity: 2.9007 ft/s

Top Width: 0.8629 ft

Froude Number: 1.5564

Critical Depth: 0.2575 ft

Critical Velocity: 2.0361 ft/s

Critical Slope: 0.0302 ft/ft

Critical Top Width: 1.03 ft

Calculated Max Shear Stress: 1.0433 lb/ft^2

Calculated Avg Shear Stress: 0.4666 lb/ft^2

Channel Analysis: DD-21

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0861 ft/ft

Manning's n: 0.0300

Flow: 0.2500 cfs

Result Parameters

Depth: 0.2055 ft

Area of Flow: 0.0845 ft^2

Wetted Perimeter: 0.9190 ft

Hydraulic Radius: 0.0919 ft

Average Velocity: 2.9599 ft/s

Top Width: 0.8220 ft

Froude Number: 1.6273

Critical Depth: 0.2497 ft

Critical Velocity: 2.0050 ft/s

Critical Slope: 0.0305 ft/ft

Critical Top Width: 1.00 ft

Calculated Max Shear Stress: 1.1041 lb/ft^2

Calculated Avg Shear Stress: 0.4938 lb/ft^2

Channel Analysis: DD-22

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0500 ft/ft

Manning's n: 0.0300

Flow: 0.3900 cfs

Result Parameters

Depth: 0.2688 ft

Area of Flow: 0.1445 ft^2

Wetted Perimeter: 1.2023 ft

Hydraulic Radius: 0.1202 ft

Average Velocity: 2.6981 ft/s

Top Width: 1.0754 ft

Froude Number: 1.2969

Critical Depth: 0.2983 ft

Critical Velocity: 2.1915 ft/s

Critical Slope: 0.0287 ft/ft

Critical Top Width: 1.19 ft

Calculated Max Shear Stress: 0.8388 lb/ft^2

Calculated Avg Shear Stress: 0.3751 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Project - Lila Canyon Operations

Designer:

Project Date: Monday, September 14, 2015

Project Units: U.S. Customary Units

Channel Analysis: DD-1

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1301 ft/ft

Manning's n: 0.0350

Flow: 4.1100 cfs

Result Parameters

Depth: 0.2724 ft

Area of Flow: 0.7676 ft^2

Wetted Perimeter: 3.7231 ft

Hydraulic Radius: 0.2062 ft

Average Velocity: 5.3545 ft/s

Top Width: 3.6347 ft

Froude Number: 2.0533

Critical Depth: 0.4110 ft

Critical Velocity: 3.0929 ft/s

Critical Slope: 0.0278 ft/ft

Critical Top Width: 4.47 ft

Calculated Max Shear Stress: 2.2118 lb/ft^2

Calculated Avg Shear Stress: 1.6737 lb/ft^2

Channel Analysis: DD-2

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1198 ft/ft

Manning's n: 0.0350

Flow: 5.1500 cfs

Result Parameters

Depth: 0.3149 ft

Area of Flow: 0.9272 ft^2

Wetted Perimeter: 3.9914 ft

Hydraulic Radius: 0.2323 ft

Average Velocity: 5.5546 ft/s

Top Width: 3.8892 ft

Froude Number: 2.0049

Critical Depth: 0.4655 ft

Critical Velocity: 3.2576 ft/s

Critical Slope: 0.0269 ft/ft

Critical Top Width: 4.79 ft

Calculated Max Shear Stress: 2.3538 lb/ft^2

Calculated Avg Shear Stress: 1.7365 lb/ft^2

Channel Analysis: DD-3

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0111 ft/ft

Manning's n: 0.0300

Flow: 0.2600 cfs

Result Parameters

Depth: 0.3062 ft

Area of Flow: 0.1875 ft^2

Wetted Perimeter: 1.3694 ft

Hydraulic Radius: 0.1369 ft

Average Velocity: 1.3865 ft/s

Top Width: 1.2248 ft

Froude Number: 0.6244

Critical Depth: 0.2536 ft

Critical Velocity: 2.0208 ft/s

Critical Slope: 0.0303 ft/ft

Critical Top Width: 1.01 ft

Calculated Max Shear Stress: 0.2121 lb/ft^2

Calculated Avg Shear Stress: 0.0949 lb/ft^2

Channel Analysis: DD-4

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1176 ft/ft

Manning's n: 0.0350

Flow: 5.5500 cfs

Result Parameters

Depth: 0.3459 ft

Area of Flow: 0.9311 ft^2

Wetted Perimeter: 3.5469 ft

Hydraulic Radius: 0.2625 ft

Average Velocity: 5.9608 ft/s

Top Width: 3.3836 ft

Froude Number: 2.0025

Critical Depth: 0.5184 ft

Critical Velocity: 3.5252 ft/s

Critical Slope: 0.0265 ft/ft

Critical Top Width: 4.07 ft

Calculated Max Shear Stress: 2.5383 lb/ft^2

Calculated Avg Shear Stress: 1.9263 lb/ft^2

Channel Analysis: DD-5a

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0333 ft/ft

Manning's n: 0.0300

Flow: 3.0000 cfs

Result Parameters

Depth: 0.3199 ft

Area of Flow: 0.8444 ft^2

Wetted Perimeter: 3.4305 ft

Hydraulic Radius: 0.2461 ft

Average Velocity: 3.5530 ft/s

Top Width: 3.2795 ft

Froude Number: 1.2339

Critical Depth: 0.3628 ft

Critical Velocity: 3.0343 ft/s

Critical Slope: 0.0212 ft/ft

Critical Top Width: 3.45 ft

Calculated Max Shear Stress: 0.6647 lb/ft^2

Calculated Avg Shear Stress: 0.5115 lb/ft^2

Channel Analysis: DD-5b

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.5545 ft/ft

Manning's n: 0.0400

Flow: 3.0000 cfs

Result Parameters

Depth: 0.1693 ft

Area of Flow: 0.3958 ft^2

Wetted Perimeter: 2.7570 ft

Hydraulic Radius: 0.1436 ft

Average Velocity: 7.5787 ft/s

Top Width: 2.6771 ft

Froude Number: 3.4732

Critical Depth: 0.3627 ft

Critical Velocity: 3.0350 ft/s

Critical Slope: 0.0377 ft/ft

Critical Top Width: 3.45 ft

Calculated Max Shear Stress: 5.8569 lb/ft^2

Calculated Avg Shear Stress: 4.9680 lb/ft^2

Channel Analysis: DD-6a

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.1176 ft/ft

Manning's n: 0.0300

Flow: 0.1300 cfs

Result Parameters

Depth: 0.1517 ft

Area of Flow: 0.0460 ft^2

Wetted Perimeter: 0.6783 ft

Hydraulic Radius: 0.0678 ft

Average Velocity: 2.8253 ft/s

Top Width: 0.6067 ft

Froude Number: 1.8079

Critical Depth: 0.1922 ft

Critical Velocity: 1.7592 ft/s

Critical Slope: 0.0332 ft/ft

Critical Top Width: 0.77 ft

Calculated Max Shear Stress: 1.1131 lb/ft^2

Calculated Avg Shear Stress: 0.4978 lb/ft^2

Channel Analysis: DD-6b

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0538 ft/ft

Manning's n: 0.0300

Flow: 0.9100 cfs

Result Parameters

Depth: 0.3643 ft

Area of Flow: 0.2655 ft^2

Wetted Perimeter: 1.6294 ft

Hydraulic Radius: 0.1629 ft

Average Velocity: 3.4275 ft/s

Top Width: 1.4574 ft

Froude Number: 1.4152

Critical Depth: 0.4186 ft

Critical Velocity: 2.5962 ft/s

Critical Slope: 0.0256 ft/ft

Critical Top Width: 1.67 ft

Calculated Max Shear Stress: 1.2232 lb/ft^2

Calculated Avg Shear Stress: 0.5470 lb/ft^2

Channel Analysis: DD-7

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0811 ft/ft

Manning's n: 0.0350

Flow: 11.9500 cfs

Result Parameters

Depth: 0.5783 ft

Area of Flow: 1.8256 ft^2

Wetted Perimeter: 4.5863 ft

Hydraulic Radius: 0.3980 ft

Average Velocity: 6.5459 ft/s

Top Width: 4.3133 ft

Froude Number: 1.7732

Critical Depth: 0.7928 ft

Critical Velocity: 4.2041 ft/s

Critical Slope: 0.0239 ft/ft

Critical Top Width: 5.17 ft

Calculated Max Shear Stress: 2.9267 lb/ft^2

Calculated Avg Shear Stress: 2.0144 lb/ft^2

Channel Analysis: DD-8

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0222 ft/ft

Manning's n: 0.0300

Flow: 16.4100 cfs

Result Parameters

Depth: 0.8763 ft

Area of Flow: 3.2885 ft^2

Wetted Perimeter: 5.9190 ft

Hydraulic Radius: 0.5556 ft

Average Velocity: 4.9901 ft/s

Top Width: 5.5053 ft

Froude Number: 1.1378

Critical Depth: 0.9383 ft

Critical Velocity: 4.5114 ft/s

Critical Slope: 0.0169 ft/ft

Critical Top Width: 5.75 ft

Calculated Max Shear Stress: 1.2139 lb/ft^2

Calculated Avg Shear Stress: 0.7696 lb/ft^2

Channel Analysis: DD-9

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0231 ft/ft

Manning's n: 0.0350

Flow: 18.4600 cfs

Result Parameters

Depth: 0.9927 ft

Area of Flow: 3.9563 ft^2

Wetted Perimeter: 6.4395 ft

Hydraulic Radius: 0.6144 ft

Average Velocity: 4.6660 ft/s

Top Width: 5.9708 ft

Froude Number: 1.0102

Critical Depth: 0.9981 ft

Critical Velocity: 4.6285 ft/s

Critical Slope: 0.0226 ft/ft

Critical Top Width: 5.99 ft

Calculated Max Shear Stress: 1.4309 lb/ft^2

Calculated Avg Shear Stress: 0.8856 lb/ft^2

Channel Analysis: DD-10

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0746 ft/ft

Manning's n: 0.0300

Flow: 0.6000 cfs

Result Parameters

Depth: 0.2931 ft

Area of Flow: 0.1719 ft^2

Wetted Perimeter: 1.3109 ft

Hydraulic Radius: 0.1311 ft

Average Velocity: 3.4913 ft/s

Top Width: 1.1725 ft

Froude Number: 1.6071

Critical Depth: 0.3544 ft

Critical Velocity: 2.3887 ft/s

Critical Slope: 0.0271 ft/ft

Critical Top Width: 1.42 ft

Calculated Max Shear Stress: 1.3646 lb/ft^2

Calculated Avg Shear Stress: 0.6102 lb/ft^2

Channel Analysis: DD-11a

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0731 ft/ft

Manning's n: 0.0350

Flow: 4.8300 cfs

Result Parameters

Depth: 0.6816 ft

Area of Flow: 0.9290 ft^2

Wetted Perimeter: 3.0480 ft

Hydraulic Radius: 0.3048 ft

Average Velocity: 5.1990 ft/s

Top Width: 2.7262 ft

Froude Number: 1.5695

Critical Depth: 0.8162 ft

Critical Velocity: 3.6250 ft/s

Critical Slope: 0.0279 ft/ft

Critical Top Width: 3.26 ft

Calculated Max Shear Stress: 3.1089 lb/ft^2

Calculated Avg Shear Stress: 1.3903 lb/ft^2

Channel Analysis: DD-11b

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0093 ft/ft

Manning's n: 0.0300

Flow: 3.2000 cfs

Result Parameters

Depth: 0.4706 ft

Area of Flow: 1.3841 ft^2

Wetted Perimeter: 4.1045 ft

Hydraulic Radius: 0.3372 ft

Average Velocity: 2.3120 ft/s

Top Width: 3.8823 ft

Froude Number: 0.6824

Critical Depth: 0.3768 ft

Critical Velocity: 3.0844 ft/s

Critical Slope: 0.0210 ft/ft

Critical Top Width: 3.51 ft

Calculated Max Shear Stress: 0.2731 lb/ft^2

Calculated Avg Shear Stress: 0.1957 lb/ft^2

Channel Analysis: DD-12a

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1532 ft/ft

Manning's n: 0.0350

Flow: 8.3000 cfs

Result Parameters

Depth: 0.4010 ft

Area of Flow: 1.1235 ft^2

Wetted Perimeter: 3.7932 ft

Hydraulic Radius: 0.2962 ft

Average Velocity: 7.3875 ft/s

Top Width: 3.6039 ft

Froude Number: 2.3317

Critical Depth: 0.6496 ft

Critical Velocity: 3.8725 ft/s

Critical Slope: 0.0251 ft/ft

Critical Top Width: 4.60 ft

Calculated Max Shear Stress: 3.8332 lb/ft^2

Calculated Avg Shear Stress: 2.8315 lb/ft^2

Channel Analysis: DD-12b

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.1429 ft/ft

Manning's n: 0.0300

Flow: 0.1000 cfs

Result Parameters

Depth: 0.1325 ft

Area of Flow: 0.0351 ft^2

Wetted Perimeter: 0.5927 ft

Hydraulic Radius: 0.0593 ft

Average Velocity: 2.8465 ft/s

Top Width: 0.5301 ft

Froude Number: 1.9486

Critical Depth: 0.1731 ft

Critical Velocity: 1.6693 ft/s

Critical Slope: 0.0344 ft/ft

Critical Top Width: 0.69 ft

Calculated Max Shear Stress: 1.1818 lb/ft^2

Calculated Avg Shear Stress: 0.5285 lb/ft^2

Channel Analysis: DD-12c

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.1105 ft/ft

Manning's n: 0.0350

Flow: 9.0800 cfs

Result Parameters

Depth: 0.4603 ft

Area of Flow: 1.3443 ft^2

Wetted Perimeter: 4.0585 ft

Hydraulic Radius: 0.3312 ft

Average Velocity: 6.7543 ft/s

Top Width: 3.8412 ft

Froude Number: 2.0120

Critical Depth: 0.6825 ft

Critical Velocity: 3.9533 ft/s

Critical Slope: 0.0248 ft/ft

Critical Top Width: 4.73 ft

Calculated Max Shear Stress: 3.1738 lb/ft^2

Calculated Avg Shear Stress: 2.2840 lb/ft^2

Channel Analysis: DD-13

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0905 ft/ft

Manning's n: 0.0300

Flow: 1.9500 cfs

Result Parameters

Depth: 0.1884 ft

Area of Flow: 0.4479 ft^2

Wetted Perimeter: 2.8427 ft

Hydraulic Radius: 0.1576 ft

Average Velocity: 4.3539 ft/s

Top Width: 2.7537 ft

Froude Number: 1.9025

Critical Depth: 0.2802 ft

Critical Velocity: 2.7186 ft/s

Critical Slope: 0.0226 ft/ft

Critical Top Width: 3.12 ft

Calculated Max Shear Stress: 1.0641 lb/ft^2

Calculated Avg Shear Stress: 0.8897 lb/ft^2

Channel Analysis: DD-14a

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0324 ft/ft

Manning's n: 0.0350

Flow: 10.4400 cfs

Result Parameters

Depth: 0.6849 ft

Area of Flow: 2.3078 ft^2

Wetted Perimeter: 5.0628 ft

Hydraulic Radius: 0.4558 ft

Average Velocity: 4.5239 ft/s

Top Width: 4.7394 ft

Froude Number: 1.1425

Critical Depth: 0.7366 ft

Critical Velocity: 4.0805 ft/s

Critical Slope: 0.0244 ft/ft

Critical Top Width: 4.95 ft

Calculated Max Shear Stress: 1.3846 lb/ft^2

Calculated Avg Shear Stress: 0.9216 lb/ft^2

Channel Analysis: DD-14b

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 2.0000 ft

Longitudinal Slope: 0.0788 ft/ft

Manning's n: 0.0350

Flow: 12.3900 cfs

Result Parameters

Depth: 0.5942 ft

Area of Flow: 1.8946 ft^2

Wetted Perimeter: 4.6574 ft

Hydraulic Radius: 0.4068 ft

Average Velocity: 6.5395 ft/s

Top Width: 4.3769 ft

Froude Number: 1.7516

Critical Depth: 0.8083 ft

Critical Velocity: 4.2385 ft/s

Critical Slope: 0.0238 ft/ft

Critical Top Width: 5.23 ft

Calculated Max Shear Stress: 2.9218 lb/ft^2

Calculated Avg Shear Stress: 2.0003 lb/ft^2

Channel Analysis: DD-15

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0694 ft/ft

Manning's n: 0.0300

Flow: 0.5300 cfs

Result Parameters

Depth: 0.2836 ft

Area of Flow: 0.1609 ft^2

Wetted Perimeter: 1.2684 ft

Hydraulic Radius: 0.1268 ft

Average Velocity: 3.2942 ft/s

Top Width: 1.1345 ft

Froude Number: 1.5416

Critical Depth: 0.3372 ft

Critical Velocity: 2.3301 ft/s

Critical Slope: 0.0276 ft/ft

Critical Top Width: 1.35 ft

Calculated Max Shear Stress: 1.2283 lb/ft^2

Calculated Avg Shear Stress: 0.5493 lb/ft^2

Channel Analysis: DD-16

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 4.0000 ft

Longitudinal Slope: 0.0152 ft/ft

Manning's n: 0.0300

Flow: 19.5900 cfs

Result Parameters

Depth: 0.8070 ft

Area of Flow: 4.5306 ft^2

Wetted Perimeter: 7.6091 ft

Hydraulic Radius: 0.5954 ft

Average Velocity: 4.3239 ft/s

Top Width: 7.2281 ft

Froude Number: 0.9625

Critical Depth: 0.7889 ft

Critical Velocity: 4.4519 ft/s

Critical Slope: 0.0165 ft/ft

Critical Top Width: 7.16 ft

Calculated Max Shear Stress: 0.7654 lb/ft^2

Calculated Avg Shear Stress: 0.5647 lb/ft^2

Channel Analysis: DD-17

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0843 ft/ft

Manning's n: 0.0300

Flow: 0.5000 cfs

Result Parameters

Depth: 0.2676 ft

Area of Flow: 0.1432 ft^2

Wetted Perimeter: 1.1966 ft

Hydraulic Radius: 0.1197 ft

Average Velocity: 3.4922 ft/s

Top Width: 1.0702 ft

Froude Number: 1.6826

Critical Depth: 0.3295 ft

Critical Velocity: 2.3031 ft/s

Critical Slope: 0.0278 ft/ft

Critical Top Width: 1.32 ft

Calculated Max Shear Stress: 1.4074 lb/ft^2

Calculated Avg Shear Stress: 0.6294 lb/ft^2

Channel Analysis: DD-18

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0775 ft/ft

Manning's n: 0.0300

Flow: 0.5600 cfs

Result Parameters

Depth: 0.2836 ft

Area of Flow: 0.1609 ft^2

Wetted Perimeter: 1.2684 ft

Hydraulic Radius: 0.1268 ft

Average Velocity: 3.4810 ft/s

Top Width: 1.1344 ft

Froude Number: 1.6290

Critical Depth: 0.3447 ft

Critical Velocity: 2.3559 ft/s

Critical Slope: 0.0274 ft/ft

Critical Top Width: 1.38 ft

Calculated Max Shear Stress: 1.3715 lb/ft^2

Calculated Avg Shear Stress: 0.6134 lb/ft^2

Channel Analysis: DD-21

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0861 ft/ft

Manning's n: 0.0300

Flow: 0.5100 cfs

Result Parameters

Depth: 0.2685 ft

Area of Flow: 0.1442 ft^2

Wetted Perimeter: 1.2007 ft

Hydraulic Radius: 0.1201 ft

Average Velocity: 3.5375 ft/s

Top Width: 1.0740 ft

Froude Number: 1.7014

Critical Depth: 0.3321 ft

Critical Velocity: 2.3123 ft/s

Critical Slope: 0.0277 ft/ft

Critical Top Width: 1.33 ft

Calculated Max Shear Stress: 1.4425 lb/ft^2

Calculated Avg Shear Stress: 0.6451 lb/ft^2

Channel Analysis: DD-22

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0500 ft/ft

Manning's n: 0.0300

Flow: 0.8000 cfs

Result Parameters

Depth: 0.3520 ft

Area of Flow: 0.2478 ft^2

Wetted Perimeter: 1.5740 ft

Hydraulic Radius: 0.1574 ft

Average Velocity: 3.2289 ft/s

Top Width: 1.4079 ft

Froude Number: 1.3564

Critical Depth: 0.3976 ft

Critical Velocity: 2.5301 ft/s

Critical Slope: 0.0261 ft/ft

Critical Top Width: 1.59 ft

Calculated Max Shear Stress: 1.0981 lb/ft^2

Calculated Avg Shear Stress: 0.4911 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Project - Lila Canyon Operations

Designer:

Project Date: Monday, September 14, 2015

Project Units: U.S. Customary Units

Channel Analysis: DC-1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.1167 ft/ft

Manning's n: 0.0240

Flow: 1.6600 cfs

Result Parameters

Depth: 0.2963 ft

Area of Flow: 0.2472 ft^2

Wetted Perimeter: 1.3817 ft

Hydraulic Radius: 0.1789 ft

Average Velocity: 6.7154 ft/s

Top Width: 1.1944 ft

Froude Number: 2.6014

Critical Depth: 0.4841 ft

Critical Velocity: 3.3652 ft/s

Critical Slope: 0.0168 ft/ft

Critical Top Width: 1.40 ft

Calculated Max Shear Stress: 2.1578 lb/ft^2

Calculated Avg Shear Stress: 1.3028 lb/ft^2

Channel Analysis: DC-2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.1000 ft/ft

Manning's n: 0.0240

Flow: 2.0800 cfs

Result Parameters

Depth: 0.3444 ft

Area of Flow: 0.3063 ft^2

Wetted Perimeter: 1.4991 ft

Hydraulic Radius: 0.2043 ft

Average Velocity: 6.7913 ft/s

Top Width: 1.2617 ft

Froude Number: 2.4291

Critical Depth: 0.5442 ft

Critical Velocity: 3.5938 ft/s

Critical Slope: 0.0169 ft/ft

Critical Top Width: 1.44 ft

Calculated Max Shear Stress: 2.1490 lb/ft^2

Calculated Avg Shear Stress: 1.2749 lb/ft^2

Channel Analysis: DC-3

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.5400 ft/ft

Manning's n: 0.0240

Flow: 0.1300 cfs

Result Parameters

Depth: 0.0612 ft

Area of Flow: 0.0244 ft^2

Wetted Perimeter: 0.6102 ft

Hydraulic Radius: 0.0400 ft

Average Velocity: 5.3240 ft/s

Top Width: 0.5935 ft

Froude Number: 4.6254

Critical Depth: 0.1322 ft

Critical Velocity: 1.7019 ft/s

Critical Slope: 0.0204 ft/ft

Critical Top Width: 0.85 ft

Calculated Max Shear Stress: 2.0622 lb/ft^2

Calculated Avg Shear Stress: 1.3485 lb/ft^2

Channel Analysis: DC-4

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0750 ft/ft

Manning's n: 0.0240

Flow: 2.4100 cfs

Result Parameters

Depth: 0.3628 ft

Area of Flow: 0.3888 ft^2

Wetted Perimeter: 1.7598 ft

Hydraulic Radius: 0.2209 ft

Average Velocity: 6.1982 ft/s

Top Width: 1.5414 ft

Froude Number: 2.1748

Critical Depth: 0.5400 ft

Critical Velocity: 3.5212 ft/s

Critical Slope: 0.0152 ft/ft

Critical Top Width: 1.78 ft

Calculated Max Shear Stress: 1.6978 lb/ft^2

Calculated Avg Shear Stress: 1.0340 lb/ft^2

Channel Analysis: DC-5

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0471 ft/ft

Manning's n: 0.0240

Flow: 1.9300 cfs

Result Parameters

Depth: 0.3647 ft

Area of Flow: 0.3918 ft^2

Wetted Perimeter: 1.7648 ft

Hydraulic Radius: 0.2220 ft

Average Velocity: 4.9261 ft/s

Top Width: 1.5445 ft

Froude Number: 1.7236

Critical Depth: 0.4819 ft

Critical Velocity: 3.3100 ft/s

Critical Slope: 0.0153 ft/ft

Critical Top Width: 1.71 ft

Calculated Max Shear Stress: 1.0719 lb/ft^2

Calculated Avg Shear Stress: 0.6525 lb/ft^2

Channel Analysis: DC-6

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.2804 ft/ft

Manning's n: 0.0240

Flow: 4.7600 cfs

Result Parameters

Depth: 0.3666 ft

Area of Flow: 0.3948 ft^2

Wetted Perimeter: 1.7698 ft

Hydraulic Radius: 0.2231 ft

Average Velocity: 12.0576 ft/s

Top Width: 1.5477 ft

Froude Number: 4.2073

Critical Depth: 0.7676 ft

Critical Velocity: 4.2876 ft/s

Critical Slope: 0.0155 ft/ft

Critical Top Width: 1.95 ft

Calculated Max Shear Stress: 6.4150 lb/ft^2

Calculated Avg Shear Stress: 3.9029 lb/ft^2

Channel Analysis: DC-7

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0774 ft/ft

Manning's n: 0.0240

Flow: 4.8800 cfs

Result Parameters

Depth: 0.5113 ft

Area of Flow: 0.6338 ft^2

Wetted Perimeter: 2.1203 ft

Hydraulic Radius: 0.2989 ft

Average Velocity: 7.7000 ft/s

Top Width: 1.7449 ft

Froude Number: 2.2515

Critical Depth: 0.7773 ft

Critical Velocity: 4.3217 ft/s

Critical Slope: 0.0155 ft/ft

Critical Top Width: 1.95 ft

Calculated Max Shear Stress: 2.4693 lb/ft^2

Calculated Avg Shear Stress: 1.4436 lb/ft^2

Channel Analysis: DC-8

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0599 ft/ft

Manning's n: 0.0240

Flow: 5.0900 cfs

Result Parameters

Depth: 0.5575 ft

Area of Flow: 0.7155 ft^2

Wetted Perimeter: 2.2247 ft

Hydraulic Radius: 0.3216 ft

Average Velocity: 7.1136 ft/s

Top Width: 1.7935 ft

Froude Number: 1.9847

Critical Depth: 0.7949 ft

Critical Velocity: 4.3746 ft/s

Critical Slope: 0.0156 ft/ft

Critical Top Width: 1.96 ft

Calculated Max Shear Stress: 2.0837 lb/ft^2

Calculated Avg Shear Stress: 1.2022 lb/ft^2

Channel Analysis: DC-9

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0591 ft/ft

Manning's n: 0.0240

Flow: 5.2500 cfs

Result Parameters

Depth: 0.5683 ft

Area of Flow: 0.7351 ft^2

Wetted Perimeter: 2.2489 ft

Hydraulic Radius: 0.3269 ft

Average Velocity: 7.1423 ft/s

Top Width: 1.8041 ft

Froude Number: 1.9718

Critical Depth: 0.8076 ft

Critical Velocity: 4.4176 ft/s

Critical Slope: 0.0156 ft/ft

Critical Top Width: 1.96 ft

Calculated Max Shear Stress: 2.0959 lb/ft^2

Calculated Avg Shear Stress: 1.2054 lb/ft^2

Channel Analysis: DC-10

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0227 ft/ft

Manning's n: 0.0240

Flow: 5.4500 cfs

Result Parameters

Depth: 0.7446 ft

Area of Flow: 1.0657 ft^2

Wetted Perimeter: 2.6251 ft

Hydraulic Radius: 0.4059 ft

Average Velocity: 5.1142 ft/s

Top Width: 1.9337 ft

Froude Number: 1.2140

Critical Depth: 0.8237 ft

Critical Velocity: 4.4669 ft/s

Critical Slope: 0.0157 ft/ft

Critical Top Width: 1.97 ft

Calculated Max Shear Stress: 1.0548 lb/ft^2

Calculated Avg Shear Stress: 0.5750 lb/ft^2

Channel Analysis: DC-11

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0495 ft/ft

Manning's n: 0.0240

Flow: 7.8600 cfs

Result Parameters

Depth: 0.7352 ft

Area of Flow: 1.0475 ft^2

Wetted Perimeter: 2.6057 ft

Hydraulic Radius: 0.4020 ft

Average Velocity: 7.5035 ft/s

Top Width: 1.9286 ft

Froude Number: 1.7942

Critical Depth: 0.9971 ft

Critical Velocity: 5.0226 ft/s

Critical Slope: 0.0166 ft/ft

Critical Top Width: 2.00 ft

Calculated Max Shear Stress: 2.2710 lb/ft^2

Calculated Avg Shear Stress: 1.2417 lb/ft^2

Channel Analysis: DC-12a

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0150

Flow: 8.6200 cfs

Result Parameters

Depth: 1.0096 ft

Area of Flow: 1.8572 ft^2

Wetted Perimeter: 3.4432 ft

Hydraulic Radius: 0.5394 ft

Average Velocity: 4.6415 ft/s

Top Width: 2.4533 ft

Froude Number: 0.9401

Critical Depth: 0.9778 ft

Critical Velocity: 4.8448 ft/s

Critical Slope: 0.0056 ft/ft

Critical Top Width: 2.44 ft

Calculated Max Shear Stress: 0.3150 lb/ft^2

Calculated Avg Shear Stress: 0.1683 lb/ft^2

Channel Analysis: DC-12b

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0155 ft/ft

Manning's n: 0.0150

Flow: 8.6200 cfs

Result Parameters

Depth: 0.8208 ft

Area of Flow: 1.2144 ft^2

Wetted Perimeter: 2.7813 ft

Hydraulic Radius: 0.4366 ft

Average Velocity: 7.0983 ft/s

Top Width: 1.9676 ft

Froude Number: 1.5923

Critical Depth: 1.0469 ft

Critical Velocity: 5.1787 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 2.00 ft

Calculated Max Shear Stress: 0.7939 lb/ft^2

Calculated Avg Shear Stress: 0.4223 lb/ft^2

Channel Analysis: DC-12c

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0246 ft/ft

Manning's n: 0.0150

Flow: 8.6200 cfs

Result Parameters

Depth: 0.7242 ft

Area of Flow: 1.0263 ft^2

Wetted Perimeter: 2.5828 ft

Hydraulic Radius: 0.3974 ft

Average Velocity: 8.3989 ft/s

Top Width: 1.9224 ft

Froude Number: 2.0257

Critical Depth: 1.0469 ft

Critical Velocity: 5.1787 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 2.00 ft

Calculated Max Shear Stress: 1.1117 lb/ft^2

Calculated Avg Shear Stress: 0.6100 lb/ft^2

Channel Analysis: DC-12d

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0034 ft/ft

Manning's n: 0.0150

Flow: 8.6200 cfs

Result Parameters

Depth: 1.1240 ft

Area of Flow: 2.1399 ft^2

Wetted Perimeter: 3.6746 ft

Hydraulic Radius: 0.5824 ft

Average Velocity: 4.0282 ft/s

Top Width: 2.4873 ft

Froude Number: 0.7653

Critical Depth: 0.9778 ft

Critical Velocity: 4.8448 ft/s

Critical Slope: 0.0056 ft/ft

Critical Top Width: 2.44 ft

Calculated Max Shear Stress: 0.2385 lb/ft^2

Calculated Avg Shear Stress: 0.1236 lb/ft^2

Channel Analysis: DC-13

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0333 ft/ft

Manning's n: 0.0240

Flow: 2.7000 cfs

Result Parameters

Depth: 0.5219 ft

Area of Flow: 0.5468 ft^2

Wetted Perimeter: 1.8927 ft

Hydraulic Radius: 0.2889 ft

Average Velocity: 4.9380 ft/s

Top Width: 1.4289 ft

Froude Number: 1.4068

Critical Depth: 0.6233 ft

Critical Velocity: 3.8882 ft/s

Critical Slope: 0.0173 ft/ft

Critical Top Width: 1.48 ft

Calculated Max Shear Stress: 1.0845 lb/ft^2

Calculated Avg Shear Stress: 0.6003 lb/ft^2

Channel Analysis: DC-14

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0500 ft/ft

Manning's n: 0.0240

Flow: 4.8400 cfs

Result Parameters

Depth: 0.6415 ft

Area of Flow: 0.7214 ft^2

Wetted Perimeter: 2.1385 ft

Hydraulic Radius: 0.3374 ft

Average Velocity: 6.7091 ft/s

Top Width: 1.4842 ft

Froude Number: 1.6959

Critical Depth: 0.8459 ft

Critical Velocity: 4.7123 ft/s

Critical Slope: 0.0195 ft/ft

Critical Top Width: 1.49 ft

Calculated Max Shear Stress: 2.0015 lb/ft^2

Calculated Avg Shear Stress: 1.0525 lb/ft^2

Channel Analysis: DC-15

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0222 ft/ft

Manning's n: 0.0240

Flow: 0.2700 cfs

Result Parameters

Depth: 0.1835 ft

Area of Flow: 0.1236 ft^2

Wetted Perimeter: 1.0721 ft

Hydraulic Radius: 0.1153 ft

Average Velocity: 2.1849 ft/s

Top Width: 0.9831 ft

Froude Number: 1.0860

Critical Depth: 0.1913 ft

Critical Velocity: 2.0560 ft/s

Critical Slope: 0.0187 ft/ft

Critical Top Width: 1.00 ft

Calculated Max Shear Stress: 0.2542 lb/ft^2

Calculated Avg Shear Stress: 0.1597 lb/ft^2

Channel Analysis: DC-16

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.1120 ft/ft

Manning's n: 0.0240

Flow: 0.5200 cfs

Result Parameters

Depth: 0.1705 ft

Area of Flow: 0.1110 ft^2

Wetted Perimeter: 1.0316 ft

Hydraulic Radius: 0.1076 ft

Average Velocity: 4.6867 ft/s

Top Width: 0.9522 ft

Froude Number: 2.4196

Critical Depth: 0.2670 ft

Critical Velocity: 2.4434 ft/s

Critical Slope: 0.0175 ft/ft

Critical Top Width: 1.15 ft

Calculated Max Shear Stress: 1.1915 lb/ft^2

Calculated Avg Shear Stress: 0.7517 lb/ft^2

Channel Analysis: DC-17

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0150 ft/ft

Manning's n: 0.0240

Flow: 0.5800 cfs

Result Parameters

Depth: 0.2926 ft

Area of Flow: 0.2427 ft^2

Wetted Perimeter: 1.3723 ft

Hydraulic Radius: 0.1769 ft

Average Velocity: 2.3893 ft/s

Top Width: 1.1887 ft

Froude Number: 0.9318

Critical Depth: 0.2823 ft

Critical Velocity: 2.5145 ft/s

Critical Slope: 0.0173 ft/ft

Critical Top Width: 1.17 ft

Calculated Max Shear Stress: 0.2739 lb/ft^2

Calculated Avg Shear Stress: 0.1656 lb/ft^2

Channel Analysis: DC-18

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0373 ft/ft

Manning's n: 0.0240

Flow: 0.3900 cfs

Result Parameters

Depth: 0.1933 ft

Area of Flow: 0.1333 ft^2

Wetted Perimeter: 1.1015 ft

Hydraulic Radius: 0.1210 ft

Average Velocity: 2.9259 ft/s

Top Width: 1.0052 ft

Froude Number: 1.4160

Critical Depth: 0.2307 ft

Critical Velocity: 2.2626 ft/s

Critical Slope: 0.0179 ft/ft

Critical Top Width: 1.08 ft

Calculated Max Shear Stress: 0.4499 lb/ft^2

Calculated Avg Shear Stress: 0.2816 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Project - Lila Canyon Operations

Designer:

Project Date: Monday, September 14, 2015

Project Units: U.S. Customary Units

Channel Analysis: DC-1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.1167 ft/ft

Manning's n: 0.0240

Flow: 4.1100 cfs

Result Parameters

Depth: 0.4682 ft

Area of Flow: 0.4711 ft^2

Wetted Perimeter: 1.7785 ft

Hydraulic Radius: 0.2649 ft

Average Velocity: 8.7244 ft/s

Top Width: 1.3901 ft

Froude Number: 2.6411

Critical Depth: 0.7764 ft

Critical Velocity: 4.4523 ft/s

Critical Slope: 0.0186 ft/ft

Critical Top Width: 1.50 ft

Calculated Max Shear Stress: 3.4098 lb/ft^2

Calculated Avg Shear Stress: 1.9289 lb/ft^2

Channel Analysis: DC-2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.1000 ft/ft

Manning's n: 0.0240

Flow: 5.1500 cfs

Result Parameters

Depth: 0.5493 ft

Area of Flow: 0.5861 ft^2

Wetted Perimeter: 1.9498 ft

Hydraulic Radius: 0.3006 ft

Average Velocity: 8.7863 ft/s

Top Width: 1.4453 ft

Froude Number: 2.4314

Critical Depth: 0.8738 ft

Critical Velocity: 4.8203 ft/s

Critical Slope: 0.0199 ft/ft

Critical Top Width: 1.48 ft

Calculated Max Shear Stress: 3.4276 lb/ft^2

Calculated Avg Shear Stress: 1.8758 lb/ft^2

Channel Analysis: DC-3

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.5400 ft/ft

Manning's n: 0.0240

Flow: 0.2600 cfs

Result Parameters

Depth: 0.0847 ft

Area of Flow: 0.0395 ft^2

Wetted Perimeter: 0.7196 ft

Hydraulic Radius: 0.0549 ft

Average Velocity: 6.5760 ft/s

Top Width: 0.6923 ft

Froude Number: 4.8493

Critical Depth: 0.1877 ft

Critical Velocity: 2.0364 ft/s

Critical Slope: 0.0188 ft/ft

Critical Top Width: 0.99 ft

Calculated Max Shear Stress: 2.8527 lb/ft^2

Calculated Avg Shear Stress: 1.8514 lb/ft^2

Channel Analysis: DC-4

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0750 ft/ft

Manning's n: 0.0240

Flow: 5.8100 cfs

Result Parameters

Depth: 0.5632 ft

Area of Flow: 0.7258 ft^2

Wetted Perimeter: 2.2375 ft

Hydraulic Radius: 0.3244 ft

Average Velocity: 8.0051 ft/s

Top Width: 1.7991 ft

Froude Number: 2.2211

Critical Depth: 0.8516 ft

Critical Velocity: 4.5568 ft/s

Critical Slope: 0.0158 ft/ft

Critical Top Width: 1.98 ft

Calculated Max Shear Stress: 2.6357 lb/ft^2

Calculated Avg Shear Stress: 1.5181 lb/ft^2

Channel Analysis: DC-5

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0471 ft/ft

Manning's n: 0.0240

Flow: 3.9100 cfs

Result Parameters

Depth: 0.5182 ft

Area of Flow: 0.6459 ft^2

Wetted Perimeter: 2.1362 ft

Hydraulic Radius: 0.3024 ft

Average Velocity: 6.0532 ft/s

Top Width: 1.7526 ft

Froude Number: 1.7571

Critical Depth: 0.6934 ft

Critical Velocity: 4.0423 ft/s

Critical Slope: 0.0153 ft/ft

Critical Top Width: 1.90 ft

Calculated Max Shear Stress: 1.5231 lb/ft^2

Calculated Avg Shear Stress: 0.8887 lb/ft^2

Channel Analysis: DC-6

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.2804 ft/ft

Manning's n: 0.0240

Flow: 10.5700 cfs

Result Parameters

Depth: 0.5459 ft

Area of Flow: 0.6948 ft^2

Wetted Perimeter: 2.1988 ft

Hydraulic Radius: 0.3160 ft

Average Velocity: 15.2123 ft/s

Top Width: 1.7819 ft

Froude Number: 4.2931

Critical Depth: 1.1650 ft

Critical Velocity: 5.5650 ft/s

Critical Slope: 0.0181 ft/ft

Critical Top Width: 1.97 ft

Calculated Max Shear Stress: 9.5514 lb/ft^2

Calculated Avg Shear Stress: 5.5290 lb/ft^2

Channel Analysis: DC-7

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0774 ft/ft

Manning's n: 0.0240

Flow: 10.8000 cfs

Result Parameters

Depth: 0.7736 ft

Area of Flow: 1.1218 ft^2

Wetted Perimeter: 2.6847 ft

Hydraulic Radius: 0.4178 ft

Average Velocity: 9.6274 ft/s

Top Width: 1.9480 ft

Froude Number: 2.2357

Critical Depth: 1.1777 ft

Critical Velocity: 5.6122 ft/s

Critical Slope: 0.0182 ft/ft

Critical Top Width: 1.97 ft

Calculated Max Shear Stress: 3.7361 lb/ft^2

Calculated Avg Shear Stress: 2.0181 lb/ft^2

Channel Analysis: DC-8

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0599 ft/ft

Manning's n: 0.0240

Flow: 11.2300 cfs

Result Parameters

Depth: 0.8478 ft

Area of Flow: 1.2676 ft^2

Wetted Perimeter: 2.8361 ft

Hydraulic Radius: 0.4470 ft

Average Velocity: 8.8591 ft/s

Top Width: 1.9767 ft

Froude Number: 1.9496

Critical Depth: 1.2021 ft

Critical Velocity: 5.6938 ft/s

Critical Slope: 0.0185 ft/ft

Critical Top Width: 1.96 ft

Calculated Max Shear Stress: 3.1690 lb/ft^2

Calculated Avg Shear Stress: 1.6707 lb/ft^2

Channel Analysis: DC-9

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0591 ft/ft

Manning's n: 0.0240

Flow: 11.5500 cfs

Result Parameters

Depth: 0.8644 ft

Area of Flow: 1.3005 ft^2

Wetted Perimeter: 2.8696 ft

Hydraulic Radius: 0.4532 ft

Average Velocity: 8.8813 ft/s

Top Width: 1.9815 ft

Froude Number: 1.9319

Critical Depth: 1.2197 ft

Critical Velocity: 5.7558 ft/s

Critical Slope: 0.0187 ft/ft

Critical Top Width: 1.95 ft

Calculated Max Shear Stress: 3.1879 lb/ft^2

Calculated Avg Shear Stress: 1.6713 lb/ft^2

Channel Analysis: DC-10

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0227 ft/ft

Manning's n: 0.0240

Flow: 11.9500 cfs

Result Parameters

Depth: 1.1714 ft

Area of Flow: 1.9118 ft^2

Wetted Perimeter: 3.4860 ft

Hydraulic Radius: 0.5484 ft

Average Velocity: 6.2506 ft/s

Top Width: 1.9704 ft

Froude Number: 1.1183

Critical Depth: 1.2422 ft

Critical Velocity: 5.8281 ft/s

Critical Slope: 0.0190 ft/ft

Critical Top Width: 1.94 ft

Calculated Max Shear Stress: 1.6592 lb/ft^2

Calculated Avg Shear Stress: 0.7768 lb/ft^2

Channel Analysis: DC-11

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0495 ft/ft

Manning's n: 0.0240

Flow: 16.9200 cfs

Result Parameters

Depth: 1.1405 ft

Area of Flow: 1.8509 ft^2

Wetted Perimeter: 3.4235 ft

Hydraulic Radius: 0.5406 ft

Average Velocity: 9.1417 ft/s

Top Width: 1.9802 ft

Froude Number: 1.6663

Critical Depth: 1.4824 ft

Critical Velocity: 6.7767 ft/s

Critical Slope: 0.0236 ft/ft

Critical Top Width: 1.75 ft

Calculated Max Shear Stress: 3.5228 lb/ft^2

Calculated Avg Shear Stress: 1.6699 lb/ft^2

Channel Analysis: DC-12a

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0150

Flow: 18.4600 cfs

Result Parameters

Depth: 1.5920 ft

Area of Flow: 3.2987 ft^2

Wetted Perimeter: 4.6199 ft

Hydraulic Radius: 0.7140 ft

Average Velocity: 5.5962 ft/s

Top Width: 2.4046 ft

Froude Number: 0.8420

Critical Depth: 1.4551 ft

Critical Velocity: 6.2265 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 2.47 ft

Calculated Max Shear Stress: 0.4967 lb/ft^2

Calculated Avg Shear Stress: 0.2228 lb/ft^2

Channel Analysis: DC-12b

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0155 ft/ft

Manning's n: 0.0150

Flow: 18.4600 cfs

Result Parameters

Depth: 1.2998 ft

Area of Flow: 2.1613 ft^2

Wetted Perimeter: 3.7506 ft

Hydraulic Radius: 0.5763 ft

Average Velocity: 8.5410 ft/s

Top Width: 1.9080 ft

Froude Number: 1.4142

Critical Depth: 1.5469 ft

Critical Velocity: 7.0802 ft/s

Critical Slope: 0.0099 ft/ft

Critical Top Width: 1.67 ft

Calculated Max Shear Stress: 1.2572 lb/ft^2

Calculated Avg Shear Stress: 0.5574 lb/ft^2

Channel Analysis: DC-12c

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.0000 ft

Longitudinal Slope: 0.0246 ft/ft

Manning's n: 0.0150

Flow: 18.4600 cfs

Result Parameters

Depth: 1.1169 ft

Area of Flow: 1.8041 ft^2

Wetted Perimeter: 3.3760 ft

Hydraulic Radius: 0.5344 ft

Average Velocity: 10.2322 ft/s

Top Width: 1.9863 ft

Froude Number: 1.8920

Critical Depth: 1.5469 ft

Critical Velocity: 7.0802 ft/s

Critical Slope: 0.0099 ft/ft

Critical Top Width: 1.67 ft

Calculated Max Shear Stress: 1.7145 lb/ft^2

Calculated Avg Shear Stress: 0.8203 lb/ft^2

Channel Analysis: DC-12d

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0034 ft/ft

Manning's n: 0.0150

Flow: 18.4600 cfs

Result Parameters

Depth: 1.8380 ft

Area of Flow: 3.8681 ft^2

Wetted Perimeter: 5.1513 ft

Hydraulic Radius: 0.7509 ft

Average Velocity: 4.7723 ft/s

Top Width: 2.2062 ft

Froude Number: 0.6351

Critical Depth: 1.4551 ft

Critical Velocity: 6.2265 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 2.47 ft

Calculated Max Shear Stress: 0.3899 lb/ft^2

Calculated Avg Shear Stress: 0.1593 lb/ft^2

Channel Analysis: DC-13

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0333 ft/ft

Manning's n: 0.0240

Flow: 4.8300 cfs

Result Parameters

Depth: 0.7190 ft

Area of Flow: 0.8371 ft^2

Wetted Perimeter: 2.2943 ft

Hydraulic Radius: 0.3649 ft

Average Velocity: 5.7696 ft/s

Top Width: 1.4987 ft

Froude Number: 1.3604

Critical Depth: 0.8452 ft

Critical Velocity: 4.7076 ft/s

Critical Slope: 0.0194 ft/ft

Critical Top Width: 1.49 ft

Calculated Max Shear Stress: 1.4941 lb/ft^2

Calculated Avg Shear Stress: 0.7582 lb/ft^2

Channel Analysis: DC-14

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0500 ft/ft

Manning's n: 0.0240

Flow: 11.1400 cfs

Result Parameters

Depth: 1.0876 ft

Area of Flow: 1.3723 ft^2

Wetted Perimeter: 3.0565 ft

Hydraulic Radius: 0.4490 ft

Average Velocity: 8.1178 ft/s

Top Width: 1.3395 ft

Froude Number: 1.4134

Critical Depth: 1.2766 ft

Critical Velocity: 6.9510 ft/s

Critical Slope: 0.0360 ft/ft

Critical Top Width: 1.07 ft

Calculated Max Shear Stress: 3.3933 lb/ft^2

Calculated Avg Shear Stress: 1.4008 lb/ft^2

Channel Analysis: DC-15

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0222 ft/ft

Manning's n: 0.0240

Flow: 0.5600 cfs

Result Parameters

Depth: 0.2612 ft

Area of Flow: 0.2062 ft^2

Wetted Perimeter: 1.2914 ft

Hydraulic Radius: 0.1597 ft

Average Velocity: 2.7153 ft/s

Top Width: 1.1377 ft

Froude Number: 1.1239

Critical Depth: 0.2772 ft

Critical Velocity: 2.4926 ft/s

Critical Slope: 0.0174 ft/ft

Critical Top Width: 1.16 ft

Calculated Max Shear Stress: 0.3618 lb/ft^2

Calculated Avg Shear Stress: 0.2212 lb/ft^2

Channel Analysis: DC-16

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.1120 ft/ft

Manning's n: 0.0240

Flow: 1.0600 cfs

Result Parameters

Depth: 0.2403 ft

Area of Flow: 0.1828 ft^2

Wetted Perimeter: 1.2354 ft

Hydraulic Radius: 0.1480 ft

Average Velocity: 5.7972 ft/s

Top Width: 1.1004 ft

Froude Number: 2.5062

Critical Depth: 0.3842 ft

Critical Velocity: 2.9657 ft/s

Critical Slope: 0.0168 ft/ft

Critical Top Width: 1.31 ft

Calculated Max Shear Stress: 1.6795 lb/ft^2

Calculated Avg Shear Stress: 1.0344 lb/ft^2

Channel Analysis: DC-17

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0150 ft/ft

Manning's n: 0.0240

Flow: 1.1700 cfs

Result Parameters

Depth: 0.4158 ft

Area of Flow: 0.3994 ft^2

Wetted Perimeter: 1.6634 ft

Hydraulic Radius: 0.2401 ft

Average Velocity: 2.9294 ft/s

Top Width: 1.3428 ft

Froude Number: 0.9466

Critical Depth: 0.4043 ft

Critical Velocity: 3.0468 ft/s

Critical Slope: 0.0167 ft/ft

Critical Top Width: 1.33 ft

Calculated Max Shear Stress: 0.3892 lb/ft^2

Calculated Avg Shear Stress: 0.2247 lb/ft^2

Channel Analysis: DC-18

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0373 ft/ft

Manning's n: 0.0240

Flow: 0.8000 cfs

Result Parameters

Depth: 0.2739 ft

Area of Flow: 0.2209 ft^2

Wetted Perimeter: 1.3247 ft

Hydraulic Radius: 0.1667 ft

Average Velocity: 3.6222 ft/s

Top Width: 1.1591 ft

Froude Number: 1.4623

Critical Depth: 0.3325 ft

Critical Velocity: 2.7455 ft/s

Critical Slope: 0.0170 ft/ft

Critical Top Width: 1.25 ft

Calculated Max Shear Stress: 0.6376 lb/ft^2

Calculated Avg Shear Stress: 0.3881 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Thursday, October 01, 2015

Project Units: U.S. Customary Units

Channel Analysis: SP2-1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0240

Flow: 2.7200 cfs

Result Parameters

Depth: 0.9037 ft

Area of Flow: 1.1125 ft^2

Wetted Perimeter: 2.6658 ft

Hydraulic Radius: 0.4173 ft

Average Velocity: 2.4449 ft/s

Top Width: 1.4682 ft

Froude Number: 0.4950

Critical Depth: 0.6255 ft

Critical Velocity: 3.8987 ft/s

Critical Slope: 0.0173 ft/ft

Critical Top Width: 1.48 ft

Calculated Max Shear Stress: 0.2820 lb/ft^2

Calculated Avg Shear Stress: 0.1302 lb/ft^2

Lila Canyon Mine
APPENDIX 1 - Culvert Outlet Rip-Rap Apron Flow Velocity Calculations

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Thursday, October 01, 2015

Project Units: U.S. Customary Units

Channel Analysis: UC-1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 5.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0240

Flow: 55.6000 cfs

Result Parameters

Depth: 2.6677 ft

Area of Flow: 10.6553 ft^2

Wetted Perimeter: 8.1896 ft

Hydraulic Radius: 1.3011 ft

Average Velocity: 5.2180 ft/s

Top Width: 4.9887 ft

Froude Number: 0.6292

Critical Depth: 2.0947 ft

Critical Velocity: 7.1282 ft/s

Critical Slope: 0.0116 ft/ft

Critical Top Width: 4.93 ft

Calculated Max Shear Stress: 0.8323 lb/ft^2

Calculated Avg Shear Stress: 0.4059 lb/ft^2

Hydraulic Analysis Report

Project Data

Project Title: Lila Canyon

Designer:

Project Date: Thursday, October 01, 2015

Project Units: U.S. Customary Units

Channel Analysis: UC-1 Outlet Velocity - 100/6

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 5.0000 ft

Longitudinal Slope: 0.0090 ft/ft

Manning's n: 0.0250

Flow: 55.6000 cfs

Result Parameters

Depth: 2.2993 ft

Area of Flow: 8.8153 ft^2

Wetted Perimeter: 7.4522 ft

Hydraulic Radius: 1.1829 ft

Average Velocity: 6.3072 ft/s

Top Width: 4.9839 ft

Froude Number: 0.8357

Critical Depth: 2.0947 ft

Critical Velocity: 7.1282 ft/s

Critical Slope: 0.0125 ft/ft

Critical Top Width: 4.93 ft

Calculated Max Shear Stress: 1.2913 lb/ft^2

Calculated Avg Shear Stress: 0.6643 lb/ft^2

Channel Analysis: UC-1 Apron Overfall - 100/6

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Channel Width: 8.0000 ft

Longitudinal Slope: 0.0010 ft/ft

Manning's n: 0.0450

Flow: 55.6000 cfs

Result Parameters

Depth: 2.6912 ft

Area of Flow: 36.0154 ft^2

Wetted Perimeter: 20.0356 ft

Hydraulic Radius: 1.7976 ft

Average Velocity: 1.5438 ft/s

Top Width: 18.7649 ft

Froude Number: 0.1964

Critical Depth: 1.0443 ft

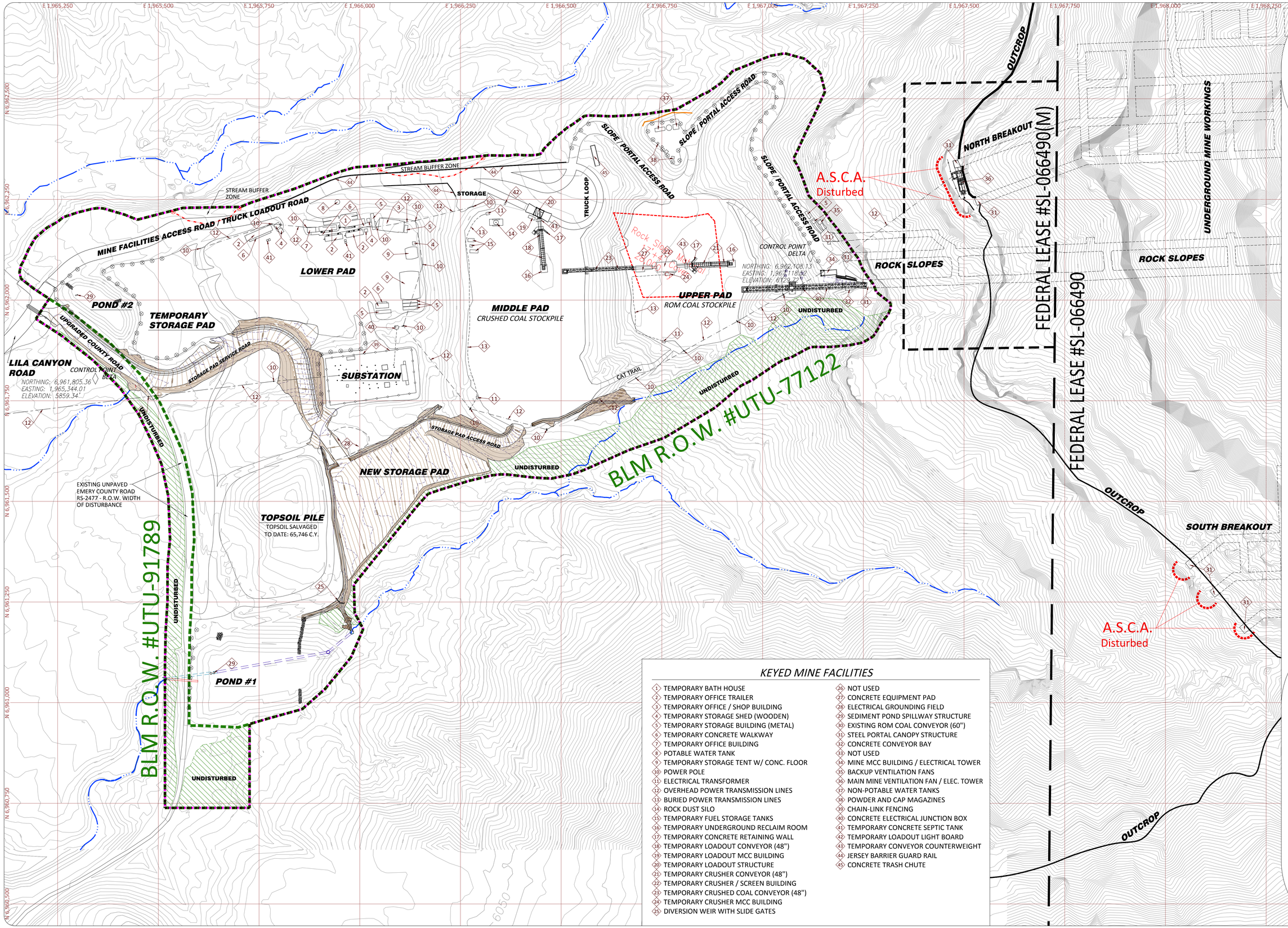
Critical Velocity: 5.2771 ft/s

Critical Slope: 0.0327 ft/ft

Critical Top Width: 12.18 ft

Calculated Max Shear Stress: 0.1679 lb/ft^2

Calculated Avg Shear Stress: 0.1122 lb/ft^2



KEYED MINE FACILITIES

1. TEMPORARY BATH HOUSE
2. TEMPORARY OFFICE TRAILER
3. TEMPORARY OFFICE / SHOP BUILDING
4. TEMPORARY STORAGE SHED (WOODEN)
5. TEMPORARY STORAGE BUILDING (METAL)
6. TEMPORARY CONCRETE WALKWAY
7. TEMPORARY OFFICE BUILDING
8. POTABLE WATER TANK
9. TEMPORARY STORAGE TENT W/ CONC. FLOOR
10. POWER POLE
11. ELECTRICAL TRANSFORMER
12. OVERHEAD POWER TRANSMISSION LINES
13. BURIED POWER TRANSMISSION LINES
14. ROCK DUST SILO
15. TEMPORARY FUEL STORAGE TANKS
16. TEMPORARY UNDERGROUND RECLAIM ROOM
17. TEMPORARY CONCRETE RETAINING WALL
18. TEMPORARY LOADOUT CONVEYOR (48")
19. TEMPORARY LOADOUT MCC BUILDING
20. TEMPORARY LOADOUT STRUCTURE
21. TEMPORARY CRUSHER CONVEYOR (48")
22. TEMPORARY CRUSHER / SCREEN BUILDING
23. TEMPORARY CRUSHED COAL CONVEYOR (48")
24. TEMPORARY CRUSHER MCC BUILDING
25. DIVERSION WEIR WITH SLIDE GATES
26. NOT USED
27. CONCRETE EQUIPMENT PAD
28. ELECTRICAL GROUNDING FIELD
29. SEDIMENT POND SPILLWAY STRUCTURE
30. EXISTING ROM COAL CONVEYOR (60")
31. STEEL PORTAL CANOPY STRUCTURE
32. CONCRETE CONVEYOR BAY
33. NOT USED
34. MINE MCC BUILDING / ELECTRICAL TOWER
35. BACKUP VENTILATION FANS
36. MAIN MINE VENTILATION FAN / ELEC. TOWER
37. NON-POTABLE WATER TANKS
38. POWDER AND CAP MAGAZINES
39. CHAIN-LINK FENCING
40. CONCRETE ELECTRICAL JUNCTION BOX
41. TEMPORARY CONCRETE SEPTIC TANK
42. TEMPORARY LOADOUT LIGHT BOARD
43. TEMPORARY CONVEYOR COUNTERWEIGHT
44. JERSEY BARRIER GUARD RAIL
45. CONCRETE TRASH CHUTE

LEGEND:

- UNDISTURBED WITHIN THE DISTURBED AREA
- DISTURBED AREA BOUNDARY:
- NATURAL DRAINAGE:
- 6' HIGH CHAIN LINK FENCE
- INCIDENTAL ROCK DISTRIBUTION:
- STREAM BUFFER ZONE SIGNS:
- SURFACE CONTOURS (5' INTERVALS):
- TEMPORARY ROADWAYS:
- BLM R.O.W. BOUNDARY LINE:
- STRUCTURAL FILL:
- TOPSOIL BERM:
- LEASE BOUNDARY LINES:

NOTES: 1. REFER TO PLATE 5-7AAB FOR CROSS-SECTIONS.

LILA CANYON MINE

AS-BUILT SURFACE FACILITIES

DATE:	APRIL 2016
DRAWN BY:	R. Jay Marshall
SCALE:	AS SHOWN
PAGE #:	5-2

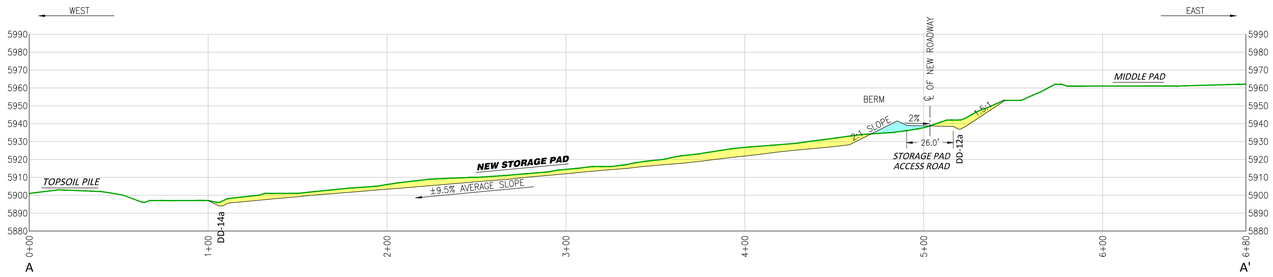
I CERTIFY THIS MAP TO BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 Jared R. Hibbs

NOTE:
CONTROL POINT COORDINATE SYSTEM IS U.S. STATE PLANE 1983 – UTAH CENTRAL (4302)
ADJUSTED TO SEA LEVEL.

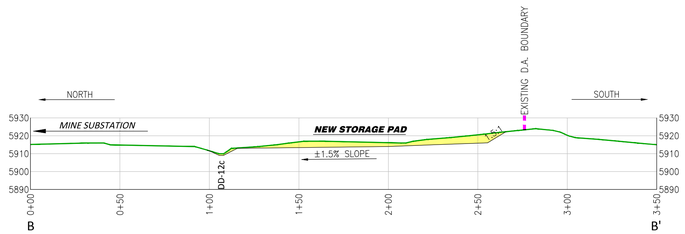
REVISION DATE:

DATE:	BY:	DATE:	BY:
JAN. 2008	RJM	JUNE 2011	PJJ
APRIL 2009	PJJ	JAN. 2012	PJJ
DEC. 2009	PJJ	MAR. 2014	PJJ
AUGUST 2010	PJJ	JULY 2014	PJJ
SEPT. 2010	PJJ	DEC. 2015	PJJ
APRIL 2011	PJJ	JUNE 2016	PJJ
MAY 2011	PJJ	NOV. 2016	PJJ



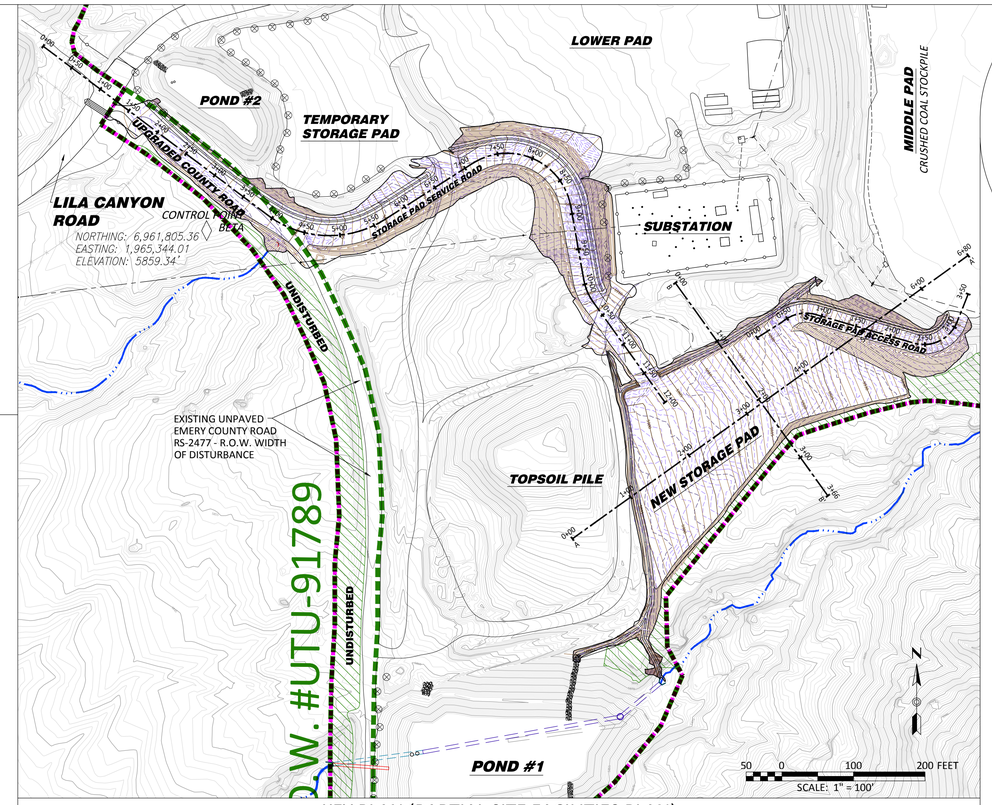
NEW STORAGE PAD PROFILE A-A'

SCALE: 1" = 40'

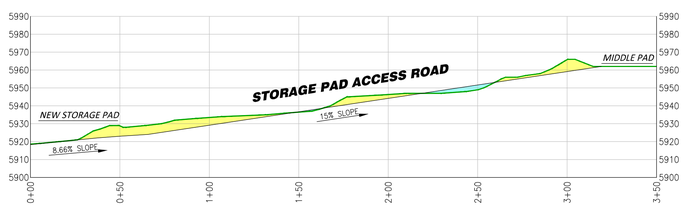


NEW STORAGE PAD PROFILE B-B'

SCALE: 1" = 40'

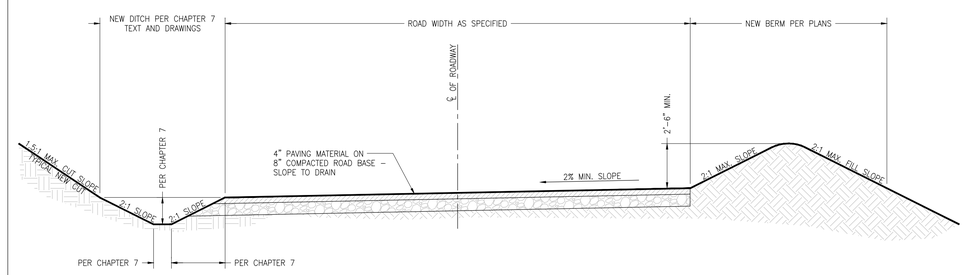


KEY PLAN (PARTIAL SITE FACILITIES PLAN)



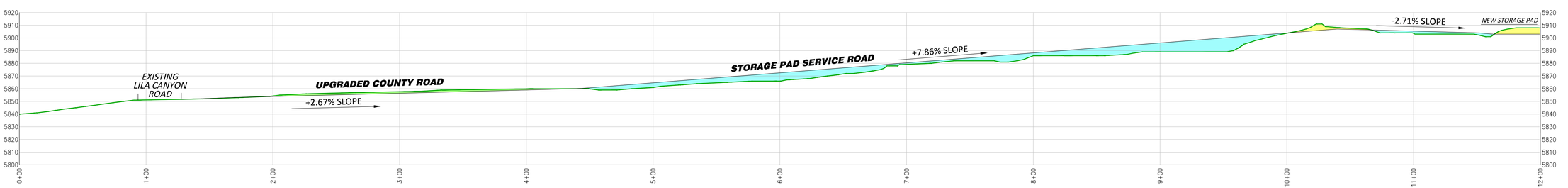
NEW STORAGE PAD ACCESS ROAD PROFILE

SCALE: 1" = 40'



TYPICAL NEW ROAD SECTION (FOR ROADS ACCESSING THE NEW STORAGE PAD)

SCALE: NONE



NEW STORAGE PAD SERVICE ROAD PROFILE

SCALE: 1" = 40'

NOTES
1. ALL NEW FILL AREAS TO HAVE A MAXIMUM SLOPE OF 2 HORIZONTAL UNITS TO 1 VERTICAL UNIT UNLESS OTHERWISE NOTED.
2. ALL NEW CUT AREAS TO HAVE A MAXIMUM SLOPE OF 1.5 HORIZONTAL UNITS TO 1 VERTICAL UNIT UNLESS OTHERWISE NOTED.

LEGEND:
- EXISTING PROFILE
- WORKING PROFILE
- EXISTING DISTURBED AREA BOUNDARY
- PROPOSED BLM RIGHT-OF-WAY LINE
- CUT AREA
- FILL AREA

LILA CANYON MINE

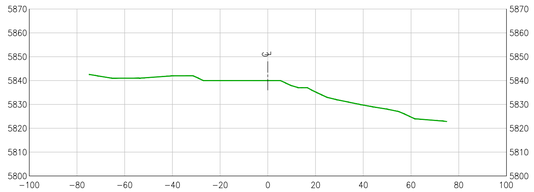
NEW STORAGE PAD AND ROADS PLANS AND PROFILES

DATE: NOVEMBER 2016 | DRAWN BY: P. JENSEN
SCALE: AS SHOWN | SHEET #: 5-7Da

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

REVISION DATE:

DATE	BY	DATE	BY
		NOV. 2016	PJJ



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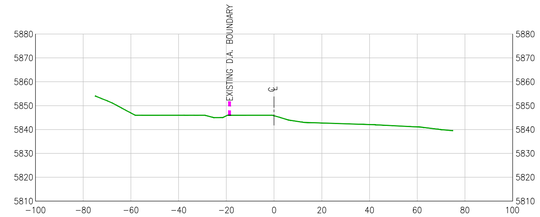

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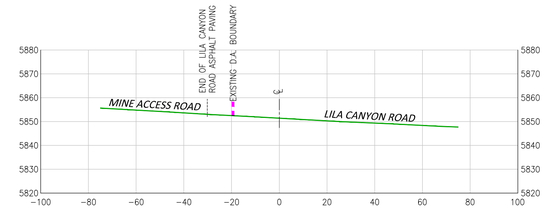

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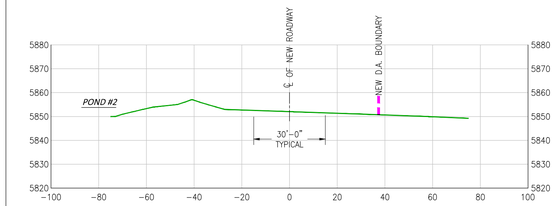

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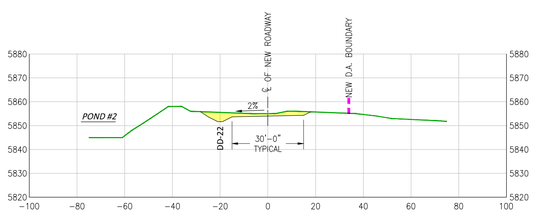

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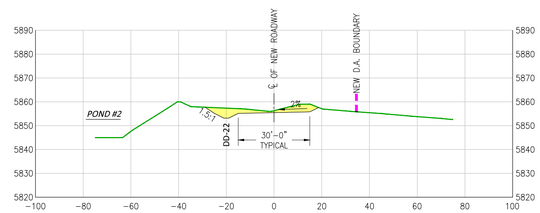

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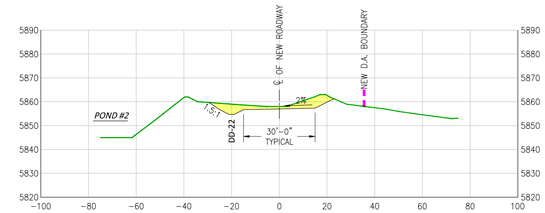

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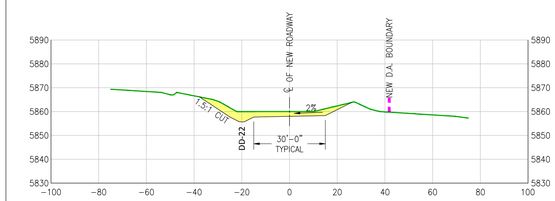

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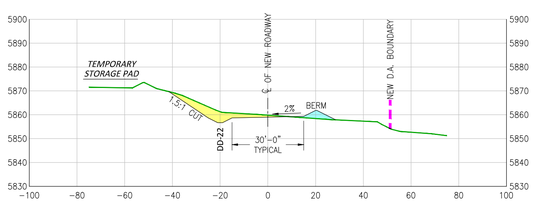

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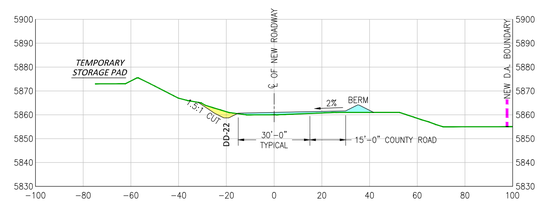

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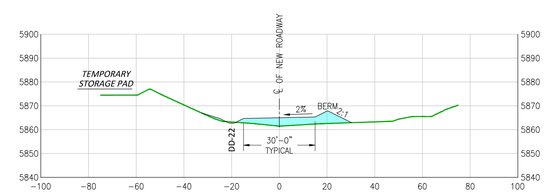

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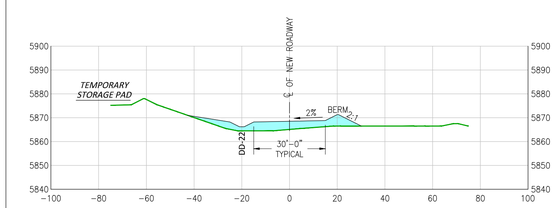

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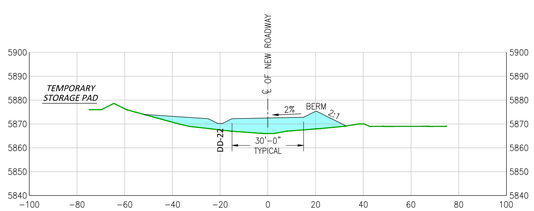

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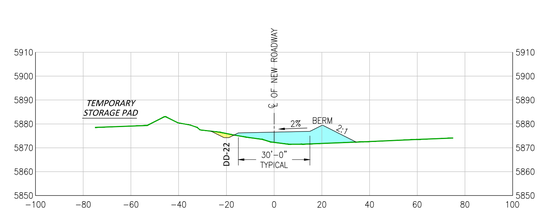

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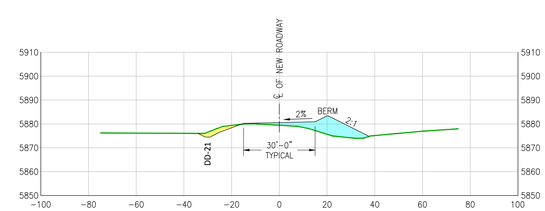

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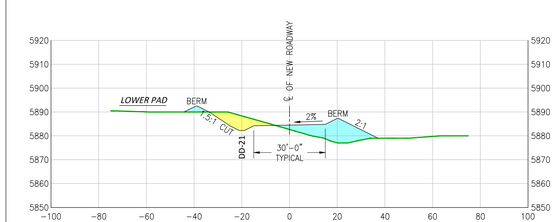

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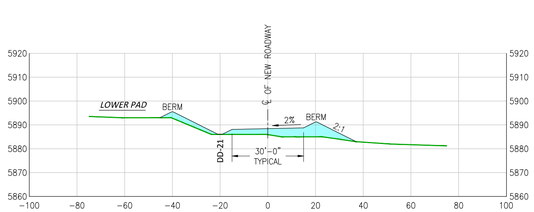

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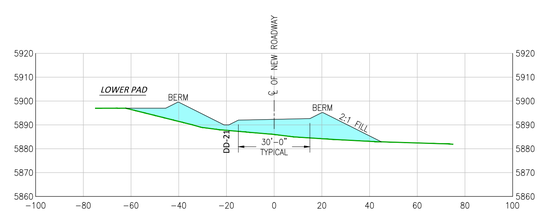

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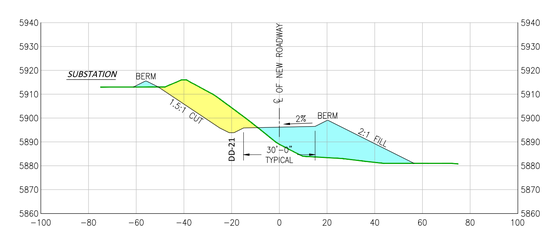

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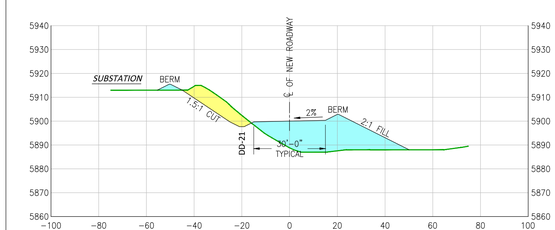

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NEW STORAGE PAD SERVICE ROAD SECTION

LILA CANYON MINE

NEW STORAGE PAD AND ROADS ROAD SECTIONS

DATE: NOVEMBER 2016 | DRAWN BY: P. JENSEN

SCALE: AS SHOWN | PAGE #: 5-7Db

LILA REGISTERED PROFESSIONAL ENGINEER #6449561 David A. Hibbs

REVISION DATE:

DATE	BY	DATE	BY
		NOV. 2016	PJJ

SCALE: 1" = 30'

15 0 30 60 FEET

NOTES
1. ALL NEW FILL AREAS TO HAVE A MAXIMUM SLOPE OF 2 HORIZONTAL UNITS TO 1 VERTICAL UNIT UNLESS OTHERWISE NOTED.
2. ALL NEW CUT AREAS TO HAVE A MAXIMUM SLOPE OF 1.5 HORIZONTAL UNITS TO 1 VERTICAL UNIT UNLESS OTHERWISE NOTED.

LEGEND:

- EXISTING PROFILE
- WORKING PROFILE
- EXISTING DISTURBED AREA BOUNDARY
- PROPOSED BLM RIGHT-OF-WAY LINE
- CUT AREA
- FILL AREA

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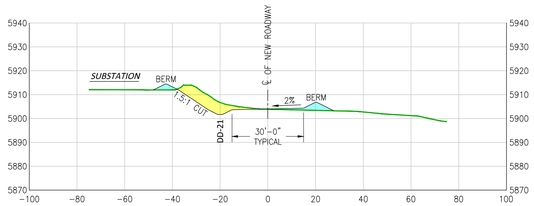

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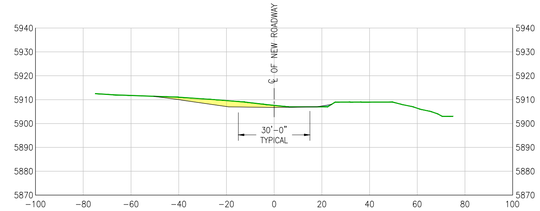

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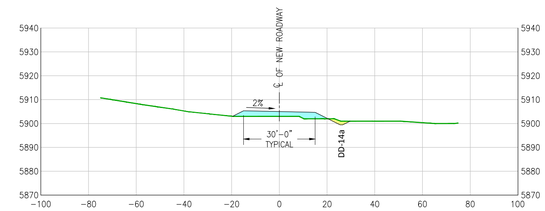

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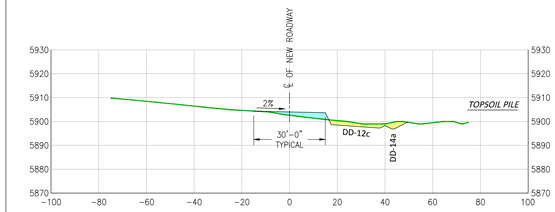

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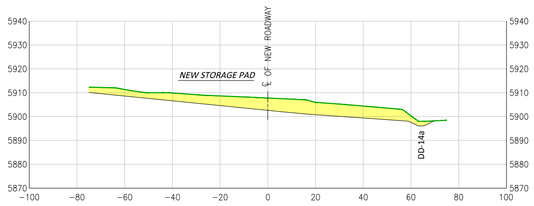

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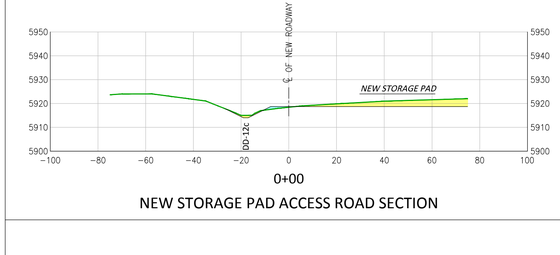

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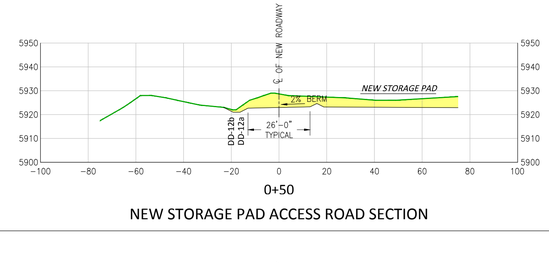

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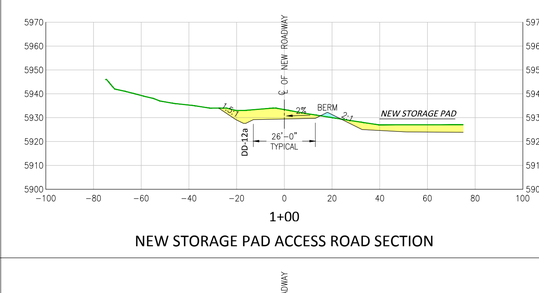

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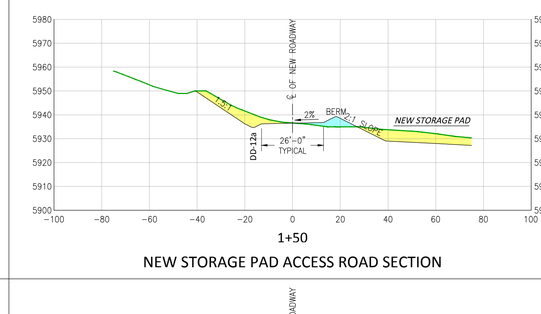

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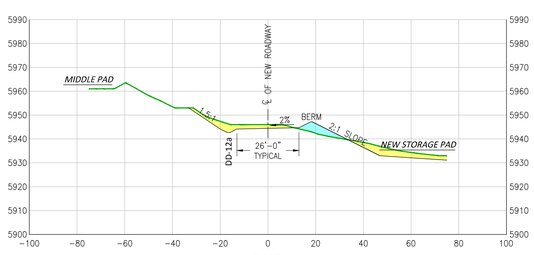

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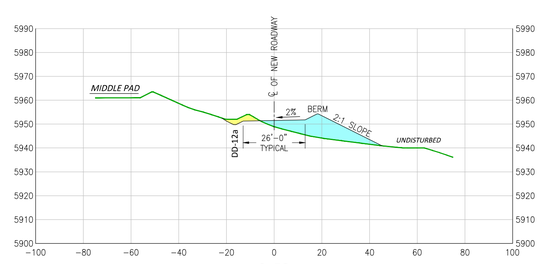

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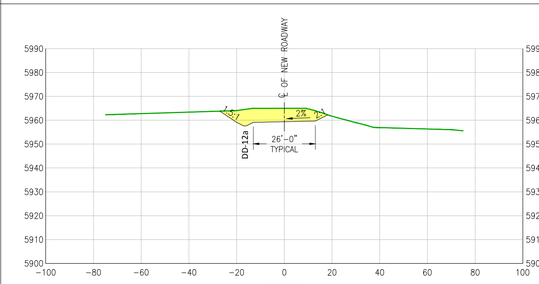

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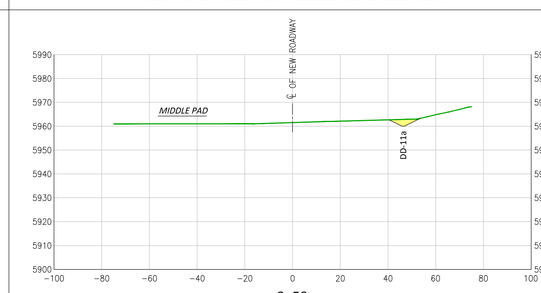

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NEW STORAGE PAD ACCESS ROAD SECTION

LILA CANYON MINE

NEW STORAGE PAD AND ROADS ROAD SECTIONS

DATE: NOVEMBER 2016 | DRAWN BY: P. JENSEN

SCALE: AS SHOWN | PAGE #: 5-7Dc

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

REVISION DATE:

DATE	BY	DATE	BY
		NOV. 2016	PJJ

15 0 30 60 FEET

SCALE: 1" = 30'

NOTES:
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LEGEND:

- EXISTING PROFILE
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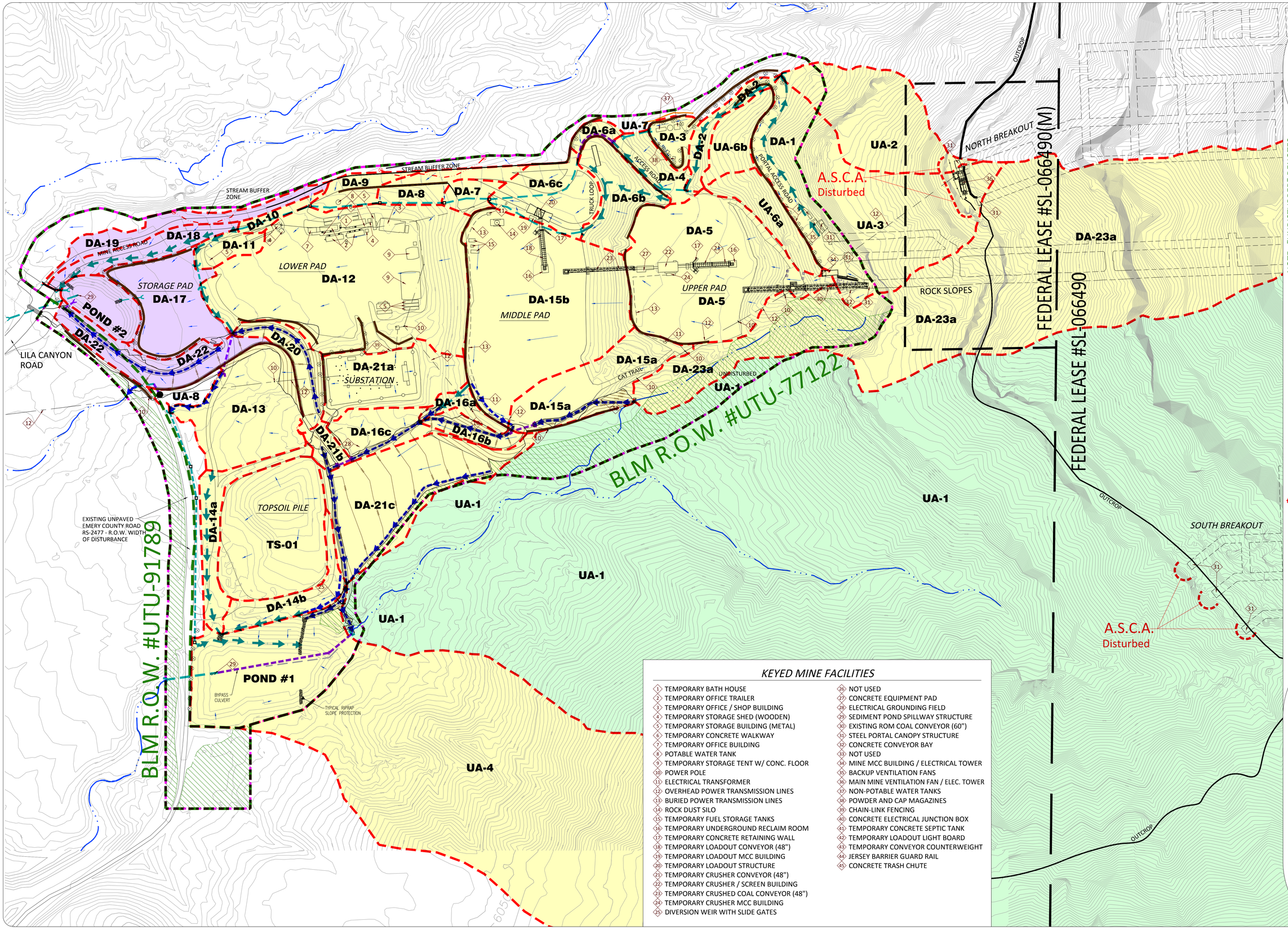
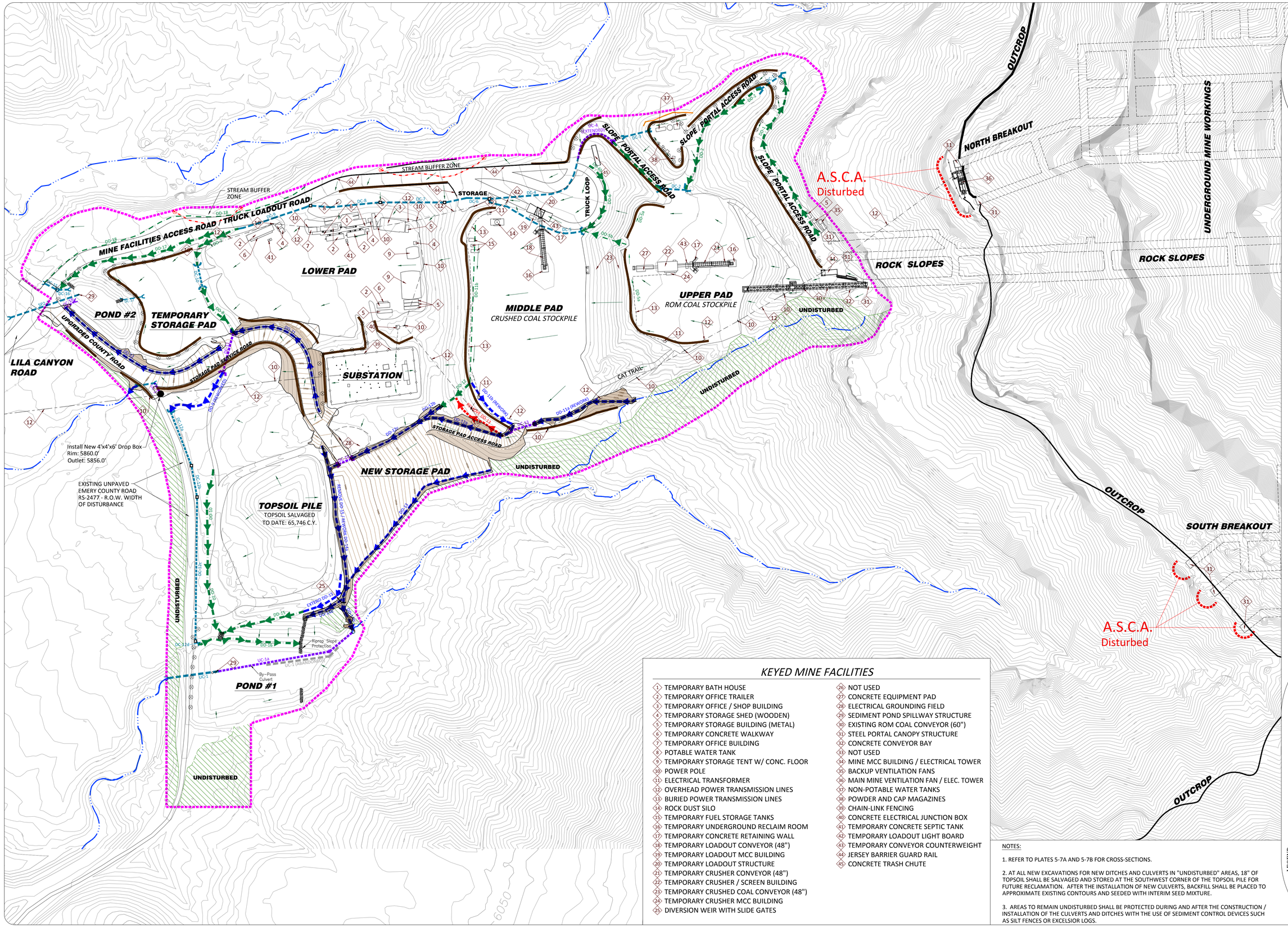
- CUT AREA
- FILL AREA

P:\Lila Canyon Mine\Drawings\NOI\Page 5-7Dc Lila Canyon Mine Storage Area\Working\Page 5-7Dc Road Cross Sections.dwg, Plot: 1:1Dc, 11/18/2016 9:38:10 AM, 1:1



KEYED MINE FACILITIES

1. TEMPORARY BATH HOUSE
2. TEMPORARY OFFICE TRAILER
3. TEMPORARY OFFICE / SHOP BUILDING
4. TEMPORARY STORAGE SHED (WOODEN)
5. TEMPORARY STORAGE BUILDING (METAL)
6. TEMPORARY CONCRETE WALKWAY
7. TEMPORARY OFFICE BUILDING
8. POTABLE WATER TANK
9. TEMPORARY STORAGE TENT W/ CONC. FLOOR
10. POWER POLE
11. ELECTRICAL TRANSFORMER
12. OVERHEAD POWER TRANSMISSION LINES
13. BURIED POWER TRANSMISSION LINES
14. ROCK DUST SILO
15. TEMPORARY FUEL STORAGE TANKS
16. TEMPORARY UNDERGROUND RECLAIM ROOM
17. TEMPORARY CONCRETE RETAINING WALL
18. TEMPORARY LOADOUT CONVEYOR (48")
19. TEMPORARY LOADOUT MCC BUILDING
20. TEMPORARY LOADOUT STRUCTURE
21. TEMPORARY CRUSHER CONVEYOR (48")
22. TEMPORARY CRUSHER / SCREEN BUILDING
23. TEMPORARY CRUSHED COAL CONVEYOR (48")
24. TEMPORARY CRUSHER MCC BUILDING
25. DIVERSION WEIR WITH SLIDE GATES
26. NOT USED
27. CONCRETE EQUIPMENT PAD
28. ELECTRICAL GROUNDING FIELD
29. SEDIMENT POND SPILLWAY STRUCTURE
30. EXISTING ROM COAL CONVEYOR (60")
31. STEEL PORTAL CANOPY STRUCTURE
32. CONCRETE CONVEYOR BAY
33. NOT USED
34. MINE MCC BUILDING / ELECTRICAL TOWER
35. BACKUP VENTILATION FANS
36. MAIN MINE VENTILATION FAN / ELEC. TOWER
37. NON-POTABLE WATER TANKS
38. POWDER AND CAP MAGAZINES
39. CHAIN-LINK FENCING
40. CONCRETE ELECTRICAL JUNCTION BOX
41. TEMPORARY CONCRETE SEPTIC TANK
42. TEMPORARY LOADOUT LIGHT BOARD
43. TEMPORARY CONVEYOR COUNTERWEIGHT
44. JERSEY BARRIER GUARD RAIL
45. CONCRETE TRASH CHUTE



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5. TEMPORARY STORAGE BUILDING (METAL)
6. TEMPORARY CONCRETE WALKWAY
7. TEMPORARY OFFICE BUILDING
8. POTABLE WATER TANK
9. TEMPORARY STORAGE TENT W/ CONC. FLOOR
10. POWER POLE
11. ELECTRICAL TRANSFORMER
12. OVERHEAD POWER TRANSMISSION LINES
13. BURIED POWER TRANSMISSION LINES
14. ROCK DUST SILO
15. TEMPORARY FUEL STORAGE TANKS
16. TEMPORARY UNDERGROUND RECLAIM ROOM
17. TEMPORARY CONCRETE RETAINING WALL
18. TEMPORARY LOADOUT CONVEYOR (48")
19. TEMPORARY LOADOUT MCC BUILDING
20. TEMPORARY LOADOUT STRUCTURE
21. TEMPORARY CRUSHER CONVEYOR (48")
22. TEMPORARY CRUSHER / SCREEN BUILDING
23. TEMPORARY CRUSHED COAL CONVEYOR (48")
24. TEMPORARY CRUSHER MCC BUILDING
25. DIVERSION WEIR WITH SLIDE GATES
26. NOT USED
27. CONCRETE EQUIPMENT PAD
28. ELECTRICAL GROUNDING FIELD
29. SEDIMENT POND SPILLWAY STRUCTURE
30. EXISTING ROM COAL CONVEYOR (60")
31. STEEL PORTAL CANOPY STRUCTURE
32. CONCRETE CONVEYOR BAY
33. NOT USED
34. MINE MCC BUILDING / ELECTRICAL TOWER
35. BACKUP VENTILATION FANS
36. MAIN MINE VENTILATION FAN / ELEC. TOWER
37. NON-POTABLE WATER TANKS
38. POWDER AND CAP MAGAZINES
39. CHAIN-LINK FENCING
40. CONCRETE ELECTRICAL JUNCTION BOX
41. TEMPORARY CONCRETE SEPTIC TANK
42. TEMPORARY LOADOUT LIGHT BOARD
43. TEMPORARY CONVEYOR COUNTERWEIGHT
44. JERSEY BARRIER GUARD RAIL
45. CONCRETE TRASH CHUTE

NOTES:

1. REFER TO PLATES 5-7A AND 5-7B FOR CROSS-SECTIONS.

2. AT ALL NEW EXCAVATIONS FOR NEW DITCHES AND CULVERTS IN "UNDISTURBED" AREAS, 18" OF TOPSOIL SHALL BE SALVAGED AND STORED AT THE SOUTHWEST CORNER OF THE TOPSOIL PILE FOR FUTURE RECLAMATION. AFTER THE INSTALLATION OF NEW CULVERTS, BACKFILL SHALL BE PLACED TO APPROXIMATE EXISTING CONTOURS AND SEEDED WITH INTERIM SEED MIXTURE.

3. AREAS TO REMAIN UNDISTURBED SHALL BE PROTECTED DURING AND AFTER THE CONSTRUCTION / INSTALLATION OF THE CULVERTS AND DITCHES WITH THE USE OF SEDIMENT CONTROL DEVICES SUCH AS SILT FENCES OR EXCELSIOR LOGS.

LEGEND:

UNDISTURBED WITHIN THE DISTURBED AREA
DISTURBED AREA BOUNDARY:
NATURAL DRAINAGE:
6' HIGH CHAIN LINK FENCE
INCIDENTAL ROCK DISTRIBUTION:
STREAM BUFFER ZONE SIGNS:
Earthen Berm:
TEMPORARY ROADWAYS:
NEW CONTOURS (5' INTERVALS)
NEW CONTOURS (1' INTERVALS)
EXISTING CONTOURS (5' INTERVALS)
NATURAL DRAINAGE
EXISTING DITCH
EXISTING CULVERT
REMPAD DITCH
NEW/REWORKED DITCH
NEW CULVERT
SHEET FLOW DRAINAGE
EXISTING DROP BOX
NEW DROP BOX
BLM R.O.W. BOUNDARY

NOTE:
UNDISTURBED DENOTES DRAINAGE AND IS NOT APPLICABLE TO SOILS.

R 14 E, T 16 S

50' 0' 100' 200'

LILA CANYON MINE

PROPOSED
SEDIMENT CONTROL

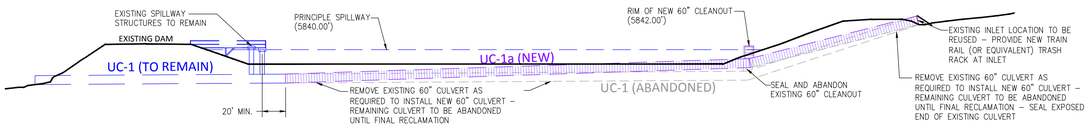
DATE: JUNE 1998 | DESIGNED BY: BLACKHAWK ENG.
SCALE: AS SHOWN | PAGE #: 7-5

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

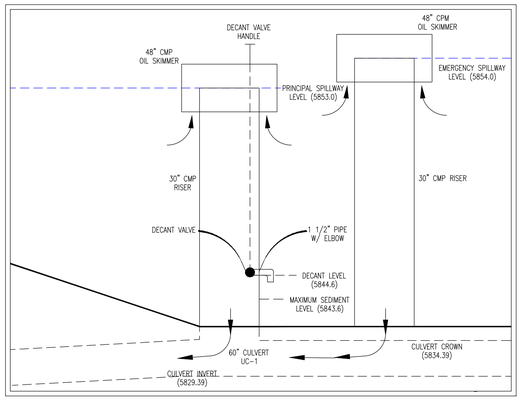
UTAH REGISTERED PROFESSIONAL ENGINEER #6149561 David W. Hibbs

REVISION DATE:

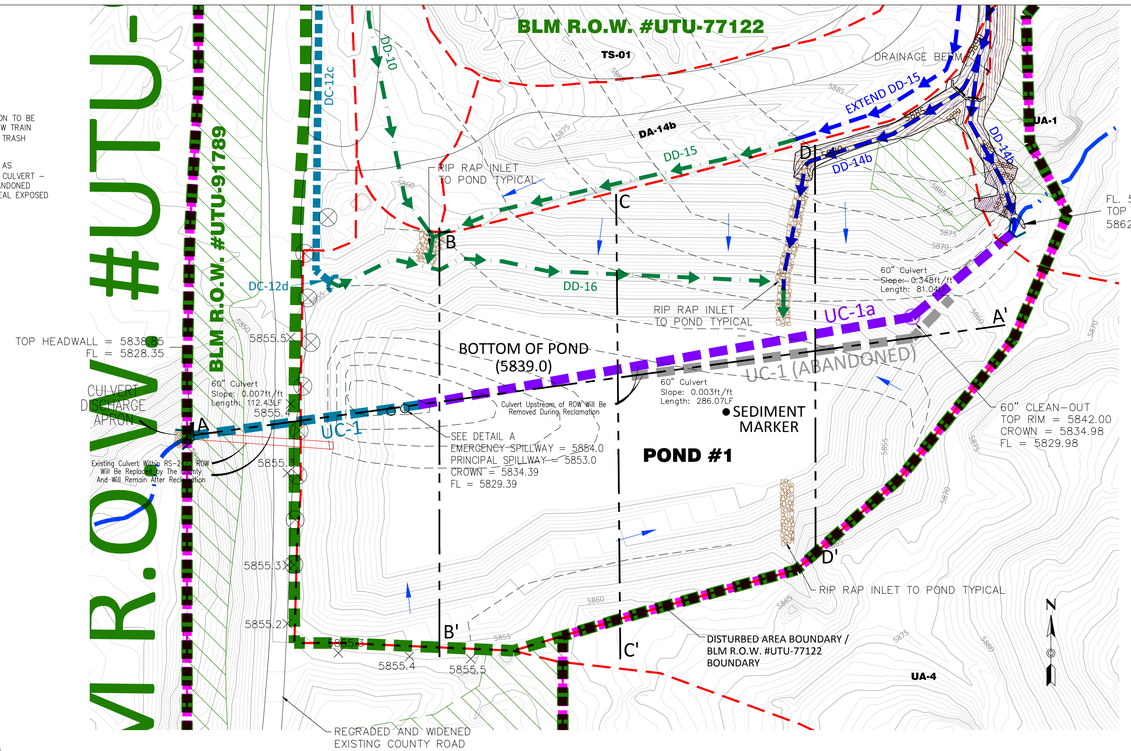
DATE:	BY:	DATE:	BY:	DATE:	BY:
OCT 1998	WJ	NOV 2003	RJM	JAN. 2012	PJJ
JAN 1999	WJ	JAN 2005	RJM	NOV. 2013	PJJ
MAR 2000	BHE	APR 2008	TJS	OCT. 2014	TJS
SEP 2000	BHE	JUL 2008	TJS	DEC. 2015	TJS
JAN 2001	BHE	JUN 2009	TJS	JUNE 2016	PJJ
MAR 2001	BJ	JAN 2010	TJS	NOV. 2016	PJJ
NOV 2002	RJM	Dec 2010	RJM		



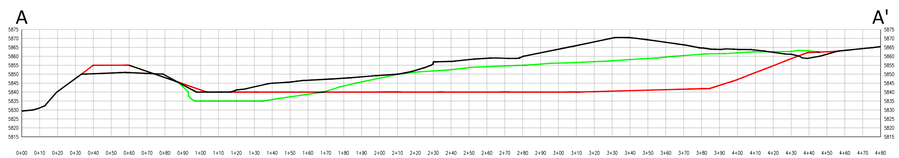
CULVERT UC-1 DETAIL



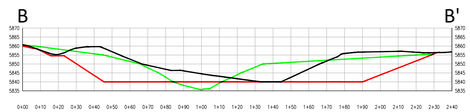
DETAIL "A"



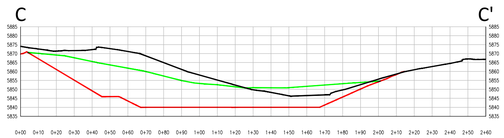
SEDIMENT POND #1 - PLAN VIEW



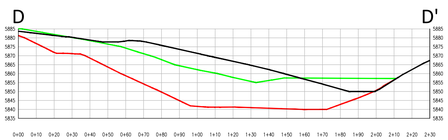
SEDIMENT POND #1 - SECTION A-A'



SEDIMENT POND #1 - SECTION B-B'



SEDIMENT POND #1 - SECTION C-C'



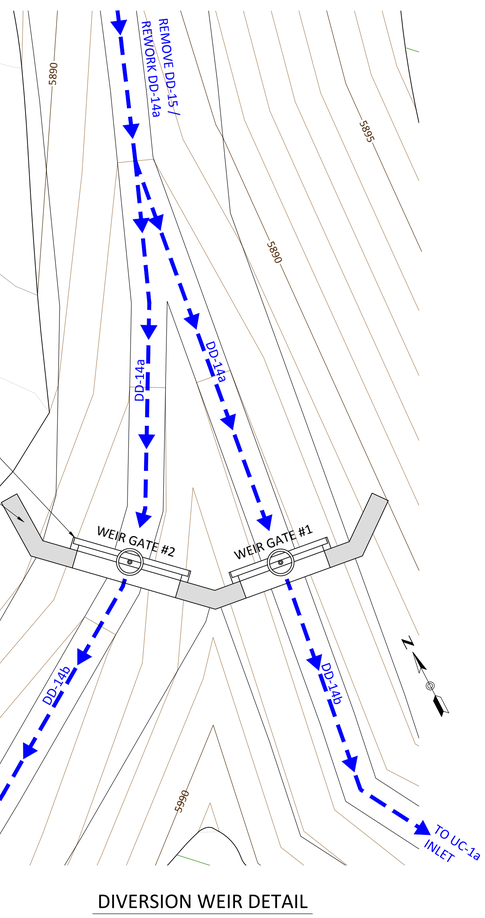
SEDIMENT POND #1 - SECTION D-D'

SECTION LEGEND

PROPOSED SURFACE:

EXISTING SURFACE:

RECLAIMED SURFACE:



DIVERSION WEIR DETAIL

LILA CANYON MINE

PROPOSED SEDIMENT POND #1

DATE:	APRIL 2008
DESIGNED BY:	HYDROLOGIC DESIGN
SCALE:	AS SHOWN
PLATE #:	7-6a

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

REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

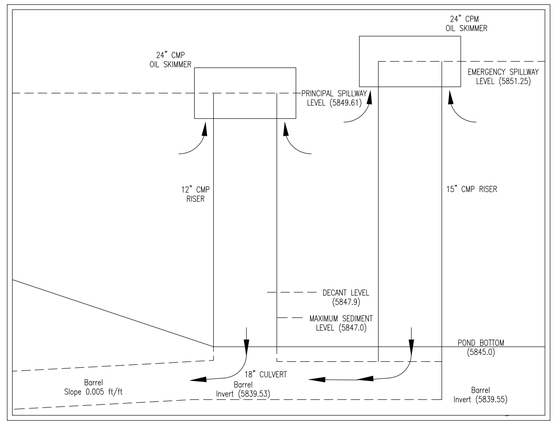
REVISION DATE:

DATE:	BY:	DATE:	BY:
Apr. 2008	TJS		
Apr. 2009	TJS		
Jul 2015	TJS		
Oct 2015	TJS		
JUNE 2016	PJJ		
NOV. 2016	PJJ		

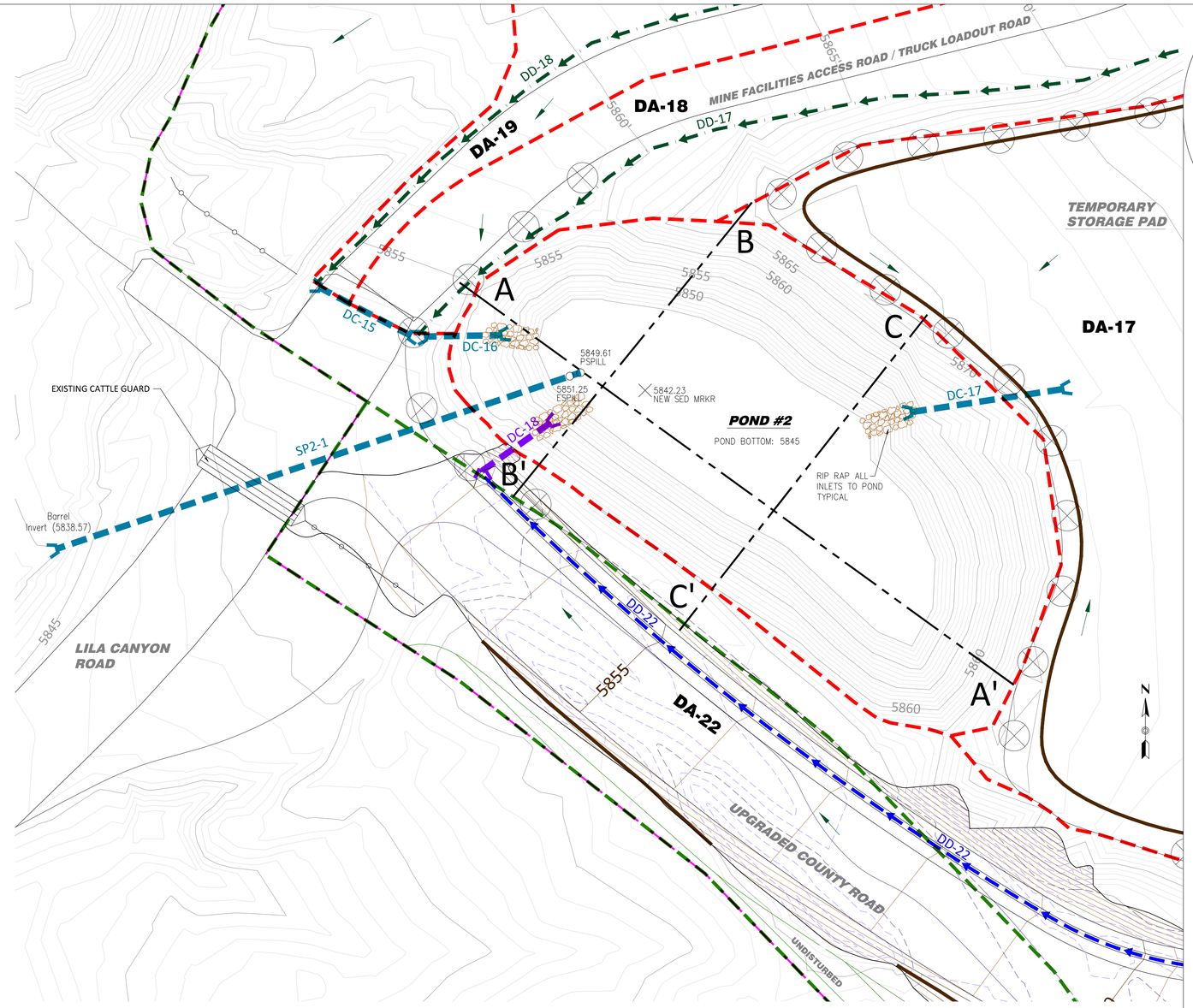
R 14 E, T 16 S

LEGEND:

- EXISTING CULVERTS:
- NEW / REWORKED DITCH:
- EXISTING DITCH
- FENCE LINE:
- BERM (DURING OPERATIONS):
- UNDISTURBED DRAINAGE:
- PROPOSED CONTOURS:
- EXISTING CONTOURS:
- RECLAIMED CONTOURS:
- DISTURBED AREA BOUNDARY:
- BLM RIGHT-OF-WAY BOUNDARY:
- NEW 4' MANHOLE:



DETAIL "A"



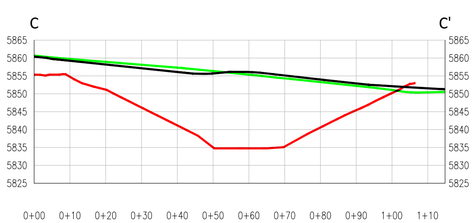
SEDIMENT POND #2 - PLAN VIEW

SECTION LEGEND

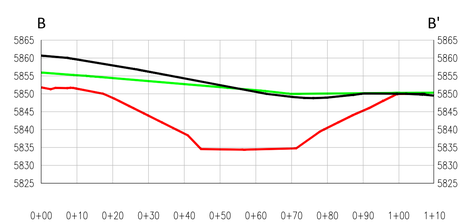
WORKING SURFACE:

PRE-MINING SURFACE:

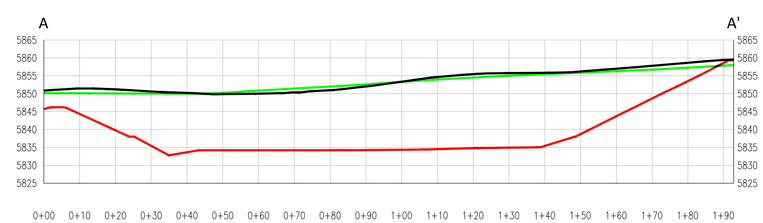
RECLAIMED SURFACE:



SEDIMENT POND #2 - SECTION C-C'



SEDIMENT POND #2 - SECTION B-B'



SEDIMENT POND #2 - SECTION A-A'

LILA CANYON MINE

PROPOSED SEDIMENT POND #2

DATE: APRIL 2008 | DESIGNED BY: HYDROLOGIC DESIGN

SCALE: AS SHOWN | PAGE #: 7-6b

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

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 David W. Hibbs

REVISION DATE:

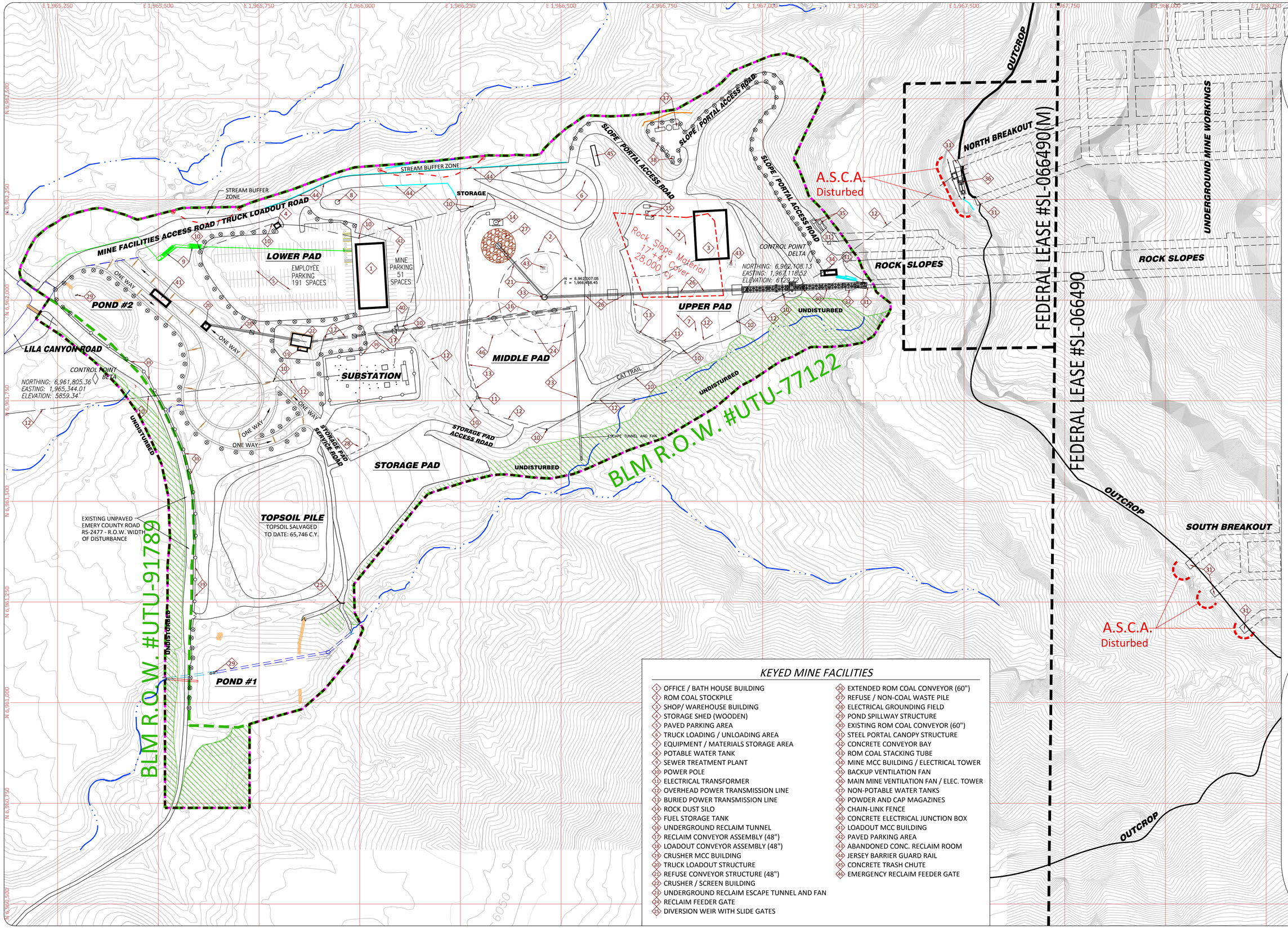
DATE:	BY:	DATE:	BY:
Apr. 2008	TJS		
Apr. 2009	TJS		
Jul 2015	TJS		
Oct 2015	TJS		
JUNE 2016	PJJ		
NOV. 2016	PJJ		

R 14 E, T 16 S

0' 6' 30' 40'

LEGEND:

- EXISTING CULVERTS:
- NEW / REWORKED DITCH:
- EXISTING DITCH
- FENCE LINE:
- BERM (DURING OPERATIONS):
- UNDISTURBED DRAINAGE:
- PROPOSED CONTOURS:
- EXISTING CONTOURS:
- RECLAIMED CONTOURS:
- DISTURBED AREA BOUNDARY:
- BLM RIGHT-OF-WAY BOUNDARY:
- NEW CULVERTS:



KEYED MINE FACILITIES

1. OFFICE / BATH HOUSE BUILDING
2. ROM COAL STOCKPILE
3. SHOP/ WAREHOUSE BUILDING
4. STORAGE SHED (WOODEN)
5. PAVED PARKING AREA
6. TRUCK LOADING / UNLOADING AREA
7. EQUIPMENT / MATERIALS STORAGE AREA
8. POTABLE WATER TANK
9. SEWER TREATMENT PLANT
10. POWER POLE
11. ELECTRICAL TRANSFORMER
12. OVERHEAD POWER TRANSMISSION LINE
13. BURIED POWER TRANSMISSION LINE
14. ROCK DUST SILO
15. FUEL STORAGE TANK
16. UNDERGROUND RECLAIM TUNNEL
17. RECLAIM CONVEYOR ASSEMBLY (48")
18. LOADOUT CONVEYOR ASSEMBLY (48")
19. CRUSHER MCC BUILDING
20. TRUCK LOADOUT STRUCTURE
21. REFUSE CONVEYOR STRUCTURE (48")
22. CRUSHER / SCREEN BUILDING
23. UNDERGROUND RECLAIM ESCAPE TUNNEL AND FAN
24. RECLAIM FEEDER GATE
25. DIVERSION WEIR WITH SLIDE GATES
26. EXTENDED ROM COAL CONVEYOR (60")
27. REFUSE / NON-COAL WASTE PILE
28. ELECTRICAL GROUNDING FIELD
29. POND SPILLWAY STRUCTURE
30. EXISTING ROM COAL CONVEYOR (60")
31. STEEL PORTAL CANOPY STRUCTURE
32. CONCRETE CONVEYOR BAY
33. ROM COAL STACKING TUBE
34. MINE MCC BUILDING / ELECTRICAL TOWER
35. BACKUP VENTILATION FAN
36. MAIN MINE VENTILATION FAN / ELEC. TOWER
37. NON-POTABLE WATER TANKS
38. POWDER AND CAP MAGAZINES
39. CHAIN-LINK FENCE
40. CONCRETE ELECTRICAL JUNCTION BOX
41. LOADOUT MCC BUILDING
42. PAVED PARKING AREA
43. ABANDONED CONC. RECLAIM ROOM
44. JERSEY BARRIER GUARD RAIL
45. CONCRETE TRASH CHUTE
46. EMERGENCY RECLAIM FEEDER GATE

LEGEND:

- UNDISTURBED WITHIN THE DISTURBED AREA
- DISTURBED AREA BOUNDARY:
- NATURAL DRAINAGE:
- 6' HIGH CHAIN LINK FENCE
- INCIDENTAL ROCK DISTRIBUTION:
- STREAM BUFFER ZONE SIGNS:
- SURFACE CONTOURS (5' INTERVALS):
- TEMPORARY ROADWAYS:
- BLM R.O.W. BOUNDARY LINE:
- STRUCTURAL FILL:
- LEASE BOUNDARY LINES:

NOTES: 1. REFER TO PLATE 5-7AAB FOR CROSS-SECTIONS.

LILA CANYON MINE

PROPOSED SURFACE FACILITIES (FINAL CONFIGURATION)

DATE: NOVEMBER 2016 | DRAWN BY: UEI | SCALE: AS SHOWN | PLATE #: 0-1 (CONTINUED FROM PLATE 5-2)

UTAH REGISTERED PROFESSIONAL ENGINEER #6449561 Jared W. Hobbs

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

NOTE: CONTROL POINT COORDINATE SYSTEM IS U.S. STATE PLANE 1983 – UTAH CENTRAL (4302) ADJUSTED TO SEA LEVEL.

REVISION DATE:

DATE	BY	DATE	BY
		NOV. 2016	PJJ