

**DUGOUT CANYON MINE  
METHANE DEGASIFICATION AMENDMENT  
WELLS G-18, G-31 AND ACCESS ROAD**

**DUGOUT CANYON MINE  
CANYON FUEL COMPANY, LLC  
C/007/039**

**JULY 2007**

Confidential  
 Shelf  
 Expandable

Refer to Record No. 0037 Date 7-9-2007  
in C/0070039, 2007, Incoming  
for additional information

Canyon Fuel Company, LLC  
SCM/Dugout Canyon Mine

Mining and Reclamation Plan  
July 9, 2007

**APPENDIX 5-6**

Reclamation Bond Estimate

BOND CALCULATIONS FOR  
DEGAS WELLS G-18 AND G-31

Ref.	Description	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Belt BC-1 No. 1																		19359
	Transfer Building No. 2																		34970
	Feed Belt BC 2 No.3																		13812
	Stack Tubes 2 No.4																		3673
	Head House 1 No.5																		6687
	Transfer Belt BC 2 No.6																		8800
	Head House 2 No.7																		1632
	Reclaim Tunnel No.8																		33969
	Reclaim Belt BC.4 No.9																		12015
	Escape Tunnel 60 inch No.10																		953
	Cruiser Building No.11																		31287
	Truck Loadout Belt BC 5 No.12																		8946
	Truck Loadout and Scale No.13																		25633
	Bathroom No.14																		138047
	Substation No.15																		1803
	Power Lines and Poles No.16																		1958
	Retaining Wall No.17																		698
	Gabion Wall No.18																		59675
	Pump House No.19																		2708
	Paved Road No.20																		141491
	Stream Culvert 72 inch No.21																		46216
	Water Tanks No.22																		3097
	Rock Dust Bin No.23																		1092
	Fuel Tank and Fuel Station No.24																		1615
	Holding Tank No.25																		331
	Ventilation Fan No.26																		2280
	Magnet 27																		491
	Water System 28																		73801
	Sewage System 29																		24734
	Item 30 removed																		
	Storage Containers 31																		9800
	Gilson Well No.32																		1517
	Shop Building No.33																		5053
	Switch House No.34																		1033
	Portals No.35																		26000
	Storage Building No.36																		1795
	Sampling System No.37																		1335
	Stoker Storage Bin No.41																		822
	Substation No.2 No.42																		2654
	Gabion Baskets No.43																		982
	Pace Fan Culvert																		2031
	Pace Fan Generator																		52771
	Refuse Site No.44																		5200
	Degas Well G2																		9913
	Degas Well G3																		12297
	Degas Well G4																		7960
	Degas Well G5																		7670
	Degas Well G6																		11058
	Degas Well G7																		8324
	Degas Well G9																		12314
	Degas Well G10																		11054
	Degas Well G11																		2301
	Degas Well G12																		9287
	Degas Well G13																		9081
	Degas Well G14																		13065
	Degas Well G15																		12924
	Degas Well G16																		11354
	Degas Well G17																		10369
	Degas Well G18																		10043
	Degas Well G19																		21636
	Degas Well G31																		13657
	<b>Total</b>																		<b>7036110</b>



Ref.	Description	Materials	Means Reference Number	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost	
	Degas Well G31																			
	Grade and Front end		02315 424	1.43 /CY						8470					CY		8470	CY	12112	
	Fill in Mud	Backfill Tr	02315 610	1.58 /CY						430					CY		430	CY	679	
	Subtotal																		12791	
	Plug Well	Concrete F	03310 220	196 /CY						21					CY		21	CY	4116	
	Subtotal																		4116	
	Spread To Front end		02315 424	1.43 /CY						4624					CY		4624	CY	6612	
	Subtotal																		6612	
	Fence																			
	Remove B	Fencing B	02220 220	1.59 /LF	1300										FT		1300	FT	2067	
	Subtotal																		2067	
	Support																			
	Pickup Tr	Pickup Ref	01 54 33 4	80.42 /day									32		hr		4	day	322	
	Foreman	Foreman A	Foreman	\$59.90 /HR									32		hr		32	hr	1917	
	Subtotal																		2239	
	Total																		27825	

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost	
	Duggout Mine Vegetation																				
	Duggout Mine Refuse Pile																				151810
	Pace Canyon Fan Portal																				104888
	Degas Well G2																				7231
	Degas Well G3																				6290
	Degas Well G4																				5179
	Degas Well G5																				4143
	Degas Well G6																				4143
	Degas Well G7																				5159
	Degas Well G9																				10350
	Degas Well G10																				8280
	Degas Well G11																				8482
	Degas Well G12																				6245
	Degas Well G13																				12574
	Degas Well G14																				9520
	Degas Well G15																				11536
	Degas Well G16																				9520
	Degas Well G17																				6394
	Degas Well G18																				6870
	Degas Well G19																				12574
	Degas Well G31																				13116
	<b>Total</b>																				<b>408418</b>





BOND CALCULATIONS FOR  
AMV ROAD

Ref	Description	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Belt BC-1 No 1																		13356
	Transfer Building No 2																		34970
	Feed Belt BC 2 No3																		13812
	Stack Tubes 2 No4																		3673
	Head House 1 No 5																		6687
	Transfer Belt BC 2 No 6																		8800
	Head House 2 No 7																		1632
	Reclaim Tunnel No 8																		33989
	Reclaim Belt BC 4 No 9																		12015
	Escape Tunnel 60 inch No 10																		953
	Crusher Building No 11																		31287
	Truck Loadout Belt BC 5 No 12																		9946
	Truck Loadout and Scale No 13																		25633
	Bathroom No 14																		138047
	Substation No 15																		1803
	Power Lines and Poles No 16																		1958
	Retaining Wall No 17																		698
	Gabion Wall No 18																		59675
	Pump House No 19																		2708
	Paved Road No 20																		141491
	Stream Culvert 72 inch No 21																		48216
	Water Tanks No 22																		3097
	Rock Dust Bin No 23																		1092
	Fuel Tank and Fuel Station No 24																		1615
	Holding Tank No 25																		331
	Ventilation Fan No 26																		2260
	Magnet 27																		491
	Water System 28																		73801
	Sewage System 29																		331
	Item 30 removed																		2260
	Storage Containers 31																		491
	Gabion Wall No 32																		9800
	Shop Building No 33																		1517
	Switch House No 34																		5053
	Portals No 35																		1035
	Storage Building No 36																		26000
	Sampling System No 37																		7992
	Stoker Storage Bin No 41																		1795
	Substation No 2 No 42																		1335
	Gabion Baskets No 43																		822
	Pace Fan Culvert																		2654
	Pace Fan Generator																		982
	Refuse Silo No 44																		2031
	Degas Well G2																		52771
	Degas Well G3																		8200
	Degas Well G4																		9913
	Degas Well G5																		12297
	Degas Well G6																		7990
	Degas Well G7																		7670
	Degas Well G9																		11058
	Degas Well G10																		8324
	Degas Well G11																		12314
	Degas Well G12																		11054
	Degas Well G13																		2301
	Degas Well G14																		9287
	Degas Well G15																		9081
	Degas Well G16																		13065
	Degas Well G17																		12924
	Degas Well G18																		11354
	Degas Well G19																		10369
	Degas Well G31																		10043
	AMV Road																		21656
	Total																		13857
																			27825
																			67998
																			1104109







Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

## **CHAPTER 1**

### **LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION**

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## **110 MINIMUM REQUIREMENTS FOR LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION**

### **111 Introduction**

The degassification wells will be located on property owned by the Milton and Ardith Thayn Trust. The well locations are found in Table 1-1 and are shown in Figure 1-1.

### **112 Identification of Interests**

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

#### **112.100 Business Entity**

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

#### **112.200 Applicant and Operator**

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

#### **112.300 Officers of the Applicant**

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

**TABLE 1-1**  
**Degas Well Locations**  
**Pine Canyon, Utah Quadrangle, Salt Lake Meridian**

Hole Number	Section	Township and Range
G-1	Portion of N1/2SE1/4NW1/4 Section 24	Township 13 South, Range 12 East
G-2	Portion of N1/2SW1/4NE1/4 Section 24	Township 13 South, Range 12 East
G-3	Portion of N1/2SW1/4NW1/4 Section 19	Township 13 South, Range 13 East
G-4	Portion of N1/2NE1/4NW1/4 Section 24	Township 13 South, Range 12 East
G-5	Portion of N1/2NW1/4NE1/4 Section 24	Township 13 South, Range 12 East
G-6	Portion of S1/2SW1/4NW1/4 Section 18	Township 13 South, Range 13 East
G-7	Portion of SW1/4NE1/4SE1/4 Section 24	Township 13 South, Range 12 East
G-8	Portion of NE1/4NE1/4NE1/4 Section 26	Township 13 South, Range 12 East
G-9	Portion of NW1/4NW1/4SW1/4 Section 21	Township 13 South, Range 13 East
G-10	Portion of NE1/4NE1/4SE1/4 Section 20	Township 13 South, Range 13 East
G-11	Portion of NE1/4SE1/4SW1/4 Section 20	Township 13 South, Range 13 East
G-12	Portion of SE1/4NW1/4SW1/4 Section 20	Township 13 South, Range 13 East
G-13	Portion of NW1/4NE1/4SE1/4 Section 19	Township 13 South, Range 13 East
G-14	Portion of SW1/4SW1/4SE1/4 Section 17	Township 13 South, Range 13 East
G-15	Portion of NW1/4SE1/4NE1/4 Section 19	Township 13 South, Range 13 East
G-16	Portion of SW1/4SE1/4SE1/4 Section 18	Township 13 South, Range 13 East
G-17	Portion of SE1/4NW1/4SE1/4 Section 18	Township 13 South, Range 13 East
G-18	Portion of NE1/4SE1/4NW1/4 Section 20	Township 13 South, Range 13 East
G-19	Portion of SW1/4NW1/4SE1/4 Section 20	Township 13 South, Range 13 East
G-31	Portion of NW1/4SW1/4NW1/4 Section 20	Township 13 South, Range 13 East

Canyon Fuel Company, LLC  
Dugout Canyon Mine

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AMV Road	Portion of S1/2NW1/4 Section 20 Portion of SW1/4SW1/4NE1/4 Section 20	Township 13 South, Range 13 East
----------	--	----------------------------------

**112.400 Coal Mining and Reclamation Operation Owned or Controlled**

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

**112.500 Legal or Equitable Owner of the Surface and Mineral Properties**

The legal and equitable owner of the surface and mineral properties to be affected by this operation during the duration of the permit period are list below.

Milton & Ardith Thayn Trust  
7730 East US Highway 6  
Sunnyside Star Route  
Price, Utah 84501

Gil L. Conover  
450 So. State  
Ferron, Utah 84523

United States of America  
State of Utah, Department of Interior  
Bureau of Land Management  
Price Field Office  
125 South 600 West  
Price, Utah 84501

State of Utah  
School and Institutional  
Trust Lands Administration  
675 East 500 South  
Salt Lake City, Utah 84102-2818

**112.600 Owners of Record of Property Contiguous to Proposed Permit Area**

Owners of record for surface and mineral properties contiguous to the proposed permit area are list below.

Canyon Fuel Company, LLC  
Dugout Canyon Mine

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United States of America  
Department of Interior  
Bureau of Land Management  
Price Field Office  
125 South 600 West  
Price, Utah 84501

State of Utah  
School and Industrial  
Trust Lands Administration  
675 East 500 South  
Salt Lake City, Utah 84102-2818

George and Alice Conover, Et Al  
2701 Georgia Way  
Sandy, Utah 84092

KFJ Ranch Partnership  
C/O Kerwin Jensen  
Cleveland, Utah 84518

J. George Conover  
275 West Main  
Ferron, Utah 84523

Gil L. Conover  
450 So. State  
Ferron, Utah 84523

**112.700 MSHA Numbers**

Refer to the same section of the approved M&RP.

**112.800 Interest In Contiguous Lands**

Canyon Fuel Company, LLC has no interest in contiguous lands other than those currently owned as shown on Plate 1-1 of the approved M&RP.

**112.900 Certification of Submittal Information**

No information has changed in the approved M&RP because of this submittal. Refer to the same section of the approved M&RP.

### **113 Violation Information**

Refer to the same section of the General Chapter 1 for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

### **114 Right-of-Entry Information**

Refer to the same section of the approved M&RP.

See Table 1-2 for disturbed acreage for each well site. The disturbed acres will be added to the total disturbed acreage for the Dugout Mine as each site is constructed.

### **115 Status of Unsuitability Claims**

Refer to the same section of the approved M&RP.

### **116 Permit Term**

Refer to the same section of the approved M&RP.

### **117 Insurance, Proof of Publication, and Facilities and Structures Used in Common**

The certificate of insurance(s) for each well will be obtained if required when the well is drilled. The certificate of insurance(s) will be included in Appendix 1-2 of the approved M&RP and General Chapter 1.

### **118 Filing Fees**

Refer to the same section of the approved M&RP.

**TABLE 1-2**  
**Disturbed Acres by Well Site**

<b>Well Site</b>	<b>Disturbed Acres</b>
<b>G-1</b>	0.6
<b>G-2</b>	1.21
<b>G-3</b>	0.97
<b>G-4</b>	0.85
<b>G-5</b>	0.75
<b>G-6</b>	0.32
<b>G-7</b>	1.25
<b>G-8</b>	0.9
<b>G-9</b>	2.2
<b>G-10</b>	1.7
<b>G-11</b>	1.6
<b>G-12</b>	2
<b>G-13</b>	2.75
<b>G-14</b>	2
<b>G-15</b>	2.5
<b>G-16</b>	2
<b>G-17</b>	1.25
<b>G-18</b>	4.70
<b>G-19</b>	2.75
<b>G-31</b>	1.75

The disturbed acreage for the AMV access road is approximately 14 acres including areas for topsoil storage and turnouts.

## **120 PERMIT APPLICATION FORMAT AND CONTENTS**

This amendment submittal will comply with R645-301-120.

## **130 REPORTING OF TECHNICAL DATA**

All technical data submitted in the amendment will be accompanied by the name or organization responsible for the collection and analysis of data, dates of collection and descriptions of methodology used. Technical analyses will be planned by or under the direction of a qualified professional in the subject to be analyzed.

## **140 MAPS AND PLANS**

The maps and plans in the Mining and Reclamation Plan will correspond with the requirements in R645-301-140.

## **150 COMPLETENESS**

CFC believes the information in this permit application to be complete and correct.

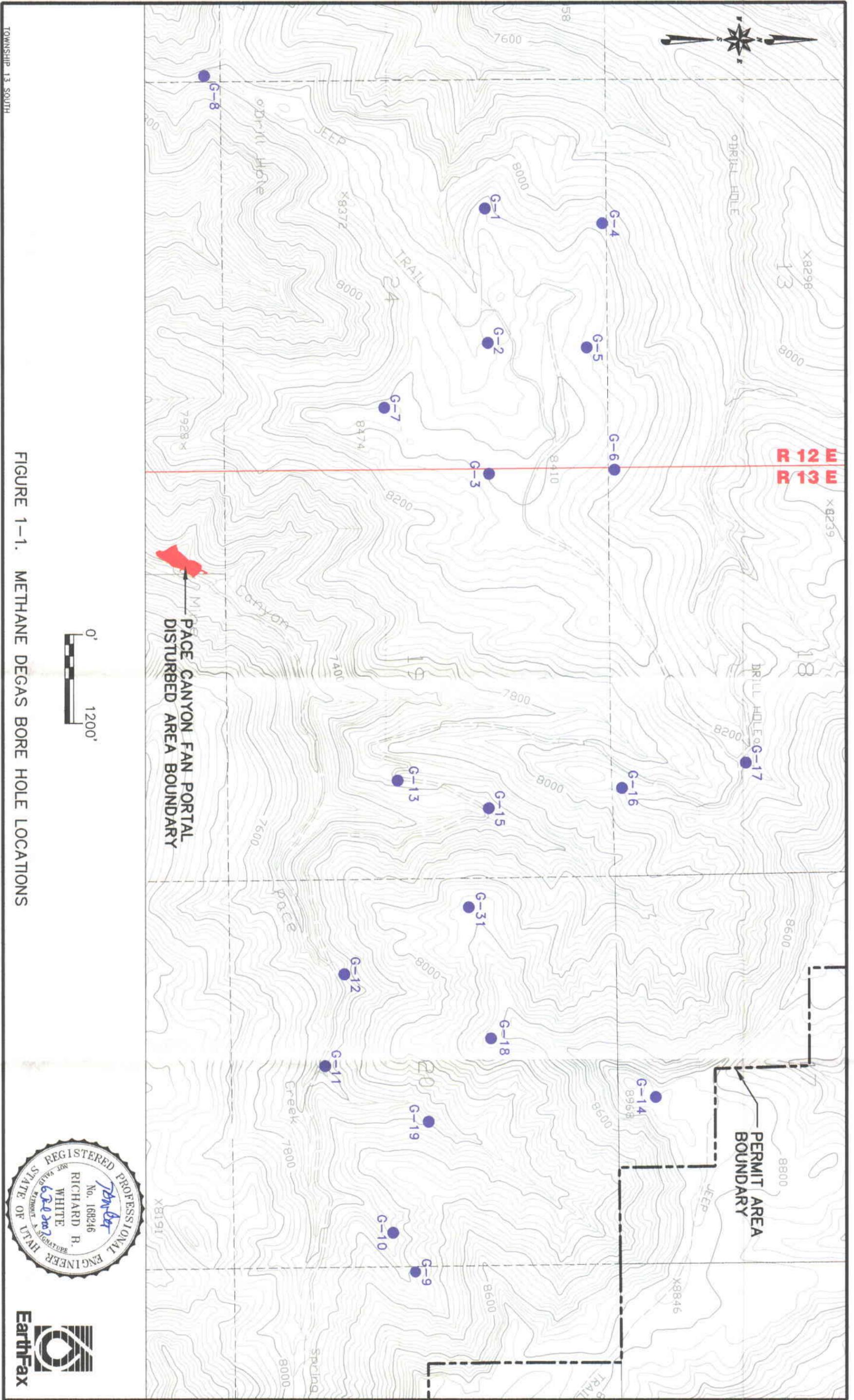


FIGURE 1-1. METHANE DEGAS BORE HOLE LOCATIONS



**CHAPTER 2**  
**SOILS**

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## **210 INTRODUCTION**

This chapter and associated attachments address the pertinent data required for the addition of the degassification well sites for the Dugout Canyon Mine. Only those sections of the Division regulations that apply to the well sites have been addressed. The remainder of the regulations have already been addressed in the existing M&RP. The M&RP and this document contain pertinent information relating to the identification, management, and reclamation activities associated with the soil resources.

## **220 ENVIRONMENTAL DESCRIPTION**

The well sites range in elevation from approximately 7400 to 9000 feet. The well sites are located in the Pace Canyon area of the Book Cliffs. General vegetation includes sagebrush, serviceberry, aspen, Douglas-fir, and snowberry.

### **221 Prime Farmland Investigation**

Due to limiting terrain, lack of water for irrigation and no evidence of past cultivation of the sites, it is concluded that no prime farmland exists within the area of the well site disturbance.

### **222 Soil Survey**

#### **222.100 Soils Map**

The soils have been mapped as part of the Soil Survey of the Carbon Area, Utah by the Soil Conservation Service (1988), at an Order III intensity level.

A description of the soils is included in Appendix 2-2 of the approved M&RP and in Attachment 2-1, which includes a report by Dan Larsen, Soil Scientist, entitled "Soil Inventory and Assessment Six

Methane Degassification Borehole Sites". An additional report for well site G-6 was prepared in 2004 and is incorporated into Attachment 2-1. Soil information for Well G-7 is incorporated into Attachment 2-1. A photograph of the G-7 site is included in Attachment 3-1. Well site G-3 and the access road can be seen on the photograph.

The soils report prepared by Dan Larsen, Soil Scientist for wells G-8 thru G-13 is provided in Attachment 2-1. Wells are being permitted in groups: G-8 thru G-10, G-11 thru G-12 and G-13 thru G-17.

### 222.200 Soil Identification

<u>Well No.</u>	<u>Soil Map Unit</u>	<u>Soil Components</u>
G-1	62/88	Midfork-Comodore complex, Rabbitex-Datino Variant
G-2	7	Brycan, Beje-Trag complex, 3-30% slopes
G-3	7	Beje-Trag complex, 3-30% slopes
G-4	62/103	Midfork-Comodore complex, Senchert-Toze complex
G-5	103	Senchert-Croydon
G-6	62	Midfork-Comodore complex
G-7	7	Beje-Trag complex, 3-30% slopes
G-8	21	Croydon Loam, 8 to 30% slopes
G-9	97/62	Midfork-Comodore complex, Rottulee family-Trag complex
G-10	97	Rottulee family-Trag complex
G-11	11, 26	Cabba- family, 40 to 70 percent slopes, Doney family, 50 to 70 percent slopes
G-12	47, 88	Guben-Rock outcrop complex, Rabbitex family-Datino Variant complex

G-13	23	Curecanti family
G-14A	62	Midfork family - Comodore complex
G-15	115, 62	Trag stony loam, 30 to 60 percent slopes, Midfork family - Comodore complex
G-16	26	Doney family
G-17	103	Senchert-Toze family Complex
G-18	97	Rottulee family-Trag complex
G-19	62, 97	Midfork family - Comodore complex, Rottulee family-Trag complex
G-31	97	Rottulee family-Trag complex
Access Road	97	Rottulee family-Trag complex

**222.300 Soil Description**

Refer to Attachment 2-1 of the submittal for soil descriptions.

**222.400 Soil Productivity**

The depth of topsoil at each site was measured to determine the amount of growth medium available for reclamation. The following table lists each well site and the approximate amount of growth medium available.

**TABLE 2-1**  
**Topsoil Volumes\***

Well No.	Cubic Yards of Material
G-1	415
G-2	3,104

G-3	1,182
G-4	1,100
G-5	1,909
G-6	792
G-7	1251
G-8	543
G-9	1,574
G-10	2,344
G-11	254
G-12	563
G-13	2,162
G-14	1,544
G-15	1,475
G-16	1,092
G-17	797
G-18	2,195
G-19	2,716
G-31	4,624
Access Road	9,167

\* These total do not include soil salvaged from short roads accessing well sites which is bladed to the side of the road.

Figure 5-1 through Figure 5-25 show the layout and approximate size of well pads for G-1 thru G-6. Figures 5-27 thru 5-29 show the layout and size for well G-7. The figures for wells G-8 thru G-19 are located in Attachment 5-1. Topsoil volume calculations can be found in Attachment 2-2.

Estimated topsoil salvage from the G-1 well site will average about 7". This site on a ridge top has previously been disturbed for exploration drilling. The site has pockets of fractured sandstone bedrock at the surface and stony subsoils, which are the limiting factors in the quantity of salvageable topsoil. The average topsoil depth at well site G-2 is 30". The average topsoil thickness for well site G-3 is 10". However, enough soil will be stripped to allow 12" of soil to be placed during reclamation. Thus some subsoils will be stripped with the topsoil to generate the required volume. The estimated topsoil salvage from well site G-4 area will be 28" except on the area of the exiting road(s). The average salvageable topsoil at well site G-5 is 22". Well site G-6 will be established on a pre-existing drill pad, with a portion of the new pad extending onto undisturbed area. Topsoil on the pre-existing drill pad ranges from 0 to 30 inches, on the north edge in from 20 to 28 inches and on the cut slope on the south edge from 6 to 30 inches. The slope will be restored to original contour with the application of topsoil, the entire site will receive at least 12 inches of topsoil. Twelve inches was used to calculate the volume of topsoil to be salvaged and to determine the size of the topsoil pile for drill site G-6. Degas well G-7 will be developed on a site with soils consistent with G-3. There is a pre-existing road to well G-3 that continues on to the G-7 proposed site. There are signs of previous vehicle disturbance at the site, however the majority of the site is undisturbed. Topsoil available for salvage has been estimated to be 10 to 12 inches. Available topsoil will be salvaged and if necessary some subsoils will be stripped with the topsoil to generate the required volume to place a minimum of 12 inches during site reclamation. Available topsoil at each site will be salvaged, stockpiled and redistributed.

Twelve inches of soil will be salvaged at well site s G-9. Well site G-9 has no topsoil over approximately half of the site, thus requiring the salvage of subsoil to generate the foot of soil proposed for reclamation. Suitable soil for salvage at site G-10 is approximately 15 inches with some areas having 24 inches of soil. Where available soil will be salvaged to a minimum of 15 inches and approximately 18 inches will be available to cover the G-10 disturbed area at the time of reclamation. G-8 was not constructed, however the available topsoil at site was estimated at about six inches.

The majority of the area at well site G-11 has been disturbed by road construction and the major part of the undisturbed portion has shallow eroded soils, except for a small area on the west side of the site. The shallow eroded soils are approximately 5 inches deep and the soils in the small area are between 10 and 16 inches deep. Approximately fifty percent of the G-12 well site is a road with no topsoil or vegetation. Between 12 and 30 inches of soil is suitable for salvage from the other fifty percent of the pad area for site G-12. Twelve inches will be returned to the reclamation slope at G-11 and between 12 and 15 inches at G-12. Large boulders are suspected to be present at the G-12 site.

At well site G-13, parent materials for soil formation are primarily colluvial deposits derived from sandstone and shale. The surface ranges from relatively smooth and non-stoney to very stoney. Suitable soil for salvage ranges from about 8 to 28 inches, limitation are due to high rock fragment content and low organic matter. Portions along the southeast edge are too stony for soil salvage. Well site G-14 (DUG205), is relatively uniform with soils of and similar to the Midfork family. Topsoil thickness range from 12 to 24 inches, with the typical depth being 15 to 18 inches. The G-14 well site has been disturbed by logging. Between 14 and 16 inches of topsoil will be placed at well sites G-13 and G-14 during reclamation.

The road to G-13 and G-14 are existing roads, however, the soil will be bladed to the side of the road at site G-14 and replaced during reclamation.

Well site G-15 is about 50 percent disturbed by a road, slope cut and fill. The undisturbed portion of the site is a slope with a southeast aspect (35 to 45 percent gradient). The topsoil on this slope is typically 13 to 20 inches thick, with a loam texture. Approximately 14 inches of topsoil will be replaced during reclamation.

Well site G-16 was previously the site of an exploration hole, having been disturbed and reclaimed. Approximately, 14 inches of soil will be salvaged as topsoil and replaced during reclamation. The topsoil on the access road will be bladed to one side of the road and replaced during reclamation.

At well site G-17 approximately one-third of the site is an existing road. Sufficient topsoil will be salvaged to replace 12 inches over the area of disturbance during reclamation.

The entire area of well site G-19 was previously disturbed by logging activities with two roads crossing through the area. During the soil survey it was determined that the topsoil ranged from 8 to 35 inches in depth. Approximately 16 inches of topsoil will be salvaged for replacement on the slopes during reclamation.

The report for sampling completed May 1 and 5, 2007 summarizes the methodology and results of the soil survey conducted by Clement Drilling & Geophysical, Inc. for the proposed access road and G-18 and G-31 wells (Attachment 2-1, May 22, 2007).

The proposed road (AMV) and drill pads for wells G-31 and G-18 were evaluated using the United States Department of Agriculture (USDA), Natural Resources Conservation Services (NRCS) WEB Soil Survey (WSS) utility. Detailed soil series descriptions for the soil series that occur in the study area are presented in Appendix A of the May 22, 2007 report located in Attachment 2-1.

Soil test pits were excavated at the two proposed well locations. The soil test pit at well G-31 was excavated by hand on May 1, 2007. The soil test pit for well G-18 was excavated by hand on May 5, 2007. Soil test pits were also excavated in areas representative of each of the three soil map units that occur in the vicinity of the proposed road and vent wells. The three test pits were excavated by hand on May 5, 2007. The coordinates of each test pit collected using a GPS receiver are presented in the test pit logs. The test pit logs are presented in Appendix B and photographs of the excavations in Appendix C. The soils observed in the test pits appear to generally correlate to the NRCS soil series map. Soil samples were collected from each test pit from each horizon, where possible, for laboratory analysis. The analyses will be incorporated into Attachment 2-1.

### **223 Soil Characterization**

The topsoil evaluation described in this chapter was performed by Daniel M. Larsen, Professional Soil Scientist and Dean Stacy, NRCS Range Management Specialist in accordance with the standards of the National Cooperative Soil Survey. The topsoil evaluation for Wells G-18, G-19, G-31 and the Access Road were performed by Craig Clement, P.G. and Dean Stacy, NRCS Management Specialist in accordance with the standards of the National Cooperative Soil Survey and the USDA/NRCS WEB Soil Survey utility.

### **224 Substitute Topsoil**

Dugout Canyon does not plan to use substitute topsoil as growth media except as described in Section 222.400.

## **230 OPERATION PLAN**

### **231 General Requirements**

#### **231.100 Removing and Storing Topsoil Methods**

The topsoil will be removed, stockpiled and protected with a berm and/or silt fence. A qualified person will be on site during soil salvage to monitor and supervise the operation for the purpose of maximizing salvage volumes. Prior to topsoil salvage shrubs/vegetation will be removed and placed/wind rowed along the inside perimeter of the disturbed area.

After the topsoil is removed, the mud pit will be excavated and the soils from the mud pit excavation will be stored immediately adjacent to the mud pit. Mud pit excavation of subsoil will be approximately 110 CY at each well site (G-2 thru G-6).

The subsoil excavation for the mud pits at G-7 thru G-19 and G-31 was approximately 430 CY. A portable container for drilling fluids will be used if necessary, should there not be sufficient subsoil depth to excavate a mud pit.

Topsoil beneath the topsoil stockpiles will not be removed. Ribbon or a marking fabric will be placed on top of the topsoil prior to placement of the topsoil from the well pad area.

The approximate volume of subsoil to be salvaged and used to create berms around the perimeter of the well site including the topsoil stockpile perimeter is: G-1 - 161 CY; G-2 - 254 CY, G-3 - 208 CY, G-4-165 CY, G-5 - 191 CY, G-6 - 156 CY, G-7 - 107 CY, G-8 - 143 CY, G-9 - 182 CY, G-10 - 137 CY, G-11 - 185 CY, G-12 - 260 CY, G-13 - 142 CY, G-14A - 123 CY, G-15 - 101 CY, G-16 - 98 CY, G-17 - 83 CY, G-18 - 39 CY excludes topsoil pile, G-19 - 48 CY, G-31 - 62 CY excludes topsoil pile, Topsoil Stockpiles STP-1 thru STP 6 - 249 CY and Access Road - 265 CY.

### **231.200 Suitability of Topsoil Substitutes/Supplements**

See Section 224.

### **231.300 Testing of Topsoil Handling and Reclamation Procedures Regarding Revegetation**

Dugout will exercise care to guard against erosion during and after application of topsoil and will employ the necessary measures to ensure the stability on graded slopes. Erosion control measures will include silt fences, berms, seeding, straw bales, soil roughening, and mulching of the soils.

Topsoil will be redistributed and the original soil surface beneath the topsoil stockpile will be roughened as presented in Section 242.100 and seeded with the seed mix described in Chapter 3, Section 352.

Methods used to evaluate success of revegetation and stabilization are discussed in Chapter 3, Section 356.

### **231.400 Construction, Modification, Use, and Maintenance of Topsoil Storage Pile**

Topsoil removed from the drill pad sites will be stockpiled on the site, except at well site G-14 where it will be stockpiled approximately 1/10 mile away. The estimated volumes of topsoil stockpile for each site are shown in Table 2-1. The stockpiles will be sized as shown in Table 2-2.

The slopes of the stockpile will be 1H:1V or approximately 45° during the construction phase. Soils in these areas generally have an angle of repose greater than 50 degrees, making a stockpile with 1:1 slopes feasible. The steeper slope also help minimize the area to be disturbed. When space is available topsoil will be stockpiled with slopes of 2H:1V.

### **232 Topsoil and Subsoil Removal**

#### **232.100 Topsoil Removal and Segregation**

All topsoil will be removed as a single layer with no segregation. Topsoil will be removed using a dozer and/or loader. Refer to Section 231.100 for additional details.

#### **232.200 Poor Topsoil**

No poor soils exist at the well sites see Attachment 2-1.

**TABLE 2-2**  
**Topsoil Stockpile Dimensions\***

<b>Well No.</b>	<b>Length (ft)</b>	<b>Width (ft)</b>	<b>Height (ft)</b>
G-1	55	35	16
G-2	156	50	20
G-3	70	60	17
G-4	110	35	17
G-5	90	65	21
G-6	105	30	13
G-7	80	70	6 to 12
G-8	168	60	6
G-9	160	90	30
G-10	170	80	65
G-11	40	50	12
G-12	60	80	18
G-13	120	100	17
G-14A	120	60	11
G-15	90	90	19
G-16	100	80	12
G-17	85	55	10

**TABLE 2-2 (Continued)**  
**Topsoil Stockpile Dimensions\***

Well No.	Description	Length (ft)	Width (ft)	Height (ft)
G-18	STP - 4	150	110	25
	STP - 5	150	70	25
G-19	Road	206	10	5
	Road	352	10	5
	Pad	125	30	40
G-31	STP-6	200	50	22
Access Road	STP-1	85	50	20
	STP-2	90	40	22
	STP-3	205	120	25

\* These are approximate dimensions of the topsoil stockpile and construction dimensions may vary. The height represents the elevation difference between the lowest point and highest point of the topsoil stockpile. The topsoil thickness will vary with the slope of the native ground surface. When stored on steep slopes the topsoil thickness will be much less than the estimated height of the stockpile.

See Section 234.200 for detailed information on the topsoil stockpile(s).

**232.300 Thin Topsoil**

Not applicable see Attachment 2-1.

**232.400 Minor Disturbances Not Requiring Topsoil Removal**

Topsoil will not be removed along the fence line at the wells sites.

**232.500 Subsoil Segregation**

The B and C soil horizons will not be removed. Any small quantity of subsoil removed with the topsoil will not be segregated.

### **232.600 Timing**

Topsoil removal will take place after all vegetation that could interfere with salvaging the topsoil has been grubbed.

### **232.700 Topsoil and Subsoil Removal Under Adverse Conditions**

The topsoil will be removed first and stockpiled and the remaining soil horizons will be left in place, except where natural conditions render removal operations hazardous or detrimental to soils outside the disturbed area then topsoil will not be removed.

Conventional Machines - In locations where steep grades, adverse terrains, severe rockiness, limited depth of soils, or other adverse conditions exist that render soil removal activities using conventional machines hazardous, soils will not be salvaged and stockpiled. Such conditions are not likely to occur in these areas.

Substitute Topsoil - Importing of substitute topsoil is not anticipated (Section 224).

## **233 Topsoil Substitutes and Supplements**

### **233.100 Overburden Materials Supplementing and/or Replacing Topsoil**

No overburden material will be used.

### **233.200 Suitability of Topsoil Substitutes and Supplements**

No substitute topsoil is planned.

### **233.300 Physical and Chemical Analysis**

See Section 243.

### **233.400 Testing of Substitute Topsoil**

No substitute topsoil is planned.

## **234 Topsoil Storage**

### **234.100 Topsoil Stockpiling**

Topsoil will be stockpiled for later use in reclamation operations. The topsoil will be stored and treated as outlined in Section 234 of this amendment. Refer to Sections 231 through 234 of the M&RP for additional information pertaining to the topsoil at the Pace Canyon Fan site.

### **234.200 Topsoil Stockpile**

Stable Stockpile Site - Stockpiled material will be placed on a stable site.

Protection from Contaminants and Compaction - To protect the topsoil from contaminants and unnecessary compaction that could interfere with vegetation, the stockpile will be isolated from the main surface area by a berm and/or silt fence. A sign designating "topsoil" will be installed on the stockpile.

The topsoil stockpile will be constructed in such a manner as to allow access for repair of the pile surfaces and diversion structures.

Wind and Water Erosion Protection - The topsoil stockpile will be protected from water erosion by berms, which trap sediment runoff from the stockpile. The berms have been designed to completely contain the 10-year 24-hour storm event (see Attachment 7-1). The stockpile will be surface pitted, gouged and/or roughened and revegetated using the grass seeds listed in Table 3-2 to prevent wind erosion.

Topsoil Redistribution - Stockpile soil will not be moved until redistribution during contemporaneous or final reclamation operations unless approved by the Division.

At well pad G-19 a portion of the salvaged topsoil will be stored on existing roads. There is no topsoil remaining on these existing roads and the roads will remain following reclamation of the G-19 pad site. Wide flagging will be used as a marker to identify the separate between the road surface and the stored topsoil.

### **234.300 Topsoil Stockpile Relocation**

Stockpiled soil in jeopardy of being detrimentally affected in terms of its quantity and quality by drilling operations may be temporarily redistributed or relocated on approval by the Division and modification of this M&RP.

## **240 RECLAMATION PLAN**

### **241 General Information**

Reclamation of the degassification sites (topsoil redistribution, amendments, and stabilization) is discussed in Sections 242, 243, and 244 respectively.

### **242 Soil Redistribution**

#### **242.100 Soil Redistribution Practices**

The topsoil will be placed after recontouring of the site has occurred. Topsoil will be handled when they are loose or in a friable condition. The moisture content will be visually monitored and water will be added as needed to enhance the soil's condition for handling. The approximate amount of topsoil available for each site is shown in Table 2-1. The reclamation time line can be found on Figure 5-15 for sites G-2 and G-3 and on Figure 5-26 for sites G-4 thru G-19 and G-31. Figure 5-26 has been revised to include the access road (AMV).

The topsoil will be distributed in two phases at well site G-2, the first phase will be the contemporaneous reclamation of a portion of the pad area used during well construction (see Figures 5-4, 5-8 and 5-12). During contemporaneous reclamation topsoil from the stockpile will be distributed in the depths shown in Table 2-3.

Final reclamation will occur at all well sites after venting of the methane gas is complete, venting equipment has been removed and the well has been plugged. Well plugging will be delayed at well sites G-2, G-5 and G-7, to allow additional time for venting of the gob behind the sealed panels and to provide surface access to the mine. The surface at well sites G-2 and G-5 will be reclaimed in 2006/2007, however the wells will not be plugged. The surface at well site G-7 will be reclaimed in 2008, but the wells will not be plugged. The topsoil stockpile storage area and access road (G-2 and G-5) will be reclaimed during this final phase. The access roads to G-3, G-4, G-6, G-7, G-8, G-9, G-10, G-11 and G-12 are pre-existing and will not be reclaimed.

The topsoil stockpile storage area and access road (G-2 and G-5) will be reclaimed following the plugging of the wells. The access roads to , G-3, G-4, G-6, G-7, G-8, G-9, G-10, G-11, G-12, G-13, G-15, G-17 and G-19 are pre-existing and will not be reclaimed. The access road joining the pre-existing road to G-16 and the portion of the access road between the topsoil stockpile and the well site at G-14 will be pocked/gouged and seeded during final reclamation of the site.

The AMV access road will be reclaimed using the technology discussed in Section 240 of this amendment following the sealing and reclamation of well pads G-18 and G-31.

Refer to Section 341 for additional information.

Soil Thickness - The topsoil will be distributed during contemporaneous and final reclamation in the thickness shown in Table 2-3.

Compaction - Prior to the application of topsoil, compacted subsoils will be roughened or loosened for a depth of 18 to 24 inches. To prevent compaction of topsoil, soil moving equipment will refrain from unnecessary operation over spread topsoil. The topsoil will be in a loosened condition prior to seeding.

Following the drying of the mud pit materials, the dirt excavated to create the mud pit will be mixed with the drill cutting and returned to the pit to prevent a boundary of hard material from forming in the mud pit area that would hamper root penetration and then compacted to minimize settling.

Erosion - Care will be exercised to ensure the stability of topsoil on graded slopes to guard against erosion during and after topsoil application. Post reclamation (contemporaneous and final) erosion control measures will be surface roughing, mulching and seeding.

#### **242.200 Regrading**

The areas will be graded to their approximate original topographic configuration, except as approved by the Division.

#### **242.300 Topsoil Redistribution on Impoundments and Roads**

The mud pits will be dismantled and filled following completion of drilling. See Section 242.100, Compaction for additional information. Mud pits will be covered with the same amount of topsoil as the rest of the site. The roads existing prior to starting the drilling program will not be reclaimed. Access roads built to allow entrance to the drilling pads will be reclaimed and will receive topsoil in the same depth as their corresponding pad areas, **unless specified otherwise**

**TABLE 2-3**  
**Approximate Topsoil Distribution Thickness**

Well Site No.	Topsoil Thickness (Inches)
G-1*	7
G-2	30
G-3	12
G-4	28
G-5	22
G-6	12
G-7	12
G-8*	12
G-9	12
G-10	18
G-11	12
G-12	15
G-13	14 - 16
G-14A	14 - 16
G-15	14
G-16	14
G-17	12
G-18	18
G-19	16
G-31	15
AMV Access Road	12

\* Wells G-1 and G-8 were never constructed.

### **243 Soil Nutrients and Amendments**

The soils will be analyzed directly following salvage to determine if amendments are needed. Testing of the topsoil will be done according to Table 6 of the Division's Topsoil and Overburden Guidelines. The topsoil will be tested at a minimum for the following parameters: pH, electrical conductivity, total carbon, SAR, water holding capacity, plant available nitrogen, and phosphorus. Results of these analyses will be incorporated into Attachment 2-2.

### **244 Soil Stabilization**

#### **244.100 Protection and Stabilization of Surface Area**

All reclaimed areas will be stabilized to control erosion by application of mulch, tackifier, and roughening of the surface. The areas will be graded to the approximately original topographic configuration. Seeding will be accomplished with the application of seeds and mulch with a long fiber tackifier or broadcast. Methods of protection and stabilization are further discussed in Chapter 3, Section 341.

#### **244.200 Mulch Application**

Mulch/tackifier will be applied to stabilize the soil on all areas that have been regraded and covered with growth media. For further discussion of revegetation practices to be utilized, see Chapter 3, Section 341.

#### **244.300 Rills and Gullies**

Postmining Land Use and Revegetation - Rills and gullies that are approximately nine (9) inches in depth and disrupt the postmining land use or reestablishment of vegetative cover will be regraded and seeded. In addition, the repair of rills and gullies will assist in the maintenance of water quality standards.

## **250 PERFORMANCE STANDARDS**

### **251 Topsoil, Subsoil, and Topsoil Supplements Management**

All topsoil, subsoil, and topsoil supplements will be managed as outlined in Sections 230 and 240.

### **252 Stockpiled Topsoil and Subsoil**

All stockpiled topsoil and subsoil will be managed according to plans outlined in Sections 230 and 240.

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**ATTACHMENT 2-1**  
**SOIL INVENTORY AND ASSESSMENT**

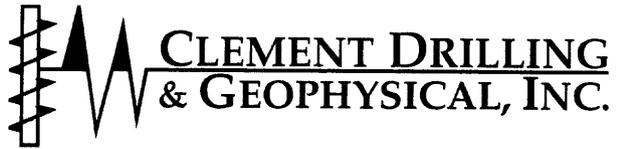
add to the back of existing information



4114 West 9950 North  
Cedar Hills, Utah 84062  
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Fax 801-785-5748

**Methane Drainage Wells Soils Report  
Sampled May 1 and May 5, 2007**

**May 22, 2007**



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Methane Drainage Wells Soils Report  
Sampled May 1 and May 5, 2007

# **Appendix A**

## **Map Unit Descriptions**

## Map Unit Description

Carbon Area, Utah, Parts of Carbon and Emery Counties

### 7 Beje-Trag complex

#### Setting

Elevation: 6980 to 9670 feet  
Mean annual precipitation: 16 to 20 inches  
Mean annual air temperature: 38 to 45 degrees F  
Frost-free period: 60 to 100 days

#### Composition

Beje and similar soils: 55 percent  
Trag and similar soils: 20 percent

#### Description of Beje

##### Setting

Landform: Ridges  
Landform position (two-dimensional): Summit  
Down-slope shape: Convex  
Across-slope shape: Convex  
Parent material: Slope alluvium and/or colluvium over residuum weathered from sandstone and shale

##### Properties and Qualities

Slope: 3 to 15 percent  
Depth to restrictive feature: 10 to 20 inches to Lithic bedrock  
Drainage class: Well drained  
Capacity of the most limiting layer to transmit water (Ksat): Moderately low or moderately high (0.06 to 0.20 in/hr)  
Frequency of flooding: None  
Frequency of ponding: None  
Calcium carbonate maximum: 5 percent  
Gypsum maximum: 0 percent  
Available water capacity: Very low (about 2.4 inches)

##### Interpretive Groups

Land capability (non irrigated): 6s  
Ecological site: Mountain Shallow Loam (Mountai (R047XA446UT)

##### Typical Profile

0 to 6 inches: loam  
6 to 14 inches: clay loam  
14 to 18 inches: unweathered bedrock

#### Description of Trag

##### Setting

Landform: Draws  
Down-slope shape: Linear  
Across-slope shape: Concave  
Parent material: Alluvium and/or colluvium derived from sandstone and shale

##### Properties and Qualities

Slope: 3 to 30 percent  
Drainage class: Well drained  
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)  
Frequency of flooding: None  
Frequency of ponding: None  
Calcium carbonate maximum: 10 percent  
Gypsum maximum: 0 percent  
Available water capacity: High (about 10.8 inches)

##### Interpretive Groups

Land capability (non irrigated): 6e  
Ecological site: MOUNTAIN LOAM (SALINA WILDRIE) (R048AY409UT)

##### Typical Profile

0 to 5 inches: clay loam  
5 to 39 inches: clay loam  
39 to 60 inches: clay loam

## Map Unit Description

Carbon Area, Utah, Parts of Carbon and Emery Counties

### 13 Cabba family-Guben-Rock outcrop complex

#### Setting

Elevation: 5980 to 8180 feet  
 Mean annual precipitation: 14 to 16 inches  
 Mean annual air temperature: 42 to 45 degrees F  
 Frost-free period: 60 to 120 days

#### Composition

Cabba and similar soils: 50 percent  
 Guben and similar soils: 20 percent  
 Rock outcrop: 15 percent

#### Description of Cabba

##### Setting

Landform: Canyons  
 Down-slope shape: Linear  
 Across-slope shape: Linear  
 Parent material: Colluvium and/or slope alluvium over residuum weathered from shale and siltstone

##### Properties and Qualities

Slope: 40 to 70 percent  
 Surface area covered with stones and boulders: 13.0 percent  
 Depth to restrictive feature: 8 to 20 inches to Paralitich bedrock  
 Drainage class: Well drained  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately low or moderately high (0.06 to 0.20 in/hr)  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Calcium carbonate maximum: 10 percent  
 Gypsum maximum: 0 percent  
 Available water capacity: Very low (about 2.3 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
 Ecological site: Upland Very Steep Shallow Loam (R034XY342UT)

##### Typical Profile

0 to 3 inches: bouldery loam  
 3 to 15 inches: loam  
 15 to 19 inches: weathered bedrock

#### Description of Guben

##### Setting

Landform: Hillslopes  
 Landform position (two-dimensional): Toeslope  
 Down-slope shape: Convex  
 Across-slope shape: Convex  
 Parent material: Colluvium derived from sandstone and shale

##### Properties and Qualities

Slope: 40 to 75 percent  
 Surface area covered with stones and boulders: 33.0 percent  
 Drainage class: Well drained  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately high or high (0.60 to 6.00 in/hr)  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Calcium carbonate maximum: 40 percent  
 Gypsum maximum: 0 percent  
 Sodium adsorption ratio maximum: 5.0  
 Available water capacity: Low (about 4.6 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
 Ecological site: Upland Very Steep Shallow Loam (R034XY342UT)

## Map Unit Description

Carbon Area, Utah, Parts of Carbon and Emery Counties

### 62 Midfork family-Comodore complex

#### Setting

Elevation: 7880 to 9470 feet  
 Mean annual precipitation: 16 to 25 inches  
 Mean annual air temperature: 34 to 45 degrees F  
 Frost-free period: 40 to 80 days

#### Composition

Midfork and similar soils: 50 percent  
 Comodore and similar soils: 20 percent

#### Description of Midfork

##### Setting

Landform: Mountain slopes  
 Down-slope shape: Convex  
 Across-slope shape: Convex  
 Parent material: Colluvium derived from sedimentary rock

##### Properties and Qualities

Slope: 50 to 70 percent  
 Surface area covered with stones and boulders: 13.0 percent  
 Drainage class: Well drained  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately high or high (0.60 to 2.00 in/hr)  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Calcium carbonate maximum: 5 percent  
 Gypsum maximum: 0 percent  
 Available water capacity: Low (about 5.1 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
 Ecological site: High Mountain Very Steep Loam (R048AY530UT)

##### Typical Profile

0 to 4 inches: bouldery loam  
 4 to 7 inches: bouldery loam  
 7 to 17 inches: very channery loam  
 17 to 60 inches: very gravelly loam

#### Description of Comodore

##### Setting

Landform: Mountain slopes  
 Down-slope shape: Convex  
 Across-slope shape: Convex  
 Parent material: Colluvium derived from sandstone

##### Properties and Qualities

Slope: 50 to 70 percent  
 Surface area covered with stones and boulders: 13.0 percent  
 Depth to restrictive feature: 10 to 20 inches to Lithic bedrock  
 Drainage class: Well drained  
 Capacity of the most limiting layer to transmit water (Ksat): Moderately low or moderately high (0.06 to 0.20 in/hr)  
 Frequency of flooding: None  
 Frequency of ponding: None  
 Calcium carbonate maximum: 0 percent  
 Gypsum maximum: 0 percent  
 Available water capacity: Very low (about 1.7 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
 Ecological site: High Mountain Very Steep Loam (R048AY530UT)

##### Typical Profile

0 to 6 inches: bouldery loam

## Map Unit Description

Carbon Area, Utah, Parts of Carbon and Emery Counties

### 97 Rottulee family-Trag complex

#### Setting

Elevation: 7080 to 8670 feet  
Mean annual precipitation: 16 to 20 inches  
Mean annual air temperature: 38 to 45 degrees F  
Frost-free period: 60 to 100 days

#### Composition

Rottulee and similar soils: 60 percent  
Trag and similar soils: 20 percent

#### Description of Rottulee

##### Setting

Landform: Mountain slopes, canyons  
Down-slope shape: Convex, linear  
Across-slope shape: Convex, linear  
Parent material: Colluvium over residuum weathered from sandstone and shale

##### Properties and Qualities

Slope: 30 to 60 percent  
Depth to restrictive feature: 20 to 40 inches to Lithic bedrock  
Drainage class: Well drained  
Capacity of the most limiting layer to transmit water (Ksat): Moderately low or moderately high (0.06 to 0.20 in/hr)  
Frequency of flooding: None  
Frequency of ponding: None  
Calcium carbonate maximum: 15 percent  
Gypsum maximum: 0 percent  
Available water capacity: Low (about 5.2 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
Ecological site: MOUNTAIN VERY STEEP STONY LOAM (R047XA473UT)

##### Typical Profile

0 to 8 inches: loam  
8 to 15 inches: clay loam  
15 to 23 inches: gravelly silty clay loam  
23 to 34 inches: gravelly silt loam  
34 to 38 inches: unweathered bedrock

#### Description of Trag

##### Setting

Landform: Canyons, mountain slopes  
Down-slope shape: Convex, linear  
Across-slope shape: Convex, linear  
Parent material: Alluvium and/or colluvium derived from sandstone and shale

##### Properties and Qualities

Slope: 30 to 60 percent  
Surface area covered with stones and boulders: 13.0 percent  
Drainage class: Well drained  
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)  
Frequency of flooding: None  
Frequency of ponding: None  
Calcium carbonate maximum: 10 percent  
Gypsum maximum: 0 percent  
Available water capacity: High (about 10.2 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
Ecological site: MOUNTAIN LOAM (SALINA WILDRIE) (R048AY409UT)

##### Typical Profile

0 to 10 inches: stony loam

## Map Unit Description

Carbon Area, Utah, Parts of Carbon and Emery Counties

### 101 Senchert loam, 30 to 50 percent slopes

#### Setting

Elevation: 8580 to 9370 feet  
Mean annual precipitation: 20 to 30 inches  
Mean annual air temperature: 36 to 38 degrees F  
Frost-free period: 40 to 60 days

#### Composition

Senchert and similar soils: 80 percent

#### Description of Senchert

##### Setting

Landform: Mountain slopes  
Down-slope shape: Convex  
Across-slope shape: Convex  
Parent material: Colluvium and/or slope alluvium over residuum weathered from sandstone and shale

##### Properties and Qualities

Slope: 30 to 50 percent  
Depth to restrictive feature: 20 to 40 inches to Lithic bedrock  
Drainage class: Well drained  
Capacity of the most limiting layer to transmit water (Ksat): Moderately low or moderately high (0.06 to 0.20 in/hr)  
Frequency of flooding: None  
Frequency of ponding: None  
Calcium carbonate maximum: 0 percent  
Gypsum maximum: 0 percent  
Sodium adsorption ratio maximum: 5.0  
Available water capacity: Moderate (about 6.2 inches)

##### Interpretive Groups

Land capability (non irrigated): 7e  
Ecological site: High Mountain Loam (Aspen) (R047XA508UT)

##### Typical Profile

0 to 4 inches: loam  
4 to 16 inches: loam  
16 to 35 inches: clay loam  
35 to 39 inches: unweathered bedrock

## Map Unit Description

### Detailed Soil Map Units

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description indicates the composition of the map unit and selected properties of the components of the unit.

Soils that have profiles that are almost alike make up a "soil series." Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into "soil phases." Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A "complex" consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An "association" is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An "undifferentiated group" is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include "miscellaneous areas." Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

**Appendix B**  
**Soil Test Pit Logs**

Site G-31 SP-1

<b>Name</b>	Craig Clement			<b>Drainage</b>	WD	Well Drained
<b>Date</b>	5/1/2007			<b>Flooding</b>	none	
<b>Weather</b>	Clear, 70°F			<b>Ponding</b>	none	
<b>Location</b>	N 39.68164°, W 110.49317°			<b>Depth to Water Table</b>	Unknown	
<b>Datum</b>	NAD 83			<b>Earth Cover</b>	SOS	Other shrub cover
<b>Topographic Map</b>	Mount Bartles, UT; 1:24,000; 1972			<b>Parent Material</b>	COL	colluvium
<b>Slope Aspect</b>	SW			<b>Bedrock, Kind</b>	SST, SIS, SHA	Interbedded sandstone, siltstone and shale
<b>Slope Gradient</b>	45%			<b>Bedrock, Fracture</b>	-	
<b>Slope Complexity</b>	Complex			<b>Bedrock, Hardness</b>	MO	Moderate
<b>Slope Shape</b>	Convex, Convex			<b>Bedrock, Depth</b>	100 cm	estimated
<b>Hillslope Profile Position</b>	SH shoulder			<b>Erosion, Kind</b>	R	rill
<b>Geomorphic Component</b>	TR tread			<b>Erosion, Degree</b>	1	>0 up to 25%
<b>Microrelief</b>	MH microhigh			<b>Runoff</b>	VH	Very High
<b>Drainage Pattern</b>	dendritic			<b>Surface Fragments</b>	Stony	
<b>Diagnostic Horizons</b>	<b>Observation Method</b>	<b>Depth (cm)</b>	<b>Boundary</b>			
				From	To	Distinctness
AO	SP	0 15	Gradual	Wavy	Moderate yellowish brown	10YR 5/4
A	SP	15 61	Gradual	Wavy	Moderate yellowish brown	10YR 5/4
B	SP	61 84	Gradual	Wavy	Yellowish gray	5Y 7/2
				<b>Description</b>		
				Loamy silt, slightly moist abundant sandstone clasts		
				Silt with trace fine sand, abundant sandstone clasts, slightly moist, moderate amount of roots		
				Silt with trace fine sand, abundant sandstone clasts, slightly moist, minor amount of root material		

Site 97 SP-1 Road

<b>Name</b>	Craig Clement	<b>Drainage</b>	WD	<b>Well Drained</b>				
<b>Date</b>	5/5/2007	<b>Flooding</b>	none					
<b>Weather</b>	Clear, 75°F	<b>Ponding</b>	none					
<b>Location</b>	N 39.69152°, W 110.48994°	<b>Depth to Water Table</b>	Unknown					
<b>Datum</b>	NAD 83	<b>Earth Cover</b>	SOS	Other shrub cover				
<b>Topographic Map</b>	Mount Bartles, UT; 1:24,000; 1972	<b>Parent Material</b>	COL	colluvium				
<b>Slope Aspect</b>	SW	<b>Bedrock, Kind</b>	SST, SIS, SHA	Interbedded sandstone, siltstone and shale				
<b>Slope Gradient</b>	80%	<b>Bedrock, Fracture</b>	-					
<b>Slope Complexity</b>	Complex	<b>Bedrock, Hardness</b>	MO	Moderate				
<b>Slope Shape</b>	LV Linear, Convex	<b>Bedrock, Depth</b>	120 cm	estimated				
<b>Hillslope Profile Position</b>	BS back slope	<b>Erosion, Kind</b>	G	gully				
<b>Geomorphic Component</b>	NS nose slope	<b>Erosion, Degree</b>	1	>0 up to 25%				
<b>Microrelief</b>	MH microhigh	<b>Runoff</b>	VH	Very High				
<b>Drainage Pattern</b>	dendritic	<b>Surface Fragments</b>	Stony					
<b>Diagnostic Horizons</b>		<b>Color (moist)</b>		<b>Description</b>				
		<b>From</b>						
		<b>To</b>						
		<b>Distinctness</b>						
		<b>Topography</b>						
AO	SP	0	15	Gradual	Wavy	Moderate brown	5YR 3/4	Fine sand with loam and silt, abundant root material, moist, with sandstone clasts
A	SP	15	46	Gradual	Wavy	Moderate brown	5YR 4/4	Silt with fine sand, moderate amount of sandstone clasts and root material, moist,
B	SP	46	68	Gradual	Wavy	Moderate brown	5YR 4/4	Silt with fine sand, abundant sandstone clasts and root material, moist,
BC	SP	68	91	Gradual	Wavy	Light brown	5YR 5/6	Fine sand with silt, trace root material, moist, abundant sandstone clasts up to ~8" diameter

Site 62 SP-1 Road

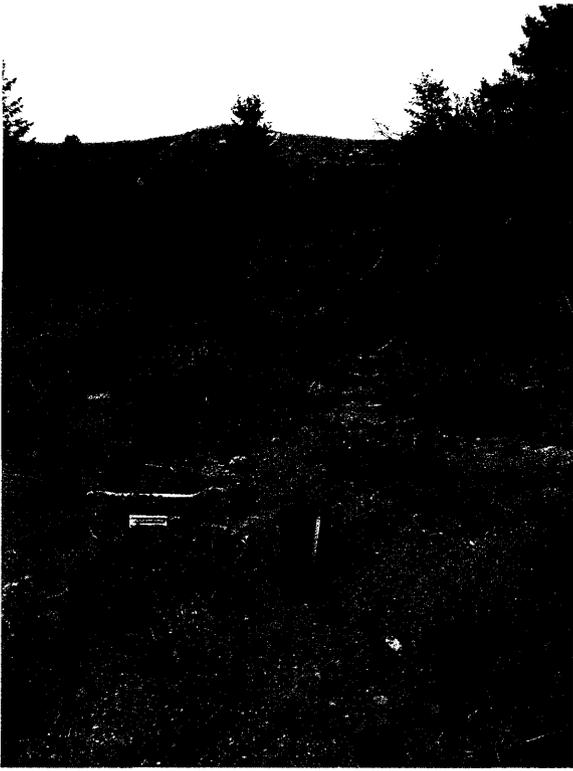
<b>Name</b>	Craig Clement	<b>Drainage</b>	Well Drained
<b>Date</b>	5/5/2007	<b>Flooding</b>	none
<b>Weather</b>	Clear, 75°F	<b>Ponding</b>	none
<b>Location</b>	N 39.68891°, W 110.48693°	<b>Depth to Water Table</b>	Unknown
<b>Datum</b>	NAD 83	<b>Earth Cover</b>	SOS
<b>Topographic Map</b>	Mount Bartles, UT; 1:24,000; 1972	<b>Parent Material</b>	COL
<b>Slope Aspect</b>	W	<b>Bedrock, Kind</b>	SST, SIS, SHA
<b>Slope Gradient</b>	80%	<b>Bedrock, Fracture</b>	-
<b>Slope Complexity</b>	Complex	<b>Bedrock, Hardness</b>	MO
<b>Slope Shape</b>	LV	<b>Bedrock, Depth</b>	120 cm
<b>Hillslope Profile Position</b>	BS	<b>Erosion, Kind</b>	G
<b>Geomorphic Component</b>	NS	<b>Erosion, Degree</b>	1
<b>Microrelief</b>	MH	<b>Runoff</b>	VH
<b>Drainage Pattern</b>	dendritic	<b>Surface Fragments</b>	Stony
<b>Diagnostic Horizons</b>		<b>Color (moist)</b>	<b>Description</b>
AO	SP	0 18 Gradual Wavy	5YR 3/2
A	SP	18 56 Gradual Wavy	5YR 4/4
BC	SP	56 91 Gradual Wavy	5YR 3/4

Site G-18 SP-1

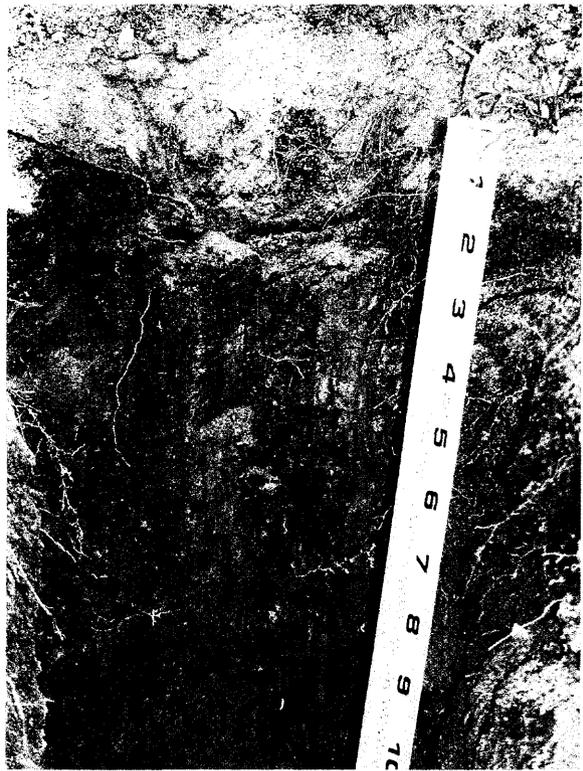
<b>Name</b>	Craig Clement	<b>Drainage</b>	Well Drained
<b>Date</b>	5/5/2007	<b>Flooding</b>	none
<b>Weather</b>	Clear, 75°F	<b>Ponding</b>	none
<b>Location</b>	N 39.68265°, W 110.48699°	<b>Depth to Water Table</b>	Unknown
<b>Datum</b>	NAD 83	<b>Earth Cover</b>	Other shrub cover
<b>Topographic Map</b>	Mount Bartles, UT; 1:24,000; 1972	<b>Parent Material</b>	colluvium
<b>Slope Aspect</b>	SSW	<b>Bedrock, Kind</b>	SST, SIS, SHA
<b>Slope Gradient</b>	45%	<b>Bedrock, Fracture</b>	-
<b>Slope Complexity</b>	Complex	<b>Bedrock, Hardness</b>	Moderate
<b>Slope Shape</b>	LV Linear, Convex	<b>Bedrock, Depth</b>	estimated
<b>Hillslope Profile Position</b>	SH shoulder	<b>Erosion, Kind</b>	rill
<b>Geomorphic Component</b>	CT crest	<b>Erosion, Degree</b>	>0 up to 25%
<b>Microrelief</b>	MH microhigh	<b>Runoff</b>	Very High
<b>Drainage Pattern</b>	dendritic	<b>Surface Fragments</b>	Stony
<b>Diagnostic Horizons</b>		<b>Color (moist)</b>	<b>Description</b>
A	SP	0 18 Gradual Wavy	10YR 5/4
			Silt with fine sand, moderate amount of root material, sandstone clasts, slightly moist
B	SP	18 53 Gradual Wavy	5Y 4/4
			Silt with trace fine sand, moderate root material decreasing with depth, slightly moist, sandstone clasts
BC	SP	53 66 Gradual Wavy	5Y 5/2
			Fine sand with trace silt, minor root material, hard @ 66cm, may be weathered bedrock



**Appendix C**  
**Photographs**



G31 SP-1 - Photograph 1  
Looking NW at SP-1



G31 SP-1 - Photograph 2  
0 to 25 cm



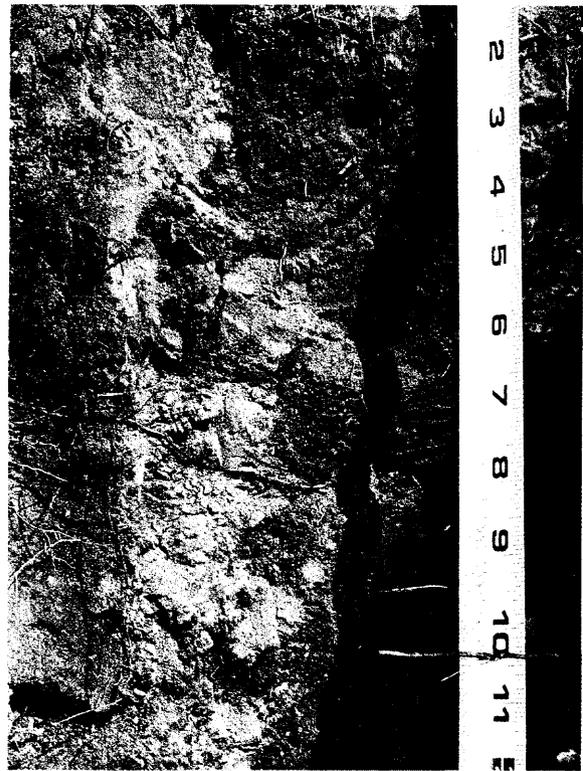
G31 SP-1 - Photograph 3  
25 to 48 cm



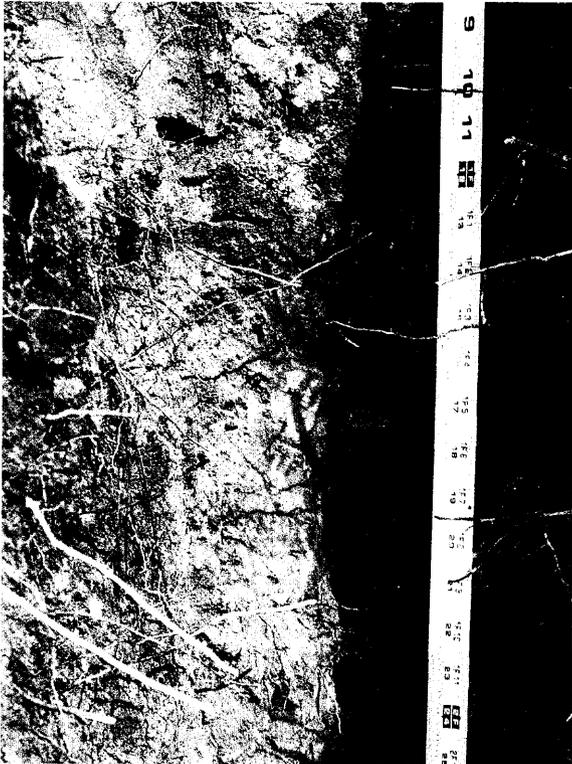
G31 SP-1 - Photograph 4  
48 to 76 cm



97 SP-I - Photograph 1  
Looking north a SP-I



97 SP-I - Photograph 2  
0 to 25 cm



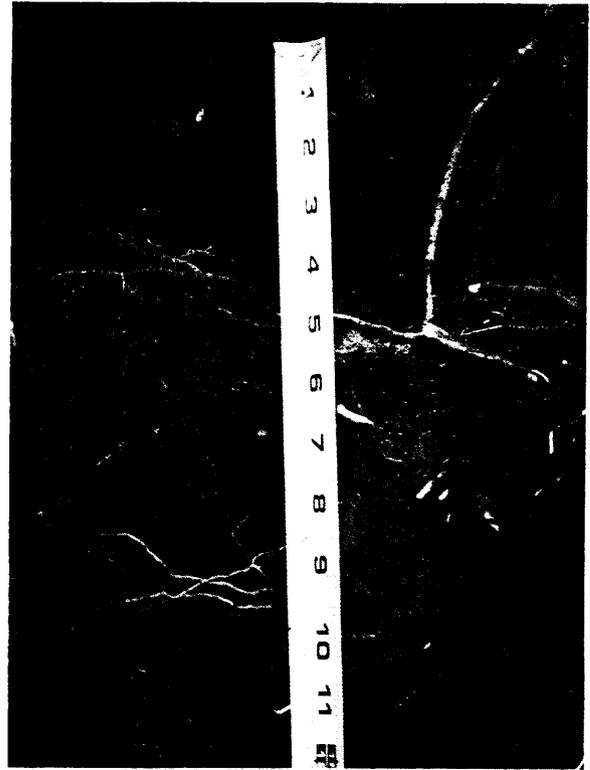
97 SP-I - Photograph 3  
25 to 50 cm



97 SP-I - Photograph 4  
50 to 91 cm



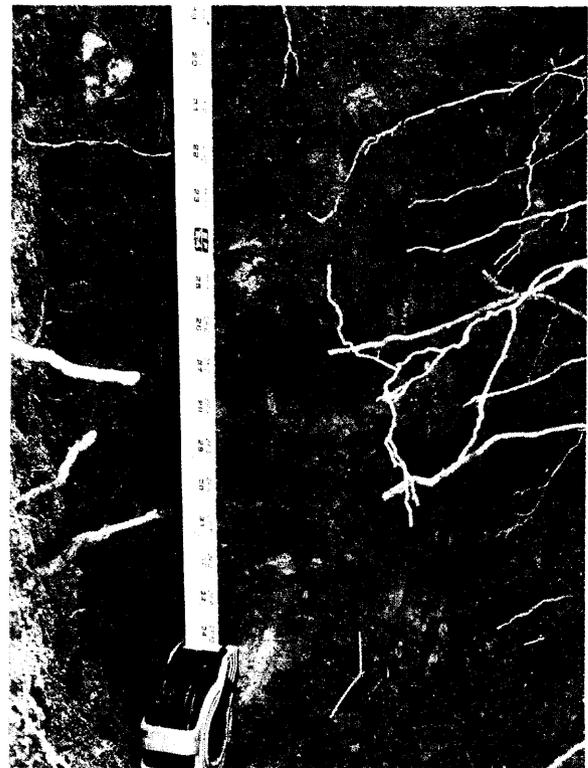
62 SP-I - Photograph 1  
Looking east at SP-I



62 SP-I - Photograph 2  
0 to 25 cm



62-SP-I - Photograph 3  
25 to 59 cm



62 SP-I - Photograph 4  
50 to 91 cm



G18 SP-1 - Photograph 1  
Looking north at SP-1



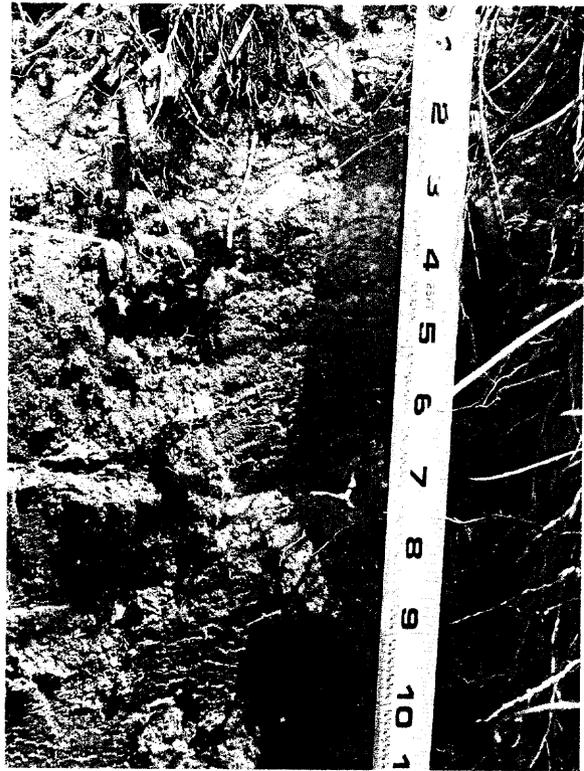
G18 SP-1 - Photograph 2  
0 to 30 cm



G18 SP-1 - Photograph 3  
30 to 66 cm



13 SP-1 - Photograph 1  
Looking east at SP-1



13 SP-1 - Photograph 2  
0 to 25 cm



13 SP-1 - Photograph 3  
25 to 50cm



13 SP-1 - Photograph 4  
50 to 86 cm

**ATTACHMENT 2-2**  
**TOPSOIL CALCULATIONS**

add to the back of existing information

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
~~June 14, 2007~~

**For ease of review this information has been provided in  
Attachment 2-2 and in Attachment 5-4**

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007

**ATTACHMENT 5-4**  
**Degas Wells Access Road**



### Cut/Fill Volumetrics

Area	Road	Pad 31	Pad 18	TOTAL
Disturbed Acreage	5.68	2.87	1.36	9.91
Disturbed Area Acreage within Boundary	13.72	4.66	1.74	20.11
Topsoil Volume (cyd)	9,167	4,624	2,195	15,986
Subsoil Cut Volume (cyd)	15,207	8,470	6,962	30,639
Cut Volume Total (cyd)	24,374	13,094	9,157	46,625
Fill Volume Required (cyd)	11,954	11,781	5,938	29,673
Net Cut(+)/Fill(-) Subsoil Only (cyd)	3,253	-3,311	1,024	966

Notes

Proposed road is 7,155 feet long.

Topsoil Volume assumes that the Disturbed Area will have 1 foot (avg) thickness topsoil to be stockpiled.

The Subsoil Cut Volume is the Cut Volume Total minus the Topsoil Volume.

The Net Cut Volume (966 cyd) does not include the volume of subsoil required to construct berms along the proposed road (265 cyd), around the proposed topsoil stockpiles (249 cyd), or around the proposed degas well pads G-31 (62 cyd) and G-18 (39 cyd). The net cut is thus  $966 - 249 - 265 - 62 - 39 = 351$  cyd. The road and pad berm volumes were calculated assuming that they will be 1 ft tall with 1H:1V side slopes. The lengths of the berms for the road, G-31, and G-18 were taken as 7155, 1670, and 1023 feet long, respectively. Stockpile berm volumes are calculated on the Stockpile Runoff Containment Volume Calculations table.

All acreages and cut/fill volumes were calculated with AutoCAD software.

### Stockpile Dimensions and Volumes

Stockpile	Length (ft)	Width (ft)	Height (ft)	Volume (yd <sup>3</sup> )
STP-1	85	50	20	800
STP-2	90	40	22	650
STP-3	205	120	25	6,000
STP-4	150	110	25	6,800
STP-5	150	70	25	2,450
STP-6	200	50	22	1,943
				<b>18,643</b>

#### Notes

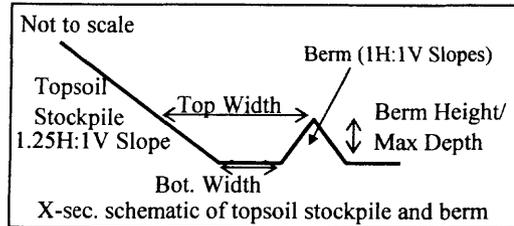
Stockpile locations are shown on the map.

Stockpile dimensions are approximate, and site conditions may affect their sizes and locations.

Stockpile volumes were calculated using AutoCAD Land Desktop Design 2008 software.

### Stockpile Runoff Containment Volume Calculations

Stockpile	Bottom Width (ft)	Top Width (ft)	Max Depth (ft)	Impounding Length of Berm (ft)	Total Length of Berm (ft)	Fill Req'd for Berm (yd <sup>3</sup> )	Cntmnt Vol. (ft <sup>3</sup> )	Contain Vol > Runoff Vol ?
STP-1	2	4.25	1	78	268	10	244	Yes
STP-2	2	4.25	1	89	257	10	278	Yes
STP-3	2	6.5	2	250	510	76	2,125	Yes
STP-4	2	6.5	2	227	509	75	1,930	Yes
STP-5	2	6.5	2	76	402	60	646	Yes
STP-6	2	4.25	1	262	513	19	819	Yes
						<b>249</b>	<b>Total fill for berms (yd<sup>3</sup>)</b>	



#### Notes

The bottom width is the distance between the toe of the topsoil stockpile and the base of the berm. (see schematic)

The top width is the horizontal distance between the crest of the berm and the topsoil stockpile. (see schematic)

The max depth is the height of the berm.

The Impounding Length of the berm accounts for the slope of the ground, and is the portion of the berm that will impound runoff.

The Total Length of Berm is its entire length around the topsoil stockpile.

The Fill Required for Berm is the volume of subsoil required to construct each berm, and is based on the length, height, and width of each berm. Berms shall be constructed with 1H:1V slopes.

The Containment Volume = Length \* Cross sectional area of the space between the topsoil stockpile and the inby side of the berm.

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**CHAPTER 3**  
**BIOLOGY**

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### LIST OF ATTACHMENTS

<b>Attachment 3-1</b>	Vegetation Inventory
<b>Attachment 3-2</b>	Threatened, Endangered, and Sensitive Species Information
<b>Attachment 3-3</b>	Information Moved to Confidential Folder in 2005

## **310 INTRODUCTION**

This chapter presents a description of the biological resources found on the Dugout Canyon degas well site areas.

### **311 Vegetative, Fish and Wildlife Resources**

Vegetative, fish, and wildlife resource conditions in and adjacent to the proposed degassification wells are discussed in Section 320 of this submittal and the approved M&RP.

### **312 Potential Impacts to Vegetative, Fish, and Wildlife Resources**

Potential impacts to vegetative, fish, and wildlife resources and the associated mitigation plan is presented in Sections 330 and 340 of this chapter.

### **313 Description of Reclamation Plan**

The reclamation plan used to restore the vegetative, fish, and wildlife resources to a condition suitable for the post mining land use is presented in Section 340.

## **320 ENVIRONMENTAL DESCRIPTION**

### **321 Vegetation Information**

This section and the approved M&RP contain the environmental descriptions of the vegetation for the permit and adjacent areas.

### **321.100 Plant Communities Within the Proposed Permit Area**

During June 2003, the degassification well sites were surveyed by Patrick Collins, Mt. Nebo Scientific. The report and survey for the areas are included in Attachment 3-1. The site for G-6 was moved to a pre-disturbed exploration well pad, the plant communities described in Mr. Collins report reflect the undisturbed portions on the north and south edges of the well pad. Vegetation information for G-7 was obtained from a report prepared by the NRCS Range Management Specialist, Dean Stacy (refer to Attachment 2-1 and 3-1) and the Patrick Collins survey prepared for well site G-3. A photograph of the G-7 site is included in Attachment 3-1. Well site G-3 and the access road can be seen on the photograph.

A vegetation survey of well sites G-8 thru G-12 was completed in July 2005 by Patrick Collins, Mt. Nebo Scientific. These sites have all been pre-disturbed, with a road running through the center of G-8 and remnants of logging activity at both G-9 and G-10. Approximately fifty percent of the well pads at sites G-11 and G-12 are existing roads which have no topsoil or vegetation. The remaining area at site G-11 has been disturbed, except for a small portion on the west side of the site. Well site G-12 has evidence of disturbance above the road cut however both soil and vegetation are intact. The reports and surveys for the areas will be included in Attachment 3-1.

The vegetation survey of well sites G-13 thru G-17 were completed between July and September 2005. The reports and surveys for the areas are included in Attachment 3-1. At well site G-13, the surface ranges from relatively smooth and non-stoney to very stoney. Portions along the southeast edge are too stoney for soil salvage. The G-14 well site has been disturbed by logging. The road to G-13 and G-14 are existing roads, however, the soil will be bladed to the side of the road at site G-14 and replaced during reclamation.

Well site G-15 is about 50 percent disturbed by a road, slopecut and fill. The undisturbed portion of the site is a slope with a southeast aspect (35 to 45 percent gradient). Well site G-16 was previously the site of an exploration hole, having been disturbed and reclaimed. The topsoil on

the access road to G-16 will be bladed to one side of the road and replaced during reclamation. At well site G-17 approximately one-third of the site is an existing road.

The entire area of well site G-19 was previously disturbed by logging activities with two roads crossing through the area. Well site G-18 appears to be undisturbed, while G-31 has evidence of disturbance by logging and evidence of use by cattle. The AMV access road to pad G-31 has been used by cattle and hunters to access the top of the ridge. The portion of the AMV road which accesses well site G-18 appears to be undisturbed.

### 321.200 Land Productivity Prior to Mining

Productivity of the well site lands prior to mining are shown in Table 3-1. Refer to Appendix 3-1 for a copy of the NRCS letter pertaining to productivity.

**TABLE 3-1**  
**Land Productivity**

<b>Well No.</b>	<b>Productivity (lbs.) Per Acre</b>
G-1 (Previously Disturbed)	100
G-2	1,500*
G-3	1,500*
G-4 (Previously Disturbed)	150
G-5	1500*
G-6 (Majority Previously Disturbed)	300*
G-7	1200*
G-8 (Previously Disturbed)	1200
G-9 (Previously Disturbed)	1000*

G-10 (Previously Disturbed)	1000*
G-11 (Previously Disturbed)	1000*
G-12 (Previously Disturbed)	1000*
G-13	1000*
G-14 (Previously Disturbed)	1000*
G-15 (Previously Disturbed)	1000*
G-16 (Previously Disturbed)	1000*
G-17 (Previously Disturbed)	1000*
G-18	900 - 1200*
G-19 (Previously Disturbed)	500 - 800*
G-31 (Previously Disturbed)	900 - 1200*
Access Road - AMV (Previously Disturbed)	900 - 1200*
<b>Reference Areas</b>	
Sagebrush/Snowberry/Grass (G-2, G-3, G-4, G-5, and G-7)	1,500*
Aspen/Maple/Douglas Fir (G-1, G-6, and G-8)	300*
Mountain Brush/Conifer (G-9 thru G-11)	1200
Conifer/Mountain Brush/Pinyon Juniper (G-12, G-13 and G-15)	1100
Aspen/Conifer (G-14 and G-19)	300
Mountain Brush/Snowberry (G-16, G-17, G-18 and G-31, AMV Access Road)	1400

\* Community composition is experiencing a declining trend, with decrease in herbaceous production, increase in shrub/tree production.

### **322 Fish and Wildlife Information**

Fish and wildlife information associated with the degas wells is provided in this chapter. A summary of the fish and wildlife resource information for the permit and adjacent areas is contained in Sections 322.100 through 322.200 of the approved M&RP.

#### **322.100 Level of Detail**

The scope and level of detail within the "Methane Degassification Amendment" are sufficient to design the protection and enhancement plan for wildlife and fish associated with the degas wells. Additional information pertaining to fish and wildlife in the permit area is located in the M&RP.

#### **322.200 Site-Specific Resource Information**

**Raptors** - An aerial raptor nest survey was done of the area by the Utah Division of Wildlife Resource (DWR, Chris Colt, Leroy Mead) and CFC personnel in May of 2003, refer to the Confidential Folder. Surveys were completed in May of 2004 and 2005, the information has been incorporated into the Confidential Folder.

No raptor nests were recorded during the survey (2003) in the area (portions of N1/2SE1/4NW1/4 and N1/2SW1/4NE1/4 of Section 24; a portions of N1/2SW1/4NW1/4 Section 19, Township 13 South, Range 13 East) of the degas wells. Refer to Figure 1-1 for mapped well locations.

During the 2004 raptor survey, there were no active or tended nests identified in the vicinity of the degas wells. During the 2005 raptor survey (May 12 & 20), there were no active or tended nests identified in the vicinity of degas wells G-9 and G-10. Two golden eagles nests were observed in the cliffs adjacent to degas well G-8 (Nest 9, DWR 2005 Raptor Survey). A single young eagle was observed, but habitually vacates the nest within 45 days of birth. A raptor survey will be conducted of the well site areas, each year that the wells are in operation.

A raptor survey was performed by Division of Wildlife Resources personnel in May 2006, a copy of the written log is included with deficiencies for Task ID #2456 (located in the confidential folder). Nest 424 when inventoried during the 1998 annual raptor survey was determined to be an inactive raven nest and was not found or inventoried again until 2004 when it was listed as inactive. Nest 424 was not inventoried or found during the annual raptor surveys in 2005 and 2006 by the Division of Wildlife Resources.

During a ground-truthing by Leroy Mead of the Division of Wildlife Resources on July 11, 2006, the two well sites with potential habitat for NSO and northern goshawks were G-14 and G-17. A calling survey will be performed if drilling at either of these sites will begin prior to the end of the exclusionary period, described as July 15.

Well G-14 will be drilled in 2006 after July 15. Well G-17 is to be drilled in 2009 ~~2007~~, the date for drilling will be scheduled in ~~2007~~ according to the availability of drilling companies and a calling survey if needed will be performed at that time. If a calling survey is performed, the results will be incorporated into the confidential folder.

A Northern Goshawk calling survey was performed in July of 2003 for four weeks in the area of well site G-17. According to the survey there was no response from a northern goshawk. A copy of this survey is located in the confidential binder.

On July 12, 2006, Nest 9 a golden eagle nest was inventoried on the ground by Leroy Mead, although there is evidence of disturbance associated with subsidence in the area, the nest was not disturbed. The 2006 raptor survey lists Nest 9 as being tended.

The G-19 well site was inventoried by Leroy Mead in November 2006 and on June 11, 2007, no wildlife concerns were noted. The area was part of the annual raptor survey, no nest are located in the area.

Well sites G-18, G-31 and the AMV access road were inventoried by Leroy Mead on June 11, 2007, no wildlife concerns were noted. Cattle were observed along the road and on the G-31 well pad site. The area was part of the annual raptor survey, no nest are located in the area.

**Bats** - No known open mine shafts, caves, adits or other man made structures that might provide habitats for bats are known to exist in the degas project area. The sites are open and the lack of a food source would force the bats to seek habitat and nourishment elsewhere.

On the nights of May 21 and 22, 2007 JBR Environmental Consultants, Inc. conducted bat surveys along the northern cliffs of Pace Creek Canyon. The inventory area of the survey included portions of Sections 16, 17, 18, 19, 20 and 21 T13SR13E. Pad G-18, G-19, G-31 and access road was within the area inventoried. During the two night of recording bat calls, no bat call files were produced. A copy of the inventory report has been included in Attachment 3-2.

**Mexican Spotted Owl** - In the Summer of 2003, a calling point survey was conducted in the degas well area by EIS Environmental and Engineering Consulting. The survey report concluded that “ within the project area, a thorough search did not reveal the presence of any Mexican spotted owls”. The report is included in Attachment 3-2. A second survey was completed in May of 2004, the information is incorporated into Appendix 3-3 of the M&RP .

**Threatened and Endangered Plant and Wildlife Species** - There are no known federally or state listed threatened and endangered plant and wildlife species within the sites planned for degassification wells.

Bureau of Land Management Environmental Assessment No. UT-070-2001-83 and UT-070-2004-49 contain determination in accordance with the United States Fish and Wildlife Service’s protocols, for sites G-11, G-15, G-16 and G-17. The sites were inventoried for the presence of threatened, endangered, and sensitive faunal, and floral species in June of 2001, April, May and June of 2004, no species were found. In the assessment the sites were being used for exploration holes and were referenced by a different number which is in parenthesis following the degas well number G-11 (DT-2), G-15(DUG0204), G-16 (E) and G-17 (DUG0304).

Mt. Nebo Scientific, Inc. conducted a survey of Pad G-18, G-19, G-31 and the AMV access road no rare, endemic, threatened or endangered or otherwise sensitive species were found in the study area (Attachment 3-1).

There are no known groundwater or surface water flows to the Colorado or Green Rivers with potential for impact by the drilling of the degas wells. Potential adverse affects to the four Colorado River endangered fish species (refer to table below) would not be likely since there is no direct route to the Colorado River or Green River from the proposed well locations. Per the Windy Gap Process (referenced by personal communication Jerriann Ernsten, 8/19/03) consumption estimates for the degas wells: evaporation from ventilation - zero, drill holes will not intersect the coal seam being mined, therefore no access to mine ventilation until after area is sealed; coal preparation - zero, no coal preparation at degas sites (see Sections 522 and 523) ; sediment pond evaporation - zero, no sediment pond at degas sites (see Section 732.200); subsidence effects on springs - zero, no anticipated subsidence at degas sites (see Section 525); alluvial aquifer abstractions into mines - zero, no alluvial aquifer abstractions associated with degas drill holes (see Sections 513.500 and 600); postmining inflow to workings - zero, no workings for postmining inflow associated with degas wells (see Sections 513.500 and 600); coal moisture loss - zero, no coal therefore no moisture loss (see Sections 522 and 523); direct diversion - zero, no direct diversions associated with degas wells (see Sections 522 and 523). Water **purchased** for drilling is estimated at 420,000 gallons per hole. Mitigation will not be required since the estimated loss for the construction and reclamation of the degas holes is zero acre feet per year.

**Windy Gap Process as it Applies to Existing Coal Mines in the Upper Colorado River Basin**

Per meetings with Division of Water Quality personnel during application for a UPDES permit in 2004, "there is no data supporting the premise that surface waters associated with the area of the mine operations reached the Price River or Colorado River prior to or since mining disturbance".

Mining Consumption:

Culinary Water is purchased from PRWID and hauled by D & D Trucking to the Mine.

Estimated **Purchased** Gallons/yr: 2,522,160

Ventilation Consumption/Evaporation:

87,108 gallons/day

$87,108 \times 0.5 = 43,554$  gallons/day (average)

$43,554 \times 365 = 15,897,210$  gallons/yr

Coal Producing Consumption/Coal Moisture Loss:

Water added to coal produced - 3.97% inherent moisture - source Dugout Geologist  
6.38% run-of-mine moisture - year to date average  
2.41% moisture added to coal by cutting operation

Projected Tonnage 2005 4,525,093 tons

Projected Tonnage 6 year average 4,894,100 tons

Tons water/yr 117,977

Pounds water/yr 235,954,986

Gallons water/yr 28,258,082

Sediment Pond Evaporation:

Mine Site Pond 0.107 acres (surface area)  
18.1 in/yr (high estimate based on HCI Technical Memo, August 22, 2002)  
0.16 ac/ft  
7030 gallons/yr

Refuse Pile Pond 0.41 acres (surface area)  
9 in/yr  
0.31 ac/ft  
5612 gallons/yr (high estimate)

Spring and Seeps Effects From Subsidence - Not Applicable

Alluvial Aquifer Abstractions into Mines - Not Applicable

Alluvial Well Pumpage - Not Applicable

Deep Aquifer Pumpage - Not Applicable

Postmining Inflow to Workings - Not Applicable

Direct Diversions: - Not Applicable

Dust Suppression - 1,000 gallons per truck load, 3 load per day, for 335 days = 1,005,000 gallons plus 1,000 per truck load, 1 load per day, for 193 days = 193,000. Total: 1,198,000 gallons per year.

Mine Discharge: 6 Month Average 420,537gpd = 155,260,050 gal/yr

Calculation estimates for water use in 2005 were necessary since we are using 2005 purchases and usage and the year is 2 months short.

**Federal and State Listed, Threatened, Endangered and Candidate Species  
Plants and Wildlife  
Carbon County, Utah  
October 2002, Updated 6/7/05**

Common Name	Scientific Name	Status	Habitat Present*
<b>Plants</b>			
Uinta Basin Hookless Cactus	<i>Sclerocactus glaucus</i>	T	No habitat available
Graham Beardtongue	<i>Penstemon grahamii</i>	C	No habitat available
<b>Fish</b>			
Humpback Chub	<i>Gila cypha</i>	E	No habitat available
Roundtail Chub**	<i>Gila robusta</i>	T	No habitat available
Bonytail	<i>Gila elegans</i>	E	No habitat available
Colorado Pikeminnow	<i>Ptychocheilus lucius</i>	E	No habitat available
Razorback Sucker	<i>Xyrauchen texanus</i>	E	No habitat available
<b>Birds</b>			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	T	No habitat available
See Confidential Folder			
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	C	No habitat available
Ferruginous Hawk**	<i>Buteo Regalis</i>	T	No habitat available
Southwestern Willow Flycatcher**	<i>Empidonax traillii extimus</i>	E	No habitat available
Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T	See Attachment 3-2 and Appendix 3-3 (M&RP)
<b>Mammals</b>			
Black-footed Ferret	<i>Mustela nigripes</i>	EX	No habitat available

\* Habitat availability in Carbon County/Dugout Mine/Degas Well Sites.

\*\* Utah State Listed Species - Information verified with Bill Bates, DWR (personal communication 7/17/03)

E = A taxon that is listed by the U.S. Fish and Wildlife Service as "endangered" with the possibility of worldwide extinction.

T = A taxon that is listed by the U.S. Fish and Wildlife Service as "threatened" with becoming endangered.

C = A taxon for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to justify it being a "candidate" for listing as and endangered or threatened.

Source: Utah Division of Wildlife Resources data base - created 10/24/02

Refer to Appendix 3-3 of the M&RP for a listing of Federal and State Listed, Threatened, Endangered and Candidate Species, Plants and Wildlife of Carbon County, Utah (2003).

### **322.300 Fish and Wildlife Service Review**

If requested, Dugout Canyon authorizes the release of information pertaining to Section 322 and 333 to the U. S. Fish and Wildlife Service Regional and Field Office for their review. On the 25<sup>th</sup> of May 2005, Leroy Mead of the DWR toured degas well sites G-8, G-9, G-10, G-11 thru G-14. During the tour no wildlife concerns were noted.

The G-18, G-19 and G-31 well sites, as well as, the AMV access road was inventoried by Leroy Mead on June 11, 2007 and no concerns were noted.

### **323 Maps and Aerial Photographs**

Location of the well sites can be seen in Figure 1-1 of this submittal.

### **323.100 Location and Boundary of Proposed Reference Area**

Reference areas for the degassification wells were established during the vegetative study conducted in the Summer of 2003. Well sites G-2, G-3, G-4, G-5, and G-7 will be compared to the Sagebrush/Snowberry/Grass reference area and G-1, G-6, and G-8 to the Aspen/Maple/Douglas Fir reference area. Mountain Brush and Conifer is the reference area for well sites G-9 thru G-11. The reference area for Degas Well G-12 , G-13 and G-15 is Conifer, Mountain Brush and Pinyon Juniper. The reference area for Degas Well G-14 and G-19 is Aspen/Conifer, the reference area for G-16 thru G-18, G-31 and the AMV access road is Mountain Brush/Snowberry. Refer to Attachment 3-1 and Figure 3-1 for the location of the reference areas associated specifically with the degas wells. Reference areas are also shown on Plate 3-1 and 3-1E in the M&RP.

### **323.200 Elevation and Locations of Monitoring Stations**

Refer to Section 323.200 of the approved M&RP.

### **323.300 Facilities for Protection and Enhancement**

Section 333.300 and 358.500 of the approved M&RP contain additional discussion pertaining to protective measures to be taken by Dugout Canyon on behalf of wildlife.

### **323.400 Vegetation Type and Plant Communities**

Vegetative types and plant communities are outlined in the vegetative report in Attachment 3-1. Figure 3-2 gives details of the vegetation types located adjacent to the well sites.

## **330 OPERATION PLAN**

### **331 Measures Taken to Disturb the Smallest Particle Area**

The well sites will be sized to disturb the smallest acreage possible and still meet the requirements for the drilling equipment. The drainage control required will be built to satisfy the environmental requirements.

### **332 Description of Anticipated Impacts of Subsidence**

Refer to Section 525.

### **333 Plan to Minimize Disturbances and Adverse Impacts**

General control and mitigation measures addressing potential related biological impacts will include the following:

- Minimizing the total area of disturbance,
- Design, construction, and operation of the well sites to minimize impacts
- Exclusion of wildlife from potentially hazardous areas, and
- Reclamation of disturbed areas when they are no longer needed.

All water associated with the drilling of these wells will be appropriated and hauled and/or pumped to the sites by a licensed contractor. Since the drilling of degas wells does not involve the mining of coal, the USWFS consumption requirements for underground operations do not apply (i.e., evaporation from ventilation, coal preparation, sediment pond evaporation, subsidence of springs, alluvial aquifer abstractions into the mine, postmining inflow to workings, coal moisture loss, direct diversions).

As inventoried by the Division of Wildlife Resources in 2003, 2004, 2005 and 2006, Nest 424 was determined to be a raven's nest, which was either inactive, not inventoried or found. Wells G-13, G-14 G-18, G-19 and G-31 will be drilled post July 15<sup>th</sup>, after the exclusionary period for NSO and northern goshawks.

#### **333.100 Minimize Disturbance to Endangered or Threatened Species**

Dugout Canyon will apply all methods necessary to minimize disturbances or any adverse effects to threatened or endangered species. See Section 322.200.

### **333.200 Species and Habitats**

All species and habitats within the permit area will be protected to the best of Dugout Canyon's ability.

### **333.300 Protective Measures**

Refer to Section 333.300 of the approved M&RP.

## **340 RECLAMATION PLAN**

### **341 Revegetation**

Revegetation of the sites will occur in two phases at drill site G-2. The first phase is to redistribute topsoil and seed the well area not needed for access and operation of the gas exhaust blower. The second phase will consist of plugging the well and distributing the remaining topsoil and seeding on the remaining pad area. Complete final reclamation at well sites G-2, G-5 and G-7 will be delayed, refer to Section 242.100 for additional detail and Attachment 5-2. Sites G-3, G-4, G-6, G-8 (never constructed), G-9, G-10, G-11 thru **G-19 and G-31** will be reclaimed in one phase. **A separate reclamation schedule has been proposed for the AMV road, it will be needed to access the degas wells during and following reclamation (Figure 5-26).**

The short-term goal of this revegetation plan is the immediate stabilization of the disturbed sites through erosion control. This objective will be achieved through controlled grading practices, proper seedbed preparation to encourage rapid plant establishment, inclusion of rapidly establishing species in the seed mixture to be planted, and mulch application.

The long-term goals are to establish useful, and productive range. These goals will be attained through the selection and placement of desirable and productive plant species and a commitment to monitor and maintain revegetated areas throughout the bond liability period.

The well sites will be fenced to discourage wildlife and livestock from grazing the reclaimed areas until bond release.

### **341.100 Schedule and Timetable**

The reclamation timetable is shown in Figures 5-15 (G-2) and 5-26 (G-3 thru G-19, G-31 and AMV access road) of this submittal and the reclamation monitoring schedule is found in Chapter 3, Table 3-3 of the approved M&RP.

### **341.200 Descriptions**

**Species and Amounts of Seed** - The well sites will be planted with the seed mix listed on Table 3-2. The seed mix will be used in both contemporaneous and final reclamation phases. The seed will be incorporated with a small amount of wood fiber mulch and applied by hydroseeding equipment or broadcast. Refer to Section 234.200 for topsoil stockpile seeding description.

**Methods Used for Planting and Seeding** - The degassification sites will be graded to final contour, then ripped to relieve compaction. The depth of ripping will be from 18 to 24 inches. Following ripping, topsoil will be applied to the ripped surface and left in a gouged and roughened state.

**Mulching Techniques** - Wood fiber mulch will be applied on top of the seed with hydroseeding equipment at the rate of 2,000 pounds per acre and anchored with a tackifier in amounts specified by the manufacturer.

**Irrigation, Pest, and Disease Control** - No irrigation is planned and pesticides will not be used unless previously approved by the Division.

**Measures Proposed for Revegetation Success** - Refer to Section 356.

### **341.300 Greenhouse Studies, Field Trials or Other Equivalent Studies**

Refer to the Section 341.300 of the approved M&RP.

## **342 Fish and Wildlife**

### **342.100 Enhancement Measures**

Post bond release enhancement measure will include the establishment of vegetation for wildlife food, cover, and the break up of large blocks of monoculture to diversify habitat. The current blocks of monoculture include large area of sagebrush and mixed brush. According to Dean Stacy, Range Management Specialist, USDA-NRCS "past management practices have allowed the shrub (mainly mountain sage brush) to surpass the 25-35%, while the herbaceous production has declined". By planting reclamation seed mixes with grasses and forbs the planted areas will breakup the monocultures and provide a future seed source.

In consultation with UDWR (Tony Wright, July 6, 2004) and UDOGM (Jerriann Ernstsens, July 6, 2004) a mitigation project was designated for the Northern Saw Whet Owl to compensate for drilling during the exclusionary period. The project will be completed prior to October 1, 2004. The project will include the construction and installation of 6 to 10 nest boxes on property owned by Canyon Fuel Company, LLC. Because of the UDWR knowledge and experience their personnel will choose the location and install the boxes. Information (goals, procedures, agencies, dates, box locations - township, range, section) concerning the owl mitigation project will be included in the annual report for 2004.

### **342.200 Plants Used for Wildlife Habitat**

**Nutritional Value** - The nutritional value will be consistent with that of vegetation in the surrounding areas.

**Cover** - Cover will be comparable to the cover on the associated reference area.

### **342.300 Cropland**

Cropland is not a postmining land use.

### **342.400 Residential, Public Service, and Industrial Land Use**

No residential, industrial or public service use is planned.

## **350 PERFORMANCE STANDARDS**

### **351 General Requirements**

Dugout Canyon commits to conduct all operations in accordance with the plans submitted in Sections R645-301-330 through R645-301-340 of the permit application.

### **352 Contemporaneous Reclamation**

Reclamation activities prior to final reclamation will to the extent feasible, be performed contemporaneously. Contemporaneous reclamation will be performed at the well sites following construction of the wells. Refer to Section 341 for additional details.

### **353 Revegetation: General Requirements**

A vegetative cover will be established on all reclaimed areas to allow for the designated postmining land use of grazing. Refer to Section 411 for additional information.

#### **353.100 Vegetative Cover**

The seed mix proposed for revegetation is intended to provide vegetative cover that will be diverse, effective, and permanent. The seed mixture was selected with respect to the climate, potential seedbed quality, erosion control, drought tolerance, and the mixture's ability for quick establishment and spreading.

**Native Species** - The reclamation vegetation mixture will be comprised of species indigenous to the area and capable of achieving the postmining land use. Diversity of species should allow utilization of plants by wildlife and domestic livestock. The recommended seed mix is comprised of native species.

**Extent of Cover** - The vegetative cover will be at least equal in extent to the cover at the designated reference areas.

**Stabilizing** - The vegetative cover mixture is capable of stabilizing the soil surfaces from erosion.

#### **353.200 Reestablished Plant Species**

**Compatible** - The reestablished plant species have been selected to insure their compatibility with the approved postmining use.

**Seasonal Characteristics** - The revegetation plant species will have the same growing season as the adjacent areas.

**Self-Generation** - The reestablished plants are species capable of self-generation and plant succession.

**Compatibility** - The seed mix suggested for revegetation contains plants native to the area and compatible with the plant and animal species of the permit area.

**Federal and Utah Laws or Regulations** - The seed mix purchased to revegetate the degassification well sites will contain no poisonous or noxious plant (see Section 234.200). No species will be introduced in the area without being approved by the Division.

### **353.300 Vegetative Exception**

Dugout Canyon does not require vegetative exception at this time.

### **353.400 Cropland**

The permit area contains no land designated as cropland.

### **354 Revegetative: Timing**

Dugout Canyon will follow the recommended guidelines for revegetation and planting during the first normal period for favorable planting conditions after replacement of the topsoil. In Utah the planting period is usually Fall due to the precipitation events.

### **355 Revegetation: Mulching and Other Soil Stabilizing Practices**

Mulch and/or other soil stabilizing practices (roughing, etc.) will be used on all areas that have been regraded and covered by topsoil (Section 341.200). Dugout Canyon Mine will exercise care to guard against erosion during and after application of topsoil.

**Table 3-2**  
**Reclamation Seed Mix**

<u>SPECIES</u>	<u># pls/acre</u>	<u># pls/sq. ft.**</u>
<b>Grasses, Forbs, and Shrubs</b>		
Kentucky Bluegrass (1,390,000 seeds/lb)*	0.5	16
Mountain Brome (64,000 seeds/lb)*	2.0	3
Sandberg Bluegrass (1,100,000 seeds/lb)*	1.0	25
Bluebunch Wheatgrass (126,000 seeds/lb)*	4.0	12
Bottlebrush Squirreltail (192,000 seeds/lb)*	1.0	4
Rocky Mountain Penstemon (478,000 seeds/lb)*	1.0	11
Mountain Lupine (12,000 seeds/lb)*	3.0	1
Mtn. Snowberry (54,000 seeds/lb)*	4.0	5
Wyoming Big Sage (2,500,000 seeds/lb)*	<u>0.5</u>	<u>29</u>
TOTAL	17	106

\* Native Plants

\*\* Rounded nearest whole seed

Grass seed quantities will be doubled if the area is broadcast seeded.

### **356 Revegetation: Standards for Success**

#### **356.100 Success of Revegetation**

The success of revegetation will be judged on the effectiveness of the vegetation for postmining land use, the extent of cover on each degassification well site compared to their respective reference areas.

**Sampling Techniques** - Dugout Canyon will comply with the standards for success, statistically valid sampling techniques for measuring success, and the approved methods outline in the Division's "Vegetation Information Guidelines, Appendix A" for sampling.

The sampling methods to be used during reclamation will be specific to the requirements at the time of reclamation. Nonetheless, according to the currently approved UDOGM guidelines, these sampling methods would be used: sample adequacy, cover (line interception), density (belt transects or plots) and productivity (clipping). The Jaccard's Community Coefficient will be used to calculate acceptable plant similarity and diversity.

**Standards for Success** - The standards for success will include criteria representative of undisturbed lands in the area of the degas wells as means to evaluate ground cover, production and stocking of the reclaimed site.

#### **356.200 Standards for Success**

Standards of success will be applied in accordance with the approved postmining land use as described in this section.

**Grazing Land and Pasture Land** - The ground cover and production of living plants on the revegetated area will be at least equal to the reference area.

**Cropland** - There is no area designated as cropland within the degassification well sites.

**Fish and Wildlife Habitat** - The postmining land use for the degas well sites will be grazing, except on pre-existing roads. Pre-existing roads will be returned to their approximate original contour and compacted.

**Industrial, Commercial or Residential** - The postmining land use for the permit area is not designated for industrial, commercial, or residential use.

**Previously Disturbed Areas** - Site G-1 (never constructed), G-4, G-6, G-7, G-8 (never constructed), G-9, G-10, G-11, G-12, G-14, G-15, G-16, G-17, G-19, G-31 and AMV access road have been previously disturbed. The AMV access road was previously used for logging, as a trail for hunting and for cattle to access the site of degas well G-31, the road from G-31 to G-18 has not been disturbed. Sites G-2, G-3, G-5, G-13 and G-18 have not been previously disturbed. Standards of success for all sites will be applied in accordance with the postmining land use of grazing as described in this section.

### **356.300 Siltation Structures**

Siltation structures will be maintained until the disturbed areas have been stabilized and revegetated. For additional details on siltation structures, see Sections 542 and 763 of this amendment.

### **356.400 Removal of Siltation Structures**

The land on which siltation structures are located will be revegetated in accordance with the reclamation plan discussed in Section 353 and 357. Refer to Section 763 for addition information pertaining to the removal of siltation structures.

### **357 Revegetation: Extended Responsibility Period**

Dugout Canyon will be responsible for the success of revegetation for a period of 10 years following seeding of the reclaimed area or upon Division bond release.

#### **357.100 Extended Period Begins**

The period of extended responsibility will begin after disturbed areas have been reseeded.

#### **357.200 Vegetation Parameters**

Vegetation parameters will equal or exceed the approved success standard during the last 2 years of the responsibility period. The success standards are outline in Section 356 of this application.

#### **357.300 Husbandry Practices**

The use of husbandry practices are not being requested by Dugout Canyon for the degas well sites.

### **358 Protection of Fish, Wildlife, and Related Environmental Values**

Dugout Canyon will minimize disturbances and adverse impacts on wildlife and their related environments as outline in Section 333 of the approved M&RP and Section 342 of this submittal. See Chapter 7, Section 731.100 of the approved M&RP for methods to protect water sources in the area.

### **358.100 Existence of Endangered or Threatened Species**

The well sites will not be constructed or operated where they might jeopardize the existence of any endangered or threatened species. Refer to Section 322.200 and Attachments 3-1, 3-2 and 3-3 for additional information pertaining to threatened, endangered, and sensitive species.

State or federally listed endangered or threatened species will be reported to the Division upon its discovery.

### **358.200 Bald and Golden Eagles**

Dugout Canyon understands that there is no permission implied by these regulations for taking of bald or golden eagles, their nests, or eggs. If found, nests will be reported to the Division.

### **358.300 Taking of Endangered or Threatened Species**

Dugout Canyon understands that there is no permission implied by these regulations for taking of endangered or threatened species, their nests, or eggs.

### **358.400 Replacement of Wetland or Riparian Vegetation**

The sites contain no wetland or riparian vegetation, **unless specifically noted in the vegetation survey.**

### **358.500 Manmade Wildlife Protection Measure**

**Electric Power Lines** - No utilities will exist at the well sites.

**Potential Barriers** - No potential barriers will exist at any of the well sites, except for the perimeter fence. No ponds exist at the well sites. Refer to Sections 231.100 and 242 for information pertaining to the mud pit.

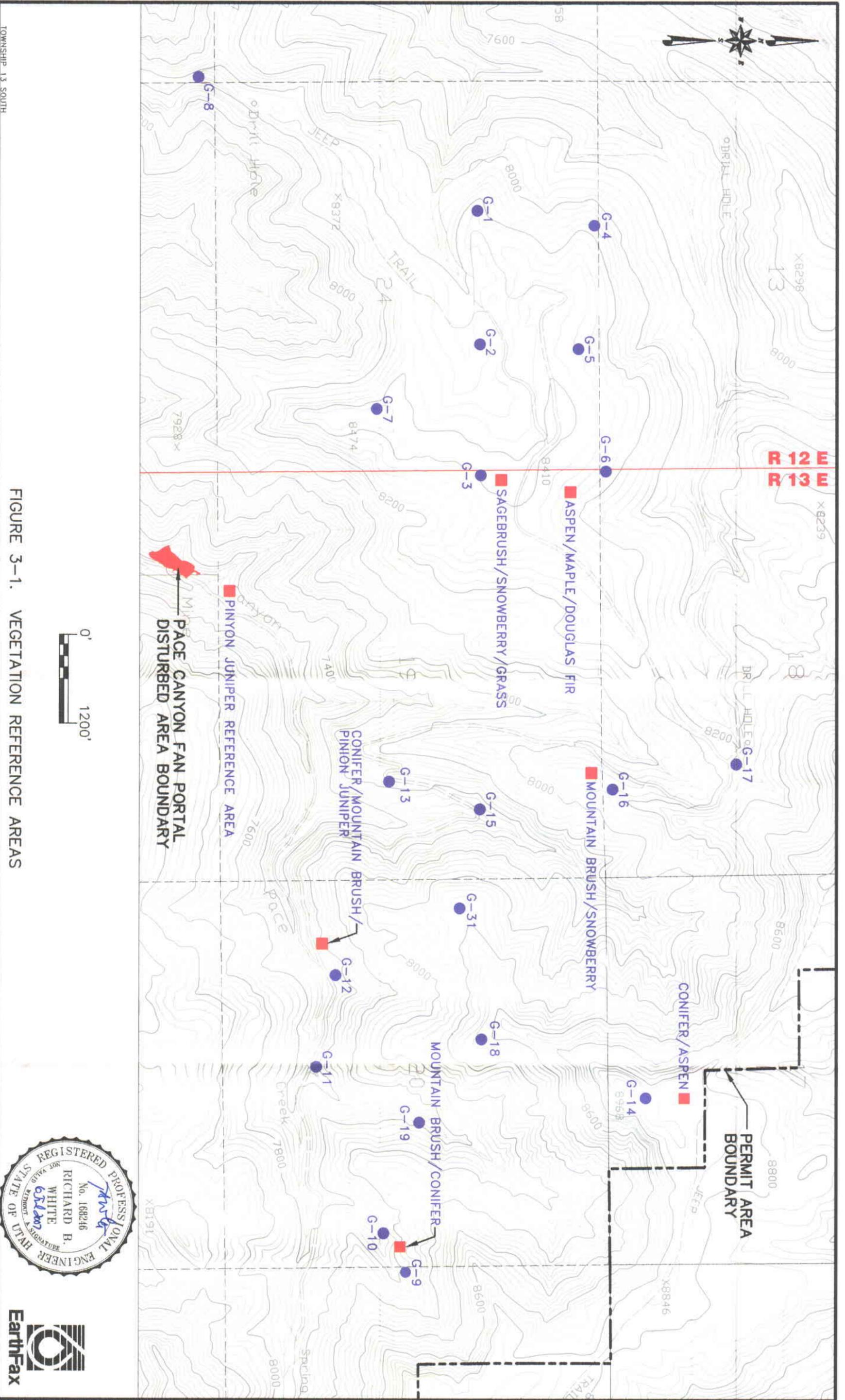
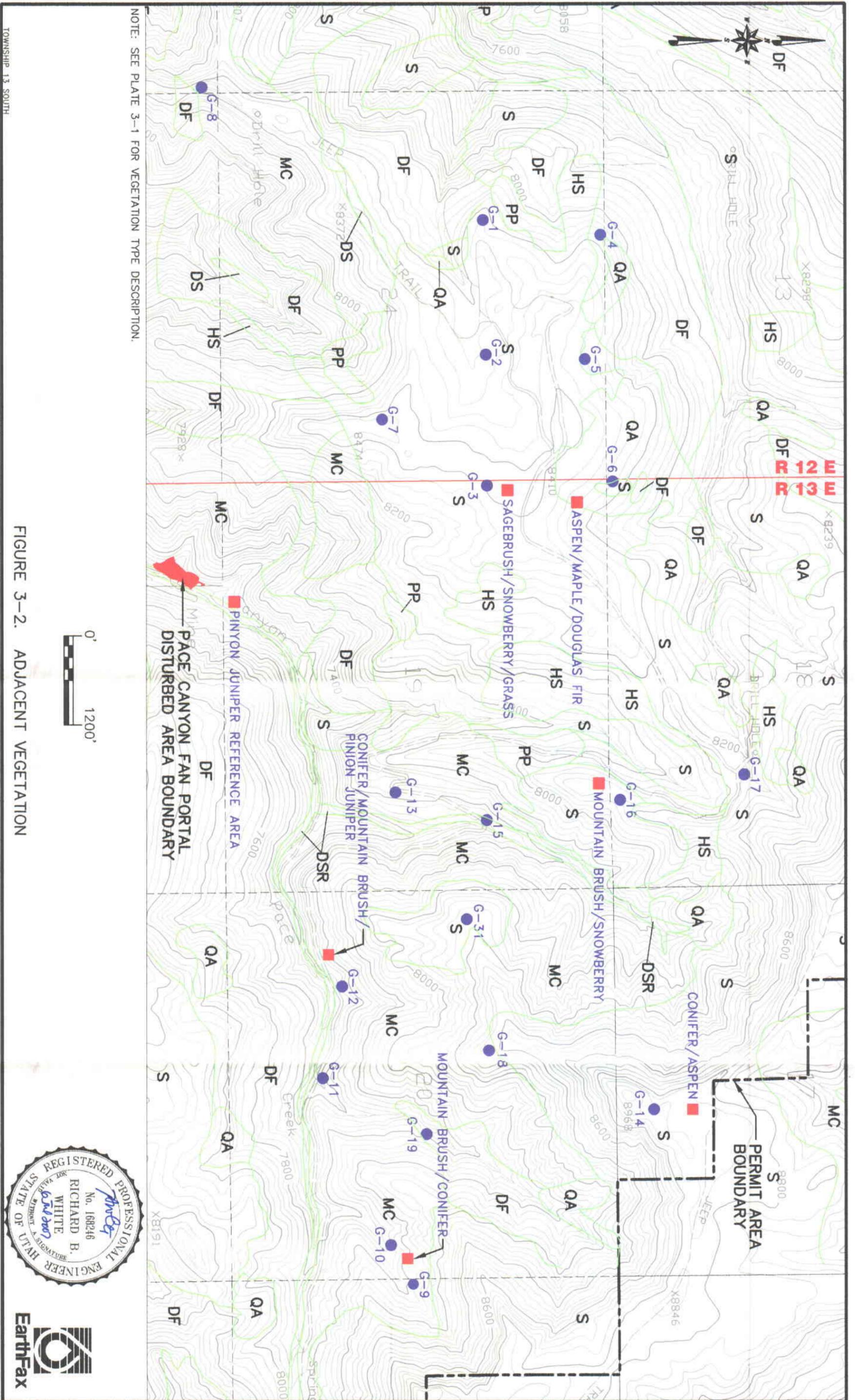


FIGURE 3-1. VEGETATION REFERENCE AREAS





NOTE: SEE PLATE 3-1 FOR VEGETATION TYPE DESCRIPTION.

FIGURE 3-2. ADJACENT VEGETATION



Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
~~June 14, 2007~~

**ATTACHMENT 3-1  
VEGETATION INVENTORY  
NRCS LETTER**

**add to the back of existing information**

VEGETATION OF THE  
DE-GAS SITES G-18, G-31  
& REFERENCE AREA

FOR THE  
DUGOUT CANYON MINE



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June 2007

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# INTRODUCTION

## History of Studies

For the past few years Canyon Fuel Company has been constructing borehole drill sites as part of a de-gasification process for safety and to facilitate coal mining operations at the Dugout Canyon Mine. The Dugout Mine is located on the Book Cliffs Plateau in eastern Utah. Permitting of the “de-gas” drill sites has been done in consecutive order on a site-by-site basis and has been driven by their location and role in the mine plan. Earlier reports have been submitted to address the plant communities to be impacted by other drill sites. The first of those reports was called *Vegetation of the Dugout Canyon Mine De-gas Borehole Sites* (July 2003). This report quantitatively described the vegetation proposed for disturbance and reference areas chosen for future revegetation success standards on sites G-1, G-2, G-3, G-4, G-5 and G-6. A report was later written for the next drill sites to be constructed called *Vegetation of the De-gas Borehole Sites: G-8, G-9, G-10 & Reference Areas* (August 2005). The next report in the sequence provided vegetation data for G-11, G-12 and the reference areas associated with them. Accordingly, this report was titled *Vegetation of the De-gas Borehole Sites: G-11, G-12 & Reference Areas* (November 2005). The next document quantified and described boreholes sites and was called *Vegetation of the De-Gas Borehole Sites: G-13, G-14, G-15, G-16, G-17 & Reference Areas* (March 2006). The last document contained quantitative information for De-Gas drill site G-19; it was called *Vegetation of the De-Gas Borehole Site G-19 & Reference Area*

(March 2007).

This information herein contains a study of the vegetation of De-Gas Borehole Sites G-18, G-31 and the associated reference area. It also has information about the access roads to them.

### Proposed Disturbed & Reference Areas

For all sites, in order to develop the drill pads, a small amount of land has been proposed to be disturbed at each location. Each proposed borehole drill pad is approximately 200 ft. x 300 ft in size. The plant communities proposed for disturbance at each of these sites have been described and sampled with the results provided in this report. A sensitive plant species survey was also conducted at the sites.

As mentioned, reference areas were chosen to represent future standards for final revegetation success. The reference areas were chosen with respect to their similarities in geology, soils, slope, aspect, and plant community composition to the areas that are proposed for disturbance.

## **METHODS**

Methodologies used for this study were performed in accordance with the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOG M). Quantitative data were recorded on the vegetation of the areas proposed for disturbance at G-18 and G-31 were recorded June 25,

2007. Qualitative data were also recorded on the access roads to these sites the same day. The reference area for this site was sampled September 14, 2005.

Proposed drill sites and access roads to them were surveyed, mapped and staked in the field by Canyon Fuel prior to the vegetation field work. The reference area chosen was approximately one acre in size and was marked in the field using a GPS instrument. The coordinates for the proposed de-gas drill pads and reference areas are given below.

---

**GPS COORDINATES FOR  
DUGOUT CANYON MINE  
DE-GAS BOREHOLE SITES:  
G-18 & G-31 REFERENCE AREA**

---

<b>Waypoint Name</b>	<b>Zone</b>	<b>Easting</b>	<b>Northing</b>	<b>Datum</b>	<b>Notes</b>
DUGG18	12S	0544107	4392469	NAD 27	Proposed Disturbed Borehole Site G-18.
DUGG31	12S	0543527	4392360	NAD 27	Proposed Disturbed Borehole Site G-31.
DUG16R	12S	0542993	4392921	NAD27	Reference Area for Borehole Sites: G-18 and G-31 (also G-16, G-17).

## Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling were placed randomly within the boundaries of the proposed disturbed and reference area. The sample boundaries included 100 ft outside the proposed drill site. The transect placement technique was employed with the goal to adequately sample a representative subset of the entire site as a whole. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

## Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 2003).

## Woody Species Density

Density of woody plant species for the proposed disturbed and reference areas were estimated using the point-quarter method. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then

recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual. The number of individuals per acre was the end results of the calculations.

### Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

- $nMIN$  = minimum adequate sample
- $t$  = appropriate confidence t-value
- $s$  = standard deviation
- $x$  = sample mean
- $d$  = desired change from mean

### Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density of each proposed disturbed borehole site with its reference area.

## Photographs

Color photographs of the sample areas were taken at the time of sampling and have been submitted with this report.

## Threatened & Endangered Plant Species

Prior to recording quantitative data on the plant communities, a sensitive plant species survey was conducted. To initiate the study, appropriate agencies were consulted (e.g. *Utah Natural Heritage Program*) and other sources were reviewed (sensitive species files at *Mt. Nebo Scientific, Inc.*) for potential plant species that are known to be rare, endemic, threatened, endangered or otherwise sensitive in the study area.

## Raw Data

The raw data for cover have been summarized on a spreadsheet and were included in the Appendix of this report.

## RESULTS

### De-Gas Borehole Site G-18

The site proposed for drilling activities at De-Gas Borehole Site G-18 was located on a knoll or a point on the plateau. This area is more flat than its surrounding areas, which was probably a consideration when it was chosen as a drill site. Because of its relatively unique (but not uncommon) location on the mountain, it supports transitional zones between three plant communities including; sagebrush/grass, mountain brush and pinyon-juniper (see Photographs of the Study Areas).

The dominant plant species present in the sample quadrats by cover and frequency (Table 1) were: Vasey sagebrush (*Artemisia tridentata* var *vaseyana*), Salina wildrye (*Elymus salinus*) and Utah serviceberry (*Amelanchier utahensis*). The total living cover, that includes overstory and understory combined, was estimated at 62.75% (Table 2-A). The composition of the understory cover by lifeform was made up of 53.72% shrubs, 26.79% grasses and 19.49% forbs (Table 2-B). Finally, the woody species density of De-Gas Site G-18 was 5,758 individuals per acre (Table 3).

### Access Road to De-Gas Borehole Site G-18

The access road to G-18, or the proposed road from G-31 to G-18 was located on a hillside with a predominantly southern exposure. Although the road will be constructed along the contours,

the slope angle of the hillside approached 30 degrees. The plant communities that dominate the access road were primarily mountain brush and sagebrush/grass (see Photographs of the Study Areas). Consequently, the most common plant species along the proposed road were noted as Utah Serviceberry, Vasey sagebrush, alder-leaf mountain-mahogany (*Cercocarpus montanus*) and Salina wildrye.

#### De-Gas Borehole Site G-31

The proposed drill site for De-Gas Borehole Site G-31 was situated similarly on the plateau as the above-described borehole site. Consequently, similar but slightly different transitional plant communities dominated the area including sagebrush/grass and mountain brush, but conifer trees were also commonly interspersed throughout the site (see Photographs of the Study Areas).

The most common plant species in the understory by cover and frequency in this study area were Vasey sagebrush, snowberry (*Symphoricarpos oreophilus*), Utah serviceberry and Salina wildrye (Table 4). The overstory was comprised of Utah serviceberry and Douglas fir (*Pseudotsuga menziesii*).

The total living cover of G-31 was estimated at 68.25%, of which 18.50% was overstory and 49.75% was understory (Table 5). The understory composition consisted of 56.76% trees and shrubs, 25.50% forbs and 17.74% grasses (Table 5-B). The total woody species density of the site was estimated as 4,319 individuals per acre (Table 6).

### Access Road to De-Gas Borehole Site G-31

The proposed access road to Borehole Site G-31 begins in a drainage near previous Borehole Site G-19. Because it begins lower in the drainage, a conifer plant community was common at the beginning of the road. As the proposed road corridor gains elevation and changes exposures it dissects mountain brush, sagebrush/grass, pinyon-juniper communities, along with transitional zones between these communities (see Photographs of the Study Areas).

Common plant species along the proposed corridor of the access road to G-31 included Douglas fir, Utah serviceberry, alder-leaf mountain-mahogany, snowberry, pinyon pine (*Pinus edulis*), Utah juniper (*Juniperus osteosperma*) and Salina wildrye.

### Mountain Brush/Snowberry/Sagebrush Reference Area

The reference area chosen for future revegetation success standards for De-Gas Borehole Sites G-18 and G-31 was a previously established reference area for Borehole Sites G-16 and G-17 (see Photographs of the Study Areas). It is located in close proximity to G-16. In this mountain brush/snowberry community, the most common species were big sagebrush, Watson's penstemon (*Penstemon watsonii*), snowberry and serviceberry (Table 7).

The total living combined cover was 64.50%, 57.00% was understory and 7.50% overstory (Table 8-A). Woody species dominated the composition at 54.44%, followed by forbs at 28.08%

and grasses at 17.49% (Table 8-B). The woody species density was estimated at 5,137 plants per acres and was dominated by big sagebrush and snowberry (Table 9).

#### Threatened & Endangered Plant Species Survey

State databases revealed only one potential sensitive species to be located in the vicinity of the proposed disturbed Borehole Sites. This plant was canyon vetch (*Hedysarum occidentale* var. *canone*). Each proposed disturbed area was surveyed in the field for canyon vetch (or any other unusual or sensitive plants). This survey was done prior to recording the quantitative data used to describe the major plant community of the study area. In addition, more searching for sensitive species was done during quantitative sampling of the areas. No rare, endemic, threatened or endangered or otherwise sensitive species were found in the study areas.

**Table 1: Cover, standard deviation and frequency by species for the De-Gas Site G-18 (2007).**

Proposed Disturbed Community: Sagebrush/Mountain Brush	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Amelanchier utahensis</i>	11.00	21.13	25.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	5.00	16.28	10.00
<i>Artemisia tridentata</i>	15.50	12.64	85.00
<i>Cercocarpus montanus</i>	2.75	6.02	25.00
<i>Chrysothamnus viscidiflorus</i>	0.95	2.48	15.00
<i>Symphoricarpos oreophilus</i>	4.25	6.57	35.00
<b>FORBS</b>			
<i>Calochortus nuttallii</i>	0.30	1.10	10.00
<i>Castilleja rhexifolia</i>	0.25	1.09	5.00
<i>Eriogonum umbellatum</i>	2.75	5.36	25.00
<i>Gayophytum ramosissimum</i>	0.25	1.09	5.00
<i>Hedysarum boreale</i>	0.50	2.18	5.00
<i>Ipomopsis aggregata</i>	0.50	1.50	10.00
<i>Penstemon watsonii</i>	1.50	4.77	10.00
<i>Petroradia pumila</i>	3.00	5.10	35.00
<i>Senecio sp.</i>	0.75	1.79	15.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	12.00	10.77	70.00
<i>Elymus trachycaulus</i>	0.50	2.18	5.00
<i>Poa secunda</i>	1.00	4.36	5.00

**Table 2: Mean total cover, composition, standard deviation and sample size for the De-Gas Site G-18 (2007).**

Proposed Disturbed Community: Sagebrush/Mountain Brush	Mean	Standard Deviation	Sample Size
<b>A. TOTAL COVER</b>			
Overstory (O)	11.00	21.13	20
Understory (U)	51.75	8.98	20
Litter	12.45	11.52	20
Bareground	31.40	14.15	20
Rock	4.40	3.95	20
O + U	62.75	26.24	20
<b>B. % COMPOSITION</b>			
Shrubs	53.72	27.15	20
Forbs	19.49	18.50	20
Grasses	26.79	19.71	20

**Table 3: Woody Species Density for the De-Gas Site G-18 (2007).**

Proposed Disturbed Community: Sagebrush/Mountain Brush	
Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	143.95
<i>Artemisia tridentata</i>	3598.72
<i>Cercocarpus montanus</i>	791.72
<i>Chrysothamnus viscidiflorus</i>	215.92
<i>Opuntia sp.</i>	71.97
<i>Pseudotsuga menziesii</i>	215.92
<i>Symphoricarpos oreophilus</i>	719.74
<b>TOTAL</b>	<b>5757.95</b>

**Table 4: Cover, standard deviation and frequency by species for the De-Gas Site G-31 (2007).**

Proposed Disturbed Community: Sagebrush/Mountain Brush/Conifer	Mean Percent	Standard Deviation	Percent Frequency
<b>OVERSTORY</b>			
<i>Amelanchier utahensis</i>	17.25	25.27	35.00
<i>Pseudotsuga menziesii</i>	1.25	3.83	10.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	4.50	8.50	25.00
<i>Artemisia tridentata</i>	18.50	15.34	75.00
<i>Pseudotsuga menziesii</i>	0.25	1.09	5.00
<i>Symphoricarpos oreophilus</i>	4.75	5.36	50.00
<b>FORBS</b>			
<i>Antennaria microphylla</i>	1.75	5.76	10.00
<i>Astragalus sp.</i>	0.25	1.09	5.00
<i>Hedysarum boreale</i>	0.25	1.09	5.00
<i>Lupinus argenteus</i>	5.75	7.95	40.00
<i>Penstemon watsonii</i>	5.00	4.47	60.00
<i>Petradoria pumila</i>	0.25	1.09	5.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	6.25	5.67	65.00
<i>Elymus spicatus</i>	0.25	1.09	5.00
<i>Elymus trachycaulus</i>	0.25	1.09	5.00
<i>Poa secunda</i>	1.75	7.63	5.00

**Table 5: Mean total cover, composition, standard deviation and sample size for the De-Gas Site G-31 (2007).**

Proposed Disturbed Community: Sagebrush/Mountain Brush/Conifer	Mean	Standard Deviation	Sample Size
<b>A. TOTAL COVER</b>			
Overstory (O)	18.50	24.70	20
Understory (U)	49.75	15.61	20
Litter	27.55	20.15	20
Bareground	19.20	16.00	20
Rock	3.50	4.47	20
O + U	68.25	17.56	20
<b>B. % COMPOSITION</b>			
Trees & Shrubs	56.76	24.12	20
Forbs	25.50	17.17	20
Grasses	17.74	16.43	20

**Table 6: Woody Species Density for the De-Gas Site G-31 (2007).**

Proposed Disturbed Community: Sagebrush/Mountain Brush/Conifer	
Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	215.96
<i>Artemisia tridentata</i>	2699.51
<i>Pseudotsuga menziesii</i>	215.96
<i>Symphoricarpos oreophilus</i>	1187.79
<b>TOTAL</b>	<b>4319.22</b>

**Table 7: Dugout Mine De-Gas Reference Area for G-18 and G-31 (also G-16 & G-17).**

**Total cover, standard deviation and sample size (2005).**

Reference Area:	Mean Percent	Standard Deviation	Percent Frequency
Mountain Brush/Snowberry/Sagebrush			
<b>OVERSTORY</b>			
<i>Amelanchier utahensis</i>	6.75	12.58	25.00
<i>Juniperus scopulorum</i>	0.75	3.27	5.00
<b>UNDERSTORY</b>			
<b>TREES &amp; SHRUBS</b>			
<i>Amelanchier utahensis</i>	7.00	16.16	35.00
<i>Artemisia tridentata</i>	15.25	14.79	75.00
<i>Juniperus scopulorum</i>	0.25	1.09	5.00
<i>Symphoricarpos oreophilus</i>	10.50	15.96	50.00
<b>FORBS</b>			
<i>Astragalus sp.</i>	0.25	1.09	5.00
<i>Lupinus argenteus</i>	4.05	4.60	55.00
<i>Penstemon watsonii</i>	10.70	7.89	80.00
<b>GRASSES</b>			
<i>Elymus salinus</i>	0.25	1.09	5.00
<i>Elymus spicatus</i>	2.00	3.67	25.00
<i>Elymus trachycaulus</i>	2.00	3.67	25.00
<i>Poa pratensis</i>	2.25	5.36	20.00
<i>Poa secunda</i>	2.50	6.22	20.00

**Table 8: Dugout Mine Degas Reference Area for G-18 and G-31 (also G-16 & G-17).**

**Total cover, standard deviation and sample size (2005).**

Reference Area:	Mean Percent	Standard Deviation	Sample Size
Mountain Brush/Snowberry/Sagebrush			
<b>A. TOTAL COVER</b>			
Overstory	7.50	12.60	20
Understory	57.00	12.08	20
Litter	18.60	7.52	20
Bareground	15.65	13.13	20
Rock	8.75	9.59	20
Overstory + Understory	64.50	19.49	20
<b>B. % COMPOSITION</b>			
Trees & Shrubs	54.44	26.60	20
Forbs	28.08	17.03	20
Grasses	17.49	14.43	20

**Table 9: Dugout Mine Degas Reference Area for G-18 and G-31 (also G-16 & G-17).**

**Woody species densities (2005).**

Reference Area:	
Mountain Brush/Snowberry/Sagebrush	
Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	834.68
<i>Artemisia tridentata</i>	2375.64
<i>Juniperus scopulorum</i>	64.21
<i>Symphoricarpos oreophilus</i>	1861.99
<b>TOTAL</b>	<b>5136.52</b>

## SUMMARY & CONCLUSIONS

The plant communities currently supported on the proposed new De-Gas Borehole Sites have been quantitatively sampled and compared statistically with a reference area chosen for future revegetation standards for success. Figure 1 shows the results of Student's t-test analyses of total living covers. When the **total living covers** of the proposed disturbed communities of Borehole Site G-18 and G-31 were compared to the reference area, the differences were non-significant statistically (Figure 1).

**Woody species densities** of those communities proposed for disturbance were also compared with the respective reference area (Figure 2). Results of statistical comparisons suggest that there were no significant differences between the proposed disturbed communities of G-18 and G-31 their reference area.

In conclusion, results from quantitatively sampling those plant communities proposed for disturbance and their reference area have been submitted in this report. Specific parameters of these communities have been compared statistically with results suggesting that the reference area chosen for revegetation success standards at the time of final reclamation may be appropriate.

**FIGURE 1.** A statistical comparison (Student's t-tests) of the **total living cover** between the proposed disturbed de-gas sites and their reference areas.

	$\bar{x}$	s	n	t	df	SL
<b>De-Gas Site G-18</b>						
<u>Proposed Disturbed:</u>	62.75	26.24	20			
<u>Reference Area:</u>	64.50	19.49	20			
t-test				-0.239	38	N.S.
<b>De-Gas Site G-31</b>						
<u>Proposed Disturbed:</u>	68.25	17.56	20			
<u>Reference Area:</u>	64.50	19.49	20			
t-test				0.369	38	N.S.

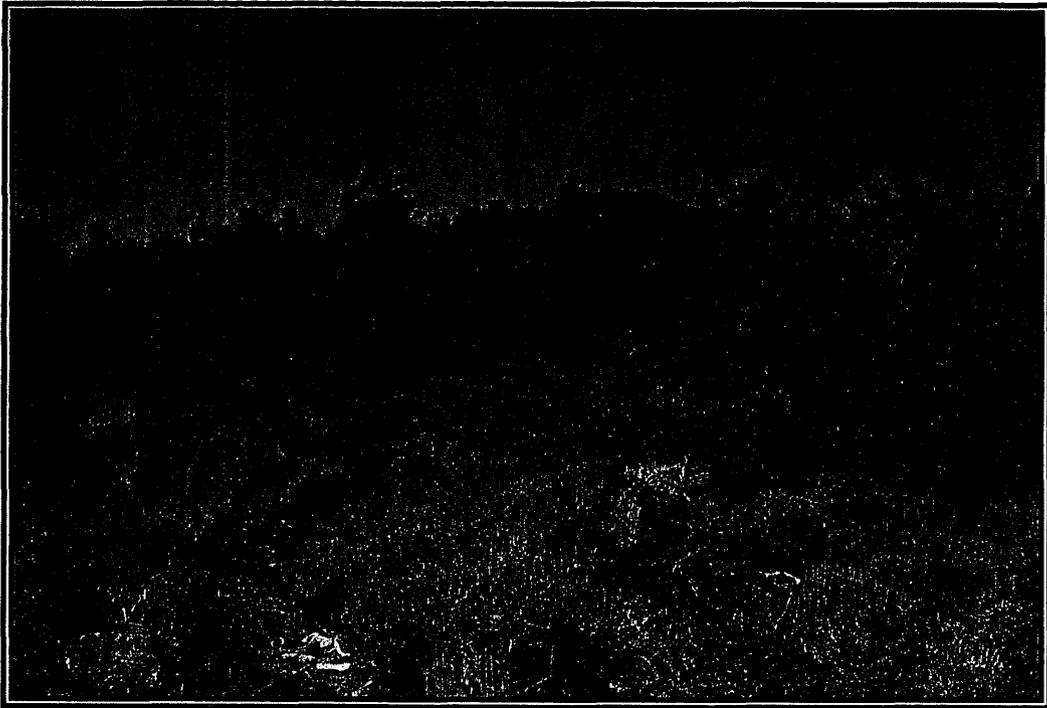
$\bar{x}$  = mean  
 s = standard deviation  
 n = sample size  
 t = Student's t-value  
 df = degrees of freedom  
 SL = Significance Level  
 N.S. = Non-Significant

**FIGURE 2.** A statistical comparison (Student's t-tests) of the **woody species density** between the proposed disturbed de-gas sites and their reference areas.

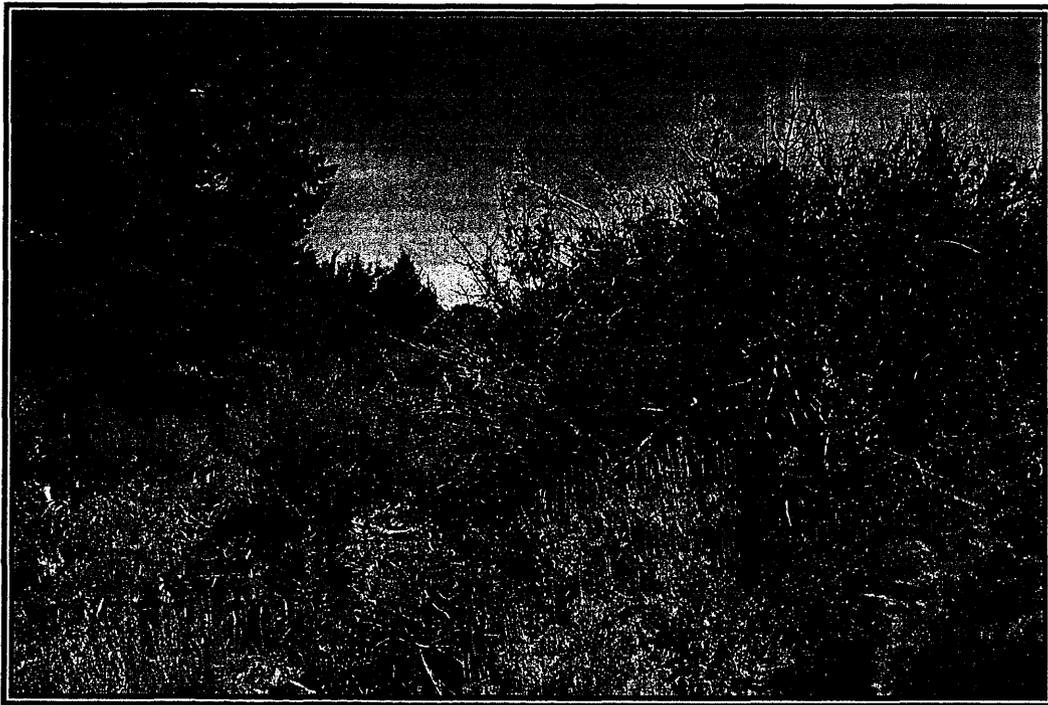
	$\bar{x}$	s	n	t	df	SL
<b>De-Gas Site G-18</b>						
<u>Proposed Disturbed:</u>	5757.95	2087.41	20			
<u>Reference Area:</u>	5136.52	2140.91	20			
t-test				0.929	38	N.S.
<b>De-Gas Site G-31</b>						
<u>Proposed Disturbed:</u>	4319.22	2632.26	20			
<u>Reference Area:</u>	5136.52	2140.91	20			
t-test				-1.077	38	N.S.

$\bar{x}$  = mean  
 s = standard deviation  
 n = sample size  
 t = Student's t-value  
 df = degrees of freedom  
 SL = Significance Level  
 N.S. = Non-Significant

**COLOR PHOTOGRAPHS  
OF THE  
SAMPLE AREAS**



De-Gas Site: G-18



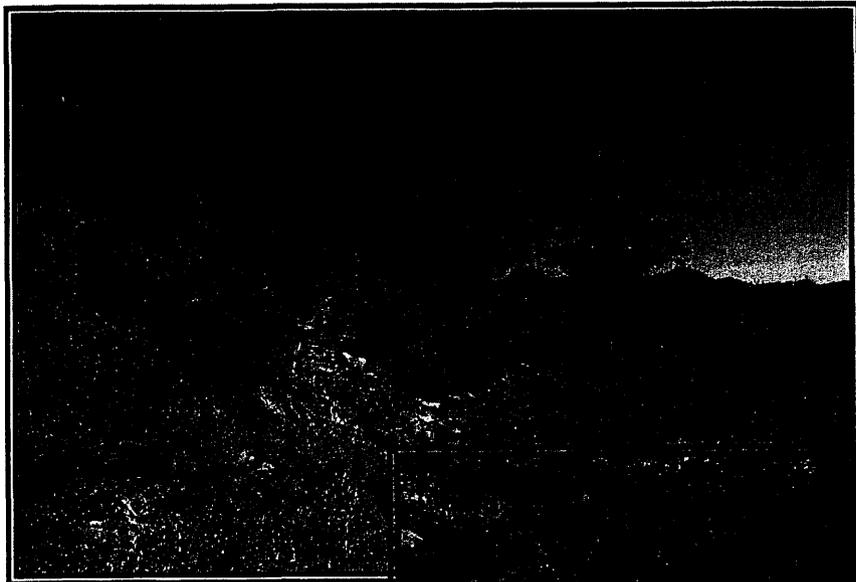
De-Gas Site: G-31



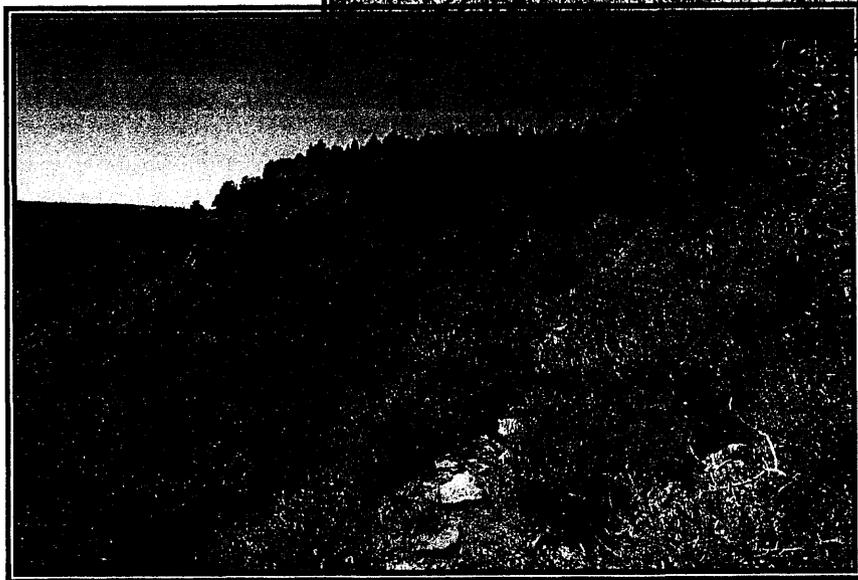
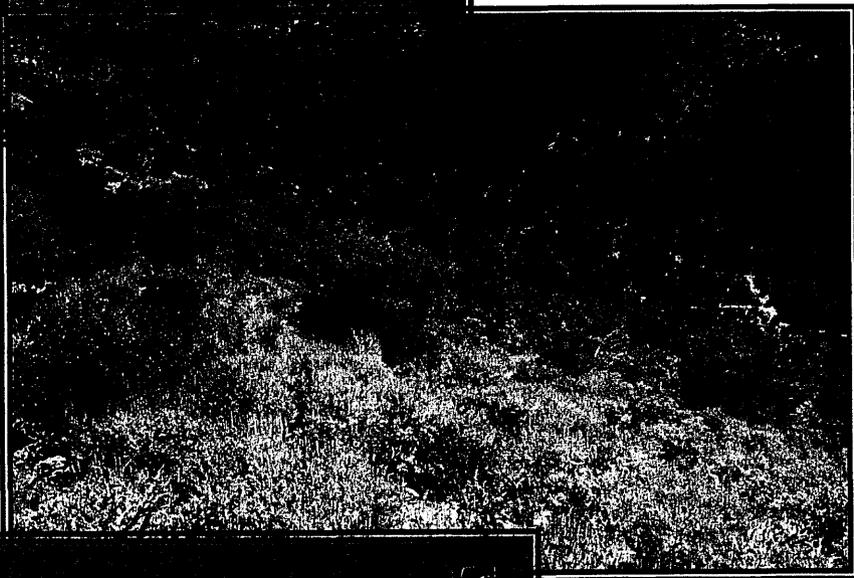
Mtn.Brush/Snowberry/Sagebrush Reference Area



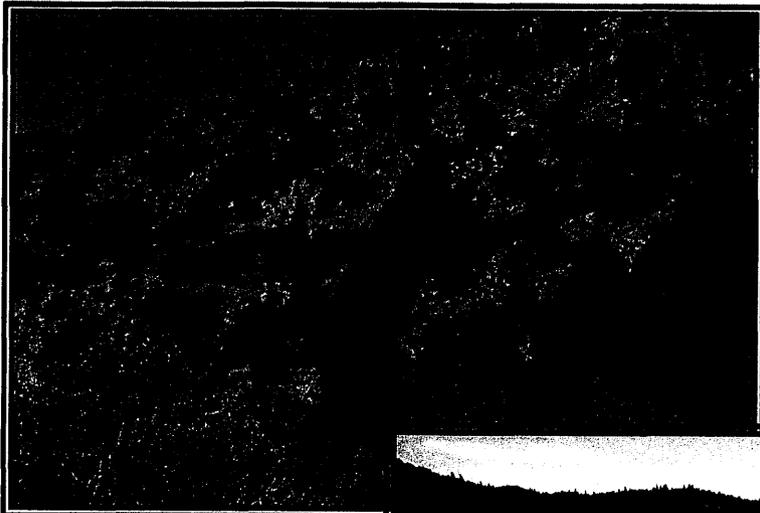
Mtn.Brush/Snowberry/Sagebrush Reference Area



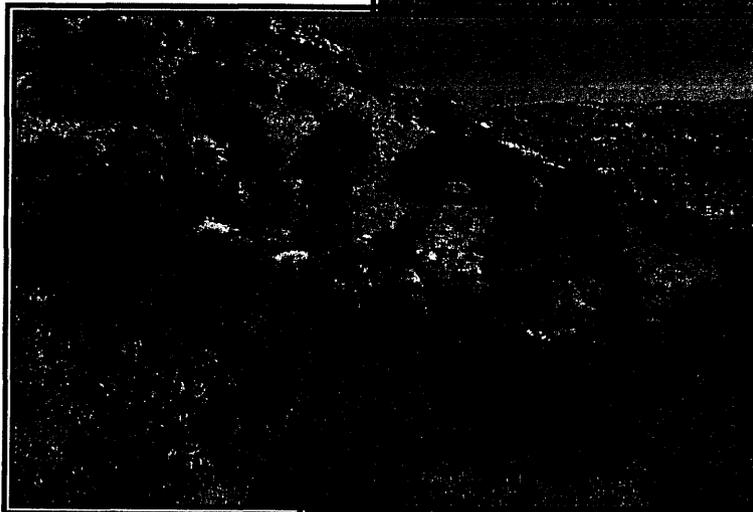
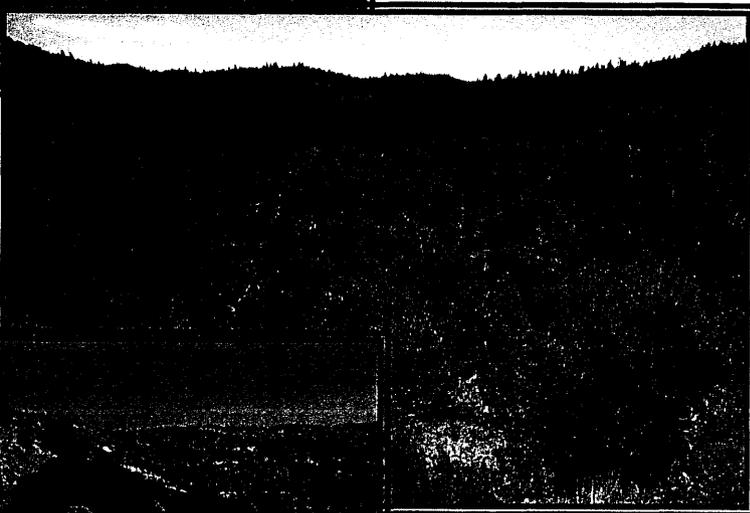
Access to De-Gas G18



Access to De-Gas G-18



Access to De-Gas G-31



Access to De-Gas G-31



Access to De-Gas G-31

**APPENDIX**  
(Raw Data)

CANYON FUEL  
 Dugout Mine  
 DE-GAS SITE: G-18

Exposure: E

Slope: 6 deg.

Sample Date: June 25 2007

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
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OVERSTORY

<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	25.00	70.00
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UNDERSTORY

TREES & SHRUBS

<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	70.00
<i>Artemisia tridentata</i>	25.00	20.00	20.00	25.00	55.00	5.00	0.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Chrysothamnus viscidiflorus</i>	0.00	0.00	4.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	10.00	0.00	0.00	10.00	0.00

FORBS

<i>Calochortus nuttallii</i>	0.00	0.00	1.00	0.00	0.00	0.00	0.00
<i>Castilleja rhexifolia</i>	0.00	5.00	0.00	0.00	0.00	0.00	0.00
<i>Eriogonum umbellatum</i>	0.00	20.00	0.00	0.00	0.00	0.00	0.00
<i>Gayophytum ramosissimum</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Hedysarum boreale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Ipomopsis aggregata</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Penstemon watsonii</i>	0.00	0.00	0.00	0.00	0.00	20.00	0.00
<i>Petroradia pumila</i>	0.00	5.00	0.00	5.00	0.00	0.00	0.00
<i>Senecio sp.</i>	0.00	0.00	5.00	0.00	0.00	5.00	0.00

GRASSES

<i>Elymus salinus</i>	0.00	10.00	0.00	10.00	10.00	10.00	0.00
<i>Elymus trachycaulus</i>	0.00	0.00	10.00	0.00	0.00	0.00	0.00
<i>Poa secunda</i>	20.00	0.00	0.00	0.00	0.00	0.00	0.00

COVER

Overstory	0.00	0.00	0.00	0.00	0.00	25.00	70.00
Understory	45.00	60.00	55.00	45.00	70.00	50.00	70.00
Litter	9.00	9.00	9.00	14.00	10.00	40.00	1.00
Bareground	45.00	30.00	35.00	40.00	15.00	9.00	25.00
Rock	1.00	1.00	1.00	1.00	5.00	1.00	4.00

% COMPOSITION

Shrubs	55.56	33.33	61.82	55.56	85.71	30.00	100.00
Forbs	0.00	50.00	20.00	22.22	0.00	50.00	0.00
Grasses	44.44	16.67	18.18	22.22	14.29	20.00	0.00

Overstory + Understory	45.00	60.00	55.00	45.00	70.00	75.00	140.00
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8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	40.00	60.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	0.00	30.00	20.00	5.00	15.00	10.00	15.00	20.00	20.00
10.00	25.00	0.00	0.00	0.00	0.00	10.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	10.00	5.00	0.00	0.00	0.00	0.00
10.00	25.00	0.00	10.00	0.00	0.00	0.00	10.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	10.00	0.00	0.00	10.00	10.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	10.00	5.00	5.00	0.00
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	20.00	25.00	20.00	5.00	15.00	20.00	10.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	40.00	60.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00
40.00	50.00	60.00	50.00	50.00	50.00	40.00	50.00	60.00	40.00
10.00	45.00	30.00	5.00	10.00	5.00	5.00	10.00	10.00	9.00
45.00	4.00	5.00	40.00	35.00	40.00	40.00	30.00	20.00	50.00
5.00	1.00	5.00	5.00	5.00	5.00	15.00	10.00	10.00	1.00
75.00	100.00	100.00	60.00	30.00	40.00	50.00	60.00	33.33	50.00
25.00	0.00	0.00	0.00	20.00	20.00	37.50	10.00	33.33	25.00
0.00	0.00	0.00	40.00	50.00	40.00	12.50	30.00	33.33	25.00
40.00	90.00	120.00	75.00	50.00	50.00	40.00	50.00	60.00	40.00

CANYON FUEL  
 Dugout Mine  
 DE-GAS SITE: G-18  
 Exposure: E  
 Slope: 6 deg.  
 Sample Date: 18 May 07

18.00	19.00	20.00	Mean	SDev	Freq Cnts	Freq	
							OVERSTORY
0.00	0.00	0.00	11.00	21.13	5.00	25.00	<i>Amelanchier utahensis</i>
							UNDERSTORY
							TREES & SHRUBS
0.00	0.00	0.00	5.00	16.28	2.00	10.00	<i>Amelanchier utahensis</i>
5.00	10.00	0.00	15.50	12.64	17.00	85.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	2.75	6.02	5.00	25.00	<i>Cercocarpus montanus</i>
0.00	0.00	0.00	0.95	2.48	3.00	15.00	<i>Chrysothamnus viscidiflorus</i>
10.00	0.00	0.00	4.25	6.57	7.00	35.00	<i>Symphoricarpos oreophilus</i>
							FORBS
0.00	0.00	0.00	0.30	1.10	2.00	10.00	<i>Calochortus nuttallii</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Castilleja rhexifolia</i>
0.00	0.00	0.00	2.75	5.36	5.00	25.00	<i>Eriogonum umbellatum</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Gayophytum ramosissimum</i>
0.00	0.00	10.00	0.50	2.18	1.00	5.00	<i>Hedysarum boreale</i>
0.00	0.00	0.00	0.50	1.50	2.00	10.00	<i>Ipomopsis aggregata</i>
0.00	0.00	0.00	1.50	4.77	2.00	10.00	<i>Penstemon watsonii</i>
0.00	10.00	20.00	3.00	5.10	7.00	35.00	<i>Petroria pumila</i>
0.00	0.00	0.00	0.75	1.79	3.00	15.00	<i>Senecio sp.</i>
							GRASSES
25.00	40.00	20.00	12.00	10.77	14.00	70.00	<i>Elymus salinus</i>
0.00	0.00	0.00	0.50	2.18	1.00	5.00	<i>Elymus trachycaulus</i>
0.00	0.00	0.00	1.00	4.36	1.00	5.00	<i>Poa secunda</i>
							COVER G-18
0.00	0.00	0.00	11.00	21.13			Overstory
40.00	60.00	50.00	51.75	8.98			Understory
4.00	4.00	10.00	12.45	11.52			Litter
55.00	35.00	30.00	31.40	14.15			Bareground
1.00	1.00	10.00	4.40	3.95			Rock
							% COMPOSITION
37.50	16.67	0.00	53.72	27.15			Shrubs
0.00	16.67	60.00	19.49	18.50			Forbs
62.50	66.67	40.00	26.79	19.71			Grasses
							Overstory + Understory
40.00	60.00	50.00	62.75	26.24			

CANYON FUEL  
 Dugout Mine  
 DE-GAS SITE: G-31

Exposure: SW

Slope: 3-5 deg.

Sample Date: June 25 2007

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
<b>OVERSTORY</b>							
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>UNDERSTORY</b>							
<b>TREES &amp; SHRUBS</b>							
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	20.00	0.00	0.00
<i>Artemisia tridentata</i>	25.00	45.00	30.00	25.00	0.00	30.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	5.00	0.00	10.00	0.00	0.00	10.00	10.00
<b>FORBS</b>							
<i>Antennaria microphylla</i>	0.00	25.00	0.00	0.00	0.00	0.00	0.00
<i>Astragalus sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Hedysarum boreale</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Lupinus argenteus</i>	10.00	0.00	5.00	15.00	20.00	15.00	0.00
<i>Penstemon watsonii</i>	5.00	0.00	0.00	10.00	10.00	0.00	10.00
<i>Petradoria pumila</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>GRASSES</b>							
<i>Elymus salinus</i>	0.00	0.00	0.00	10.00	0.00	10.00	0.00
<i>Elymus spicatus</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus trachycaulus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Poa secunda</i>	0.00	0.00	0.00	0.00	0.00	0.00	35.00
<b>COVER</b>							
Overstory	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Understory	55.00	70.00	50.00	60.00	50.00	65.00	60.00
Litter	10.00	25.00	30.00	25.00	30.00	9.00	10.00
Bareground	15.00	4.00	10.00	10.00	18.00	25.00	25.00
Rock	20.00	1.00	10.00	5.00	2.00	1.00	5.00
<b>% COMPOSITION</b>							
Shrubs	54.55	64.29	90.00	41.67	40.00	61.54	16.67
Forbs	36.36	35.71	10.00	41.67	60.00	23.08	25.00
Grasses	9.09	0.00	0.00	16.67	0.00	15.38	58.33
Overstory + Understory	55.00	70.00	50.00	60.00	50.00	65.00	60.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
50.00	0.00	50.00	70.00	15.00	0.00	60.00	0.00	0.00	50.00
0.00	10.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
0.00	0.00	10.00	0.00	25.00	25.00	0.00	0.00	0.00	0.00
35.00	15.00	0.00	0.00	5.00	25.00	0.00	45.00	35.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	10.00	10.00	15.00	0.00	0.00	0.00	0.00	15.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	25.00	0.00	0.00	0.00	15.00	10.00	0.00	0.00
10.00	5.00	0.00	0.00	10.00	5.00	0.00	5.00	10.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	15.00	10.00	0.00	10.00	5.00	10.00	10.00	5.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50.00	10.00	50.00	70.00	15.00	15.00	60.00	0.00	0.00	50.00
50.00	45.00	60.00	15.00	50.00	60.00	30.00	70.00	65.00	15.00
10.00	9.00	35.00	75.00	30.00	30.00	9.00	25.00	10.00	75.00
35.00	45.00	4.00	5.00	19.00	9.00	60.00	4.00	20.00	9.00
5.00	1.00	1.00	5.00	1.00	1.00	1.00	1.00	5.00	1.00
70.00	55.56	33.33	100.00	60.00	83.33	0.00	64.29	76.92	66.67
20.00	11.11	41.67	0.00	20.00	8.33	66.67	21.43	15.38	0.00
10.00	33.33	25.00	0.00	20.00	8.33	33.33	14.29	7.69	33.33
100.00	55.00	110.00	85.00	65.00	75.00	90.00	70.00	65.00	65.00

CANYON FUEL  
 Dugout Mine  
 DE-GAS SITE: G-31

Exposure: SW  
 Slope: 3-5 deg.  
 Sample Date: June 25 2007

18.00	19.00	20.00	Mean	SDev	Freq Cnts	Freq	
							OVERSTORY
0.00	0.00	50.00	17.25	25.27	7.00	35.00	<i>Amelanchier utahensis</i>
0.00	0.00	0.00	1.25	3.83	2.00	10.00	<i>Pseudotsuga menziesii</i>
							UNDERSTORY
							TREES & SHRUBS
0.00	0.00	10.00	4.50	8.50	5.00	25.00	<i>Amelanchier utahensis</i>
30.00	10.00	10.00	18.50	15.34	15.00	75.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	5.00	4.75	5.36	10.00	50.00	<i>Symphoricarpos oreophilus</i>
							FORBS
0.00	10.00	0.00	1.75	5.76	2.00	10.00	<i>Antennaria microphylla</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Astragalus sp.</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Hedysarum boreale</i>
0.00	0.00	0.00	5.75	7.95	8.00	40.00	<i>Lupinus argenteus</i>
10.00	0.00	10.00	5.00	4.47	12.00	60.00	<i>Penstemon watsonii</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Petradoria pumila</i>
							GRASSES
10.00	20.00	0.00	6.25	5.67	13.00	65.00	<i>Elymus salinus</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Elymus spicatus</i>
0.00	0.00	0.00	0.25	1.09	1.00	5.00	<i>Elymus trachycaulus</i>
0.00	0.00	0.00	1.75	7.63	1.00	5.00	<i>Poa secunda</i>
							COVER G-31
0.00	0.00	50.00	18.50	24.70			Overstory
50.00	40.00	35.00	49.75	15.61			Understory
40.00	9.00	55.00	27.55	20.15			Litter
9.00	50.00	8.00	19.20	16.00			Bareground
1.00	1.00	2.00	3.50	4.47			Rock
							% COMPOSITION
60.00	25.00	71.43	56.76	24.12			Shrubs
20.00	25.00	28.57	25.50	17.17			Forbs
20.00	50.00	0.00	17.74	16.43			Grasses
50.00	40.00	85.00	68.25	17.56			Overstory + Understory

CANYON FUEL  
 Dugout Mine  
 AMUT/SYOR/ARTR  
 Reference Area G-16, G-17, G-18, G-13

Slope: W

Exposure: 10 deg

Sample Date: 13-14 Sept 2005

	1.00	2.00	3.00	4.00
<hr/>				
OVERSTORY				
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	15.00
UNDERSTORY				
SHRUBS				
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00
<i>Artemisia tridentata</i>	10.00	10.00	20.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	5.00
<i>Symphoricarpos oreophilus</i>	0.00	15.00	5.00	5.00
FORBS				
<i>Astragalus sp.</i>	0.00	0.00	0.00	0.00
<i>Lupinus argenteus</i>	10.00	10.00	0.00	10.00
<i>Penstemon watsonii</i>	25.00	0.00	20.00	0.00
GRASSES				
<i>Elymus salinus</i>	0.00	0.00	0.00	0.00
<i>Elymus spicatus</i>	10.00	5.00	10.00	0.00
<i>Elymus trachycaulus</i>	0.00	0.00	0.00	0.00
<i>Poa pratensis</i>	0.00	0.00	0.00	20.00
<i>Poa secunda</i>	0.00	0.00	0.00	0.00
<hr/>				
COVER				
Overstory	0.00	0.00	0.00	15.00
Understory	55.00	40.00	55.00	40.00
Litter	25.00	8.00	15.00	40.00
Bareground	10.00	45.00	25.00	5.00
Rock	10.00	7.00	5.00	15.00
<hr/>				
% COMPOSITION				
Shrubs	18.18	62.50	45.45	25.00
Forbs	63.64	25.00	36.36	25.00
Grasses	18.18	12.50	18.18	50.00
<hr/>				
Overstory + Understory	55.00	40.00	55.00	55.00
<hr/>				

5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00
0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	15.00	0.00	0.00	0.00	0.00	70.00	5.00
15.00	5.00	20.00	50.00	35.00	45.00	0.00	35.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	20.00	0.00	0.00	0.00	0.00	0.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	1.00	15.00	0.00	5.00	0.00	0.00	5.00
10.00	19.00	5.00	15.00	15.00	15.00	5.00	15.00
0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	10.00	0.00	10.00	10.00	0.00	5.00
15.00	5.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00
45.00	65.00	50.00	70.00	70.00	70.00	75.00	70.00
10.00	15.00	20.00	15.00	15.00	25.00	20.00	25.00
30.00	15.00	15.00	10.00	10.00	4.00	4.00	4.00
15.00	5.00	15.00	5.00	5.00	1.00	1.00	1.00
33.33	61.54	40.00	71.43	50.00	64.29	93.33	64.29
33.33	30.77	40.00	21.43	28.57	21.43	6.67	28.57
33.33	7.69	20.00	7.14	21.43	14.29	0.00	7.14
45.00	65.00	50.00	70.00	70.00	70.00	100.00	70.00

13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00
35.00	0.00	40.00	0.00	20.00	15.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.00	5.00	10.00	0.00	0.00	0.00	0.00	5.00
0.00	10.00	10.00	20.00	0.00	0.00	10.00	10.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	15.00	45.00	0.00	0.00	55.00	0.00	10.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	5.00	0.00	0.00	10.00	0.00	5.00	0.00
0.00	5.00	0.00	25.00	10.00	5.00	15.00	10.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	10.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	15.00	25.00	0.00	5.00	5.00
35.00	0.00	40.00	0.00	20.00	15.00	0.00	0.00
65.00	50.00	65.00	60.00	45.00	70.00	40.00	40.00
19.00	20.00	30.00	20.00	15.00	15.00	10.00	10.00
15.00	15.00	1.00	15.00	35.00	5.00	45.00	5.00
1.00	15.00	4.00	5.00	5.00	10.00	5.00	45.00
100.00	60.00	100.00	33.33	0.00	78.57	25.00	62.50
0.00	20.00	0.00	41.67	44.44	7.14	62.50	25.00
0.00	20.00	0.00	25.00	55.56	14.29	12.50	12.50
100.00	50.00	105.00	60.00	65.00	85.00	40.00	40.00

CANYON FUELS  
 Dugout Mine  
 AMUT/SYOR/ARTR  
 G-16, G-17, G-18, G-13 Reference Area  
 Slope: W  
 Exposure: 10 deg  
 Sample Date: 13-14 Sept 2005

Mean	SDev	Freq	
<hr/>			
OVERSTORY			
6.75	12.58	25.00	<i>Amelanchier utahensis</i>
0.75	3.27	5.00	<i>Juniperus scopulorum</i>
UNDERSTORY			
SHRUBS			
7.00	16.16	35.00	<i>Amelanchier utahensis</i>
15.25	14.79	75.00	<i>Artemisia tridentata</i>
0.25	1.09	5.00	<i>Juniperus scopulorum</i>
10.50	15.96	50.00	<i>Symphoricarpos oreophilus</i>
FORBS			
0.25	1.09	5.00	<i>Astragalus sp.</i>
4.05	4.60	55.00	<i>Lupinus argenteus</i>
10.70	7.89	80.00	<i>Penstemon watsonii</i>
GRASSES			
0.25	1.09	5.00	<i>Elymus salinus</i>
2.00	3.67	25.00	<i>Elymus spicatus</i>
2.00	3.67	25.00	<i>Elymus trachycaulus</i>
2.25	5.36	20.00	<i>Poa pratensis</i>
2.50	6.22	20.00	<i>Poa secunda</i>
<hr/>			
COVER			
7.50	12.60		Overstory
57.00	12.08		Understory
18.60	7.52		Litter
15.65	13.13		Bareground
8.75	9.59		Rock
<hr/>			
% COMPOSITION			
54.44	26.60		Shrubs
28.08	17.03		Forbs
17.49	14.43		Grasses
<hr/>			
64.50	19.49		Overstory + Understory
<hr/>			

United States Department of Agriculture



Natural Resources Conservation Service  
540 West Price River Drive  
Field Office  
Price, UT 84501  
(435) 637-0041  
FAX (435) 637-3146

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July 3, 2007

Ms Vicky Miller  
Canyon Fuel Company, LLC  
Dugout Canyon Mine  
P.O. Box 1029  
Wellington, UT 84542

Re: Vegetation Production of Proposed Degas Wells G-18, 19, 20, 31 and AMV Road.

Dear Ms Miller,

Following the review of the photos you provided, as well as experience with recent climatic conditions, I have made the following determinations for vegetative production and overall health and trend of the sites. The three ecotypes that will be described in relation to these proposed well sites are, *browse/sagebrush*, *Douglas-fir* and *aspen*. It is noted that most of the sites have previously been disturbed with differing levels of success in the reestablishment of the Potential Natural Community (PNC). Not having a chance to visit the sites personally, I will use my best judgment based on the photos provided and my knowledge of past and present climatic conditions and anthropogenic disturbances.

Well location G-19 lies within a complex landscape with three primary Ecological Site Descriptions (ESDs). The first two, *Mountain very steep stony loam (browse)* and *Mountain loam (Mountain big sagebrush)* experience less effective moisture during the growing season due to their aspect (mostly southern/eastern). The third, *High mountain very steep loam (Douglas-fir)* has more effective moisture associated with a north aspect. It is difficult to distinguish from the photos exactly which ESD the proposed well location lies, I will therefore give productivity estimates for all of them until a site visit can help make this designation.

Based on the PNC for the first ESD (*browse*) percent air-dry weight for the primary functional groups should be as such; 20% grasses, 10% forbs and 70% shrubs. It appears that there has been some disturbance in the past (timber harvest) which would set back the Community from PNC within the State to one going through secondary succession. Based on this factor and the past and present precipitation experienced at these elevations, I would estimate that the production for the site would be 700 lbs Ac<sup>-1</sup>.

The second ESD (*Mountain big sagebrush*) would have a PNC with 60% grasses, 10% forbs and 30% shrubs. Like the previous ESD and associated disturbances and climatic conditions, I would estimate that the production for this site would be 1000 lbs Ac<sup>-1</sup>.

The final ESD (*Douglas-fir*) has production broken out into different classes based on the percent canopy cover. From the pictures provided, and the evidence of past timber harvesting, the canopy cover appears to be sparse (11-20%). The PNC for this site would have an overstory tree canopy of 30-40% with 25% grasses, 10% forbs and 65% shrubs. Knowing that the timber has been harvested and canopy cover is only 11-20% now, I would estimate that the current understory composition is 35% grasses, 15% forbs and 50% shrubs. Based on the previous disturbances and climatic conditions, I would estimate that the production for the site to be 500 lbs. Ac<sup>-1</sup>.

Well locations G-18, G-31 and the AMV road are within the same complexes (*browse and Mountain big sagebrush*) as listed above and would follow under the same description. Portions of well location G-31 have been previously disturbed by logging activities, however well location G-18 does not appear to have been previously disturbed. The AMV road follows a trail used to drive cows and for logging. Based on the recent climatic conditions and photos provided, I would estimate production to be 900 lbs. Ac<sup>-1</sup> for the *browse* site and 1200 lbs. Ac<sup>-1</sup> for the *Mountain big sagebrush* site.

Well location G-20 is located within ESD *High mountain loam (Aspen)* which is also previously disturbed. The PNC for this ESD would typically have an overstory tree canopy of 40-60%. Based on the photos provided, this site is nowhere near the PNC as it is going through secondary succession and has an understory dominated by perennial grasses and shrubs. Based on the overstory canopy cover being open (0-10%), I would estimate that the production for the site would be 900 lbs. Ac<sup>-1</sup>.

I look forward to our rescheduled site visit on July 13, 2007.

Please feel free to contact me if you have any further questions or concerns.

Sincerely,



M. DEAN STACY  
Range Management Specialist  
USDA-NRCS, Price FO

cc: Barry Hamilton, ASTC-FO, Price AO  
Wayne Greenhalgh, District Conservationist, Price FO  
File

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**ATTACHMENT 3-2**  
**THREATENED, ENDANGERED, AND SENSITIVE SPECIES INFORMATION**

Add to the back of existing information

**Bat Survey Report  
Canyon Fuel Company  
Dugout Mine  
Pace Creek Canyon, Northern Cliffs**



**Prepared by:  
JBR Environmental Consultants  
321 N Mall Drive #1-202  
St. George, Utah 84790  
435.652.8301**

**12 June 2007**

## **Introduction**

On the nights of 21 and 22 May 2007, JBR Environmental Consultants Inc. (JBR) conducted bat surveys along the northern cliffs of Pace Creek Canyon, Carbon County, Utah (**Figures 1 and 2**). These surveys were conducted as required under an existing Utah Division of Oil, Gas, and Mining permit, due to the potential for subsidence in the area as a result of activities at Canyon Fuel Company's Dugout Mine operation.

## **Inventory Area**

The Inventory Area lies between 7,800 – 9,000 feet elevation and is characterized by steep sided canyon walls consisting of exposed rock outcrops (see cover photo). The vegetative community is dominated by mixed-age stands of pinyon, juniper, Douglas-fir, and aspen. Shrub species include mountain mahogany, maple, serviceberry, and sagebrush.

As a function of the vast expanses of rock outcrops and associated fissures and cracks, the Inventory Area appears to contain a virtually unlimited potential for day and night bat roosting sites. Snag habitat is also available. No known caves, open mine shafts, adits, or other man made structures that might provide additional habitats are known to exist in the Inventory Area. Perhaps the only habitat feature limiting bat presence within the Inventory Area is the availability of water for drinking and foraging.

## **Results**

During the 2 nights of recording bat calls, no bat call files were produced. The lack of detecting bat calls does not infer that bats are not present in the Inventory Area; it simply means that no bats were active near the locations in which the ANABAT was used. It is unknown why bats were not active at the ANABAT stops, but it was likely a function of both the lack of good foraging habitat (water) and that a cold front had pushed through the area during the nights of the survey. In 2005, JBR conducted bat surveys along Pace Creek and left the ANABAT unattended for 4 nights at a relatively large pond located within 0.25 miles of the southeast corner of the 2007 Inventory Area (JBR 2005). During the 2005 survey, over 3,000 bat calls were recorded from at least 7 different species of bats. It is likely that many of the individual bats that forage over and/or drink from the pond, also utilize at least portions of the 2007 Inventory Area.

## **Methodology**

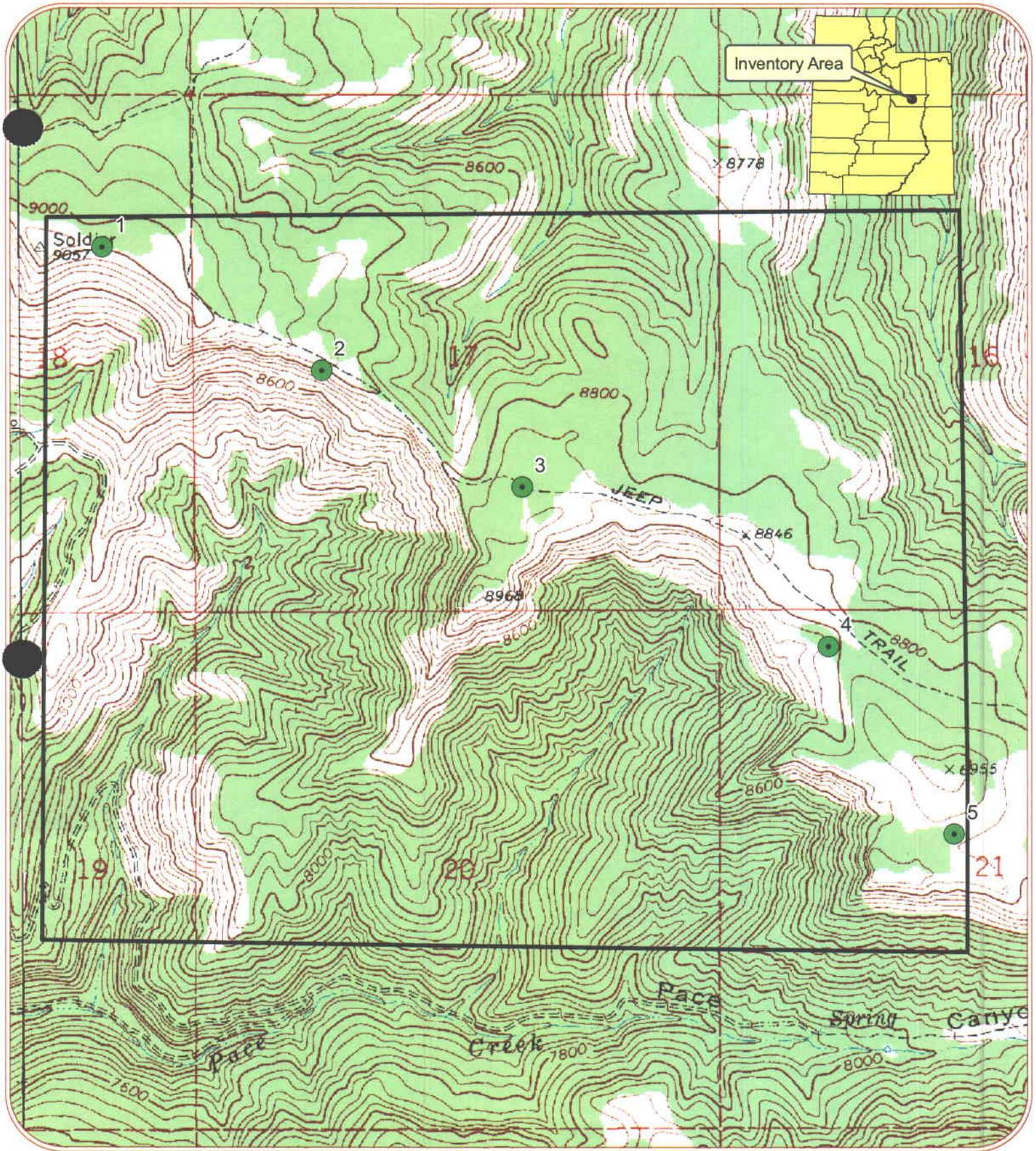
To record bat activity, JBR used an ANABAT II Bat Detector and an ANABAT CF Storage Zero Crossing Analysis Interface Module (ZCAIM) manufactured by Titley Electronics, Ltd., Ballina, NSW, Australia. Between the hours of approximately 20:30 – 22:30 on the nights of 21 and 22 May, JBR biologists ran the ANABAT at each of the 5 stops (**Figure 1**) for approximately 20 minutes.

In addition to the above surveys, the ANABAT was left unattended at stop #4, which contained a small cattle trough (see photo), on 21 and 22 May (2 nights). When left unattended, the bat detector and ZCAIM were enclosed in a weatherproof container. The bat detector's ultrasound transducer was positioned at a 45-degree angle to an acrylic reflector plate. This arrangement allowed the transducer to remain dry while recording bat

calls unattended. Bat calls were recorded automatically; the equipment was programmed to turn on at 20:30 and to turn off at 06:00.

The ANABAT system records bat echolocation calls and stores them as digital format computer files. The file names specify the date and time the files were recorded. The recorded files were analyzed on a desktop computer using Analook software. The call identification process consists of visually comparing time-frequency displays of recorded call sequences against reference files (provided with the ANABAT system), which were recorded from known species that were hand released under controlled conditions. The analysis is somewhat subjective because it depends on making a visual comparison. The training and experience of the biologist doing the analysis is also important. At present, there is no objective, standardized procedure that can be used to analyze and identify the recorded calls.





**Figure 1. Inventory Area and Stops - Topo**

Scale: Mount Bartles, Utah - 1:24,000 (USGS)  
 T13S R13E Sections 16, 17, 18, 19, 20, and 21

- ANABAT Stop
- Inventory Area

**Canyon Fuel Company**  
 Pace Creek Canyon, Northern Cliffs

0 0.5 1 Miles

1:14,782



Created: 05 June 2007  
 Edited: Version 1



**Figure 2. Inventory Area and Stops - Aerial**

Source: 2006 NAIP (USDA)

Location: T13S R13E Sections 16, 17, 18, 19, 20, and 21

-  ANABAT Stop
-  Inventory Area

**Canyon Fuel Company**  
Pace Creek Canyon, Northern Cliffs



1:14,782



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**LIST OF ATTACHMENTS**

- Attachment 4-1** Information Moved to Confidential Folder in 2005  
**Attachment 4-2** Surface Land Owner Agreement

## **410 LAND USE**

### **411 Environmental Description**

A statement of the conditions and capabilities of the land to be affected by mining and reclamation operations follows in this section.

#### **411.100 Preming Land Use**

The area is utilized for the landowners private use, including hunting and as open range for livestock and wildlife.

#### **411.110 Land Use Map and Narrative**

Refer to the same section of the approved M&RP.

#### **411.120 Land Capability**

The major plant communities at the well sites are identified in Section 321. No cultivated lands lie within the well boundaries, due to the limiting terrain and lack of water for irrigation. Refer to Section 321.200, Table 3-1 of this submittal for forage production per acre for each well site.

The well site areas are located on the flatter mesa tops and rolling terrain. This type of terrain receives heavier pressure because of more available forage and easier movement by livestock.

#### **411.130 Land Use Description**

The wells are located on land administered by Milton & Ardith Thayn Trust and zoned by Carbon County for mining and grazing (MG-1).

No industrial or municipal facilities are located on or immediately adjacent to the well sites.

#### **411.140 Cultural and Historic Resources Information**

**Cultural and Historic Resource Maps** - Archaeological surveys were conducted in 2003 of the well sites G-1 through G-6. Nothing was found that required future investigation. There are no cemeteries, public parks, or units of the National System of Trails or the Wild and Scenic Rivers System located within the well site boundaries. The reports can be found in Attachment 4-1 of this submittal, Appendix 4-1 and 4-3 of the M&RP and in the Confidential Folder. Well site G-7 and G-8 were inventoried by AERC in 1980 (see below), a letter from John Senulis of Senco-Phenix to SHPO has been written requesting proof of clearance for the G-7 and G-8 sites. A copy of the Senco-Phenix letter is included in the confidential folder.

Previous research in 1980 by "AERC surveyed several sample blocks in Sections 13 and 24, T13S, R12E and Sections 18, 19 and 30 T13S, R13E. They also surveyed the access road into the Snow Mine site. One archeological site (42CB292) was located. The site was described as "Coal mine located in Pace Canyon consists of one known mine portal which has been closed. Site of historic Snow Mine in Pace Canyon which was active in 1906 but had its primary production period from 1932-1940." The site was relatively pristine at the time and still contained a standing coal loadout and foundation with depth potential. Avoidance was recommended pending further historic research. As noted the site has since been extensively modified" (Attachment 4-1, Senco-Phenix, June 24, 2003, SPUT-455, page 2).

Access to the degas holes will not impact or disturb what remains of the archeological site (42CB292). The road in the bottom of Pace Canyon passes the archeological site, but the closed portal is not visible from the road, therefore there is nothing to draw attention to the site. The loadout referenced in the survey no longer exist at the site.

During June 2005 a Class III intensive walkover survey was performed of the access roads and degas well sites G-9 thru G-13 and site DUG0105/DUG0205 (G-14) by Senco-Phenix. The well sites are being permitted in groups. Wells G-8 thru G-10 are the group currently being presented for consideration for approval. In the canyon where degas well sites G-9 and G-10 are located near site 42CB2435. The major portion of the site has been removed and there is little potential for further information. The site is not considered eligible for the NRHP. Reference the Confidential Binder for further information pertaining to the aforementioned survey. Per the survey "No other cultural resources were located and the potential for undetected remains is remote. A finding of no effect is appropriate and archeological clearance without stipulations is recommended" by Senco-Phenix to SHPO for the G-8 thru G-14 degas well sites. Site 42CB1595 was recommended for archeological clearance without stipulations by Senco-Phenix to SHPO and was not recommended as eligible for the NRHP.

The sites of G-11 and G-16 were previously used for coal exploration holes. No "areas of critical environmental concern" or "native american religious concerns" were identified for either site in the archeological inventory of the area conducted by Senco-Phenix Archeological Consulting Services in June 20, 2001 (SPUT-387, Confidential Binder) and no cultural or historical properties were listed by NRHP. Site G-11 was labeled as "DT-2" and site G-16 was labeled as "E" in SPUT-387.

Sites G-15(DUG0204), G-17 (DUG0304) were previously used for coal exploration holes. An archeological inventory of the area was conducted by Senco-Phenix Archeological Consulting Services in 2001 (SPUT-387, Confidential Binder) and no historical or cultural resources were identified for listing by NRHP/SHPO per the BLM EA UT-070-2004-49, provided for incorporation into Attachment 3-3. Site G-15 was labeled as "DUG0204" and site G-17 was labeled as "DUG0304" in the Environmental Assessment prepared by the BLM for the drilling of these

exploration holes. The areas for the exploration holes were presumably cleared by the BLM prior to the drilling of the exploration holes.

In SPUT-387 the drill pad areas are not labeled with a number but are designated as being inventoried by a blue outline on the drawing provided in the sput. A IMACS site form was prepared and submitted to SHPO for a site at well pad G-17 (42CB1596), this site was "Determined NR ineligible and non-significant for National Register Status.

A drawing has been prepared by archeological consultants "Senco-Phenix" designating areas including roads surveyed for archeological and cultural resources. The drawing entitled "Previous Archeological Surveys, July 2006" is included in the confidential binder. The road used for access to all degas drill sites have been surveyed.

Dugout Canyon agrees to notify the Division and State Historical Preservation Office (SHPO) of previously unidentified cultural resources discovered in the course of operations. Dugout Canyon also agrees to have any such cultural resources evaluated in terms of NRHP eligibility criteria. Protection of eligible cultural resources will be in accordance with Division and SHPO requirements. Dugout Canyon will also instruct its employees that it is a violation of federal and state law to collect individual artifacts or to otherwise disturb cultural resources.

#### **411.200 Previous Mining Activity**

Dugout Canyon has no knowledge of ~~the~~ removal of coal or other minerals in the well site areas.

#### **412 Reclamation Plan**

##### **412.100 Postmining Land-Use Plan**

All uses of the land prior to the wells construction/operation and the capacity of the land to support prior alternate uses will remain available throughout the life of the sites.

Dugout Canyon intends the postmining land use to be livestock and wildlife grazing and other uses as dictated by the land owner (hunting, roads, etc.). Final reclamation activities will be completed in a manner to provide the lands able to parallel the premining land use.

#### **412.200 Land Owner or Surface Manager Comments**

Milton & Ardith Thayn Trust is the landowner. Canyon Fuel Company, LLC has a surface land owner agreement with the Thayne Trust for the drilling of degassification holes (Attachment 4-2). Prior to drilling the landowner will be contacted and the requirements related to drilling as outlined in the surface land owner agreement will be met. A copy of the letter will be included in Attachment 4-2.

#### **413 Performance Standards**

##### **413.100 Postmining Land Use**

Postmining land uses are discussed in Section 412.100. The postmining lands will be reclaimed in a timely manner and capable of supporting such uses (see Chapters 2, 3, 5, and 7).

##### **413.200 Determining Premining Uses of Land**

Refer to Section 411.100.

##### **413.300 Criteria for Alternative Postmining Land Uses**

No alternative postmining land uses have been planned.

#### **414 Alternative Land Use**

No alternative postmining land uses have been planned.

## **420 AIR QUALITY**

### **421 Air Quality Standards**

Dugout Canyon activities will be conducted in compliance with the requirements of the Federal Clean Air Act and the Utah Air Conservation Rules.

### **422 Compliance Efforts**

See Fugitive Dust Control Plan, Section 424.

### **423 Monitoring Program**

Refer to the same section in the approved M&RP.

### **424 Fugitive Dust Control Plan**

Operational areas that are used by mobile equipment will be water sprayed to control fugitive dust. The application of water will be of sufficient frequency and quantity to maintain the surface material in a damp/moist condition unless it is below freezing.

### **425 Additional Division Requirements**

Refer to the same section of the approved M&RP.

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**CHAPTER 4**  
**LAND USE AND AIR QUALITY**

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### LIST OF ATTACHMENTS

**Attachment 4-1** Information Moved to Confidential Folder in 2005  
**Attachment 4-2** Surface Land Owner Agreement

## **410 LAND USE**

### **411 Environmental Description**

A statement of the conditions and capabilities of the land to be affected by mining and reclamation operations follows in this section.

#### **411.100 Premining Land Use**

The area is utilized for the landowners private use, including hunting and as open range for livestock and wildlife.

#### **411.110 Land Use Map and Narrative**

Refer to the same section of the approved M&RP.

#### **411.120 Land Capability**

The major plant communities at the well sites are identified in Section 321. No cultivated lands lie within the well boundaries, due to the limiting terrain and lack of water for irrigation. Refer to Section 321.200, Table 3-1 of this submittal for forage production per acre for each well site.

The well site areas are located on the flatter mesa tops and rolling terrain. This type of terrain receives heavier pressure because of more available forage and easier movement by livestock.

#### 411.130 Land Use Description

The wells are located on land administered by Milton & Ardith Thayn Trust and zoned by Carbon County for mining and grazing (MG-1).

No industrial or municipal facilities are located on or immediately adjacent to the well sites.

#### 411.140 Cultural and Historic Resources Information

**Cultural and Historic Resource Maps** - Archaeological surveys were conducted in 2003 of the well sites G-1 through G-6. Nothing was found that required future investigation. There are no cemeteries, public parks, or units of the National System of Trails or the Wild and Scenic Rivers System located within the well site boundaries. The reports can be found in Attachment 4-1 of this submittal, Appendix 4-1 and 4-3 of the M&RP and in the Confidential Folder. Well site G-7 and G-8 were inventoried by AERC in 1980 (see below), a letter from John Senulis of Senco-Phenix to SHPO has been written requesting proof of clearance for the G-7 and G-8 sites. A copy of the Senco-Phenix letter is included in the confidential folder.

Previous research in 1980 by "AERC surveyed several sample blocks in Sections 13 and 24, T13S, R12E and Sections 18, 19 and 30 T13S, R13E. They also surveyed the access road into the Snow Mine site. One archeological site (42CB292) was located. The site was described as "Coal mine located in Pace Canyon consists of one known mine portal which has been closed. Site of historic Snow Mine in Pace Canyon which was active in 1906 but had its primary production period from 1932-1940." The site was relatively pristine at the time and still contained a standing coal loadout and foundation with depth potential. Avoidance was recommended pending further historic research. As noted the site has since been extensively modified" (Attachment 4-1, Senco-Phenix, June 24, 2003, SPUT-455, page 2).

Access to the degas holes will not impact or disturb what remains of the archeological site (42CB292). The road in the bottom of Pace Canyon passes the archeological site, but the closed portal is not visible from the road, therefore there is nothing to draw attention to the site. The loadout referenced in the survey no longer exist at the site.

During June 2005 a Class III intensive walkover survey was performed of the access roads and degas well sites G-9 thru G-13 and site DUG0105/DUG0205 (G-14) by Senco-Phenix. The well sites are being permitted in groups. Wells G-8 thru G-10 are the group currently being presented for consideration for approval. In the canyon where degas well sites G-9 and G-10 are located near site 42CB2435. The major portion of the site has been removed and there is little potential for further information. The site is not considered eligible for the NRHP. Reference the Confidential Binder for further information pertaining to the aforementioned survey. Per the survey "No other cultural resources were located and the potential for undetected remains is remote. A finding of no effect is appropriate and archeological clearance without stipulations is recommended" by Senco-Phenix to SHPO for the G-8 thru G-14 degas well sites. Site 42CB1595 was recommended for archeological clearance without stipulations by Senco-Phenix to SHPO and was not recommended as eligible for the NRHP.

The sites of G-11 and G-16 were previously used for coal exploration holes. No "areas of critical environmental concern" or "native american religious concerns" were identified for either site in the archeological inventory of the area conducted by Senco-Phenix Archeological Consulting Services in June 20, 2001 (SPUT-387, Confidential Binder) and no cultural or historical properties were listed by NRHP. Site G-11 was labeled as "DT-2" and site G-16 was labeled as "E" in SPUT-387.

Sites G-15(DUG0204), G-17 (DUG0304) were previously used for coal exploration holes. An archeological inventory of the area was conducted by Senco-Phenix Archeological Consulting Services in 2001 (SPUT-387, Confidential Binder) and no historical or cultural resources were identified for listing by NRHP/SHPO per the BLM EA UT-070-2004-49, provided for incorporation into Attachment 3-3. Site G-15 was labeled as "DUG0204" and site G-17 was labeled as "DUG0304" in the Environmental Assessment prepared by the BLM for the drilling of these

exploration holes. The areas for the exploration holes were presumably cleared by the BLM prior to the drilling of the exploration holes.

In SPUT-387 the drill pad areas are not labeled with a number but are designated as being inventoried by a blue outline on the drawing provided in the sput. A IMACS site form was prepared and submitted to SHPO for a site at well pad G-17 (42CB1596), this site was "Determined NR ineligible and non-significant for National Register Status.

A drawing has been prepared by archeological consultants "Senco-Phenix" designating areas including roads surveyed for archeological and cultural resources. The drawing entitled "Previous Archeological Surveys, July 2006" is included in the confidential binder. The road used for access to all degas drill sites have been surveyed.

SPUT-542 is an intensive cultural resource survey covering three drill holes and a staging area. The site for Degas well G-19 (G-190) is part of this survey. Refer to the drawing within the survey and Figure 1-1 of this amendment for verification of the surveyed location. "No cultural resources were located and the potential for undetected remains is remote. A finding of no effect is appropriate and archeological clearance without stipulations is recommended."

SPUT-553 prepared by Senco-Phenix contains an intensive survey on 14 acres. Part of this survey was an access road connect the existing road to well pad G-19 and a trail to G-31 and on to well pad G-18. " A finding of no effect is appropriate and archeological clearance without stipulations is recommended" for the area associated with the sites listed above.

The G-31 well pad was surveyed in 2001 by Senco-Phenix (SPUT-387). In the report, the site is referenced as DT-3 and was inventoried as a location for a potential exploration well. A copy of SPUT-387 is on file at the Division and was submitted to SHPO in association with the Pace Canyon Fan Portal amendment. In the report it states that, "a finding of no effect is appropriate and archeological clearance without stipulations is recommended" for this site.

SPUT-553 also includes a survey of a proposed well site G-22 and the existing road from G-14 to G-22. Cultural resources (42CB2621) were located during this survey, but are not related to the AMV access road, well site G-31 or G-18. The information for this site was provided to the Division on June 14, 2007 under separate cover for submittal to SHPO.

Dugout Canyon agrees to notify the Division and State Historical Preservation Office (SHPO) of previously unidentified cultural resources discovered in the course of operations. Dugout Canyon also agrees to have any such cultural resources evaluated in terms of NRHP eligibility criteria. Protection of eligible cultural resources will be in accordance with Division and SHPO requirements. Dugout Canyon will also instruct its employees that it is a violation of federal and state law to collect individual artifacts or to otherwise disturb cultural resources.

#### **411.200 Previous Mining Activity**

Dugout Canyon has no knowledge of ~~previous~~ the removal of coal or other minerals in the well site areas.

#### **412 Reclamation Plan**

##### **412.100 Postmining Land-Use Plan**

All uses of the land prior to the wells construction/operation and the capacity of the land to support prior alternate uses will remain available throughout the life of the sites.

Dugout Canyon intends the postmining land use to be livestock and wildlife grazing and other uses as dictated by the land owner (hunting, roads, ~~corrals~~, ~~stock ponds~~, etc.). Final reclamation activities will be completed in a manner to provide the lands able to parallel the premining land use.

#### **412.200 Land Owner or Surface Manager Comments**

Milton & Ardith Thayn Trust is the landowner. Canyon Fuel Company, LLC has a surface land owner agreement with the Thayne Trust for the drilling of degassification holes (Attachment 4-2). Prior to drilling the landowner will be contacted and the requirements related to drilling as outlined in the surface land owner agreement will be met. A copy of the letter will be included in Attachment 4-2.

#### **413 Performance Standards**

##### **413.100 Postmining Land Use**

Postmining land uses are discussed in Section 412.100. The postmining lands will be reclaimed in a timely manner and capable of supporting such uses (see Chapters 2, 3, 5, and 7).

##### **413.200 Determining Premining Uses of Land**

Refer to Section 411.100.

##### **413.300 Criteria for Alternative Postmining Land Uses**

No alternative postmining land uses have been planned.

#### **414 Alternative Land Use**

No alternative postmining land uses have been planned.

## **420 AIR QUALITY**

### **421 Air Quality Standards**

Dugout Canyon activities will be conducted in compliance with the requirements of the Federal Clean Air Act and the Utah Air Conservation Rules.

### **422 Compliance Efforts**

See Fugitive Dust Control Plan, Section 424.

### **423 Monitoring Program**

Refer to the same section in the approved M&RP.

### **424 Fugitive Dust Control Plan**

Operational areas that are used by mobile equipment will be water sprayed to control fugitive dust. The application of water will be of sufficient frequency and quantity to maintain the surface material in a damp/moist condition unless it is below freezing.

### **425 Additional Division Requirements**

Refer to the same section of the approved M&RP.

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## **510 INTRODUCTION**

This chapter provides a discussion of general engineering aspects, an operation plan, a reclamation plan, design criteria, and performance standards related to the degassification well sites. The activities associated with the construction and reclamation of the well sites have been or will be designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plans.

### **511 General Requirements**

The permit application includes descriptions of construction, maintenance, and reclamation operations of the proposed well sites with maps and plans. Potential environmental impact as well as methods and calculations utilized to achieve compliance with the design criteria are also presented.

### **512 Certification**

Where required by the regulations, cross sections and maps in this permit application have been prepared by or under the direction of, and certified by, qualified registered professional engineers or land surveyors. As appropriate, these persons were assisted by experts in the fields of hydrology, geology, biology, etc.

#### **512.100 Cross Sections and Maps**

Cross sections for the degassification well pads are shown on Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24 and typical road cross sections are shown on Figures 5-13 and 5-14. Cross sections for the degassification well pads G-8, G-9, G-10, G-11 thru **G-19 and G-31** are shown on figures located in Attachment 5-1.

### **512.200 Plans and Engineering Designs**

**Excess Spoil** - No excess spoil will be generated from the well sites.

**Durable Rock Fills** - No durable rock fills will exist at the well sites.

**Coal Mine Waste** - No coal mine waste will exist at the well sites.

**Impoundments** - Refer to Section 733.200 of this submittal.

**Primary Roads** - Short sections of road are required to access well sites G-2, G-5, and G-16. These access roads are classified as primary roads. Well sites G-1 and G-8 (not drilled), G-3 thru G-15 and G-19, are on existing roads, no access roads will be constructed. Refer to Section 527.200 for additional information.

**Variance from Approximate Original Contour** - No variance from approximate original contour is required for the well sites.

### **513 Compliance with MSHA Regulations and MSHA Approval**

#### **513.100 Coal Processing Waste Dams and Embankments**

No coal processing waste dams and embankments will exist at the well sites.

#### **513.200 Impoundments and Sedimentation Ponds**

Refer to Section 733.200 of this submittal.

**513.300 Underground Development Waste, Coal Processing Waste, and Excess Spoil**

No underground waste, coal processing waste, and excess spoil will exist at the well sites.

**513.400 Refuse Piles**

No refuse piles will exist at the well sites.

**513.500 Underground Openings to the Surface**

The well will be equipped with a valve that will be closed and locked when not in use. A typical well head is shown in Figure 5-16.

**513.600 Discharge to Underground Mine**

No discharge to the underground mine will occur at the well sites.

**513.700 Surface Coal Mining and Reclamation Activities**

No surface coal mining, or reclamation activities associated with surface coal mining will occur at the well sites.

**513.800 Coal Mine Waste Fire**

No coal waste will be developed, therefore, no coal waste fires will occur at the well sites.

## **514 Inspection**

### **514.100 Excess Spoil**

No excess spoil will be stored at the well sites.

### **514.200 Refuse Piles**

No refuse piles will exist at the well sites.

### **514.300 Impoundments**

Refer to Section 733.200 of this submittal.

## **515 Reporting and Emergency Procedures**

### **515.100 Slides**

Refer to Section 515.100 in the approved M&RP.

### **515.200 Impoundments Hazards**

No impoundments will exist at the well sites.

### **515.300 Temporary Cessation of Operations**

If temporary cessation of the mining operations does occur, the wells will remain open. Once liberation of the methane gas is completed, the wells will be sealed as discussed in Section 542.700 of this submittal.

## 520 OPERATION PLAN

### 521 General

See Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-19 and G-31) for the contour map showing pre-disturbance and drilling phase contours. These figures also show the disturbed area boundary and the new access road contours. Figures 5-3, 5-7, 5-11, 5-19, 5-22, 5-25, 5-29 and Attachment 5-1 (G-8 thru G-19 and G-31) show the layout of the well sites during the drilling phase. Figures 5-4, 5-8, 5-12 show the layout of the well sites during the operational phase and the area to be reclaimed at the completion of drilling. Cross sections for each site can be found on Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24, 5-28 and Attachment 5-1 (G-8 thru G-19 and G-31).

#### 521.100 Cross Sections and Maps

**Existing Surface and Subsurface Facilities Features** - No buildings are located on or within 1,000 feet of any of the well sites.

**Landowner, Right-of-Entry, and Public Interest** - The land which the wells will be drilled on is owned by the Milton and Ardith Thayn Trust. Canyon Fuels, LLC has reached an agreement with the Thayn trustees to allow access for the construction and drilling of the wells (see Attachment 4-2).

**Mining Sequence and Planned Subsidence** - Refer to Section 525. Mining sequence maps showing the location of drilled degas wells are submitted to the BLM and UDOGM as part of their annual reports. A drawing representing the drill holes previously permitted for drilling and those currently proposed for drilling in 2007 are shown on a drawing included in Attachment 5-4. The drawing shows the pad locations not the location where the drill hole will be completed. Drill holes from the G-9 pad were or are being drilled to release gas from the Gil-5 and Gil-6 panels. Drill holes from the G-10, G-11, G-12, and G13 pads were drilled to release gas from the Gil-5 panel.

Drill holes from the G-15, G-18, G-19, and G-31 pads will be drilled to release gas from the Gil-6 panel.

**Land Surface Configuration** - Surface contours of undisturbed well sites are included in Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-19 and G-31).

**Surface Facilities** - No permanent surface facilities will exist at the well sites.

### 521.200 Signs and Markers

**Mine and Permit Identification Signs** - A mine and permit identification sign will be displayed at each well site. This sign will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the well site areas. The sign will contain the following information:

- Mine name,
- Company name,
- Company address and telephone number
- MSHA identification number, and
- Permanent program permit identification number

**Perimeter Markers** - The perimeter of all areas affected will be clearly marked before beginning mining activities. The markers will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the permit area.

**Buffer Zone Markers** - Stream buffer zone markers will not be required at the G-2 thru G-10, G-13, G-14, G-16 and G-17 well sites. Stream buffer zone markers will be placed at G-11, G-12, G-15 and G-19.

**Topsoil Markers** - Markers will be placed on all topsoil stockpiles. These markers will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until topsoil is redistributed on the well sites.

**Construction Markers** - Not applicable.

**Hazard Signs** - Signs will be placed at the degas wells with open degas holes, declaring danger, no smoking, etc.

### **522 Coal Recovery**

No coal recovery will be performed at the well sites. The operator has been contacted by the BLM, in reference to changes in Operator's R2P2 associated with Federal Regulation 43 CFR Chapter 11, Subpart 3484. Degas wells G-11, G-12, G18, G19 and G-31 are on the SITLA lease and not on a federal lease, therefore changes in the R2P2 are not required.

### **523 Mining Methods**

No mining will be performed at the well sites.

### **524 Blasting and Explosives**

No explosives are to be used at the well sites.

### **525 Subsidence**

No subsidence will occur at the well sites, as a result of drilling and development of the degassification well sites. Subsidence could occur at the well site because of underground mining see Section 525 of the approved M&RP.

### **526 Mine Facilities**

#### **526.100 Mine Structures and Facilities**

No buildings exist or are proposed at the well sites; therefore, no existing building will be used in connection with or to facilitate this proposed coal mining and reclamation plan.

#### **526.200 Utility Installation and Support Facilities**

No utilities are to be installed at the well sites. A portable methane exhaust unit will be temporarily installed to draw methane to the surface from the mined panel. The exhaust blower will be started by using propane from portable tanks. Once started and running, the unit will be powered by burning the extracted methane gas. The level of extracted methane required to operate the exhaust blower is greater than 30%. Excess methane will be vented to the atmosphere. The blower is approximately 12-feet long by 6-feet wide and about 10-feet tall. It is not known how long the degassification of the longwall panel will take.

### **527 Transportation Facilities**

#### **527.100 Road Classification**

Well sites will be developed near existing private roads as shown on Figures 1-1, 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-17 and G-19). The new short segments of access roads will be classified as primary roads and will be maintained by the permittee (see

Figure 5-14). The AMV access road will be classified as an ancillary road per a discussion with Wayne Western during a meeting at the UDOGM offices on April 16, 2007. The road is improving a trail used for hunting, cattle and for logging. There are small slash piles along segments of the trail.

### 527.200 Description of Transportation Facilities

The well sites were chosen close to existing roads in the area to limit surface disturbance. The existing roads were constructed and are maintained by the land owner. The existing roads are approximately 20 feet wide and are shown on Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-17 and G-19). See Figure 5-13 for a typical cross section of the existing roads.

The access road to the G-16 well site follows an existing road which has been reclaimed. The incised road is approximately 500 feet long, 15 to 20 feet wide and will be constructed on compacted subsoil. Topsoil will be stripped from the road alignment and either wind rowed adjacent to the road or stored with the topsoil stripped from the pad area. The access road will have a maximum grade of 10% and an average grade of 5%. The road will be constructed as shown on Figure 5-14 in the approved methane degassification amendment. As needed, water bars will be used to direct flow off the road and either silt fences or strawbales will be used to treat runoff. Refer to Chapter 5, Attachment 5-1 for drawings of well site. The access road to G-16 is also discussed in Chapter 7, Section 732.400.

The AMV access road will be classified as an ancillary road per a discussion with Wayne Western during a meeting at the UDOGM offices on April 16, 2007. The road is improving a trail used for hunting, cattle and for logging. A drawing showing the alignment of the road can be found in Attachment 5-4, as Plate 1. The drawing outlines the disturbed area and shows the road center line, water bars, turnouts and topsoil stockpile locations. Topsoil will be removed from the road and stockpiles along the road as shown on Plate 1. The cut and fill volumes for the road have been determined to be close, making it unlikely that subsoil will need to be stored. However, should it

be necessary to store subsoil a pile will be created on one of the proposed turnouts. The subsoil pile will be bermed, pocked, gouged and seeded. The topsoil piles will be treated as described in Chapters 2 and 3 of the Methane Degassification Amendment.

A typical road cross section is found in Attachment 5-4 as Figure 1. The road will be at a minimum 14 feet wide, with two addition feet of the road width being added as a berm, making the road approximately 16 feet wide. Additional descriptive information for the road is located in Attachment 5-4.

The steepness of access road cut slopes will depend on the stability of the exposed subsurface material. Cuts into competent material such as bedrock will be sloped at angles of approximately 0.5H:1V (63.4 degrees). Cut into unconsolidated material such as soils will be sloped at angles of approximately 1H:1V (45 degrees). The steepness of these slopes is justified by the presence of several near-vertical bedrock outcrops and naturally steep (approximately 1H:1V) colluvial slopes in the vicinity of the proposed access road. Furthermore, the nearby cut slopes along access roads have maintained such slopes for several years. Cut slopes will be maintained along the length of the proposed access road. Area determined to be unstable will be regraded to a stable configuration. Materials excavated during road maintenance will be stockpiled for use during reclamation.

#### **528 Handling and Disposal of Coal, Excess Spoil, and Coal Mine Waste**

No disposal of coal, excess spoil, and coal mine waste will occur at the well sites.

#### **529 Management of Mine Openings**

The perimeter of the sites, including the topsoil stockpiles will be fenced with gates on the access roads. The well casing will have a valve that is closed and locked. The valve will also prevent access by animals or other material. Mine openings will be monitored in accordance with Federal and State Regulations.

During the life of the methane wells, the sites will be inspected as needed by mine personnel to verify the continued operation of the pumping equipment and general site conditions. Motorized vehicles to access the methane wells may include trucks, four-wheelers, a snow cat, snowmobiles and etc.

## **530 OPERATIONAL DESIGN CRITERIA AND PLANS**

### **531 General**

This section contains the general plans for the construction of sediment controls and general construction and maintenance of the well sites.

The decision to construct each well will be based on the amount of methane encountered during mining. If small amounts of methane are encountered and the mine's ventilation system can dilute the methane, no well will be drilled. The proposed well site locations are shown on Figure 1-1.

The topography above the Dugout Canyon Mine severely limits the selection of methane drainage drill sites (degas wells). Various other factors also affect the drill site locations. These include proximity to the mining area, existing access verses new access, site slope, meeting reclamation success standards, etc. Sites with exiting access are given preference over sites without, where possible sites are located along existing roads and at other pre-disturbed areas. In addition, drill methods are often modified (using directional drilling methods vs. conventional vertical drilling methods) to allow drilling along existing access and to reduce environmental impacts. Directional drilling methods allow the surface site to be located as described yet allow the bottom of the hole to be completed in the required mining area.

### **532 Sediment Control**

Sediment control measures for the well sites are described in Sections 732 and 742 of this submittal. Runoff control structures at the well sites have been designed to convey runoff in a non-erosive manner. Sediment yields in the well permit area are minimized by:

- Disturbing the smallest practicable area during the construction of the well site and
- Contemporaneously reclaiming areas suitable for such reclamation.
- 

The runoff control measures for the AMV access road are discussed in Attachment 5-4.

### **533 Impoundments**

No impoundments will exist at the well sites.

### **534 Roads**

Refer to Section 527 of this submittal.

### **535 Spoil**

No spoil will be generated at the well sites.

### **536 Coal Mine Waste**

No coal mine waste will be stored at the well sites.

### **537 Regraded Slopes**

#### **537.100 Division Approval**

No mining or reclamation activities will be conducted in the permit area that requires approval of the Division for alternative specifications or for steep cut slopes.

#### **537.200 Regrading of Settled and Revegetated Fills**

Upon completion of the well site, the areas not required for the exhaust blower will be regraded to approximate original contour. Because of the nature of the well site, settling is not anticipated. However, if settlement does occur, these areas will be regraded.

### **540 RECLAMATION PLAN**

#### **541 General**

##### **541.100 Commitment**

Upon the permanent cessation of methane venting, Dugout Canyon Mine will seal the wells and permanently reclaim all affected areas in accordance with the R645 regulations and this reclamation plan.

##### **541.200 Surface Coal Mining and Reclamation Activities**

Not applicable.

##### **541.300 Underground Coal Mining and Reclamation Activities**

Upon completion of the methane venting activities the wells will be reclaimed.

##### **541.400 Environmental Protection Performance Standards**

The plan presented is designed to meet the requirements of R645-301 and the environmental protection performance standards of the State Program.

## **542 Narratives, Maps, and Plans**

### **542.100 Reclamation Timetable**

A timetable for the completion of each major step in the reclamation plan is presented in Figure 5-15 (G-2 and G-5) and 5-26 (G-3, G-4, G-6 thru **G-19, G-31 and the AMV access road**). Per Task ID #2408, "the Division requires notification and a reasonably specific time to initiate the reclamation activities associated with degassification well sites". In addition to the two figures referenced above, information pertaining to reclamation timing for methane degas wells is provided in Attachment 5-2 of this amendment.

### **542.200 Plan for Backfilling, Soil Stabilization, Compacting, and Grading**

Following completion of the venting activities, the well site will be prepared for contouring and soil distribution. Details regarding topsoil placement and revegetation are provided in Section 242 and Section 353, respectively.

**Sedimentation Pond Removal and Interim Sediment Control** - See Section 542.500 of this submittal.

### **542.300 Final Surface Configuration Maps and Cross Sections**

The sites will be regraded to the approximate original contour, the contours representing the pre-disturbance topography also represent the reclamation topography. Refer to Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24, 5-28 and Attachment 5-1 (G-8 thru **G-19 and G-31**) to see cross sections representing the final surface configuration.

#### **542.400 Removal of Temporary Structures**

The well sites will not have surface structures.

#### **542.500 Removal of Sedimentation Pond**

No sediment pond will be constructed at the well sites.

#### **542.600 Roads**

The roads which existed prior to the drilling program will be retained after reclamation. The access roads established during the drilling program will be reclaimed after methane extraction has been completed. See Section 242 for additional detail concerning the reclamation plan.

The road to well site G-16 is pre-existing however it has been reclaimed, the road to access well sites G-13, G-14, G-15, G-17 and G-19 are existing roads. Subsoil being cut in order to construction the pad for well G-15 will be placed on the existing road, causing it to be elevated. Refer to Section 527.200 and Attachment 5-4 for a description of the AMV access road.

#### **542.700 Final Abandonment of Mine Openings and Disposal Areas**

Degas drill holes G-9 thru G-19 and G-31 will be sealed in accordance with Federal Regulations 43 CFR Ch. 11, Subpart 3484, (3) per a decision by the BLM and UDOGM.

The casings on degas well sites G-2 thru G-7 will be plugged at the bottom to hold concrete. A lean concrete mixture will be poured into the casing until the concrete is within five (5) feet of the surface. At that time the casing will be cut off at ground level and the rest of the casing will be filled with lean concrete. The concrete will be allowed to harden before final reclamation is completed.

A copy of 43 CFR Ch. 11, Subpart 3484, (3) and a discussion of how methane is removed from mines is contained in Attachment 5-2.

#### **542.800 Estimated Cost of Reclamation**

Refer to the Appendix 5-6 of the existing M&RP. It is anticipated that the cost of reclamation of the well sites is adequately covered by the Dugout Canyon Reclamation Bond, refer to Chapter 8 for additional detail.

### **550 RECLAMATION DESIGN CRITERIA AND PLANS**

#### **551 Casing and Sealing of Underground Openings**

Permanent sealing is described in Section 542.700.

#### **552 Permanent Features**

##### **552.100 Small Depressions**

No permanent small depressions will be created as part of the well site construction and reclamation.

##### **552.200 Permanent Impoundments**

See Section 515.200 of this submittal.

#### **553 Backfilling and Grading**

##### **553.100 Disturbed Area Backfilling and Grading**

**Approximate Original Contour** - The well sites will be returned to their approximate original contour after reclamation is completed.

**Erosion and Water Pollution** - Sediment controls will consist of gouging the surface to create depressions and mounds which store and impede the movement of water. As vegetation becomes established on the reclaimed surface, erosion potential will be further minimized.

**Post-Mining Land Use** - The disturbed area will be reclaimed in a manner that supports the approved post-mining land use. Refer to Sections 411 and 412 for additional detail.

#### **553.200 Spoil and Waste**

**Spoil** - No spoil will be generated within the well sites.

**Coal Processing Waste** - No coal processing waste will be generated within the well sites.

#### **553.250 Refuse Piles**

No refuse piles will exist at the well sites.

#### **553.300 Exposed Coal Seams, Acid and Toxic Forming Materials and Combustible Materials**

No coal seams will be left exposed at the well sites. All wells will be sealed according to Federal and State regulations.

#### **553.400 Cut and Fill Terraces**

No cut and fill terraces will be constructed at the well sites.

**553.500 Highwall From Previously Mined Areas**

No highwalls exist or will be built at the well sites.

**553.600 Previously Mined Area**

No previously mined areas exist at the well sites.

**553.700 Backfilling and Grading - Thin Overburden**

No surface mining and reclamation activities involving thin overburden will occur at the well sites.

**553.800 Backfilling and Grading - Thick Overburden**

No surface mining and reclamation activities involving thick overburden will occur at the well sites.

**553.900 Regrading of Settled and Revegetated Rills**

If settlement or rills occur at the well sites, they will be regraded and revegetated. Refer to Section 244.300.

**560 PERFORMANCE STANDARDS**

Dugout Canyon Mine well sites will be conducted in accordance with the approved permit and the requirements of R645-301-510 through R645-301-553.

**FIGURE 5-26**  
**Reclamation Schedule - Wells G-3, G-4, G-6 thru G-19 and G-31**

Task	Weeks to Complete from Start of Reclamation Activities		
	1	2	3
Plug Well			
Regrade Site to Original Contour			
Rip Subsoil			
Place Topsoil and Roughen			
Seed and Mulch			

The schedule assumes that weather conditions are conducive. Schedule is for each individual well not wells collectively. If necessary the timing may be extended.

**Reclamation Schedule - AMV Access Road**

Task	Weeks to Complete from Start of Reclamation Activities		
	1	2	3
Regrade Road to Original Contour			
Rip Subsoil			
Place Topsoil and Roughen			
Seed and Mulch			
Move to Next Road Segment, Repeat First Four Tasks.			

The schedule assumes that weather conditions are conducive. Schedule is for individual segments of the road not the entire road. The road will be broken up into 3 to 4 segments, thus the reclamation will take from six to eight weeks. If necessary the timing may be extended.

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**ATTACHMENT 5-1**  
**Degas Wells G-8 thru G-19 and G-31**

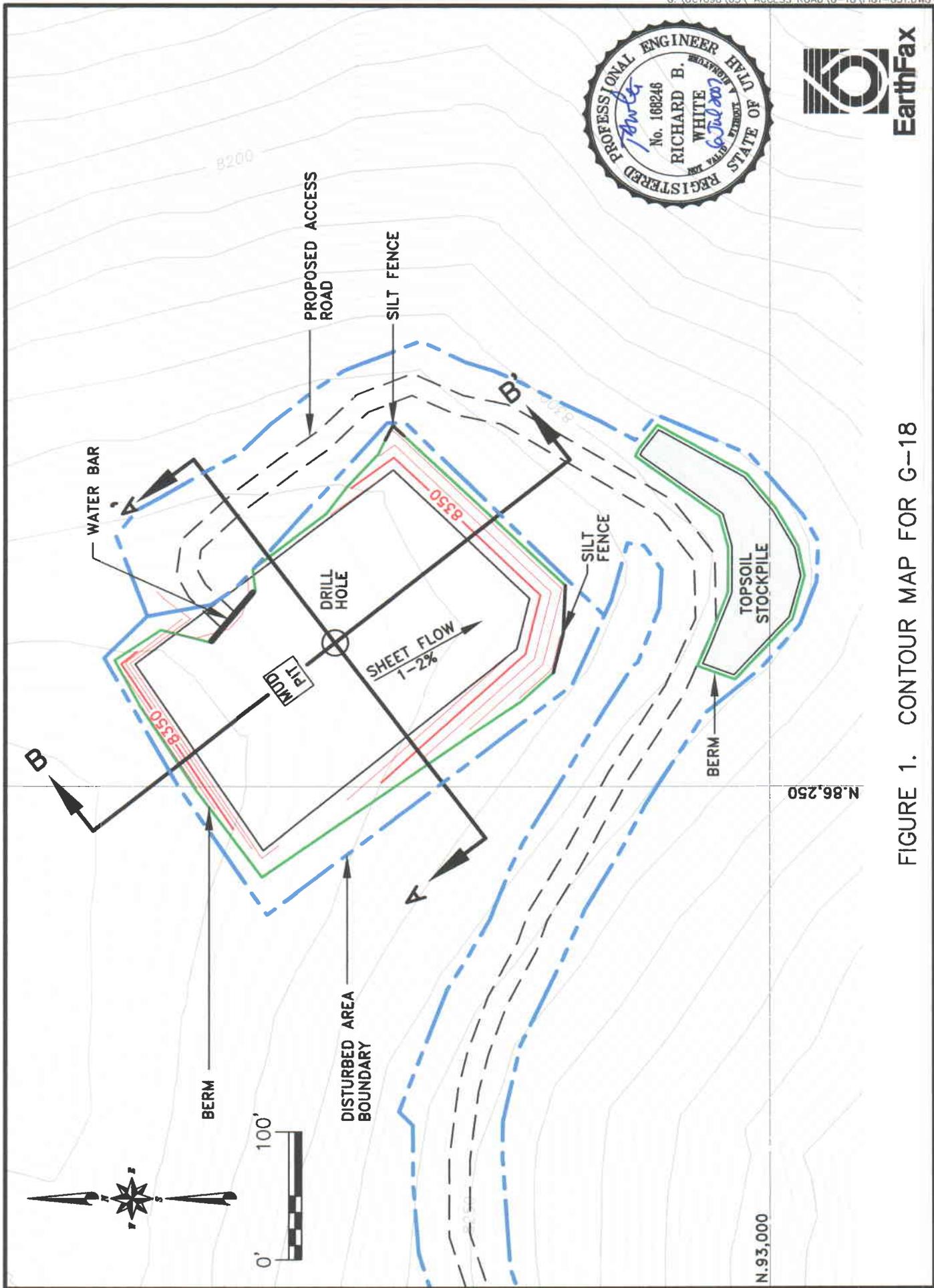
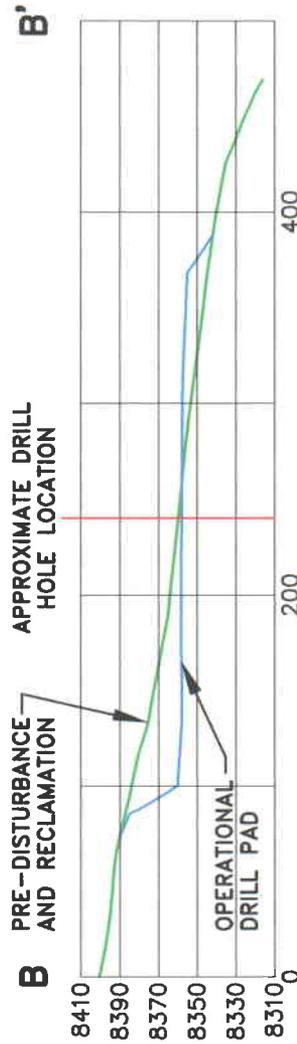
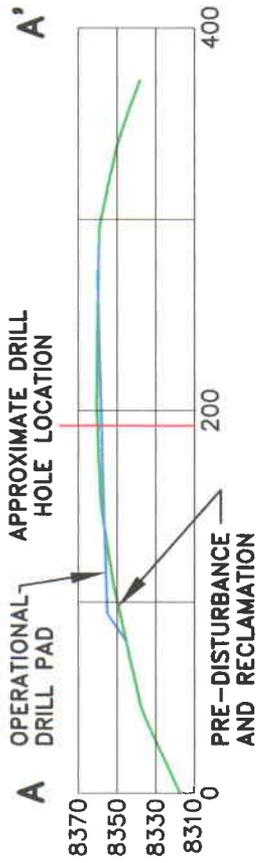
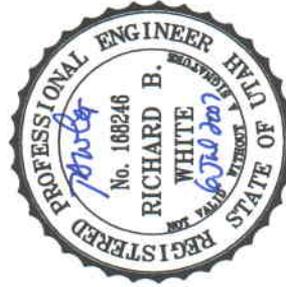


FIGURE 1. CONTOUR MAP FOR G-18



HORZ. AND VERT.

FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-18



EarthFax



NOTES:

1. DRILL HOLE LOCATION MAY VARY.
2. BERMS WILL BE PLACED AROUND THE TOPSOIL STOCKPILES.
3. TOPSOIL WILL BE REMOVED FROM THE ENTIRE DRILLING PAD AREA.
4. TOPSOIL REMOVED FROM THIS SITE WILL BE STORED IN STOCKPILES USED TO STORE TOPSOIL TAKEN FROM THE ACCESS ROAD AND/OR OTHER DEGAS WELL PADS.
5. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIRECT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD. THE BERM WILL DIRECT RUNOFF FROM DISTURBED AREAS TO A SILT FENCE AND OR/STRAW BALE DIKE AT THE LOWEST POINT FOR TREATMENT.

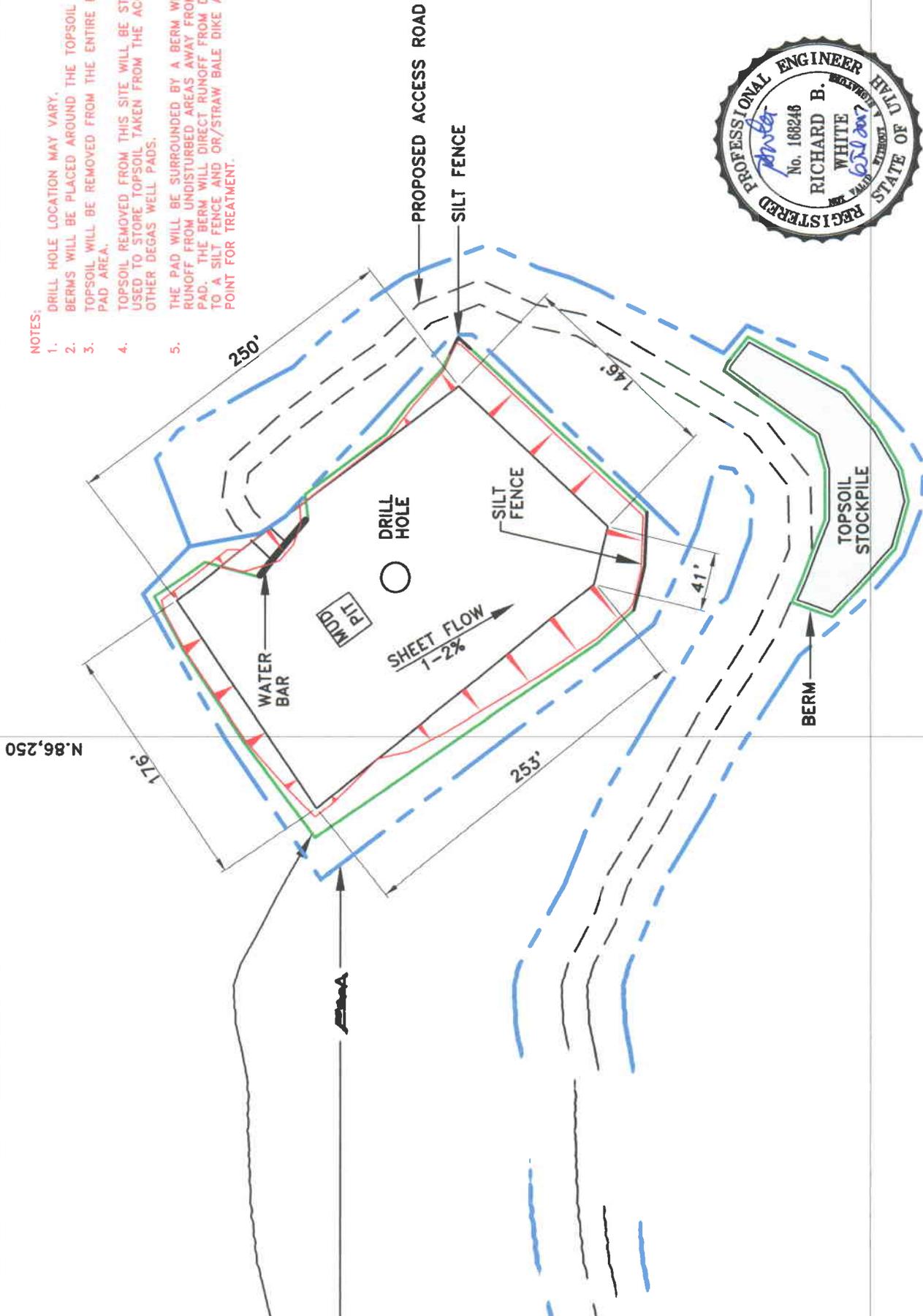


FIGURE 3. APPROXIMATE DRILLING LOCATION FOR G-18

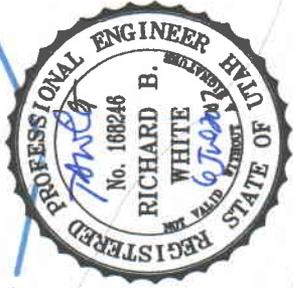
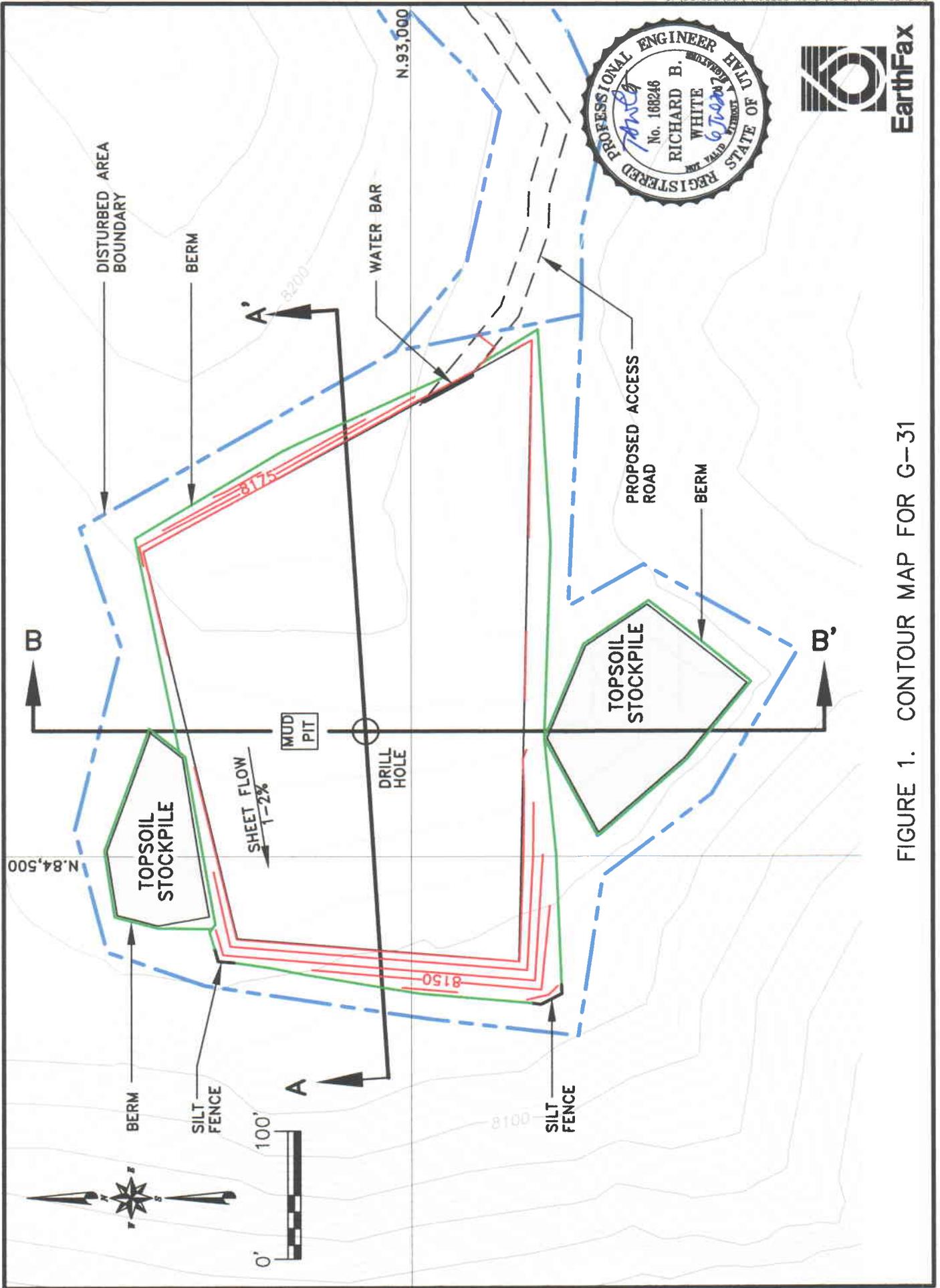


FIGURE 1. CONTOUR MAP FOR G-31

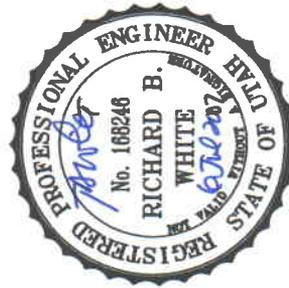
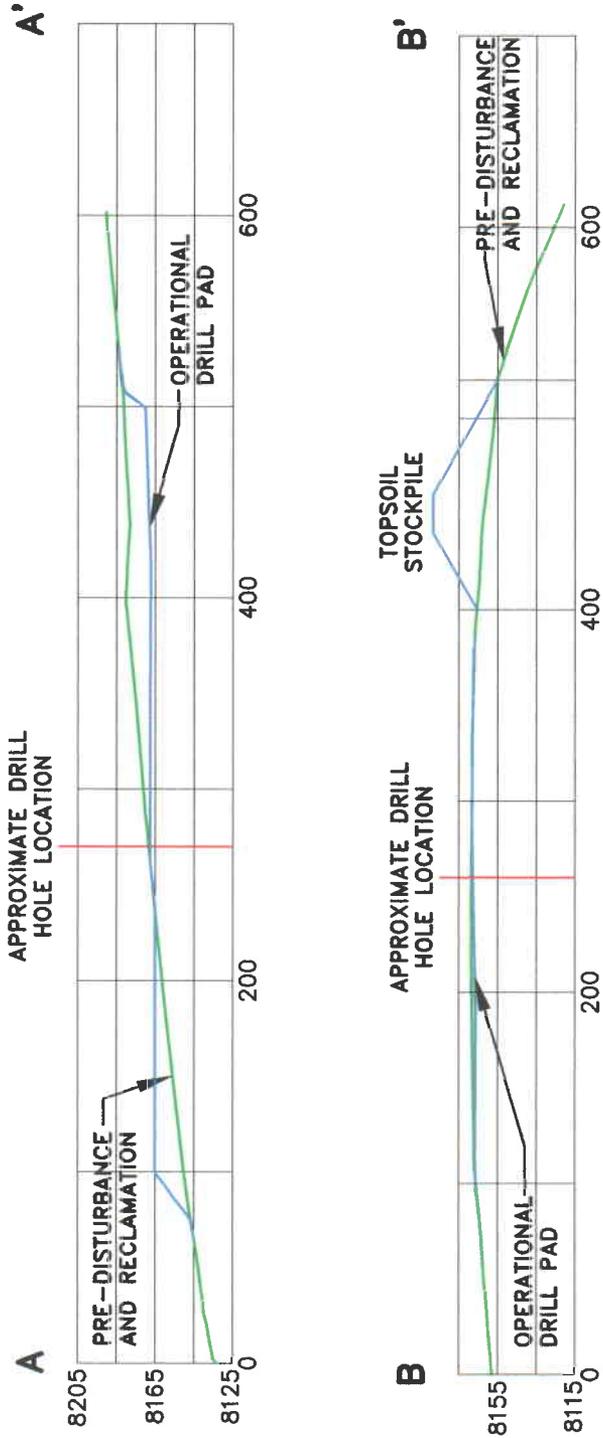


FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-31

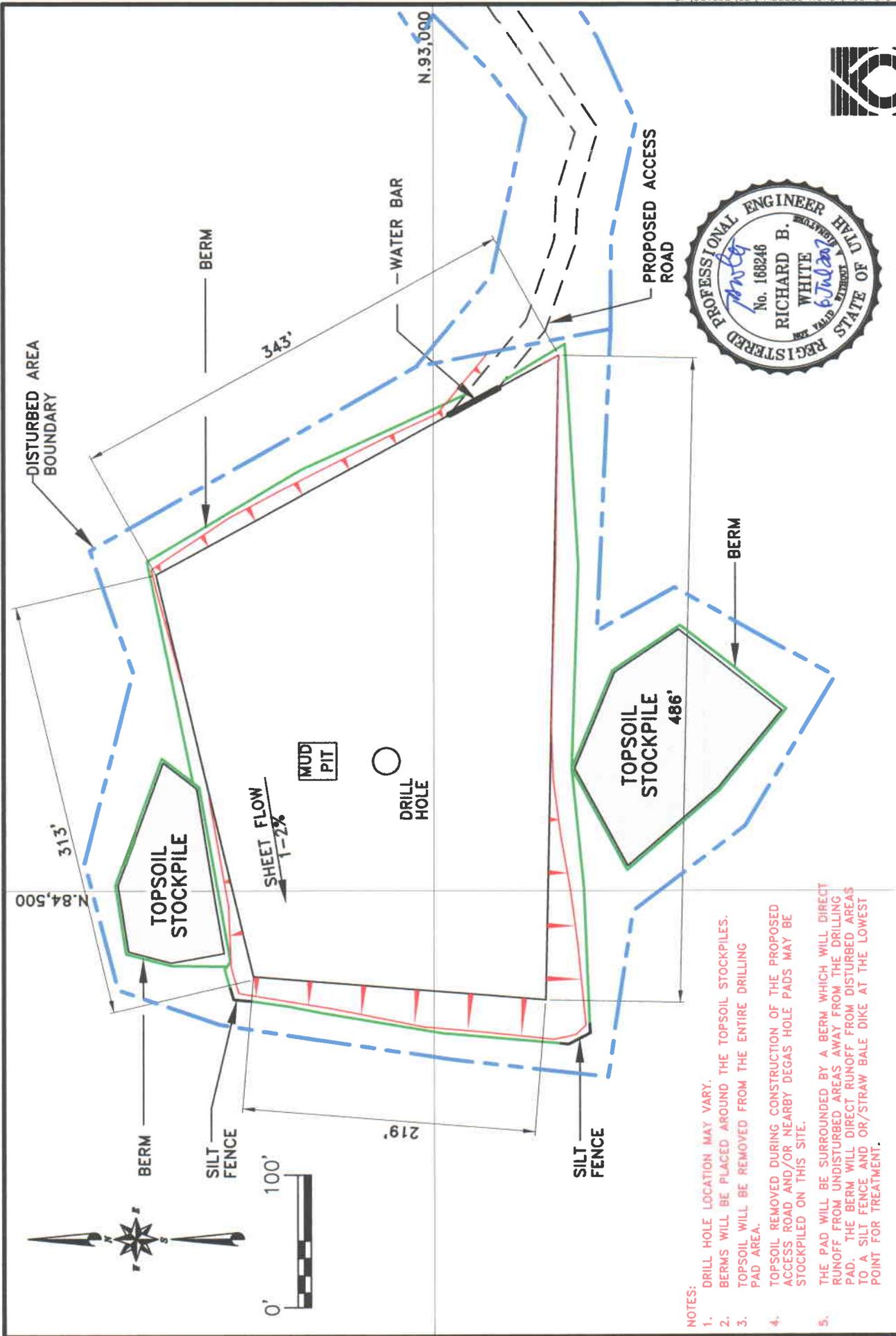
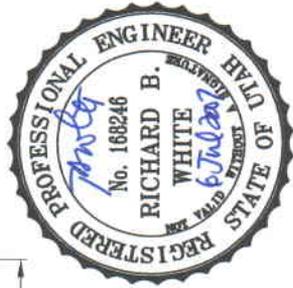


FIGURE 3. APPROXIMATE DRILLING LOCATION FOR G-31

- NOTES:
1. DRILL HOLE LOCATION MAY VARY.
  2. BERMS WILL BE PLACED AROUND THE TOPSOIL STOCKPILES.
  3. TOPSOIL WILL BE REMOVED FROM THE ENTIRE DRILLING PAD AREA.
  4. TOPSOIL REMOVED DURING CONSTRUCTION OF THE PROPOSED ACCESS ROAD AND/OR NEARBY DEGAS HOLE PADS MAY BE STOCKPILED ON THIS SITE.
  5. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIRECT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD. THE BERM WILL DIRECT RUNOFF FROM DISTURBED AREAS TO A SILT FENCE AND OR/STRAW BALE DIKE AT THE LOWEST POINT FOR TREATMENT.

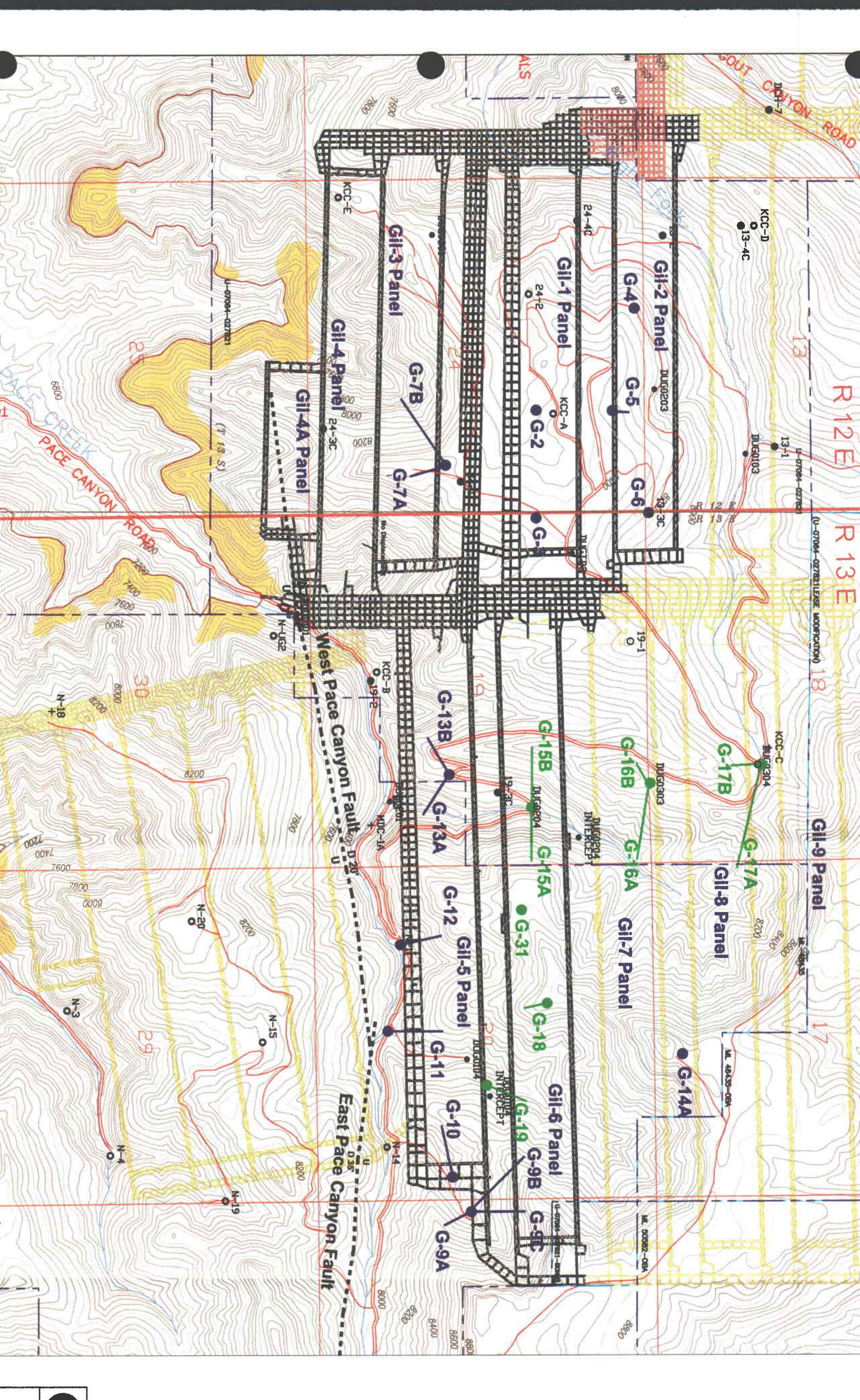
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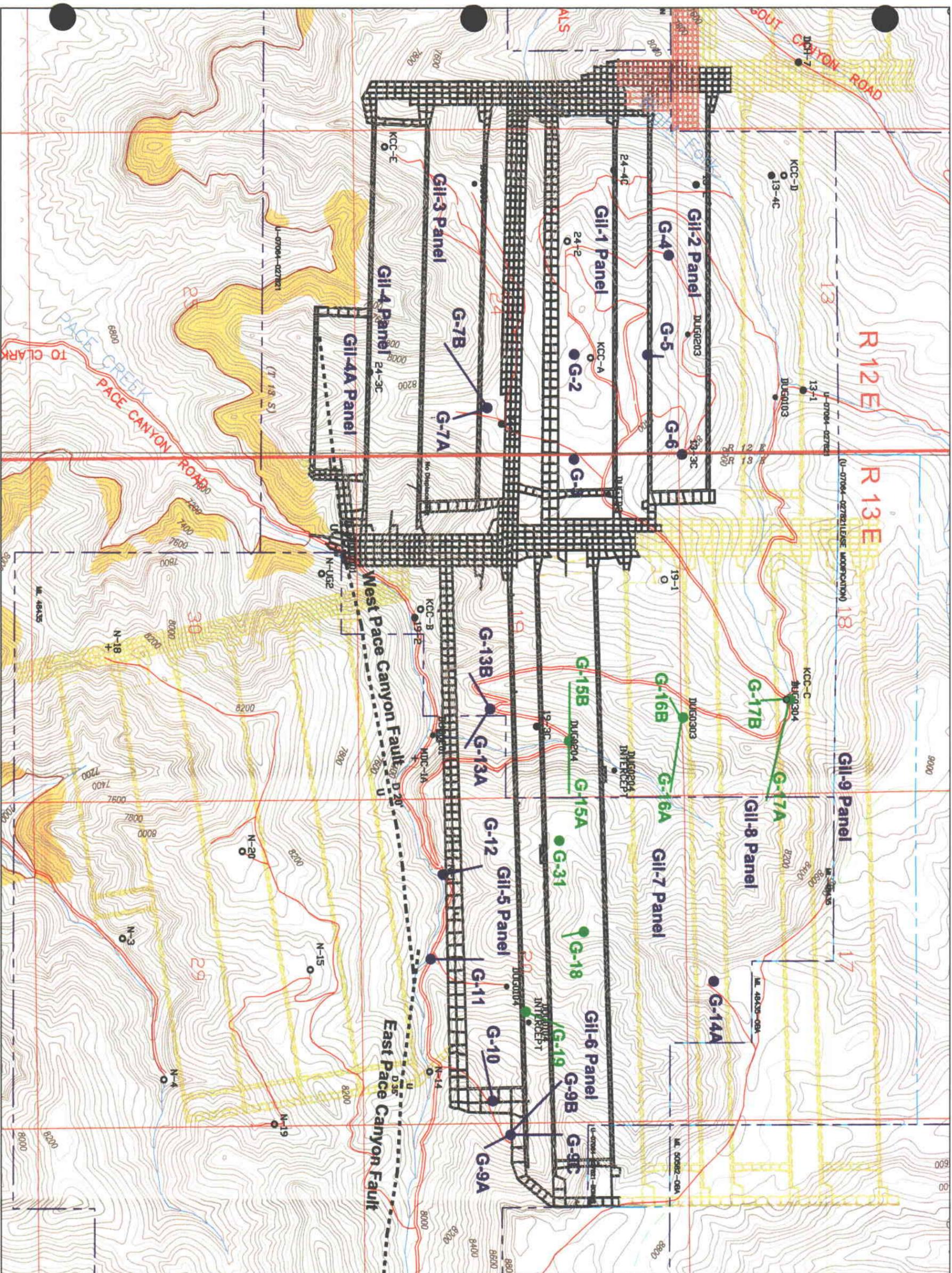
Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**ATTACHMENT 5-2**  
**Methane Degassification**

Well No.	Year Constructed		Plugged	Contemporaneous Reclamation		Final Reclamation	
	Planned	Actual		Actual	Planned	Actual	Planned
G-2		2004		2007			
G-3		2004	2005		2005		2006
G-4		2004	2005				2005
G-5		2004		2007			
G-6		2004	2005			2007	
G-7		2005		2007			
G-9		2005		2008			
G-10		2006		2007			
G-11		2006		2007			
G-12		2006					
G-13		2006		2007			
G-14		2006					
G-15	2007/2008						
G-16	2008						
G-17	2008						
G-18	2007						
G-19	2007						
G-31	2007						

Dates are approximate, all events are subject to availability of contractors, weather, mining needs, etc.  
 Although permitted, wells G-1 and G-8 were never drilled/constructed.





- EXPLANATION**
- Existing Road
  - Lease Boundary
  - Existing Methane Drainage Wells
  - Proposed Methane Drainage Wells
  - Burn



**CF** Canyon Fuel Co., LLC.  
Dugout Canyon Mine

Location of Methane  
Drainage Wells

P.O. BOX 1028  
WILLINGTON, UTAH 84642

DATE: 06-14-2007  
WELL LOC WITH MINE PLAN, AND  
ATTACHMENT 5-2

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007

**ATTACHMENT 5-4**  
**Degas Wells Access Road**



**ATTACHMENT 5-4**  
**G31/G18 ACCESS ROAD HYDROLOGY CALCULATIONS**  
**AND CUT/FILL VOLUMETRICS CALCULATIONS**

### Cut/Fill Volumetrics

Area	Road	Pad 31	Pad 18	TOTAL
Disturbed Acreage	5.68	2.87	1.36	9.91
Disturbed Area Acreage within Boundary	13.72	4.66	1.74	20.11
Topsoil Volume (cyd)	9,167	4,624	2,195	15,986
Subsoil Cut Volume (cyd)	15,207	8,470	6,962	30,639
Cut Volume Total (cyd)	24,374	13,094	9,157	46,625
Fill Volume Required (cyd)	11,954	11,781	5,938	29,673
Net Cut(+)/Fill(-) Subsoil Only (cyd)	3,253	-3,311	1,024	966

#### Notes

Proposed road is 7,155 feet long.

Topsoil Volume assumes that the Disturbed Area will have 1 foot (avg) thickness topsoil to be stockpiled.

The Subsoil Cut Volume is the Cut Volume Total minus the Topsoil Volume.

The Net Cut Volume (966 cyd) does not include the volume of subsoil required to construct berms along the proposed road (265 cyd), around the proposed topsoil stockpiles (249 cyd), or around the proposed degas well pads G-31 (62 cyd) and G-18 (39 cyd). The net cut is thus  $966 - 249 - 265 - 62 - 39 = 351$  cyd. The road and pad berm volumes were calculated assuming that they will be 1 ft tall with 1H:1V side slopes. The lengths of the berms for the road, G-31, and G-18 were taken as 7155, 1670, and 1023 feet long, respectively. Stockpile berm volumes are calculated on the Stockpile Runoff Containment Volume Calculations table.

All acreages and cut/fill volumes were calculated with AutoCAD software.

### Stockpile Dimensions and Volumes

Stockpile	Length (ft)	Width (ft)	Height (ft)	Volume (yd <sup>3</sup> )
STP-1	85	50	20	800
STP-2	90	40	22	650
STP-3	205	120	25	6,000
STP-4	150	110	25	6,800
STP-5	150	70	25	2,450
STP-6	200	50	22	1,943
				<b>18,643</b>

#### Notes

Stockpile locations are shown on the map.

Stockpile dimensions are approximate, and site conditions may affect their sizes and locations.

Stockpile volumes were calculated using AutoCAD Land Desktop Design 2008 software.

### Stockpile Runoff Volume Calculations

Stockpile	Watershed Area (sq. ft.)	Watershed Area (acres)	Precip. - <i>P</i> (in)	Curve Number ( <i>CN</i> )	Potential Max. Retention - <i>S</i> (in.)	Runoff - <i>Q</i> (in)	Runoff Volume - <i>V</i> (ft <sup>3</sup> )
STP-1	3,282	0.08	2.05	87	1.49	0.94	258
STP-2	3,312	0.08	2.05	87	1.49	0.94	261
STP-3	15,690	0.36	2.05	87	1.49	0.94	1,235
STP-4	14,734	0.34	2.05	87	1.49	0.94	1,160
STP-5	7,895	0.18	2.05	87	1.49	0.94	622
STP-6	8,417	0.19	2.05	87	1.49	0.94	663

#### Notes

Calculations have been performed for the 10-year, 24-hour design storm event.

Topsoil is derived from the Midfork Family - Comodore Complex, as described in the NRCS Soil Survey for Carbon Area, Parts of Carbon and Emery Counties.

Calculations based on Soil Conservation Service (SCS) Method, National Engineering Handbook Section 4, Chapters 9 & 10 by Victor Mockus, 1972

Precipitation for 10-year, 24-hour event taken from National Weather Service web site ([http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut\\_pfds.html](http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html))

CN = 87, based on Table 9.1, NEH s4 ch9. Assume Hyd. Soil Gp. C (as given for Rottulee family - Trag complex in NRCS survey). Assume road, dirt surface (non-vegetated, conservative case).

$$S = (1000/CN) - 10$$

$$L = [(I^{0.8} (S+1)^{0.7}) / (1900Y^{0.5})]$$

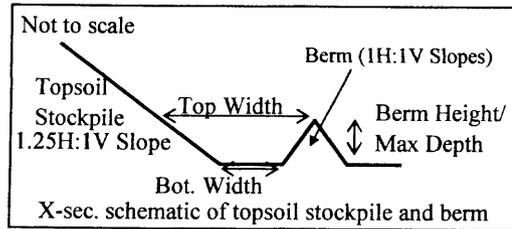
$$T_c = 1.67L$$

$$Q = (P - 0.2*S)^2 / (P + 0.8*S)$$

$$V = \text{Area} * Q$$

## Stockpile Runoff Containment Volume Calculations

Stockpile	Bottom Width (ft)	Top Width (ft)	Max Depth (ft)	Impounding Length of Berm (ft)	Total Length of Berm (ft)	Fill Req'd for Berm (yd <sup>3</sup> )	Cntnmt Vol. (ft <sup>3</sup> )	Contain Vol > Runoff Vol ?
STP-1	2	4.25	1	78	268	10	244	Yes
STP-2	2	4.25	1	89	257	10	278	Yes
STP-3	2	6.5	2	250	510	76	2,125	Yes
STP-4	2	6.5	2	227	509	75	1,930	Yes
STP-5	2	6.5	2	76	402	60	646	Yes
STP-6	2	4.25	1	262	513	19	819	Yes
<b>249</b> Total fill for berms (yd <sup>3</sup> )								



### Notes

The bottom width is the distance between the toe of the topsoil stockpile and the base of the berm. (see schematic)

The top width is the horizontal distance between the crest of the berm and the topsoil stockpile. (see schematic)

The max depth is the height of the berm.

The Impounding Length of the berm accounts for the slope of the ground, and is the portion of the berm that will impound runoff.

The Total Length of Berm is its entire length around the topsoil stockpile.

The Fill Required for Berm is the volume of subsoil required to construct each berm, and is based on the length, height, and width of each berm. Berms shall be constructed with 1H:1V slopes.

The Containment Volume = Length \* Cross sectional area of the space between the topsoil stockpile and the inby side of the berm.

### Watershed Hydrology - Culvert Design

Watershed	Watershed Area (sq. ft.)	Watershed Area (acres)	Precip. P (in)	Hydraulic Length - I (ft)	Avg Watershed Slope - Y (%)	Duration of Storm (hr)	Curve Number (CN)	Potential Max. Retention S (in.)	Lag - L (hr)	Time of Concentration - Tc (hr)	Runoff - Q (in)	Runoff Volume - V (ft <sup>3</sup> )	Peak Discharge (cfs)
WS1	1,532,383	35.2	2.05	2,262	60.5	24	77	2.99	0.09	0.14	0.48	60,692	24.68
WS2	276,566	6.3	2.05	1,502	60.1	24	77	2.99	0.06	0.10	0.48	10,954	4.94
WS3	205,995	4.7	2.05	1,151	57.7	24	77	2.99	0.05	0.09	0.48	8,159	3.79
WS4	395,010	9.1	2.05	1,100	49.8	24	77	2.99	0.05	0.09	0.48	15,645	7.25
WS5	74,016	1.7	2.05	589	45.7	24	82	2.20	0.03	0.05	0.68	4,206	2.25

**Notes**

Calculations have been performed for the 10-year, 24-hour design storm event.

Refer to attached figures for locations of watersheds and NRCS soils units

Calculations based on Soil Conservation Service (SCS) Method, National Engineering Handbook Section 4, Chapters 9 & 10 by Victor Mockus, 1972

CN determined based on NRCS soils map, which shows that each watershed (except WS5) contains soils of which half are in Hydrologic Soils Group B and half are in Group C. According to the UDOT Manual of Instruction, Table 7-14, woods-grass combination, poor condition has a CN of 73 for Group B and 82 for Group C. The weighted average CN is thus approximately 77. WS5 is comprised entirely of soils in Group C.

$$S = (1000/CN) - 10$$

$$L = [(1^{0.8} (S+1)^{0.7}) / (1900Y^{0.5})]$$

$$T_c = 1.67L$$

$$Q = (P - 0.2*S)^2 / (P + 0.8*S)$$

$$V = Area * Q$$

Peak discharge calculated using HydroCad 2005 software (see attached sheets for output).

**Average Watershed Slope Calculation (Sum of lengths of contour lines X contour interval / Area)**

WS1	Contour (ft)	Length (ft)
	7,900	825
	8,000	1,021
	8,100	1,353
	8,200	1,483
	8,300	1,481
	8,400	1,327
	8,500	843
	8,600	546
	8,700	256
	8,800	131
<b>TOTAL</b>		<b>9,266</b>
<b>AvgSlope</b>		<b>60.5%</b>

**WS2**

Contour (ft)	Length (ft)
7,800	142
7,900	298
8,000	251
8,100	328
8,200	245
8,300	398
<b>TOTAL</b>	<b>1,662</b>
<b>AvgSlope</b>	<b>60.1%</b>

**WS3**

Contour (ft)	Length (ft)
7,800	246
7,900	231
8,000	294
8,100	202
8,200	156
8,300	60
<b>TOTAL</b>	<b>1,189</b>
<b>AvgSlope</b>	<b>57.7%</b>

**WS4**

Contour (ft)	Length (ft)
7,800	284
7,900	380
8,000	624
8,100	451
8,200	170
8,300	60
<b>TOTAL</b>	<b>1,969</b>
<b>AvgSlope</b>	<b>49.8%</b>

**WS5**

Contour (ft)	Length (ft)
8,100	282
8,200	56
<b>TOTAL</b>	<b>338</b>
<b>AvgSlope</b>	<b>45.7%</b>

### Culvert Sizing Summary

Culvert No.	Diameter (in)	Length (ft)	Inlet Elevation (ft)	Outlet Elevation (ft)	Average Slope (ft/ft)	Peak Flow (cfs)	Peak Inlet Depth (ft)	Peak Inside Depth (ft)
1	36	203	7,890	7,845	0.22	24.68	2.52	0.79
2	24	117	7,735	7,730	0.04	4.94	1.14	0.34
3	18	89	7,735	7,700	0.39	3.79	1.02	0.34
4	24	64	7,712	7,690	0.34	7.25	1.5	0.44
5	18	80	8,020	7,997	0.29	2.25	0.6	0.28

**Notes**

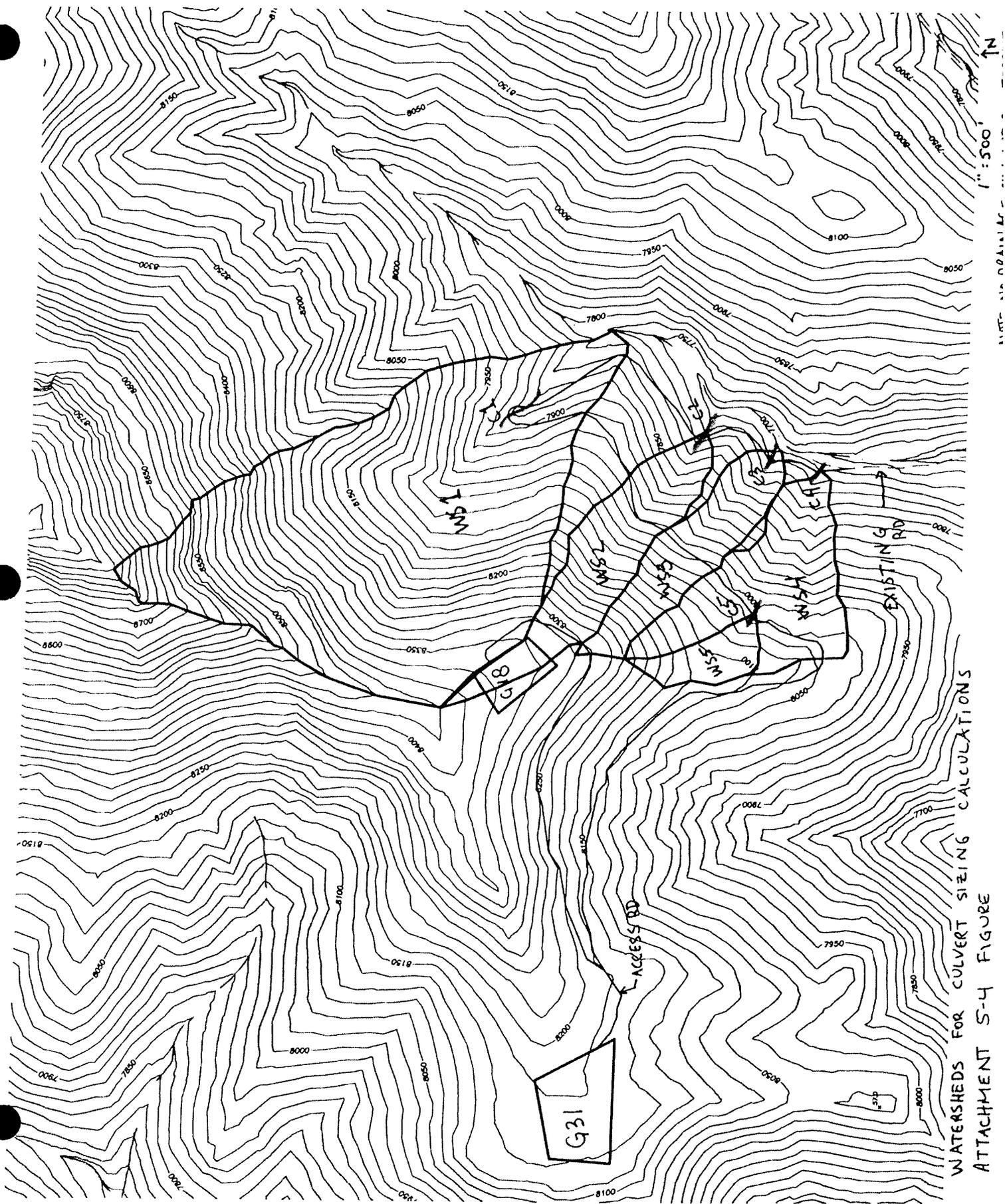
Culvert No. corresponds to Watershed No. on Watershed Hydrology - Culvert Design Table. i.e. Culvert No. 1 will be located where WS-1 crosses the road.

Culverts were conservatively assumed to be corrugated metal pipe. Polyethylene pipe may also be used.

The peak flow in each culvert was calculated using HydroCad 2005 software using the Soil Conservation Service (SCS) method, as shown in the Watershed Hydrology - Culvert Design Table. The design storm was the 10-year, 24-hour precipitation event.

The peak inlet depth was determined using Hydraulic Engineering Circular No. 5 Chart 5 (U.S. Department of Transportation, 1977). As a conservative measure, the projecting condition was assumed. See the attached nomograph for additional information.

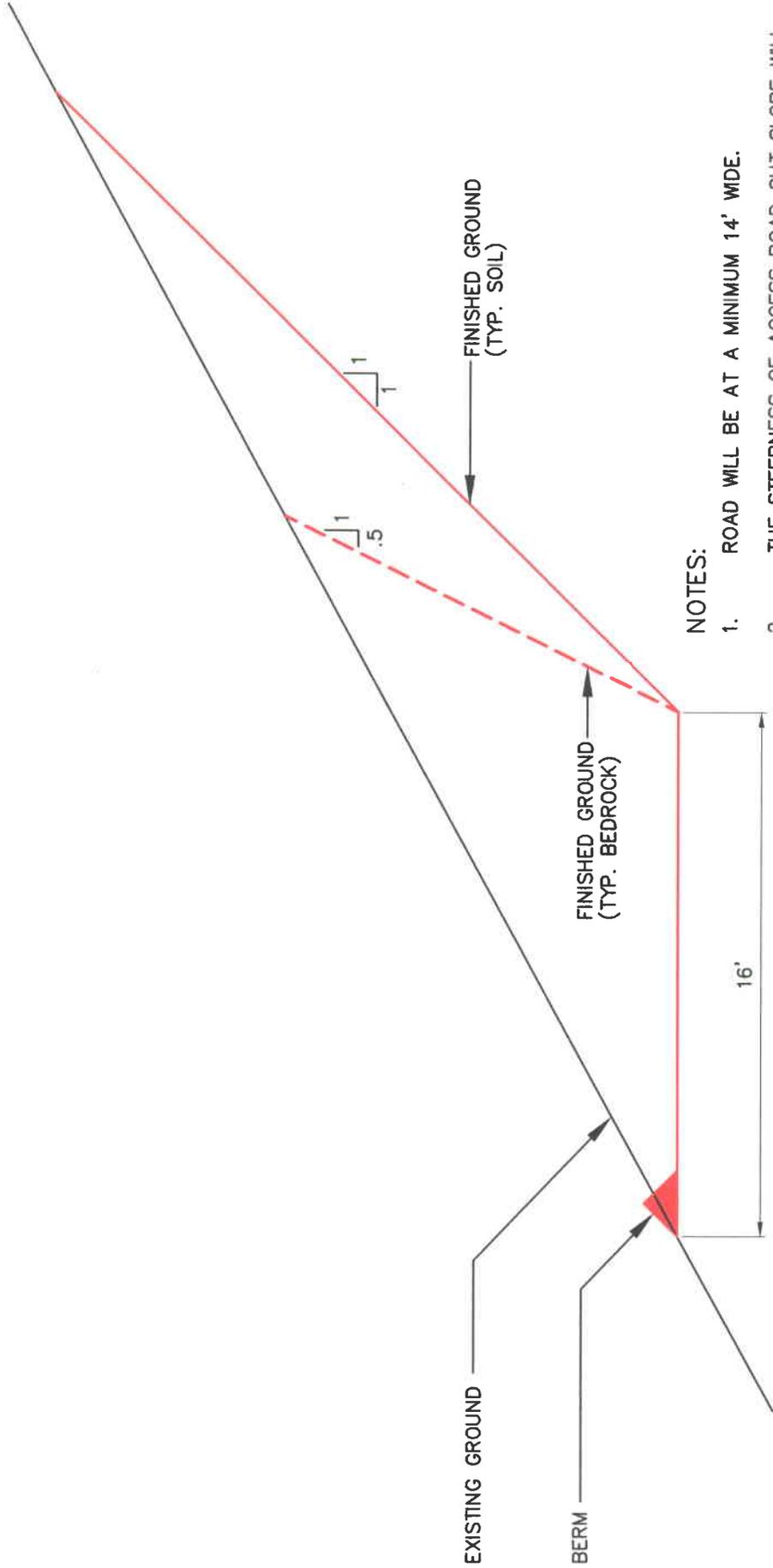
The peak inside depth was calculated using HydroCad 2005 software. See attached output sheets for additional information.



WATERSHEDS FOR CULVERT SIZING CALCULATIONS  
 ATTACHMENT S-4 FIGURE



ATTACHMENT 5--4



NOTES:

1. ROAD WILL BE AT A MINIMUM 14' WIDE.
2. THE STEEPNESS OF ACCESS ROAD CUT SLOPE WILL DEPEND ON THE STABILITY OF THE MATERIAL BEING EXCAVATED. CUTS INTO BEDROCK WILL BE SLOPED AT APPROXIMATELY 0.5H:1V. CUTS INTO SOILS WILL BE SLOPED AT APPROXIMATELY 1H:1V.

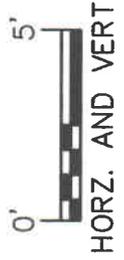


FIGURE 1. TYPICAL ROAD CROSS SECTION

**BACKUP INFORMATION**

# SOIL SURVEY OF CARBON AREA, UTAH, PARTS OF CARBON AND EMERY COUNTIES



## Tables - Hydrologic Soil Group

### Summary by Map Unit - Carbon Area, Utah, Parts of Carbon and Emery Counties

Soil Survey Area Map Unit Symbol	Map Unit Name	Rating	Total Acres in AOI	Percent of AOI
62	Midfork family-Comodore complex	B	81.7	25.3
97	Rottulee family-Trag complex	C	230.8	71.3
100	Senchert loam, 3 to 15 percent slopes	C	11.0	3.4

## Description - Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Parameter Summary - Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff:

Tie-break Rule: Lower

**TABLE 7-14 — Other Agricultural Lands<sup>1</sup>**

Cover Description Cover Type	Hydrologic Condition	Curve Numbers for Hydrologic Soil Group			
		A	B	C	D
Pasture, grassland, or range — continuous forage for graving <sup>2</sup>	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow — continuous grass — protected from grazing and generally mowed for hay		30	58	71	78
Brush — brush-weed-grass mixture with brush the major element <sup>3</sup>	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 <sup>4</sup>	48	65	73
Woods — grass combination (orchard or tree farm) <sup>5</sup>	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods <sup>6</sup>	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 <sup>4</sup>	55	70	77
Farmsteads — buildings, land, driveways and surrounding lots	—	59	74	82	86

<sup>1</sup> Average runoff condition and  $I_a = 0.2S$ .

<sup>2</sup> Poor: < 50% ground cover or heavily grazed with no mulch  
 Fair: 50% to 75% ground cover and not heavily grazed  
 Good: > 75% ground cover and lightly or only occasionally grazed

<sup>3</sup> Poor: < 50% ground cover  
 Fair: 50% to 75% ground cover  
 Good: > 75% ground cover

<sup>4</sup> Actual Curve Number is less than 30; use CN = 30 for runoff computations.

<sup>5</sup> CNs shown were computed for areas with 50% grass (pasture) cover. Other combinations of conditions may be computed from CNs for woods and pasture.

<sup>6</sup> Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.  
 Fair: Woods grazed but not burned, and some forest litter covers the soil.  
 Good: Woods protected from grazing; litter and brush adequately cover soil.



# POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14



Utah 39.68175 N 110.48129 W 7946 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4  
G M Bonnin, D Martin, B Lin, T Parzybok, M Yekta, and D Riley  
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Tue Jun 26 2007

Confidence Limits Seasonality Location Maps Other Info GIS data Maps Help D

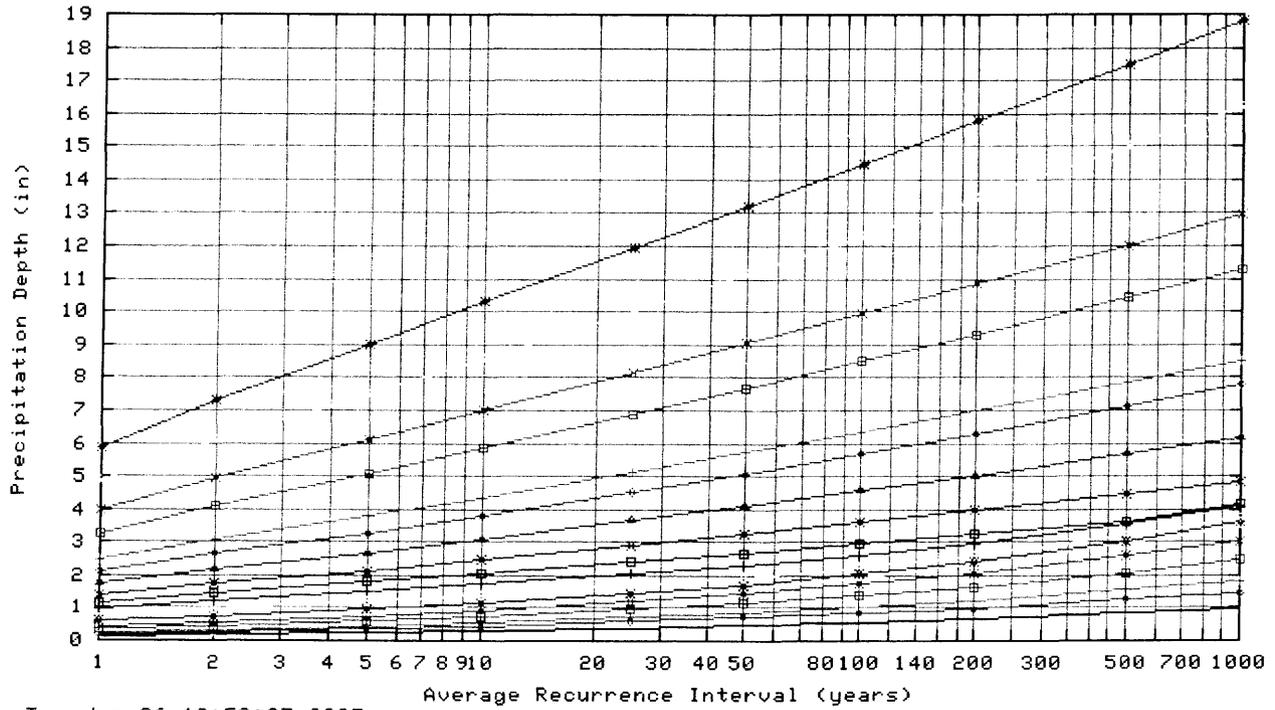
## Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.14	0.20	0.25	0.34	0.42	0.52	0.59	0.77	0.99	1.18	1.40	1.74	2.12	2.44	3.26	3.97	4.88	5.83
2	0.17	0.26	0.33	0.44	0.55	0.65	0.74	0.96	1.23	1.46	1.74	2.16	2.65	3.06	4.08	4.95	6.10	7.31
5	0.24	0.36	0.45	0.60	0.74	0.86	0.95	1.19	1.50	1.78	2.13	2.67	3.29	3.78	5.05	6.09	7.50	9.00
10	0.29	0.45	0.55	0.74	0.92	1.06	1.15	1.38	1.73	2.05	2.46	3.08	3.80	4.36	5.82	6.98	8.59	10.29
25	0.38	0.58	0.72	0.97	1.20	1.36	1.45	1.67	2.05	2.40	2.89	3.65	4.52	5.14	6.86	8.15	10.04	11.96
50	0.46	0.70	0.86	1.16	1.44	1.64	1.72	1.92	2.32	2.68	3.24	4.09	5.08	5.74	7.66	9.04	11.15	13.22
100	0.55	0.83	1.03	1.39	1.72	1.96	2.04	2.22	2.60	2.96	3.60	4.55	5.67	6.36	8.48	9.94	12.29	14.50
200	0.65	0.99	1.23	1.66	2.05	2.33	2.41	2.57	2.94	3.25	3.96	5.03	6.28	7.00	9.31	10.84	13.44	15.78
500	0.82	1.24	1.54	2.08	2.57	2.93	3.03	3.18	3.53	3.64	4.45	5.67	7.11	7.86	10.44	12.03	14.99	17.48
1000	0.97	1.47	1.83	2.46	3.04	3.49	3.59	3.74	4.09	4.13	4.84	6.17	7.77	8.53	11.30	12.94	16.22	18.80

Text version of table

\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the [documentation](#) for more information. NOTE: Formatting forces estimates near zero to appear as zero.

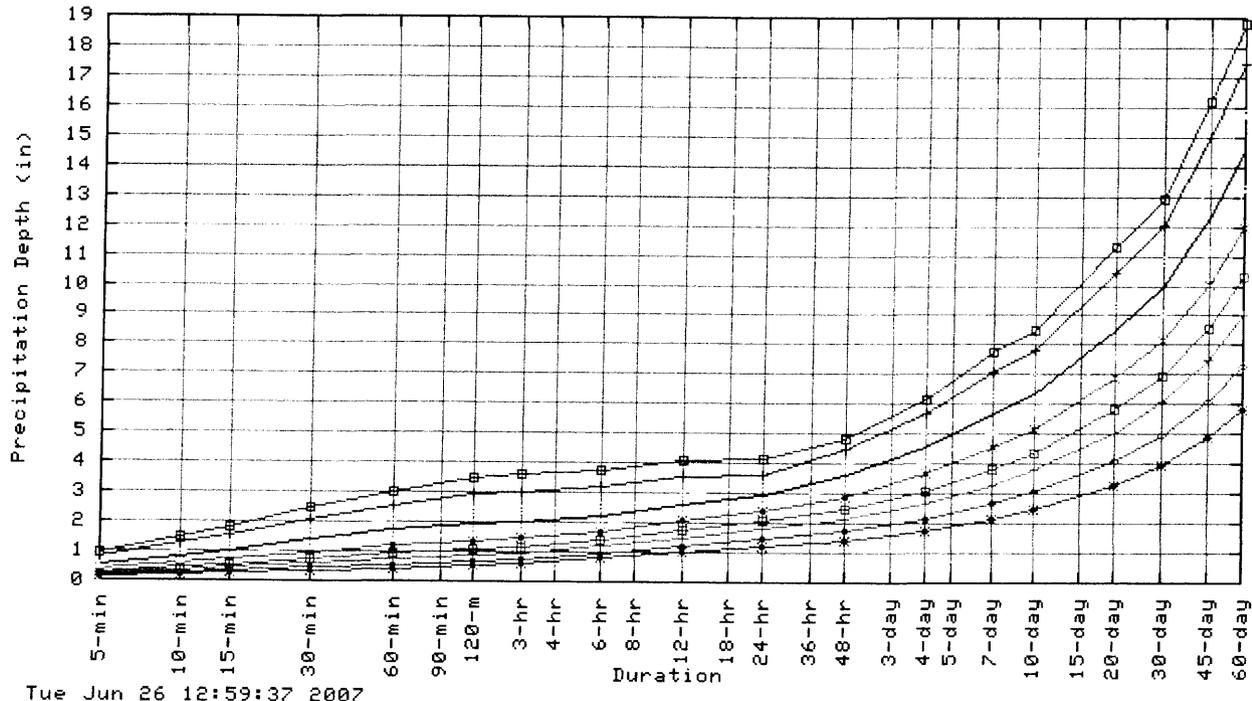
Partial duration based Point Precipitation Frequency Estimates Version: 4  
 39.68175 N 110.48129 W 7946 ft



Tue Jun 26 12:59:37 2007

Duration			
5-min —		48-hr —x—	30-day —x—
10-min —+—	3-hr —*—	4-day —▲—	
15-min —+—		7-day —+—	60-day —*—
30-min —□—	12-hr —+—	10-day —+—	
60-min —x—	24-hr —□—	20-day —□—	

Partial duration based Point Precipitation Frequency Estimates Version: 4  
 39.68175 N 110.48129 W 7946 ft



Average Recurrence Interval (years)	
1	*
2	+
5	+
10	+
25	*
100	—
500	+
1000	+

**Confidence Limits -**

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)																		
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.16	0.24	0.30	0.41	0.51	0.60	0.69	0.88	1.11	1.31	1.56	1.94	2.41	2.74	3.65	4.43	5.44	6.49
2	0.21	0.32	0.39	0.53	0.65	0.76	0.86	1.09	1.38	1.63	1.94	2.42	3.01	3.42	4.56	5.54	6.80	8.12
5	0.28	0.43	0.53	0.72	0.89	1.01	1.11	1.35	1.68	2.00	2.38	2.98	3.73	4.24	5.66	6.80	8.37	10.00
10	0.35	0.53	0.66	0.89	1.10	1.24	1.33	1.58	1.94	2.29	2.74	3.44	4.33	4.89	6.53	7.79	9.60	11.44
25	0.46	0.69	0.86	1.16	1.43	1.60	1.69	1.91	2.32	2.69	3.23	4.08	5.15	5.76	7.70	9.12	11.24	13.33
50	0.55	0.83	1.04	1.40	1.73	1.93	2.01	2.21	2.63	3.00	3.62	4.58	5.80	6.45	8.61	10.14	12.51	14.77
100	0.66	1.00	1.24	1.67	2.07	2.33	2.40	2.58	2.97	3.33	4.03	5.11	6.50	7.17	9.55	11.18	13.80	16.25
200	0.79	1.20	1.49	2.01	2.49	2.79	2.87	3.01	3.38	3.66	4.45	5.65	7.22	7.91	10.53	12.23	15.15	17.77
500	1.01	1.54	1.90	2.56	3.17	3.59	3.67	3.79	4.13	4.17	5.04	6.42	8.24	8.93	11.88	13.66	17.01	19.80
1000	1.22	1.85	2.30	3.09	3.83	4.35	4.43	4.52	4.85	4.90	5.51	7.04	9.06	9.75	12.94	14.77	18.49	21.43

\* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.  
 \*\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.  
 Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

**\* Lower bound of the 90% confidence interval**

### Precipitation Frequency Estimates (inches)

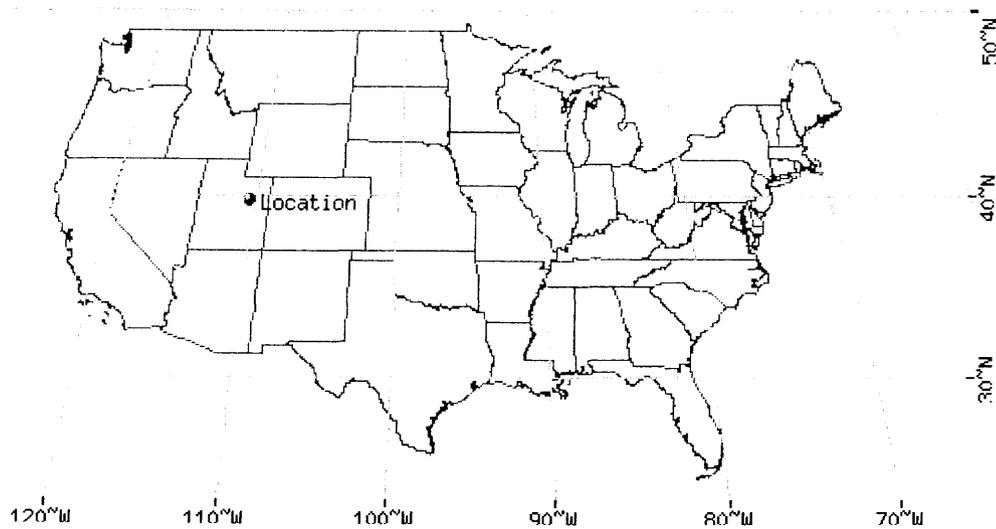
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.12	0.18	0.22	0.29	0.36	0.45	0.52	0.69	0.90	1.07	1.26	1.56	1.89	2.19	2.94	3.59	4.41	5.28
2	0.15	0.23	0.28	0.38	0.47	0.57	0.65	0.85	1.11	1.32	1.57	1.95	2.36	2.75	3.68	4.48	5.51	6.61
5	0.20	0.31	0.38	0.52	0.64	0.75	0.84	1.05	1.34	1.61	1.92	2.39	2.92	3.38	4.53	5.49	6.75	8.10
10	0.25	0.38	0.47	0.63	0.79	0.90	1.00	1.22	1.54	1.84	2.20	2.75	3.37	3.88	5.22	6.26	7.69	9.22
25	0.32	0.48	0.59	0.80	0.99	1.14	1.24	1.45	1.81	2.15	2.58	3.23	3.97	4.55	6.10	7.27	8.94	10.66
50	0.37	0.56	0.70	0.94	1.17	1.34	1.44	1.65	2.02	2.39	2.86	3.60	4.43	5.05	6.76	8.02	9.86	11.71
100	0.43	0.66	0.82	1.10	1.36	1.56	1.67	1.88	2.23	2.62	3.15	3.97	4.90	5.55	7.41	8.75	10.78	12.73
200	0.50	0.76	0.94	1.27	1.57	1.81	1.93	2.13	2.48	2.85	3.44	4.34	5.36	6.06	8.07	9.47	11.69	13.73
500	0.60	0.91	1.13	1.52	1.88	2.17	2.32	2.56	2.93	3.15	3.81	4.82	5.99	6.71	8.90	10.36	12.86	15.01
1000	0.68	1.04	1.29	1.73	2.15	2.48	2.65	2.94	3.34	3.38	4.10	5.18	6.46	7.19	9.53	11.03	13.76	15.97

\* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

\*\* These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.

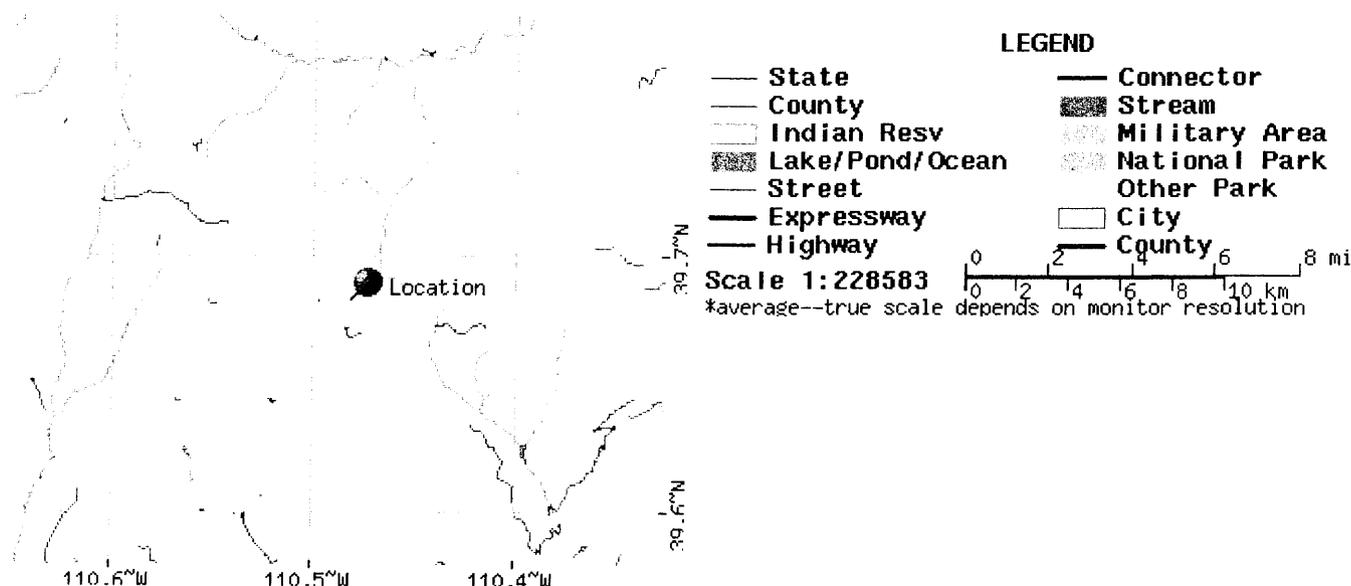
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

### Maps -



These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.



### Other Maps/Photographs -

View [USGS digital orthophoto quadrangle \(DOQ\)](#) covering this location from TerraServer; [USGS Aerial Photograph](#) may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the [USGS](#) for more information.

### Watershed/Stream Flow Information -

Find the [Watershed](#) for this location using the U.S. Environmental Protection Agency's site.

### Climate Data Sources -

*Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to our documentation.*

Using the [National Climatic Data Center's \(NCDC\)](#) station search engine, locate other climate stations within:

...OR...  of this location (39.68175/-110.48129). Digital ASCII data can be obtained directly from [NCDC](#).

Find [Natural Resources Conservation Service \(NRCS\) SNOTEL \(SNOWpack TELEmetry\)](#) stations by visiting the [Western Regional Climate Center's state-specific SNOTEL station maps](#).

**Hydrometeorological Design Studies Center**  
DOC/NOAA/National Weather Service  
1325 East-West Highway  
Silver Spring, MD 20910

(301) 713-1669  
Questions?: [HIDSC\\_QUESTIONS@noaa.gov](mailto:HIDSC_QUESTIONS@noaa.gov)

[Disclaimer](#)



WS5



WS5 Culvert



WS4



WS4 Culvert



WS3



WS3 Culvert



WS2



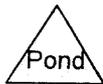
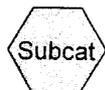
WS2 Culvert



WS1



WS1 Culvert



**Drainage Diagram for culverts**

Prepared by {enter your company name here} 7/5/2007  
HydroCAD® 7.10 s/n 003900 © 2005 HydroCAD Software Solutions LLC

culverts - watershed 1

Type II 24-hr Rainfall=2.05"

Prepared by {enter your company name here}

HydroCAD® 7.10 s/n 003900 © 2005 HydroCAD Software Solutions LLC

6/21/2007

### Subcatchment 1S: WS1

Runoff = 24.68 cfs @ 12.01 hrs, Volume= 60,692 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.05"

Area (sf)	CN	Description
1,532,383	77	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	2,262	0.6050	4.4		Lag/CN Method,

culverts - WATERSHED 2

Type II 24-hr Rainfall=2.05"

Prepared by {enter your company name here}

HydroCAD® 7.10 s/n 003900 © 2005 HydroCAD Software Solutions LLC

6/21/2007

### Subcatchment 2S: WS2

Runoff = 4.94 cfs @ 11.99 hrs, Volume= 10,954 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Type II 24-hr Rainfall=2.05"

Area (sf)	CN	Description
276,566	77	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	1,502	0.6010	4.0		Lag/CN Method,

**culverts - WATERSHED 3**

Type II 24-hr Rainfall=2.05"

Prepared by {enter your company name here}

HydroCAD® 7.10 s/n 003900 © 2005 HydroCAD Software Solutions LLC

6/21/2007

**Subcatchment 3S: WS3**

Runoff = 3.95 cfs @ 11.97 hrs, Volume= 8,159 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs  
Type II 24-hr Rainfall=2.05"

Area (sf)	CN	Description
205,995	77	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	1,151	0.5770	3.7		Lag/CN Method,

culverts - WATERSHED 4

Type II 24-hr Rainfall=2.05"

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### Subcatchment 4S: WS4

Runoff = 7.51 cfs @ 11.98 hrs, Volume= 15,645 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs  
Type II 24-hr Rainfall=2.05"

Area (sf)	CN	Description
395,010	77	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	1,100	0.4980	3.4		Lag/CN Method,

culverts - WATERSHED 5

Type II 24-hr Rainfall=2.05"

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**Subcatchment 5S: WS5**

Runoff = 2.32 cfs @ 11.94 hrs, Volume= 4,206 cf, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs  
Type II 24-hr Rainfall=2.05"

Area (sf)	CN	Description
74,016	82	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	589	0.4570	3.4		Lag/CN Method,

culverts - CULVERT 1

Type II 24-hr Rainfall=2.05"

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### Reach 6R: WS1 Culvert

[52] Hint: Inlet conditions not evaluated

Inflow Area = 1,532,383 sf, Inflow Depth = 0.48"  
Inflow = 24.68 cfs @ 12.01 hrs, Volume= 60,692 cf  
Outflow = 24.32 cfs @ 12.02 hrs, Volume= 60,692 cf, Atten= 1%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Max. Velocity= 16.5 fps, Min. Travel Time= 0.2 min  
Avg. Velocity = 6.1 fps, Avg. Travel Time= 0.6 min

Peak Depth= 0.79' @ 12.02 hrs  
Capacity at bank full= 163.30 cfs  
Inlet Invert= 7,890.00', Outlet Invert= 7,845.00'  
36.0" Diameter Pipe, n= 0.025 Corrugated metal  
Length= 203.0' Slope= 0.2217 '/'

**culverts - CULVERT 2**

Type II 24-hr Rainfall=2.05"

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**Reach 7R: WS2 Culvert**

[52] Hint: Inlet conditions not evaluated

Inflow Area = 276,566 sf, Inflow Depth = 0.48"  
Inflow = 4.94 cfs @ 11.99 hrs, Volume= 10,954 cf  
Outflow = 4.91 cfs @ 11.99 hrs, Volume= 10,954 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Max. Velocity= 13.7 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 4.9 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.34' @ 11.99 hrs  
Capacity at bank full= 76.90 cfs  
Inlet Invert= 7,780.00', Outlet Invert= 7,730.00'  
24.0" Diameter Pipe, n= 0.025  
Length= 117.0' Slope= 0.4274 '/'

**culverts - CULVERT 3**

Type II 24-hr Rainfall=2.05"

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### Reach 8R: WS3 Culvert

[52] Hint: Inlet conditions not evaluated

Inflow Area = 205,995 sf, Inflow Depth = 0.48"  
Inflow = 3.95 cfs @ 11.97 hrs, Volume= 8,159 cf  
Outflow = 3.94 cfs @ 11.98 hrs, Volume= 8,159 cf, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs  
Max. Velocity= 12.9 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 4.5 fps, Avg. Travel Time= 0.3 min

Peak Depth= 0.34' @ 11.98 hrs  
Capacity at bank full= 34.25 cfs  
Inlet Invert= 7,735.00', Outlet Invert= 7,700.00'  
18.0" Diameter Pipe, n= 0.025  
Length= 89.0' Slope= 0.3933 '/

**culverts - CULVERT 4**

Type II 24-hr Rainfall=2.05"

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**Reach 9R: WS4 Culvert**

[52] Hint: Inlet conditions not evaluated

Inflow Area = 395,010 sf, Inflow Depth = 0.48"  
Inflow = 7.25 cfs @ 11.98 hrs, Volume= 15,645 cf  
Outflow = 7.22 cfs @ 11.98 hrs, Volume= 15,645 cf, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Max. Velocity= 14.1 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 5.1 fps, Avg. Travel Time= 0.2 min

Peak Depth= 0.44' @ 11.98 hrs  
Capacity at bank full= 68.97 cfs  
Inlet Invert= 7,712.00', Outlet Invert= 7,690.00'  
24.0" Diameter Pipe, n= 0.025  
Length= 64.0' Slope= 0.3438 '/

culverts - CULVERT 5

Type II 24-hr Rainfall=2.05"

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### Reach 10R: WS5 Culvert

[52] Hint: Inlet conditions not evaluated

Inflow Area = 74,016 sf, Inflow Depth = 0.68"  
Inflow = 2.25 cfs @ 11.94 hrs, Volume= 4,206 cf  
Outflow = 2.22 cfs @ 11.94 hrs, Volume= 4,206 cf, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs  
Max. Velocity= 9.8 fps, Min. Travel Time= 0.1 min  
Avg. Velocity = 3.2 fps, Avg. Travel Time= 0.4 min

Peak Depth= 0.28' @ 11.94 hrs  
Capacity at bank full= 29.29 cfs  
Inlet Invert= 8,020.00', Outlet Invert= 7,997.00'  
18.0" Diameter Pipe, n= 0.025  
Length= 80.0' Slope= 0.2875 '/'

# Hydraulic Charts for the Selection of Highway Culverts

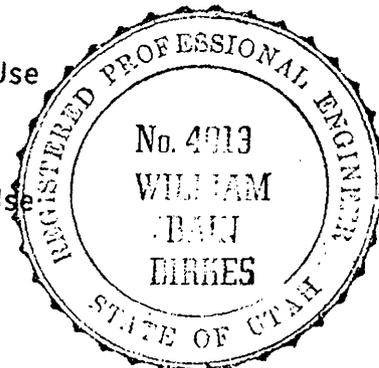
Hydraulic Engineering Circular No. 5

December 1965\*

Prepared by the Hydraulics Branch, Bridge Division, Office of Engineering, Federal Highway Administration, Washington, D.C. 20590

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\*Reprinted April 1977

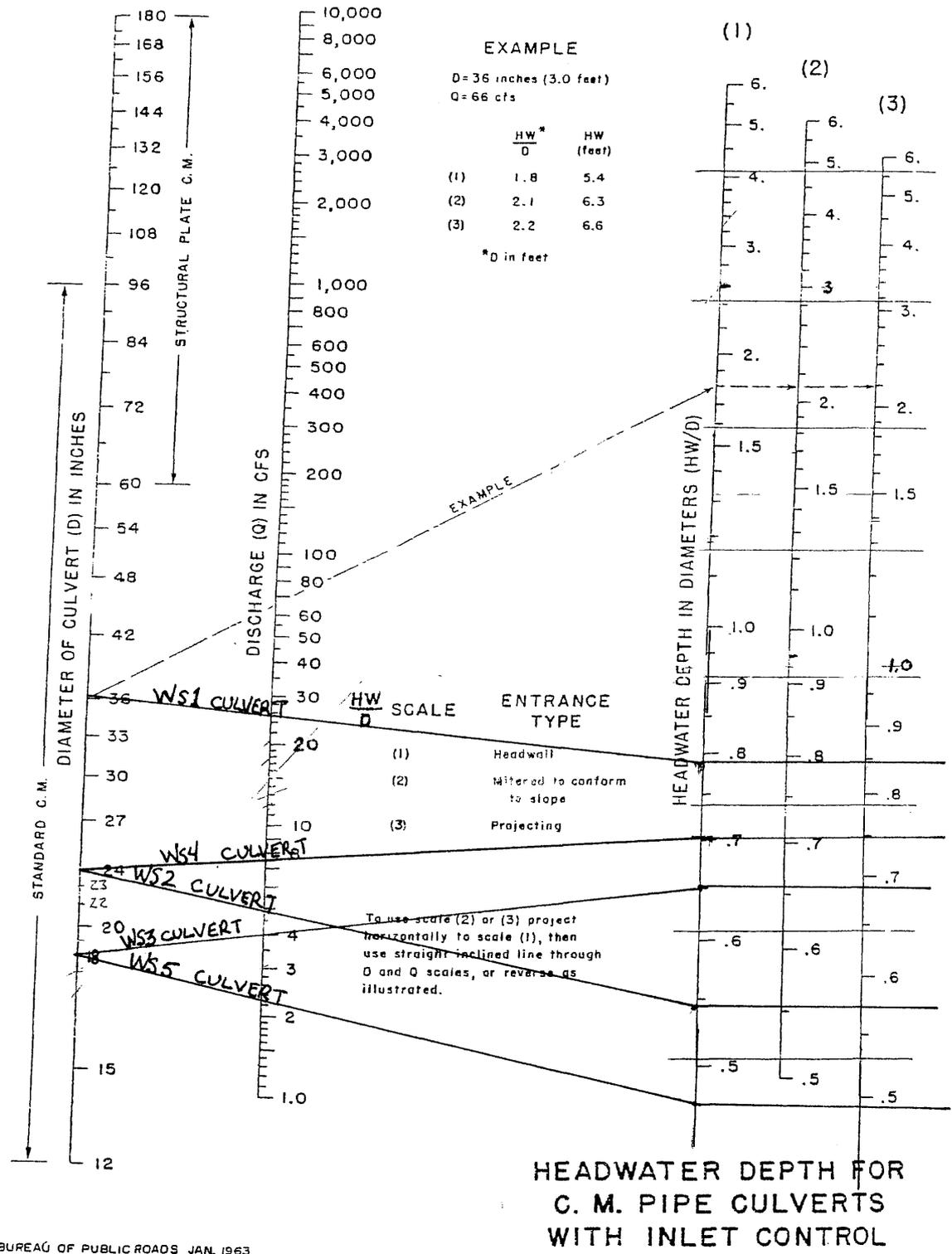
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# CHART 5



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5-23

Ref (U.S. Dept. of Transportation, 1977)

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**CHAPTER 7**  
**HYDROLOGY**

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**LIST OF ATTACHMENTS**

**Attachment 7-1**      Hydrology Calculations

## **710 INTRODUCTION**

### **711 General Requirements**

This chapter presents a description of the following:

- Proposed operations and the potential impacts to the hydrologic balance;
- Methods of compliance with design criteria and the calculations utilized to show compliance; and
- Applicable hydrologic performance standards.

### **712 Certification**

All maps, plans, and cross sections presented in this chapter have been certified by a qualified, registered professional engineer.

### **713 Inspection**

Inspections are not required since no permanent impoundments will exist at the well sites.

## **720 ENVIRONMENTAL DESCRIPTION**

### **721 General Requirements**

The application will include a description of the existing premining hydrologic resources with the proposed permit and adjacent areas that may be affected or impacted by the proposed coal mining and reclamation operations.

## **722 Cross Sections and Maps**

### **722.100 Location and Extent of Subsurface Water**

Figure 7-1 in the approved M&RP shows a generalized hydrostratigraphic cross section of the permit and adjacent areas including the well sites. Section 724.100 of the approved M&RP provides baseline groundwater conditions.

### **722.200 Location of Surface Water Bodies**

Plate 7-2 in the approved M&RP shows the locations of surface-water bodies and existing or pending water rights. Section 724.200 of the approved M&RP provides baseline surface water conditions.

### **722.300 Locations of Monitoring Stations**

Plate 7-1 in the approved M&RP shows the location of surface water and groundwater monitoring stations.

### **722.400 Locations and Depth of Water Wells**

Refer to Section 722.400 and Plate 7-1 of the approved M&RP for information pertaining to the groundwater monitoring wells. Refer to Appendix 7-9 of approved M&RP for details pertaining to the Gilson well.

### **722.500 Surface Topography**

Surface topography features at the well sites and adjacent areas are shown on Figures 1-1, 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and in Attachment 5-1 for Degas Wells G-8 thru **G-19 and G-31**. Refer to Plate 1-4 in the M&RP for well locations.

**The surface topography for the AMV access road is shown on Plate 1 included in Attachment 5-4.**

### **723 Sampling and Analysis**

Refer to Section 723 of the approved M&RP.

### **724 Baseline Information**

Refer to Section 724 of the approved M&RP.

#### **724.100 Groundwater Information**

Refer to Section 724.100 of the approved M&RP.

#### **724.200 Surface Water Information**

Refer to Section 724.200 of the approved M&RP.

#### **724.300 Geologic Information**

Geologic information related to the well sites and adjacent areas is presented in Chapter 6 of this submittal and in the approved M&RP.

#### **724.400 Climatological Information**

Climatological data are summarized in Appendix 4-1 behind the Air Quality Permit of the approved M&RP and RA Attachment 7-5 of the Refuse Pile Amendment.

#### **724.500 Supplemental Information**

Refer to Section 724.500 of the approved M&RP.

#### **724.600 Survey of Renewable Resource Lands**

Refer to Section 724.600 of the approved M&RP.

#### **724.700 Alluvial Valley Floor Requirements**

Information regarding the presence or absence of alluvial valley floors in the well sites and adjacent areas is presented in Chapter 9 of this submittal and the approved M&RP.

#### **725 Baseline Cumulative Impact Area Information**

The CHIA currently in place for the Dugout Canyon Mine covers the well sites. The hydrologic and geologic information required for the Division to develop a Cumulative Hydrologic Impact Assessment (CHIA) is presented in the approved M&RP.

#### **726 Modeling**

No groundwater or surface water modeling was conducted in support of this submittal.

### **727 Alternative Water Source Information**

Not applicable.

### **728 Probable Hydrologic Consequences**

This section addresses the probable hydrologic consequences of construction and reclamation operations at the well sites. Mitigation measures are discussed generally in this section and in detail in Section 730 of the approved M&RP.

#### **728.100 Potential Impacts of Surface and Groundwater**

Potential impacts of the well sites in this area on the quality and quantity of surface and groundwater flow may include contamination from materials associated with the drilling of the wells. Once installed, the wells are designed as an ambient vent of methane gas, having no affect on the surface or groundwater. The potential impact is addressed in Section 728.300 of this submittal and the approved M&RP.

#### **728.200 Baseline Hydrologic and Geologic Information**

Baseline geologic information is presented in Chapter 6 of the approved M&RP. Baseline hydrologic information is presented in Section 724.100 and 724.200 of the approved M&RP.

#### **728.300 PHC Determination**

**Potential Impacts to the Hydrologic Balance** - Potential impacts of the Dugout Canyon Mine on the hydrologic balance of the well sites and adjacent areas are addressed in the subsections of this submittal and the approved M&RP. The PHC prepared by Mayo and Associates for the Dugout Canyon Mine is located in Appendix 7-3, Section 3 , of the approved M&RP. Refer to Chapter 3,

Section 322.200 for information addressing water usage for degas well drilling, as well as mining. Little to no impacts to the Hydrologic Balance are anticipated since 1) the potential impacts are limited to the drilling and construction of the wells; 2) BTCA techniques for sediment control are implemented for the surface disturbance of the well pad; 3) hydrogeologic information from in-mine observations, Degas wells G-1 through G-9, and PHC information included in the approved M&RP support that minimal groundwater is encountered in the geologic formations being drilled; and 4) any water encountered during drilling and construction of the well will need to be sealed for the well to function as an ambient vent of methane gas.

**Acid and Toxic Forming Materials** - No acid or toxic forming materials have been identified in the soils or strata of the Dugout Canyon Mine (Chapter 6, Section 623 of this submittal). Additional information is located in Appendix 6-2 of the approved M&RP.

**Groundwater** - When encountered during drilling groundwater aquifers will be sealed using drilling mud. At completion, the casing will be grouted and cement placed inside the well casing during reclamation.

Once drilling is completed, the casing is grouted in the well hole, sealing aquifers to prevent groundwater migration, including groundwater migrating down the outside of the casing into the mine. Should water inflow greater than 15 gallon per minute be encountered during the drilling of the degas wells the depth and volume will be recorded and included in Attachment 7-1. No measurable inflows of water have been encountered during the drilling of degas wells G-1 thru G-9.

The development and construction of degas wells does not have the potential to decrease creek flow or spring discharges, the wells are not designed to capture water, dewater aquifers or cause subsidence. Methane gas, not liquid (water) is pumped from the wells following construction.

**Surface Water** - Degas wells are not used to access water to be discharged to the surface. As mentioned above, no measureable water has been encountered during the drilling, construction

and operation of degas wells G-1 thru G-9. Also, the well cannot function as a degas well if significant water is encountered, and will need to be abandoned.

**Potential Hydrocarbon Contamination** - Hydrocarbon products will not be stored at the well sites, however fuels, greases, and other oils may leak from equipment during drilling operations. Absorbent materials will be used for the collection of leaked fuels, greases, and other oils. The saturated absorbent materials will be disposed of at an appropriate landfill facility.

### **729 Cumulative Hydrologic Impact Assessment (CHIA)**

The Cumulative Hydrologic Impact Assessment currently in place for the Dugout Canyon Mine includes the well sites and adjacent areas.

## **730 OPERATION PLAN**

### **731 General Requirements**

#### **731.100 Hydrologic - Balance Protection**

**Groundwater Protection** - The effect on groundwater at the well sites is expected to be minimal. Groundwater encountered during drilling will be sealed off, refer to Section 728.300.

**Surface Water Protection** - To protect the hydrologic balance, construction, maintenance, and reclamation operations will be conducted to handle earth materials and runoff in a manner that prevents, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area, and otherwise prevent water pollution.

During initial drilling, the sites will be graded to ensure that storm runoff will flow towards the berms surrounding the drilling pad area. The berms will direct the runoff to the lowest point(s) within the

pad area where a silt fence and/or straw bale dike(s) will treat the runoff (see Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1). The berm placed at the top of the drilling pad cut slopes will divert runoff around the drilling pad. Thus reducing the runoff affected by the drilling pad.

The pad will be re-graded to cause the storm runoff to sheet flow towards a silt fence and/or straw bale dike. A berm will be placed at the top of the fill slope to direct any runoff from the operational pad to the silt fence and/or straw bale dike(see Figures 5-4, 5-8, 5-12, 5-19, 5-22, 5-25, 5-29 and Attachment 5-1). The silt fences and/or straw bale dikes will be periodically inspected, and accumulated sediment will be removed as needed to maintain functionality. The sediment from the silt fence and/or straw bale dikes will be piled on the pad and will be used for fill during final reclamation of the well site. During the drilling phase a berm and silt fence will be installed at the toe of the fill slope as shown on Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 to treat any runoff from the drilling pad.

#### **731.200 Water Monitoring**

No water monitoring will be conducted at the degas well sites. Refer to approved M&RP for a description of water monitoring.

#### **731.300 Acid or Toxic Forming Materials**

No acid or toxic forming materials are anticipated at the well sites (see Section 728.300).

#### **731.400 Transfer of Wells**

Refer to Section 731.400 of the approved M&RP.

### **731.500 Discharge**

No discharges to underground workings.

### **731.600 Stream Buffer Zones**

**Stream Channel Diversions** - No stream channel diversions are planned at the well sites.

**Buffer Zone Designation** - When drilling sites are adjacent to a perennial or an intermittent stream, a stream buffer zone will be established. Well sites G-11, G-12, G-15 and G-19 require buffer zone designation. Refer to Chapter 5, Attachment 5-1 for drawings of well sites G-8 through G-17 and G-19.

### **731.700 Cross Section and Maps**

Not applicable.

### **731.800 Water Rights and Replacement**

Refer to Sections 728.300 and 731.800 of the approved M&RP.

### **732 Sediment Control Measures**

The sediment control measures within the well sites have been designed to prevent additional contributions of sediment to stream flow or to runoff outside the well sites. In addition, the well sites have been designed to minimize erosion to the extent possible.

The structures to be used for runoff control at the well sites are berms, silt fences and/or straw bale dikes.

### **732.100 Siltation Structures**

Berms, silt fences and straw bales dikes will be used to treat runoff.

### **732.200 Sedimentation Pond**

The drilling sites will not have sedimentation ponds.

### **732.300 Diversions**

Refer to Section 731.100 of this submittal.

### **732.400 Road Drainage**

No diversion ditches will be constructed along the primary roads leading to the well sites. See Figures 5-13 and 5-14 for typical road cross sections. Where needed roads accessing the drill sites will have a water bar constructed at the base of the road to divert water off the road prior to the runoff reaching the drilling pad.

The incised road to well site G-16 will be constructed as shown on Figure 5-14 in the approved permit, water bars will be used to direct flow off the road and either silt fences or strawbales will be used to treat runoff. Refer to Chapter 5, Attachment 5-1 for drawings of well site G-16 showing the location of a single water bar, additional water bar(s) will be constructed as required to direct water from the road. Refer to Section 527.200 for road construction information.

Subsoil being cut in order to construction the pad for well G-15 will be placed on the existing road, causing it to be elevated, no new access road will be constructed to well site G-15.

The AMV access road will be classified as an ancillary road per a discussion with Wayne Western during a meeting at the UDOGM offices on April 16, 2007. The road is improving a trail used for hunting, cattle and for logging. A drawing showing the alignment of the road can be found in Attachment 5-4, as Plate 1. A typical road cross section is found in Attachment 5-4 as Figure 1. The drawing outlines the disturbed area and shows the road center line, water bars, turnouts and topsoil stockpile locations.

The steepness of access road cut slopes will depend on the stability of the exposed subsurface material. Cuts into competent material such as bedrock will be sloped at angles of approximately 0.5H:1V (63.4 degrees). Cut into unconsolidated material such as soils will be sloped at angles of approximately 1H:1V (45 degrees). The steepness of these slopes is justified by the presence of several near-vertical bedrock outcrops and naturally steep (approximately 1H:1V) colluvial slopes in the vicinity of the proposed access road.

Water on the roads will be directed off the road with water bars, placed at intervals along the road. The road berm will be broken at the water bars to allow the runoff to drain. The water bar outlets will be rip rapped with native rock, collected during the construction of the road. Undisturbed runoff will be directed thru culverts beneath the road. As required, siltation structures will be installed prior to beginning road construction.

### **733 Impoundments**

#### **733.100 General Plans**

Not applicable.

#### **733.200 Permanent and Temporary Impoundments**

No permanent impoundments will exist at the well sites.

### **734 Discharge Structures**

A berm will surround the entire drill pad at each well site during the drilling phase (excepted as noted). The berm will divert undisturbed runoff around the drilling pad and direct runoff from the pad to a silt fence/straw bale dike at the lowest point within the well pad disturbed area. A silt fence and/or straw bale dike will be the discharge structure for each of the well sites during the operational phase.

### **735 Disposal of Excess Spoil**

There will be no excess spoil generated at the well sites.

### **736 Coal Mine Waste**

There will be no coal mine waste generated or stored at the well sites.

### **737 Non-Coal Mine Waste**

There will be no non-coal mine waste disposed at the well sites.

### **738 Temporary Casing and Sealing of Wells**

Refer to Section 542.700 of this submittal.

## **740 DESIGN CRITERIA AND PLANS**

### **741 General Requirements**

This submittal includes general well site plans that incorporate design criteria for the control of drainage.

## **742 Sediment Control Measures**

### **742.100 General Requirements**

**Design** - Sediment control measures have been formulated to prevent additional contributions of sediment to stream flow or to runoff outside the well site area; and minimize erosion to the extent possible.

**Measures and Methods** - Sediment control methods will include silt fences, berms, and straw bales to reduce runoff and trap sediment.

### **742.200 Siltation Structures**

**General Requirements** - Additional contributions of suspended solids and sediment or runoff outside the well site area, including access roads will be prevented to the extent possible using silt fences, berms, and straw bale dikes. Construction activities will not occur during major precipitation events. As required, siltation structures will be installed prior to beginning site construction.

**Design** - All hydrology calculations were made using the 10-year, 24-hour precipitation event. Hydrology calculations are in Attachment 7-1. Locations of the berms and silt fences are shown on Figures 5-1, 5-4, 5-5, 5-8, 5-9, 5-12, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1.

### **742.300 Diversions**

No diversion ditches will be constructed as part of the drilling or operational phases.

#### **742.400 Road Drainage**

Refer to Section 732.400 of this submittal. The road design for G-16 is shown on drawings located in Chapter 5, Attachment 5-1 and Figure 5-16. The road design for the AMV access road is shown in Attachment 5-4.

#### **743 Impoundments**

No impoundments will exist at the well sites.

#### **744 Discharge Structures**

No discharge structures have been planned or designed.

#### **745 Disposal of Excess Spoil**

There will be no excess spoil generated at the well sites.

#### **746 Coal Mine Waste**

##### **746.100 General Requirements**

There will be no coal mine waste used at the well sites.

##### **746.200 Refuse Piles**

There will be no refuse piles at the well sites.

#### **746.300 Impounding Structures**

Refer to Section 733.200 of this submittal.

#### **746.400 Return of Coal Processing Waste to Abandoned Underground Workings**

No coal processing waste will be generated at the well sites.

#### **747 Disposal of Non-Coal Mine Waste**

All non-coal mine waste will be disposed of at an approved landfill.

#### **748 Casing and Sealing Wells**

Refer to Section 542.700 of this submittal.

### **750 PERFORMANCE STANDARDS**

#### **751 Water Quality Standards and Effluent Limitations**

Water encountered during drilling and runoff water will be treated using silt fence and/or straw bale dikes prior to leaving the site. Should it become necessary the water encountered during drilling will be pumped into a tank and hauled from the site for disposal at a licensed facility.

#### **752 Sediment Control Measures**

All sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs presented in Section 732, 742, and 760 of this submittal.

### **752.100 Siltation Structures and Diversions**

Siltation structures will be located, maintained, constructed and reclaimed according to plans and designs presented in Section 732, 742, and 763 of the submittal.

### **752.200 Road Drainage**

Refer to Section 732.400 of this submittal.

### **753 Impoundments and Discharge Structures**

Refer to Section 733.200 of this submittal.

### **754 Disposal of Excess Spoil, Coal Mine Waste and Non-Coal Mine Waste**

There will be no excess spoil or coal mine waste generated at the well sites. Refer to Section 747 of this submittal regarding non-coal waste disposal.

### **755 Casing and Sealing**

Refer to Section 542.700 of this submittal.

## **760 RECLAMATION**

### **761 General Requirements**

A detailed reclamation plan for the well sites is presented in Section 540. No structures will exist at the well sites.

## **762 Roads**

Refer to Section 542.600.

### **762.100 Restoring the Natural Drainage Patterns**

The natural drainage patterns will be restored after degassification is completed.

### **762.200 Reshaping Cut and Fill Slopes**

Cut and fill slopes will be reshaped at the well sites.

## **763 Siltation Structures**

### **763.100 Maintenance of Siltation Structures**

All siltation structures will be maintained until removed in accordance with the approved reclamation plan.

### **763.200 Removal of Siltation Structures**

When a siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan presented in Section 540.

## **764 Structure Removal**

A timetable for the reclamation of the sites is presented in Figures 5-15 (G-2 and G-5) and 5-26 (G-3, G-4, G-6 thru G-19, G-31 and AMV access road).

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007 ~~June 14, 2007~~

**765 Permanent Casing and Sealing of Wells**

Refer to Section 542.700 of this submittal.

Canyon Fuel Company, LLC  
Dugout Canyon Mine

Methane Degassification Amendment  
July 9, 2007

**ATTACHMENT 7-1**  
**Hydrology Calculations - Degas Wells G-18 and G-31**



**HYDROLOGY CALCULATIONS  
FOR  
DEGAS WELL G-18**

### Stockpile Runoff Volume Calculations

Stockpile	Watershed Area (sq. ft.)	Watershed Area (acres)	Precip. - <i>P</i> (in)	Curve Number ( <i>CN</i> )	Potential Max. Retention - <i>S</i> (in.)	Runoff - <i>Q</i> (in)	Runoff Volume - <i>V</i> (ft <sup>3</sup> )
STP-4	14,734	0.34	2.05	87	1.49	0.94	1,160
STP-5	7,895	0.18	2.05	87	1.49	0.94	622

#### Notes

Calculations have been performed for the 10-year, 24-hour design storm event.

Topsoil is derived from the Midfork Family - Comodore Complex, as described in the NRCS Soil Survey for Carbon Area, Parts of Carbon and Emery Counties.

Calculations based on Soil Conservation Service (SCS) Method, National Engineering Handbook Section 4, Chapters 9 & 10 by Victor Mockus, 1972

Precipitation for 10-year, 24-hour event taken from National Weather Service web site ([http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut\\_pfds.html](http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html))

CN = 87, based on Table 9.1, NEH s4 ch9. Assume Hyd. Soil Gp. C (as given for Rottulee family - Trag complex in NRCS survey). Assume road, dirt surface (non-vegetated, conservative case).

$$S = (1000/CN) - 10$$

$$L = [(1^{0.8} (S+1)^{0.7}) / (1900Y^{0.5})]$$

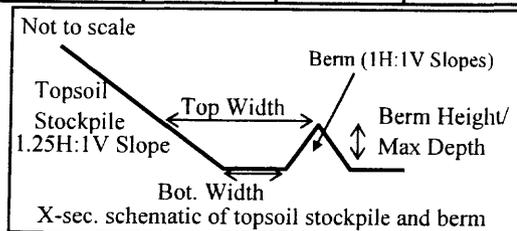
$$T_c = 1.67L$$

$$Q = (P - 0.2*S)^2 / (P + 0.8*S)$$

$$V = \text{Area} * Q$$

### Stockpile Runoff Containment Volume Calculations

Stockpile	Bottom Width (ft)	Top Width (ft)	Max Depth (ft)	Impounding Length of Berm (ft)	Total Length of Berm (ft)	Fill Req'd for Berm (yd <sup>3</sup> )	Cntnmt Vol. (ft <sup>3</sup> )	Contain Vol > Runoff Vol ?
STP-4	2	6.5	2	227	509	75	1,930	Yes
STP-5	2	6.5	2	76	402	60	646	Yes
<b>135</b> Total fill for berms (yd <sup>3</sup> )								



#### Notes

The bottom width is the distance between the toe of the topsoil stockpile and the base of the berm. (see schematic)

The top width is the horizontal distance between the crest of the berm and the topsoil stockpile. (see schematic)

The max depth is the height of the berm.

The Impounding Length of the berm accounts for the slope of the ground, and is the portion of the berm that will impound runoff.

The Total Length of Berm is its entire length around the topsoil stockpile.

The Fill Required for Berm is the volume of subsoil required to construct each berm, and is based on the length, height, and width of each berm. Berms shall be constructed with 1H:1V slopes.

The Containment Vol = Length \* Cross sectional area of the space between the topsoil stockpile and the inby side of the berm.



# POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14



**Utah 39.68175 N 110.48129 W 7946 feet**

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4  
G M Bonnin, D Martin, B Lin, T Parzybok, M Yekta, and D Riley  
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Tue Jun 26 2007

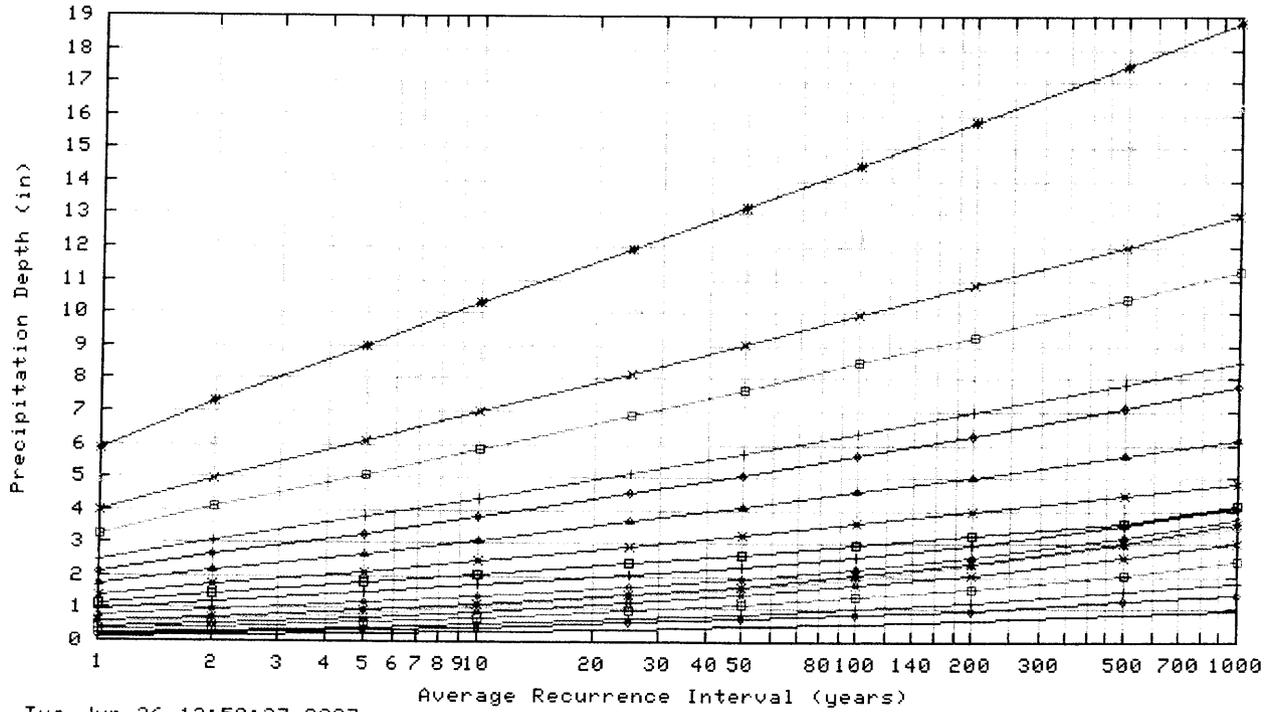
Confidence Limits	Seasonality	Location Maps	Other Info.	GIS data	Maps	Help	D
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Precipitation Frequency Estimates (inches)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.14	0.20	0.25	0.34	0.42	0.52	0.59	0.77	0.99	1.18	1.40	1.74	2.12	2.44	3.26	3.97	4.88	5.83
2	0.17	0.26	0.33	0.44	0.55	0.65	0.74	0.96	1.23	1.46	1.74	2.16	2.65	3.06	4.08	4.95	6.10	7.31
5	0.24	0.36	0.45	0.60	0.74	0.86	0.95	1.19	1.50	1.78	2.13	2.67	3.29	3.78	5.05	6.09	7.50	9.00
10	0.29	0.45	0.55	0.74	0.92	1.06	1.15	1.38	1.73	2.05	2.46	3.08	3.80	4.36	5.82	6.98	8.59	10.29
25	0.38	0.58	0.72	0.97	1.20	1.36	1.45	1.67	2.05	2.40	2.89	3.65	4.52	5.14	6.86	8.15	10.04	11.96
50	0.46	0.70	0.86	1.16	1.44	1.64	1.72	1.92	2.32	2.68	3.24	4.09	5.08	5.74	7.66	9.04	11.15	13.22
100	0.55	0.83	1.03	1.39	1.72	1.96	2.04	2.22	2.60	2.96	3.60	4.55	5.67	6.36	8.48	9.94	12.29	14.50
200	0.65	0.99	1.23	1.66	2.05	2.33	2.41	2.57	2.94	3.25	3.96	5.03	6.28	7.00	9.31	10.84	13.44	15.78
500	0.82	1.24	1.54	2.08	2.57	2.93	3.03	3.18	3.53	3.64	4.45	5.67	7.11	7.86	10.44	12.03	14.99	17.48
1000	0.97	1.47	1.83	2.46	3.04	3.49	3.59	3.74	4.09	4.13	4.84	6.17	7.77	8.53	11.30	12.94	16.22	18.80

Text version of table

\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

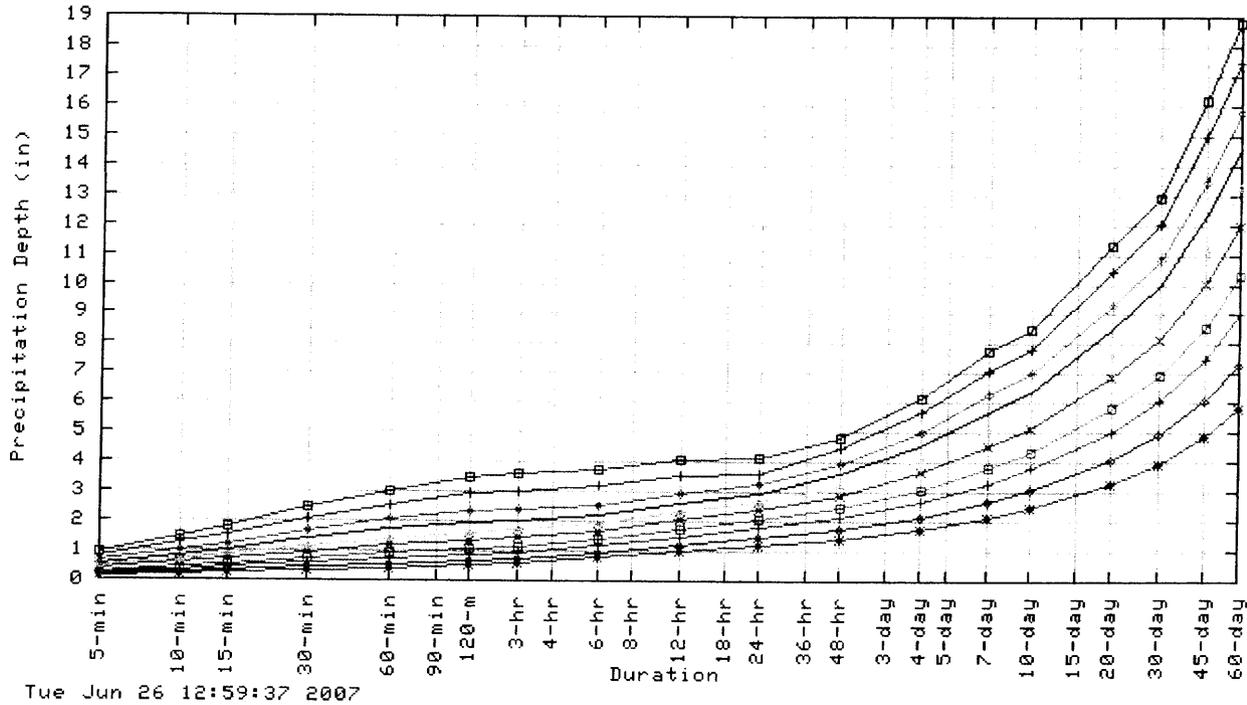
Partial duration based Point Precipitation Frequency Estimates Version: 4  
 39.68175 N 110.48129 W 7946 ft



Tue Jun 26 12:59:37 2007

Duration			
5-min	—	48-hr	✕
10-min	◆	4-day	▲
15-min	+	6-hr	◆
30-min	□	12-hr	+
60-min	✕	24-hr	□
		30-day	✕
		60-day	✕
		20-day	□

Partial duration based Point Precipitation Frequency Estimates Version: 4  
39.68175 N 110.48129 W 7946 ft



Average Recurrence Interval (years)	
1	*
2	+
5	+
10	+
25	+
100	—
200	+
500	+
1000	—

**Confidence Limits -**

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)																		
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.16	0.24	0.30	0.41	0.51	0.60	0.69	0.88	1.11	1.31	1.56	1.94	2.41	2.74	3.65	4.43	5.44	6.49
2	0.21	0.32	0.39	0.53	0.65	0.76	0.86	1.09	1.38	1.63	1.94	2.42	3.01	3.42	4.56	5.54	6.80	8.12
5	0.28	0.43	0.53	0.72	0.89	1.01	1.11	1.35	1.68	2.00	2.38	2.98	3.73	4.24	5.66	6.80	8.37	10.00
10	0.35	0.53	0.66	0.89	1.10	1.24	1.33	1.58	1.94	2.29	2.74	3.44	4.33	4.89	6.53	7.79	9.60	11.44
25	0.46	0.69	0.86	1.16	1.43	1.60	1.69	1.91	2.32	2.69	3.23	4.08	5.15	5.76	7.70	9.12	11.24	13.33
50	0.55	0.83	1.04	1.40	1.73	1.93	2.01	2.21	2.63	3.00	3.62	4.58	5.80	6.45	8.61	10.14	12.51	14.77
100	0.66	1.00	1.24	1.67	2.07	2.33	2.40	2.58	2.97	3.33	4.03	5.11	6.50	7.17	9.55	11.18	13.80	16.25
200	0.79	1.20	1.49	2.01	2.49	2.79	2.87	3.01	3.38	3.66	4.45	5.65	7.22	7.91	10.53	12.23	15.15	17.77
500	1.01	1.54	1.90	2.56	3.17	3.59	3.67	3.79	4.13	4.17	5.04	6.42	8.24	8.93	11.88	13.66	17.01	19.80
1000	1.22	1.85	2.30	3.09	3.83	4.35	4.43	4.52	4.85	4.90	5.51	7.04	9.06	9.75	12.94	14.77	18.49	21.43

\* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.  
\*\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.  
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

**\* Lower bound of the 90% confidence interval**

### Precipitation Frequency Estimates (inches)

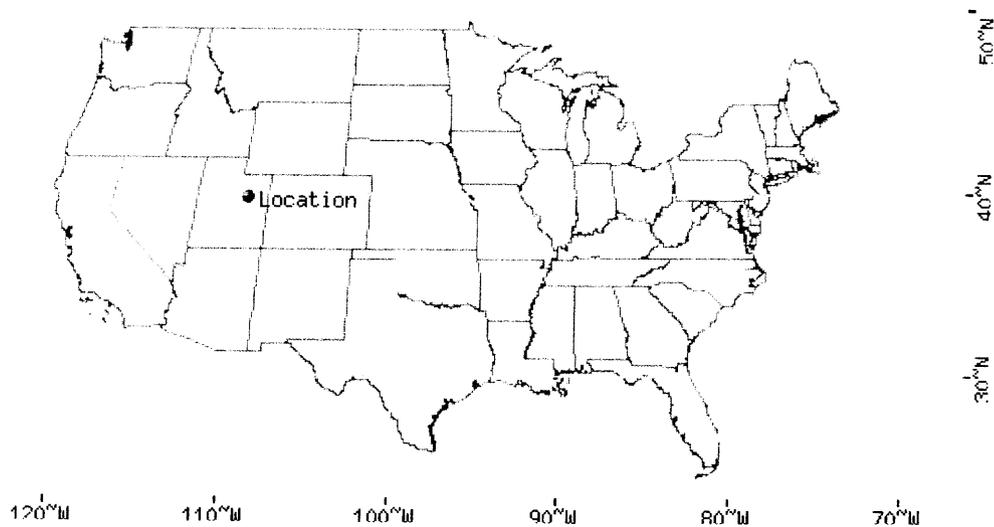
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.12	0.18	0.22	0.29	0.36	0.45	0.52	0.69	0.90	1.07	1.26	1.56	1.89	2.19	2.94	3.59	4.41	5.28
2	0.15	0.23	0.28	0.38	0.47	0.57	0.65	0.85	1.11	1.32	1.57	1.95	2.36	2.75	3.68	4.48	5.51	6.61
5	0.20	0.31	0.38	0.52	0.64	0.75	0.84	1.05	1.34	1.61	1.92	2.39	2.92	3.38	4.53	5.49	6.75	8.10
10	0.25	0.38	0.47	0.63	0.79	0.90	1.00	1.22	1.54	1.84	2.20	2.75	3.37	3.88	5.22	6.26	7.69	9.22
25	0.32	0.48	0.59	0.80	0.99	1.14	1.24	1.45	1.81	2.15	2.58	3.23	3.97	4.55	6.10	7.27	8.94	10.66
50	0.37	0.56	0.70	0.94	1.17	1.34	1.44	1.65	2.02	2.39	2.86	3.60	4.43	5.05	6.76	8.02	9.86	11.71
100	0.43	0.66	0.82	1.10	1.36	1.56	1.67	1.88	2.23	2.62	3.15	3.97	4.90	5.55	7.41	8.75	10.78	12.73
200	0.50	0.76	0.94	1.27	1.57	1.81	1.93	2.13	2.48	2.85	3.44	4.34	5.36	6.06	8.07	9.47	11.69	13.73
500	0.60	0.91	1.13	1.52	1.88	2.17	2.32	2.56	2.93	3.15	3.81	4.82	5.99	6.71	8.90	10.36	12.86	15.01
1000	0.68	1.04	1.29	1.73	2.15	2.48	2.65	2.94	3.34	3.38	4.10	5.18	6.46	7.19	9.53	11.03	13.76	15.97

\* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

\*\* These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.

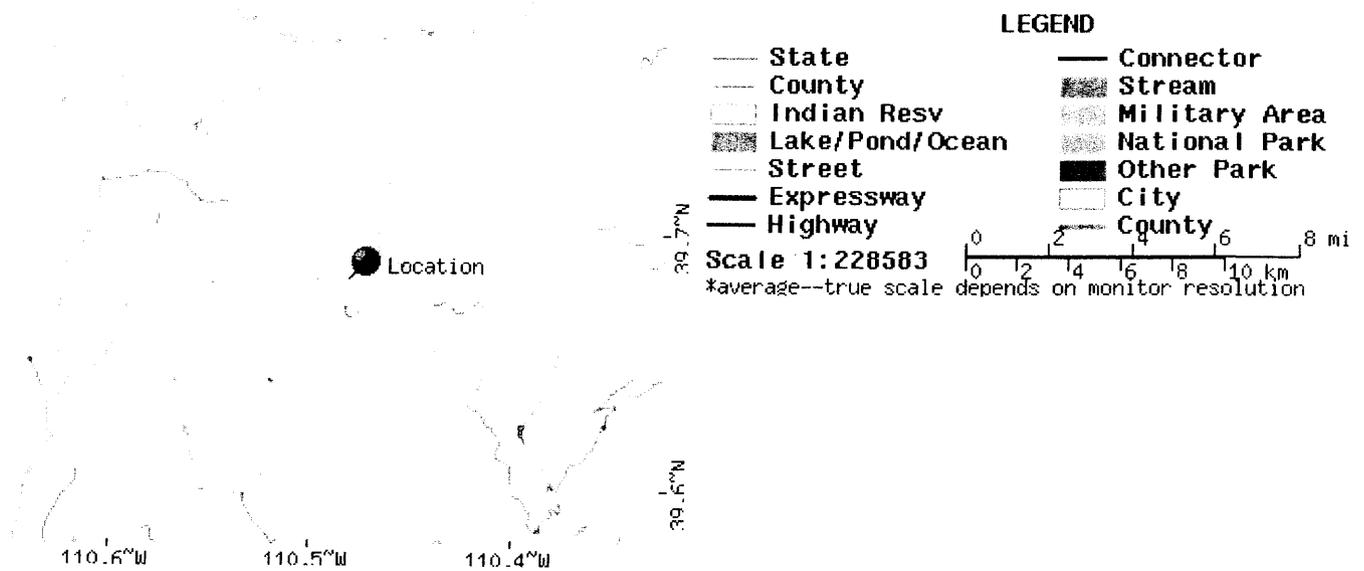
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

### Maps -



These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read [disclaimer](#) for more information.



### Other Maps/Photographs -

View [USGS digital orthophoto quadrangle \(DOQ\)](#) covering this location from TerraServer; [USGS Aerial Photograph](#) may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the [USGS](#) for more information.

### Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

### Climate Data Sources -

*Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to our documentation.*

Using the [National Climatic Data Center's \(NCDC\)](#) station search engine, locate other climate stations within:

...OR...  of this location (39.68175/-110.48129). Digital ASCII data can be obtained directly from [NCDC](#).

Find [Natural Resources Conservation Service \(NRCS\)](#) SNOTEL (SNOWpack TELemetry) stations by visiting the [Western Regional Climate Center's state-specific SNOTEL station maps](#).

Hydrometeorological Design Studies Center  
 DOC/NOAA/National Weather Service  
 1325 East-West Highway  
 Silver Spring, MD 20910

(301) 713-1669  
 Questions? [HDSC\\_Questions@noaa.gov](mailto:HDSC_Questions@noaa.gov)

[Disclaimer](#)

**HYDROLOGY CALCULATIONS  
FOR  
DEGAS WELL G-31**

### Stockpile Runoff Volume Calculations

Stockpile	Watershed Area (sq. ft.)	Watershed Area (acres)	Precip. - <i>P</i> (in)	Curve Number ( <i>CN</i> )	Potential Max. Retention - <i>S</i> (in.)	Runoff - <i>Q</i> (in)	Runoff Volume - <i>V</i> (ft <sup>3</sup> )
STP-6	8,417	0.19	2.05	87	1.49	0.94	663

#### Notes

Calculations have been performed for the 10-year, 24-hour design storm event.

Topsoil is derived from the Midfork Family - Comodore Complex, as described in the NRCS Soil Survey for Carbon Area, Parts of Carbon and Emery Counties.

Calculations based on Soil Conservation Service (SCS) Method, National Engineering Handbook Section 4, Chapters 9 & 10 by Victor Mockus, 1972

Precipitation for 10-year, 24-hour event taken from National Weather Service web site ([http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut\\_pfds.html](http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html))

CN = 87, based on Table 9.1, NEH s4 ch9. Assume Hyd. Soil Gp. C (as given for Rottulee family - Trag complex in NRCS survey). Assume road, dirt surface (non-vegetated, conservative case).

$$S = (1000/CN) - 10$$

$$L = [(I^{0.8} (S+1)^{0.7}) / (1900Y^{0.5})]$$

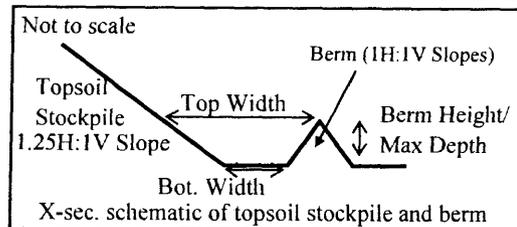
$$T_c = 1.67L$$

$$Q = (P - 0.2*S)^2 / (P + 0.8*S)$$

$$V = \text{Area} * Q$$

### Stockpile Runoff Containment Volume Calculations

Stockpile	Bottom Width (ft)	Top Width (ft)	Max Depth (ft)	Impounding Length of Berm (ft)	Total Length of Berm (ft)	Fill Req'd for Berm (yd <sup>3</sup> )	Cntnmt Vol. (ft <sup>3</sup> )	Contain Vol > Runoff Vol ?
STP-6	2	4.25	1	262	513	19	819	Yes



#### Notes

The bottom width is the distance between the toe of the topsoil stockpile and the base of the berm. (see schematic)

The top width is the horizontal distance between the crest of the berm and the topsoil stockpile. (see schematic)

The max depth is the height of the berm.

The Impounding Length of the berm accounts for the slope of the ground, and is the portion of the berm that will impound runoff.

The Total Length of Berm is its entire length around the topsoil stockpile.

The Fill Required for Berm is the volume of subsoil required to construct each berm, and is based on the length, height, and width of each berm. Berms shall be constructed with 1H:1V slopes.

The Containment Volume = Length \* Cross sectional area of the space between the topsoil stockpile and the inby side of the berm.



# POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14



Utah 39.68175 N 110.48129 W 7946 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4

G M Bonnin, D Martin, B Lin, T Parzybok, M Yekta, and D Riley

NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Tue Jun 26 2007

Confidence Limits

Seasonality

Location Maps

Other Info.

GIS data

Maps

Help

D

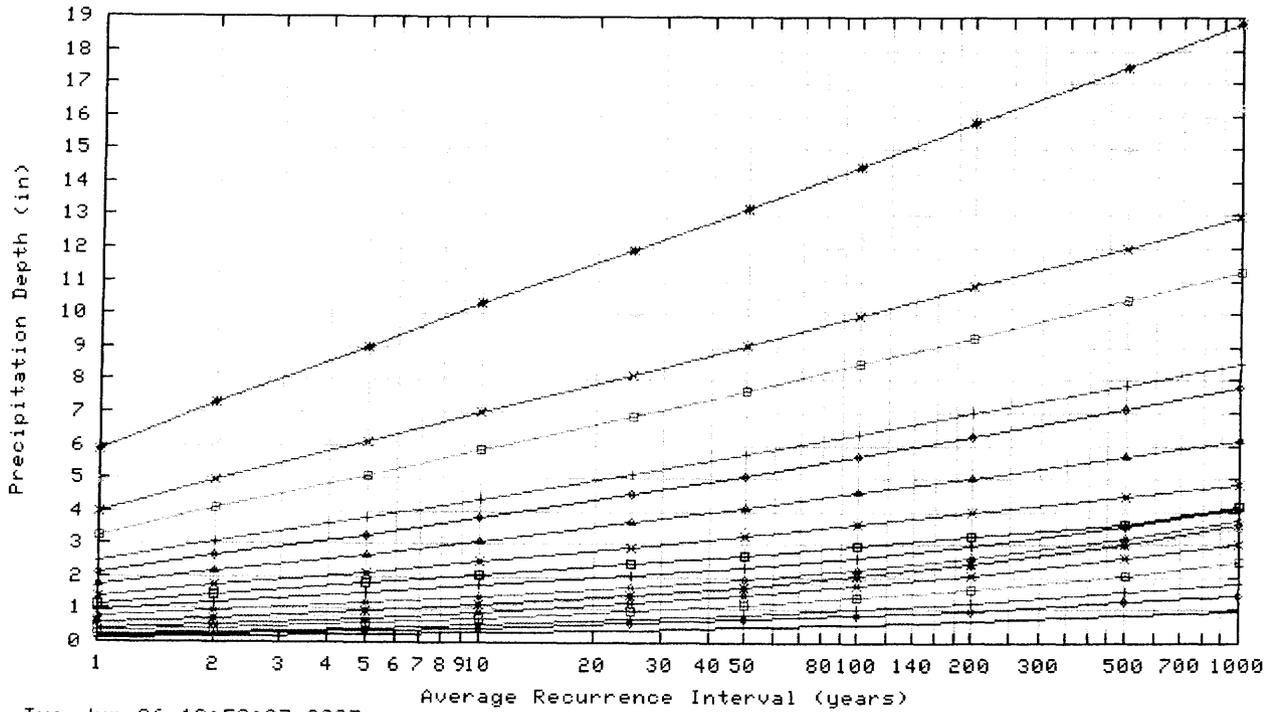
## Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.14	0.20	0.25	0.34	0.42	0.52	0.59	0.77	0.99	1.18	1.40	1.74	2.12	2.44	3.26	3.97	4.88	5.83
2	0.17	0.26	0.33	0.44	0.55	0.65	0.74	0.96	1.23	1.46	1.74	2.16	2.65	3.06	4.08	4.95	6.10	7.31
5	0.24	0.36	0.45	0.60	0.74	0.86	0.95	1.19	1.50	1.78	2.13	2.67	3.29	3.78	5.05	6.09	7.50	9.00
10	0.29	0.45	0.55	0.74	0.92	1.06	1.15	1.38	1.73	2.05	2.46	3.08	3.80	4.36	5.82	6.98	8.59	10.29
25	0.38	0.58	0.72	0.97	1.20	1.36	1.45	1.67	2.05	2.40	2.89	3.65	4.52	5.14	6.86	8.15	10.04	11.96
50	0.46	0.70	0.86	1.16	1.44	1.64	1.72	1.92	2.32	2.68	3.24	4.09	5.08	5.74	7.66	9.04	11.15	13.22
100	0.55	0.83	1.03	1.39	1.72	1.96	2.04	2.22	2.60	2.96	3.60	4.55	5.67	6.36	8.48	9.94	12.29	14.50
200	0.65	0.99	1.23	1.66	2.05	2.33	2.41	2.57	2.94	3.25	3.96	5.03	6.28	7.00	9.31	10.84	13.44	15.78
500	0.82	1.24	1.54	2.08	2.57	2.93	3.03	3.18	3.53	3.64	4.45	5.67	7.11	7.86	10.44	12.03	14.99	17.48
1000	0.97	1.47	1.83	2.46	3.04	3.49	3.59	3.74	4.09	4.13	4.84	6.17	7.77	8.53	11.30	12.94	16.22	18.80

Text version of table

\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

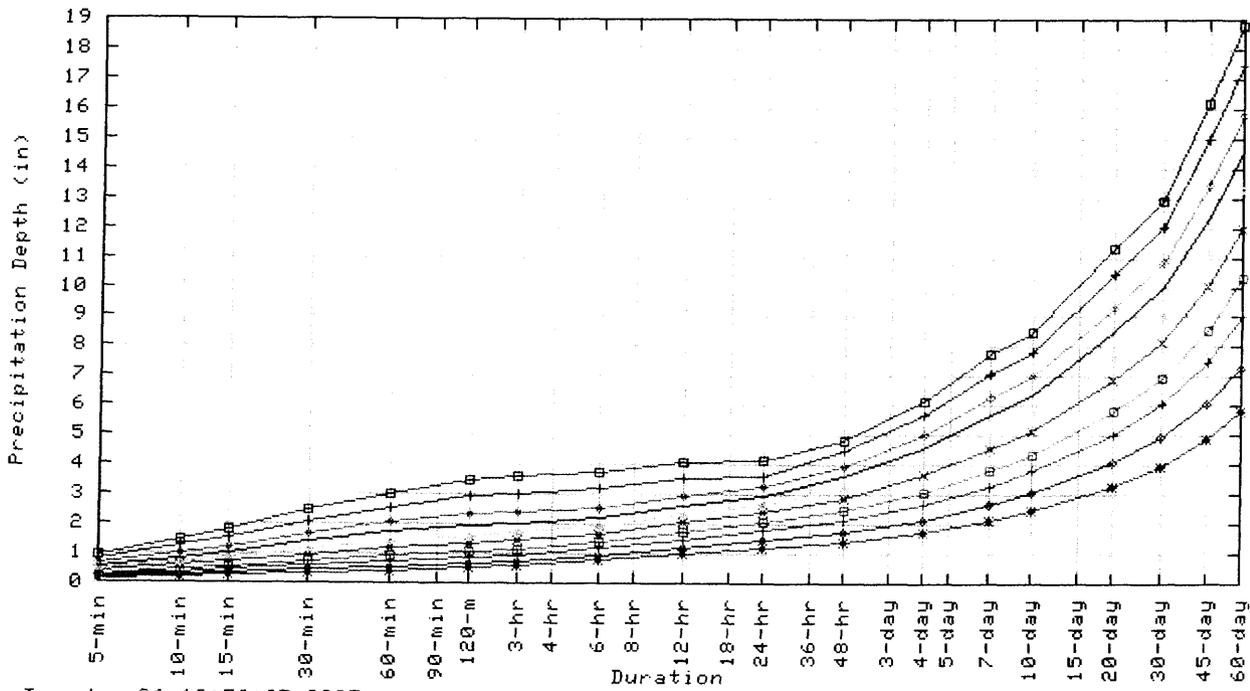
Partial duration based Point Precipitation Frequency Estimates Version: 4  
 39.68175 N 110.48129 W 7946 ft



Tue Jun 26 12:59:37 2007

Duration			
5-min	—	48-hr	✕
10-min	+	4-day	◆
15-min	+	6-hr	+
30-min	⊖	12-hr	+
60-min	✕	24-hr	⊖
		30-day	✕
		60-day	✕

Partial duration based Point Precipitation Frequency Estimates Version: 4  
 39.68175 N 110.48129 W 7946 ft



Tue Jun 26 12:59:37 2007

Average Recurrence Interval (years)	
1	*
2	○
5	+
10	□
25	x
100	—
200	*
500	+
1000	□

**Confidence Limits -**

<b>* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)</b>																		
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.16	0.24	0.30	0.41	0.51	0.60	0.69	0.88	1.11	1.31	1.56	1.94	2.41	2.74	3.65	4.43	5.44	6.49
2	0.21	0.32	0.39	0.53	0.65	0.76	0.86	1.09	1.38	1.63	1.94	2.42	3.01	3.42	4.56	5.54	6.80	8.12
5	0.28	0.43	0.53	0.72	0.89	1.01	1.11	1.35	1.68	2.00	2.38	2.98	3.73	4.24	5.66	6.80	8.37	10.00
10	0.35	0.53	0.66	0.89	1.10	1.24	1.33	1.58	1.94	2.29	2.74	3.44	4.33	4.89	6.53	7.79	9.60	11.44
25	0.46	0.69	0.86	1.16	1.43	1.60	1.69	1.91	2.32	2.69	3.23	4.08	5.15	5.76	7.70	9.12	11.24	13.33
50	0.55	0.83	1.04	1.40	1.73	1.93	2.01	2.21	2.63	3.00	3.62	4.58	5.80	6.45	8.61	10.14	12.51	14.77
100	0.66	1.00	1.24	1.67	2.07	2.33	2.40	2.58	2.97	3.33	4.03	5.11	6.50	7.17	9.55	11.18	13.80	16.25
200	0.79	1.20	1.49	2.01	2.49	2.79	2.87	3.01	3.38	3.66	4.45	5.65	7.22	7.91	10.53	12.23	15.15	17.77
500	1.01	1.54	1.90	2.56	3.17	3.59	3.67	3.79	4.13	4.17	5.04	6.42	8.24	8.93	11.88	13.66	17.01	19.80
1000	1.22	1.85	2.30	3.09	3.83	4.35	4.43	4.52	4.85	4.90	5.51	7.04	9.06	9.75	12.94	14.77	18.49	21.43

\* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.

\*\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

**\* Lower bound of the 90% confidence interval**

### Precipitation Frequency Estimates (inches)

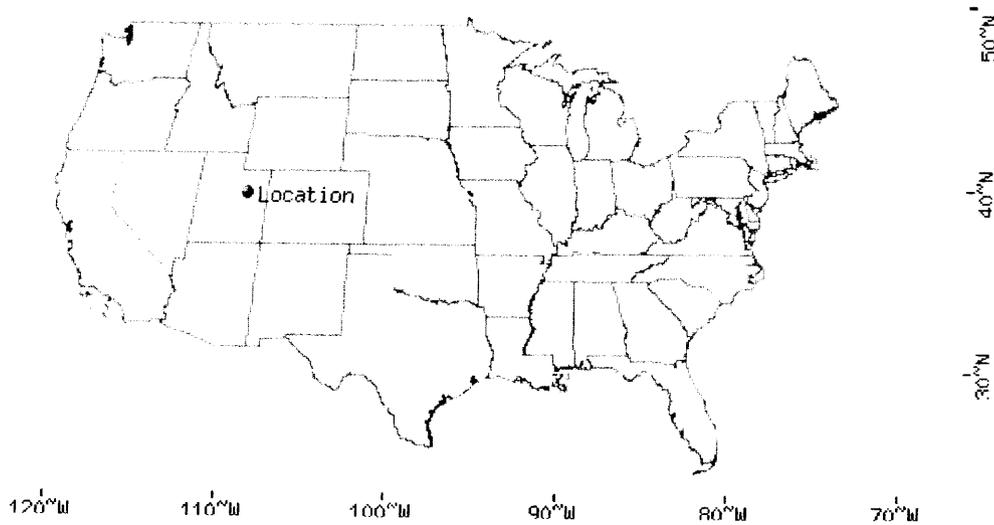
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.12	0.18	0.22	0.29	0.36	0.45	0.52	0.69	0.90	1.07	1.26	1.56	1.89	2.19	2.94	3.59	4.41	5.28
2	0.15	0.23	0.28	0.38	0.47	0.57	0.65	0.85	1.11	1.32	1.57	1.95	2.36	2.75	3.68	4.48	5.51	6.61
5	0.20	0.31	0.38	0.52	0.64	0.75	0.84	1.05	1.34	1.61	1.92	2.39	2.92	3.38	4.53	5.49	6.75	8.10
10	0.25	0.38	0.47	0.63	0.79	0.90	1.00	1.22	1.54	1.84	2.20	2.75	3.37	3.88	5.22	6.26	7.69	9.22
25	0.32	0.48	0.59	0.80	0.99	1.14	1.24	1.45	1.81	2.15	2.58	3.23	3.97	4.55	6.10	7.27	8.94	10.66
50	0.37	0.56	0.70	0.94	1.17	1.34	1.44	1.65	2.02	2.39	2.86	3.60	4.43	5.05	6.76	8.02	9.86	11.71
100	0.43	0.66	0.82	1.10	1.36	1.56	1.67	1.88	2.23	2.62	3.15	3.97	4.90	5.55	7.41	8.75	10.78	12.73
200	0.50	0.76	0.94	1.27	1.57	1.81	1.93	2.13	2.48	2.85	3.44	4.34	5.36	6.06	8.07	9.47	11.69	13.73
500	0.60	0.91	1.13	1.52	1.88	2.17	2.32	2.56	2.93	3.15	3.81	4.82	5.99	6.71	8.90	10.36	12.86	15.01
1000	0.68	1.04	1.29	1.73	2.15	2.48	2.65	2.94	3.34	3.38	4.10	5.18	6.46	7.19	9.53	11.03	13.76	15.97

\* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

\*\* These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.

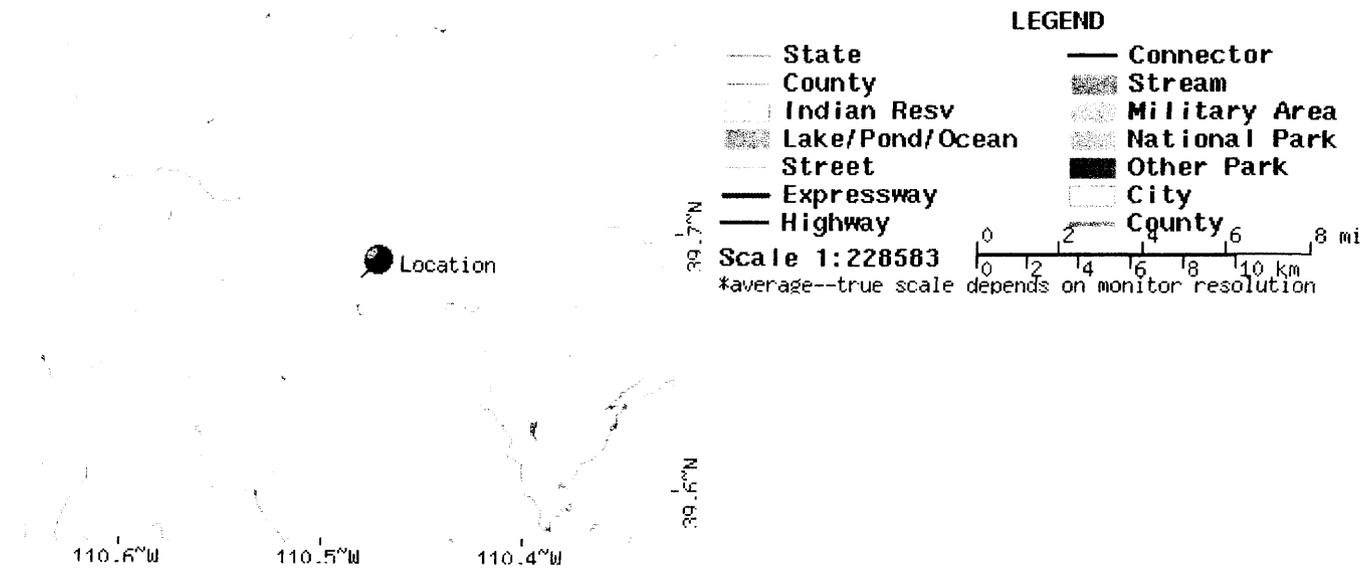
Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

### Maps -



These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read *disclaimer* for more information.



**Other Maps/Photographs -**

View **USGS digital orthophoto quadrangle (DOQ)** covering this location from TerraServer; **USGS Aerial Photograph** may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the [USGS](#) for more information.

**Watershed/Stream Flow Information -**

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

**Climate Data Sources -**

*Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to our documentation.*

Using the **National Climatic Data Center's (NCDC)** station search engine, locate other climate stations within:

...OR...  of this location (39.68175/-110.48129). Digital ASCII data can be obtained directly from **NCDC**.

Find **Natural Resources Conservation Service (NRCS) SNOTEL (SNOWpack TELemetry)** stations by visiting the **Western Regional Climate Center's state-specific SNOTEL station maps**.

**Hydrometeorological Design Studies Center**  
**DOC/NOAA/National Weather Service**  
 1325 East-West Highway  
 Silver Spring, MD 20910  
 (301) 713-1669  
 Questions? [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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