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FILE IN Expandable 09202006
Refer to Record No. 0087 0002
in 00070039, 2006, INCOMING
for additional 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-14A	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

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

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.

United States of America
Department of Interior
Bureau of Land Management

State of Utah
School and Industrial
Trust Lands Administration

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 16, 2006

Price Field Office
125 South 600 West
Price, Utah 84501

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

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.

TABLE 1-2
Disturbed Acres by Well Site

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

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 Filling Fees

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

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.

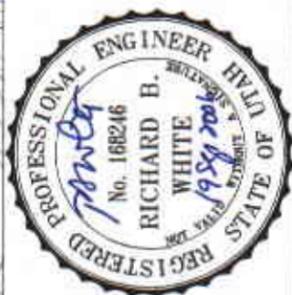
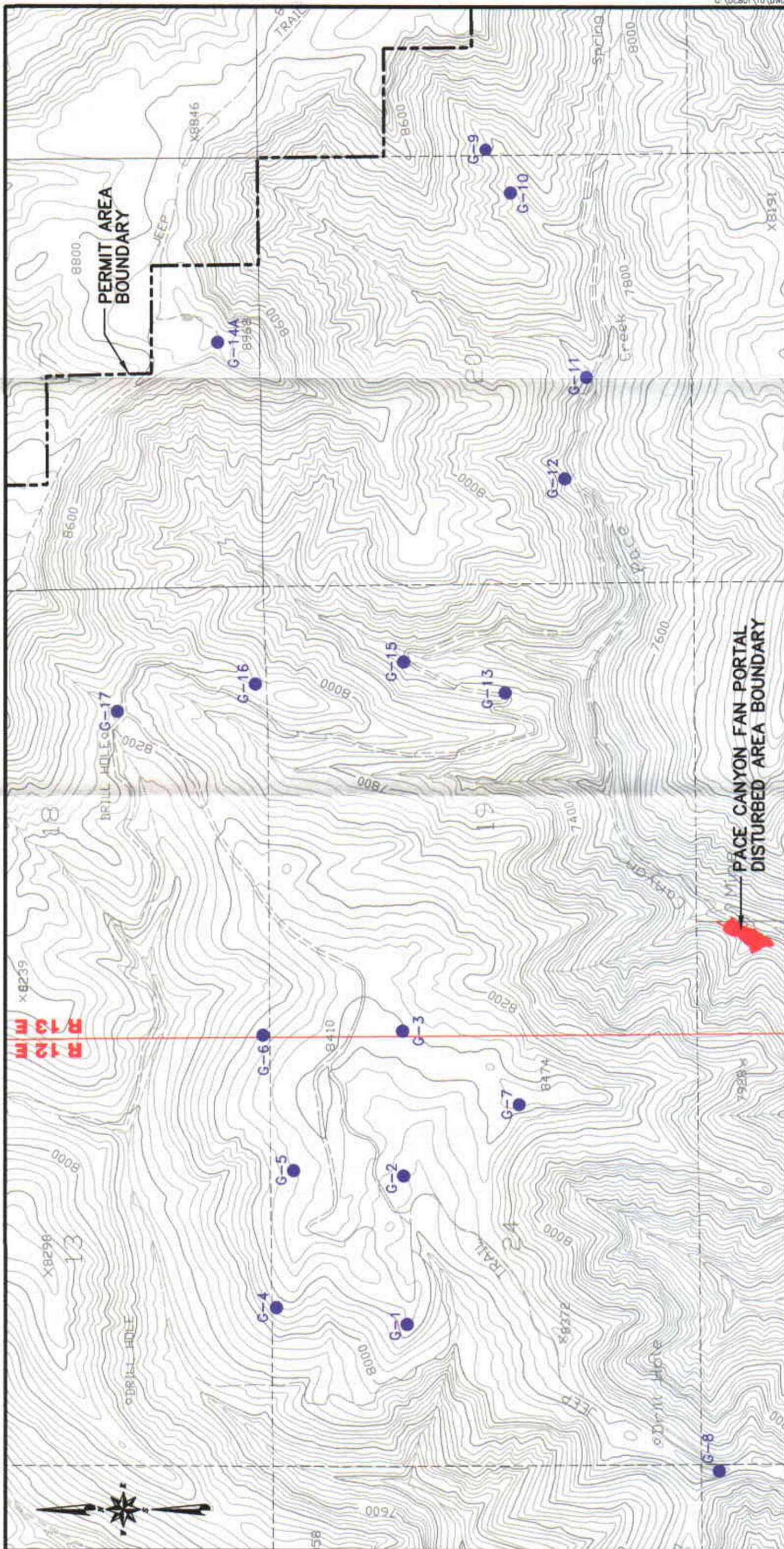


FIGURE 1-1. METHANE DEGAS BORE HOLE LOCATIONS



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

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

* These total do not include soil salvaged from roads 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-17 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 sites 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, slopecut 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.

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.

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. The subsoil excavation for the mud pits at G-7 thru G-17 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, and G-17 - 83 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

TABLE 2-2
Topsoil Stockpile Dimensions*

Well No.	Length (ft)	Width (ft)	Height (ft)
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

* 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).

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.

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.

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-17.

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 and G-17 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.

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.

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

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

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 .

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.

ATTACHMENT 2-1
SOIL INVENTORY AND ASSESSMENT

add to the back of existing information

**Soil Inventory and Assessment
Degasification Borehole Locations
G15, 16 & 17
Dugout Canyon Mine
Carbon County, Utah**

Prepared For:

**Canyon Fuel Company
Dugout Canyon Mine
P.O. Box 1029
Wellington, Utah 84542**

Prepared By:

**Daniel M. Larsen
Professional Soil Scientist**

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eisec@preciscom.net**

December 2005

**Soil Inventory and Assessment
Degasification Borehole Locations
G15, G16 & G17**

Dugout Canyon Mine

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**Soil Inventory and Assessment
Degasification Borehole Locations
G15, G16 & G17**

Dugout Canyon Mine

Introduction

This soil inventory and assessment was conducted to identify and evaluate the soil resources at three proposed methane gas ventilation borehole sites in the Pace Canyon area at the Dugout Canyon Mine in Carbon County, Utah. The sites are identified as G-15, G-16 and G-17. They are located in Sections 18 and 19, T13S, R13E and are approximately 2 ¼ miles east of the mine portal site.

Setting

The sites are located in the Book Cliff's area at approximately 7,600 to 8,200 feet in elevation in steep mountainous topography. Soil parent materials are composed of sandstone and shale bedrock and colluvial materials. Vegetation is primarily Douglas fir and aspen on the cooler north facing slopes, with serviceberry, sagebrush and oak brush along the ridges.

Precipitation is about 16 to 20 inches annually and soil temperature regimes are frigid and cryic (average annual temperatures of about 36 to 40 degrees F.)

Procedures

Fieldwork was conducted on October 3 and 7, 2005. Site and soils information was obtained by observations and procedures consistent with a detailed soil survey. A spade and soil auger were used to identify soils. Representative soils were described at each site and spot checks for topsoil thickness were made throughout each location. Photographs and site sketches were used to document site and soil conditions.

A limited number of soil samples were taken of representative soils to further characterize the soils and help in making soil suitability ratings. The samples were submitted to Inter-Mountain Laboratories, Sheridan, Wyoming for analysis.

Soil suitability was evaluated based on guidelines from the Utah State Division of Oil, Gas & Mining.

Soil Resources

General Overview

The area has been mapped at the order 3 intensity level as part of the Soil Survey of the Carbon Area, Utah by the Soil Conservation Service, now the Natural Resources Conservation Service. Each of the proposed drill sites are located near the transition of two soil map units. The soil map units identified near the sites are 97 and 62 at G-15, 13 and 97 at G-16, and 103 and 97 at G-17.

Map Unit 13: Cabba family – Guben – Rock Outcrop complex
 Map Unit 62: Midfork family – Comodore complex
 Map Unit 97: Rottulee family – Trag complex
 Map Unit 103: Senchert – Toze family complex

These soils range from shallow over sandstone and shale to very deep on colluvial materials. They have thin to very thick dark colored topsoil layers and subsoils that are clayey to very stony.

The general soils in the area are classified as follows:

Cabba family:	Loamy, mixed (calcareous), superactive, shallow Typic Ustorthents
Comodore:	Loamy, skeletal, mixed, superactive, Lithic Haploborolls
Guben:	Loamy, skeletal, mixed, superactive, Typic Calciborolls
Midfork:	Loamy, skeletal, mixed superactive, Typic Haplocryolls
Ruttulee family:	Fine, loamy, mixed superactive, Typic Haploborolls
Senchert:	Fine, loamy, mixed, superactive, Pachic Agricryolls
Toze:	Fine, loamy, mixed, superactive, Pachic Calcicryolls
Trag:	Fine, loamy, mixed; superactive, Typic Argiborolls

Soil Resources at G-15

This site is located at the toeslope of a drainage dissection (small side canyon) and is about 50 percent disturbed by a road, slopecut and fill. The general vegetation is Douglas fir, maple, snowberry, and a few junipers. The undisturbed slope above the road has a southeast aspect with a 35 to 45 percent gradient.

The soils have formed in colluvium derived from sandstone and shale. They are well drained and have moderate permeability. Dark colored surface soils (topsoil) are typically 13 to 20 inches thick and have loam texture. Subsoils are brown, cobbly loam to clay loam. The topsoil layer is thinner and there are more stones and boulders near the north end of the site than at the southern end. The site is at a transition of the frigid and cryic soil temperature regimes, having soils similar to Trag and the Midfork family. There is an increase in clay in the subsoil compared to the surface but it is a weak argillic horizon. The subsoil rock fragment content is estimated at about 30 to 40 percent while the surface is about 15 to 25 percent.

Soil Resources at G-16

This site is along a narrow ridge in a slight saddle (high at each end and dropping steeply off to the sides). Most of the site has been previously disturbed and reclaimed with a pitted surface. The general vegetation is mostly serviceberry, sagebrush and grasses. Slopes on the site are about 15 to 20 percent gradient and they increase to about 45 percent off from the sides.

The soils have formed mostly over a yellowish brown colored shale with remnants of sandstone rock fragments at the surface. The disturbed portion has mixed soil materials about 10 to 14 inches thick over soft, weathered shale. The undisturbed portion is mostly represented by about six inches of topsoil over clayey subsoil increasing in shale content with depth. Weathered shale with essentially no soil material is at about 10 to 20 inches. Thicker soils are present in the southeast corner of the site, where up to 14 inches of dark colored surface soil is present.

The shallow soils are similar to Cabba and these that are moderately deep are similar to Rottulee and Doney. The Rottulee soils have a thicker dark colored topsoil layer than the Doney soils. They are both 20 to 40 inches deep over shale. Surface soils are typically loam to silt loam and subsoils are silty clay loam. These soils are mildly alkaline to moderately alkaline (pH 7.4 to 8.0).

Soil Resources at G-17

This site is along a ridge that benches off to the north. Vegetation is mostly sagebrush and serviceberry with aspen being present in the northwest corner. The elevation is about 8,200 feet and slope gradient is about 15 to 20 percent. About a third of the site is disturbed from a road which runs along the south portion.

The soils at this site range from very shallow to very deep. Topsoils are lacking on eroded spots on shale near the road and are dark colored to nearly five feet in depth on the northern side of the site. The deeper soils appear to be developed in local alluvium in a slight swale position. Soil textures are silt loam to silty clay loam in the soil matrix and silty clay in the weathered shale. Subsoils are high in carbonates.

The deep soils are similar to the Toze family and the moderately deep soils are similar to the Senchert family. Shallow soils are similar to Cabba.

Soil Testing Results and Suitability Assessment

Eight soil samples were analyzed by Inter-Mountain Laboratories, Inc., Sheridan, Wyoming. The "Soil Analysis Report" is enclosed along with a copy containing interpretive notes. These soil samples were only for reference and not intended for complete soil characterization.

Table 1: Soil Sample Identification

Site	Depth (Inches)	
G-15	0-14	Profile No. 1, A and Upper B Horizon, 10 YR 3/2 – 3/3
G-15	14-24	Profile No. 1, BT Horizon 10 YR 4/3
G-16	0-6	Profile No. 1, A Horizon, 10 YR 3/2
G-16	6-12	Profile No. 1, AB Horizon, 2.5 YR 5/3
G-16	20-26	Profile No. 1, BC Horizon, 2.5 YR 6/4
G-17	0-6	Spot check, surface of eroded spot
G-17	0-15	Profile No. 1, A and upper part of B horizon 7.5 YR 3/2 – 3/3

The soils are rated as "good" and "fair" based on soil suitability evaluation criteria given by the State of Utah, Department of Natural Resources, Division of Oil, Gas and Mining in "Guidelines For Management of Topsoil and Overburden" draft of June 2003.

Soil Testing Results

Report ID: 010509546

Soil Analysis Report

Canyon Fuel Co

Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon

Date Received: 10/12/05

1633 Terra Avenue
Sheridan, WY 82801

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August

Set #010509546

Report Date: 11/17/05

Lab Id	Sample Id	Depth (inches)	pH	Saturation %	EC @ 25°C dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	SAR	Sand %	Silt %	Clay %	Texture
105S09546	G-15	0-14	7.6	48.8	0.70	3.85	1.96	0.09	0.05	49.0	29.0	22.0	LOAM
105S09547	G-15	14-24	7.8	43.2	0.40	2.32	0.60	0.37	0.31	42.0	30.0	28.0	CLAY LOAM
105S09548	G-16	0-6	7.5	74.2	0.53	3.87	0.39	0.08	0.05	38.0	36.0	26.0	LOAM
105S09549	G-16	6-12	7.7	40.7	0.38	2.62	0.41	0.13	0.11	39.0	28.0	33.0	CLAY LOAM
105S09550	G-16	20-26	7.9	47.7	0.28	1.93	0.32	0.22	0.20	12.0	53.0	35.0	SILTY CLAY LOAM
105S09551	G-17 EC	0-6	8.0	37.2	0.32	1.86	0.39	0.16	0.15	18.0	56.0	26.0	SILT LOAM
105S09552	G-17 NE	0-15	7.4	59.4	0.54	3.45	0.65	0.07	0.05	34.0	40.0	26.0	LOAM

these results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: *Joey Sheeley*
 Joey Sheeley, Soils Lab Supervisor

Report ID: 010509546

1633 Terra Avenue
Sheridan, WY 82801

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Soil Analysis Report

Canyon Fuel Co
Dugout Mine -Canyon Fuel
P.O. Box 1029
Wellington, UT 84542

Client Project ID: Dugout Canyon

Date Received: 10/12/05

Set #0105S09546

Report Date: 11/17/05

Lab Id	Sample Id	Depths (inches)	Very Fine Sand %	Field Capacity %	Wilt Point %	TOC %	Total Sulfur %	T.S. AB /1000t	Neutral. Pot. /1000t	T.S. ABP /1000t
1105S09546	G-15	0 - 14	19.1	27.7	14.2	1.5	0.01	0.31	176	176
1105S09547	G-15	14 - 24	17.6	24.3	14.5	0.9	0.01	0.31	288	288
1105S09548	G-16	0 - 6	23.5	47.0	24.6	4.4	0.01	0.31	51.9	51.5
1105S09549	G-16	6 - 12	31.8	26.2	15.5	0.6	0.01	0.31	302	302
1105S09550	G-16	20 - 26	7.60	26.3	17.2	0.3	0.01	0.31	398	398
1105S09551	G-17 EC	0 - 6	15.2	20.4	11.7	<0.1	<0.01	0.00	263	263
1105S09552	G-17 NE	0 - 15	20.3	42.4	21.9	2.5	0.01	0.31	39.1	38.8

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2Osol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shulley
 Joy Shulley, State Lab Chemist

Report ID: 010509546

Soil Analysis Report

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Sheridan, WY 82801

Canyon Fuel Co

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Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon

Date Received: 10/12/05

Set #0105S09546

Report Date: 11/17/05

Lab Id	Sample Id	Depth (Inches)	Boron ppm	Nitrogen		TKN %	Selenium ppm	Available Sodium meq/100g	Exchangeable Sodium meq/100g
				Nitrate ppm	Nitrite ppm				
0105S09546	G-15	0 - 14	0.44	<0.02	<0.02	0.21	<0.02	0.06	0.06
0105S09547	G-15	14 - 24	0.17	<0.02	<0.02	0.18	<0.02	0.05	0.03
0105S09548	G-16	0 - 6	0.52	<0.02	<0.02	0.43	<0.02	0.05	0.04
0105S09549	G-16	6 - 12	0.23	0.38	0.27	0.27	<0.02	0.08	0.05
0105S09550	G-16	20 - 28	0.26	0.36	0.09	0.09	<0.02	0.07	0.06
0105S09551	G-17 EC	0 - 6	0.13	3.44	0.11	<0.02	<0.02	0.06	0.05
0105S09552	G-17 NE	0 - 15	0.51	<0.02	0.20	<0.02	<0.02	0.05	0.05

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2SO4= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shulley
 Inter-Molecular Laboratories

Report ID: 010509546

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Dugout Mine -Canyon Fuel
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Client Project ID: Dugout Canyon

Date Received: 10/12/05

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Lab Id	Sample Id	Depth (Inches)	pH	Saturation %	EC @ 25°C dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	SAR	Sand %	Silt %	Clay %	Texture
010509546	G-15	0 - 14	7.6	48.8	0.70	3.85	1.96	0.09	0.05	48.0	29.0	22.0	LOAM
010509546D	G-15	0 - 14	7.6	47.9	0.70	3.99	2.03	0.11	0.06	48.0	29.0	23.0	LOAM

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Jerry Shirley
 Jerry Shirley, Soil Lab Supervisor

Report ID: 010509546

1633 Terra Avenue
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Client Project ID: Dugout Canyon
Date Received: 10/12/05

Set #0105S09546
Report Date: 11/17/05

Lab Id	Sample Id	Depths (Inches)	Very Fine Sand %	Field Capacity %	Wilt Point %	TOC %	Total Sulfur %	T.S. AB /1000t	Neutral. Pot /1000t	T.S. ABP /1000t
0105S09546	G-15	0 - 14	19.1	27.7	14.2	1.5	0.01	0.31	178	178
0105S09546D	G-15	0 - 14	16.0	28.4	14.0	1.5	0.01	0.31	178	175

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shulley
Inter-Mou Laboratories, Inc.

Report ID: 010509546

Soil Analysis Report

Canyon Fuel Co
Dugout Mine -Canyon Fuel

P.O. Box 1029
 Wellington, UT 84542

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Client Project ID: Dugout Canyon
 Date Received: 10/12/05

Set #0105S09546
 Report Date: 11/17/05

Lab Id	Sample Id	Depths (Inches)	Boron ppm	Nitrogen		TKN %	Selenium ppm	Available Sodium		Exchangeable Sodium	
				Nitrate ppm	ppm			meq/100g	meq/100g	meq/100g	meq/100g
0105S09546	G-15	0 - 14	0.44	<0.02	<0.02	0.21	<0.02	0.06	<0.01	0.06	<0.01
0105S09546D	G-15	0 - 14		<0.02	<0.02	0.21	<0.02	<0.01	<0.01	<0.01	<0.01

These results only apply to the samples tested.

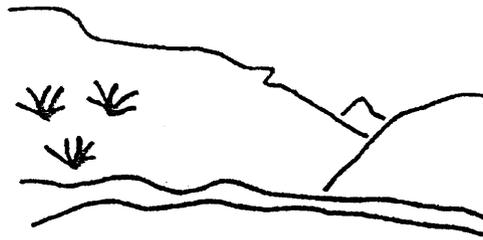
Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, Pyr-S= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shulley
 Joy Shulley, Soil Lab Supervisor

Suitability Evaluation

GUIDELINES FOR MANAGEMENT of TOPSOIL and OVERBURDEN

R645-301-200 SOILS



Utah Oil Gas and Mining

**STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
1594 W. North Temple, Suite 1210
P.O. Box 14501
Salt Lake City, Utah 84114-5801
(801) 538-5340**

**DRAFT
June 2003**

Table 4. Soil and Spoil Suitability/Unsuitability Evaluation

CRITERIA	GOOD	FAIR	POOR	UNACCEPTABLE
Saturation %	25 to 55	≥56 - 80	<25 >80	
pH	6.5 to 8.2	6.0 to 6.4 8.2 to 8.5	5.5 to 6.0 8.6 to 9.0	< 5.5 > 9.0
EC (mS/cm 25°C)	0 to 4	4 to 8	8 to 15	> 15
SAR ^{a,b}	0 to 4	5 to 10	10 to 14	> 14
%CaCO ₃	<15	15 - 30	>30	
Texture ^c	sl, l, sil, scl, vsl, fsl	cl, sil, sc, ls, lfs	sic, s, sc, c, cos, fs, vfs	g, vcoss
Total Organic Carbon	<10%			10%
Available Water Capacity ^d	> 0.10 moderate	0.05 to 0.10 low	<0.05 very low	
K factor ^e	< 0.37	0.37	> 0.37	

^a For clay textured soils unacceptable is SAR >14. For sandy textured soils unacceptable is >20.

^b For most Western soils, the SAR to ESP relationship is usually 1:1, up to ESP ≈ 20. If SAR>20, then determine ESP. (Evangelou, 2000.)

^c s=sand, l= loam, si= silt, c= clay, v= very, f= fine, co=coarse, g=gravel

^d Available Water Capacity is adjusted for texture and SAR.

^e K factor recommendations from the USDA Soil Conservation Service, 1978. National Soils Handbook Notice 24. (3/31/78). NSH Part II -403.6(a). For Prime Farmland soils, the K factor times the percent slope should be a value of five or less for minimal erosion hazard.

Table 9. Acidity/Toxicity Evaluation

PARAMETERS	UNACCEPTABLE LEVELS
Soluble Selenium	≥ 0.15 mg/kg ¹ ≥0.10 mg/kg ^{2,3}
Available Boron	≥5.0 mg/kg
Acid/Base Potential	≤ 0 tons CaCO ₃ /1000 tons overburden

¹ unacceptable level for the rooting zone (top four feet of fill) and/or ephemeral drainages with 100 year flood plains, top 4 feet fill

² unacceptable level for the top 4 feet of fill in surface-water impoundments.

³ unacceptable level for intermittent/perennial drainages including 100 year flood plains

Order ID: 010509546

Soil Analysis Report
Canyon Fuel Co
 Dugout Mine -Canyon Fuel
 P.O. Box 1029
 Wellington, UT 84542

Project: Dugout Canyon
 Received: 10/12/05

With Suitability
Notes DML

1633 Terra Avenue
 Sheridan, WY 82801
 Page 1 of 6
 August 11, 2005
 Set #010509546
 Report Date: 11/17/05

Id	Sample Id	Depth (inches)	pH	Saturation %	EC @ 25°C dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	SAR	Sand %	Silt %	Clay %	Texture	Silt	
														VFS	VFS
309546	G-15	0-14	7.6	48.8	0.70	3.85	1.96	0.09	0.05	29.9	49.0	22.0	LOAM (G)	48.7	29.0
309547	G-15	14-24	7.8	43.2	0.40	2.32	0.60	0.37	0.31	24.4	42.0	28.0	CLAY LOAM (F)	46.6	30.0
309548	G-16	0-6	7.5	74.2	0.53	3.87	0.39	0.08	0.05	14.5	38.0	26.0	LOAM (G)	57.5	36.0
309549	G-16	6-12	7.7	40.7	0.38	2.82	0.41	0.13	0.11	7.2	39.0	33.0	CLAY LOAM (F)	57.8	28.0
309550	G-16	20-26	7.9	47.7	0.28	1.93	0.32	0.22	0.20	4.4	12.0	35.0	SILTY CLAY LOAM (F)	64.6	53.0
309551	G-17 EC	0-6	8.0	37.2	0.32	1.86	0.39	0.16	0.15	2.8	18.0	26.0	SILT LOAM (G)	74.2	56.0
309552	G-17 NE	0-15	7.4	59.4	0.54	3.45	0.65	0.07	0.05	13.7	34.0	26.0	LOAM (G)	64.3	40.0

7.4-8.0 All Good
 <4 All Good
 <4 All Good
 A high % is VFS;
 See next page for very fine sand
 Fair and Good

Results only apply to the samples tested.

Abbreviations: PE= Saturated Paste Extract, H2Osol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Analysed By Joey Sheeley
 Joey Sheeley, Soils Lab Supervisor

Report ID: 010509546

1833 Terra Avenue
Sheridan, WY 82801

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Soil Analysis Report

Canyon Fuel Co
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Project ID: Dugout Canyon

Received: 10/12/05

Set #0105S08546

Report Date: 11/17/05

Sample Id	Depth (inches)	Very Fine Sand %	Field Capacity %	Wilting Point %	Avail. Cap %	TOC %	Total Sulfur %	T.S. AB /1000t	Neutral. Pot. /1000t	T.S. ABP /1000t
X9546	0-14	19.1	27.7	14.2	13.5	1.5	0.01	0.31	176	176
X9547	14-24	17.6	24.3	14.5	9.8*	0.9	0.01	0.31	268	268
X9548	0-6	23.5	47.0	24.6	22.4	4.4	0.01	0.31	51.9	51.6
X9549	6-12	31.8	26.2	15.5	10.7	0.6	0.01	0.31	302	302
X9550	20-28	7.90	26.3	17.2	9.1*	0.3	0.01	0.31	398	398
X9551	0-6	15.2	20.4	11.7	8.7*	<0.1	<0.01	0.00	263	263
X9552	0-15	20.3	42.4	21.9	20.5	2.5	0.01	0.31	39.1	38.8

(Ave) Less than 10% is Fair Others are Good at 70%

(Ave) Good 40%

All Good

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Abbreviations: PE= Saturated Paste Extract, H2O Sol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Anal By: Jay Shuley
 In: Sheridan, WY 82801

ort ID: 010509546

1633 Terra Avenue
Sheridan, WY 82801

Soil Analysis Report

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Dugout Mine -Canyon Fuel

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Wellington, UT 84542

Project ID: Dugout Canyon

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Set #010509546

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id	Sample Id	Depth (Inches)	Nitrogen		TKN %	Selenium ppm	Available Sodium meq/100g	Exchangeable Sodium meq/100g
			Boron ppm	Nitrate ppm				
19546	G-15	0 - 14	0.44	<0.02	0.21	<0.02	0.05	0.06
19547	G-15	14 - 24	0.17	<0.02	0.18	<0.02	0.05	0.03
19548	G-16	0 - 6	0.52	<0.02	0.43	<0.02	0.05	0.04
19549	G-16	6 - 12	0.23	0.38	0.27	<0.02	0.06	0.05
19550	G-16	20 - 28	0.28	0.36	0.09	<0.02	0.07	0.06
19551	G-17 EC	0 - 6	0.13	3.44	0.11	<0.02	0.06	0.05
19552	G-17 NE	0 - 15	0.51	<0.02	0.20	<0.02	0.05	0.05

All acceptable < 5 mg/kg

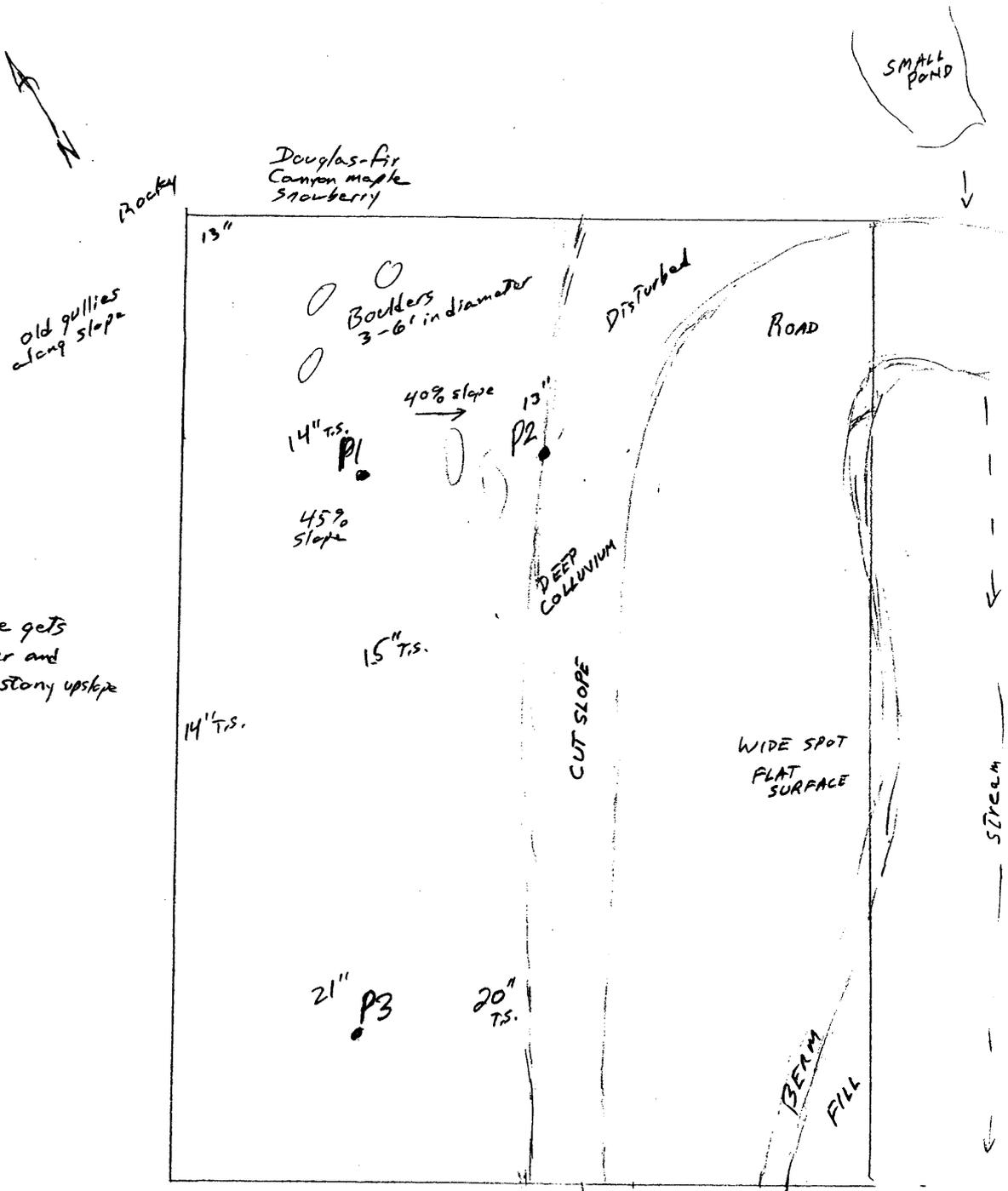
All acceptable < 10 mg/kg

results only apply to the samples tested.

ations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 tations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 aneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

ved By: Jay Shuley
 Toni Sheridan, Sales Lab Coordinator

Site Sketches



Slope gets steeper and more stony upslope

Undisturbed soils have 1 to 21" of dark surface soil over brown cobbly subsoils - Thicker on south end than the north (About 165 feet by 135 feet)

T.S. = Topsoil (mollic colors)

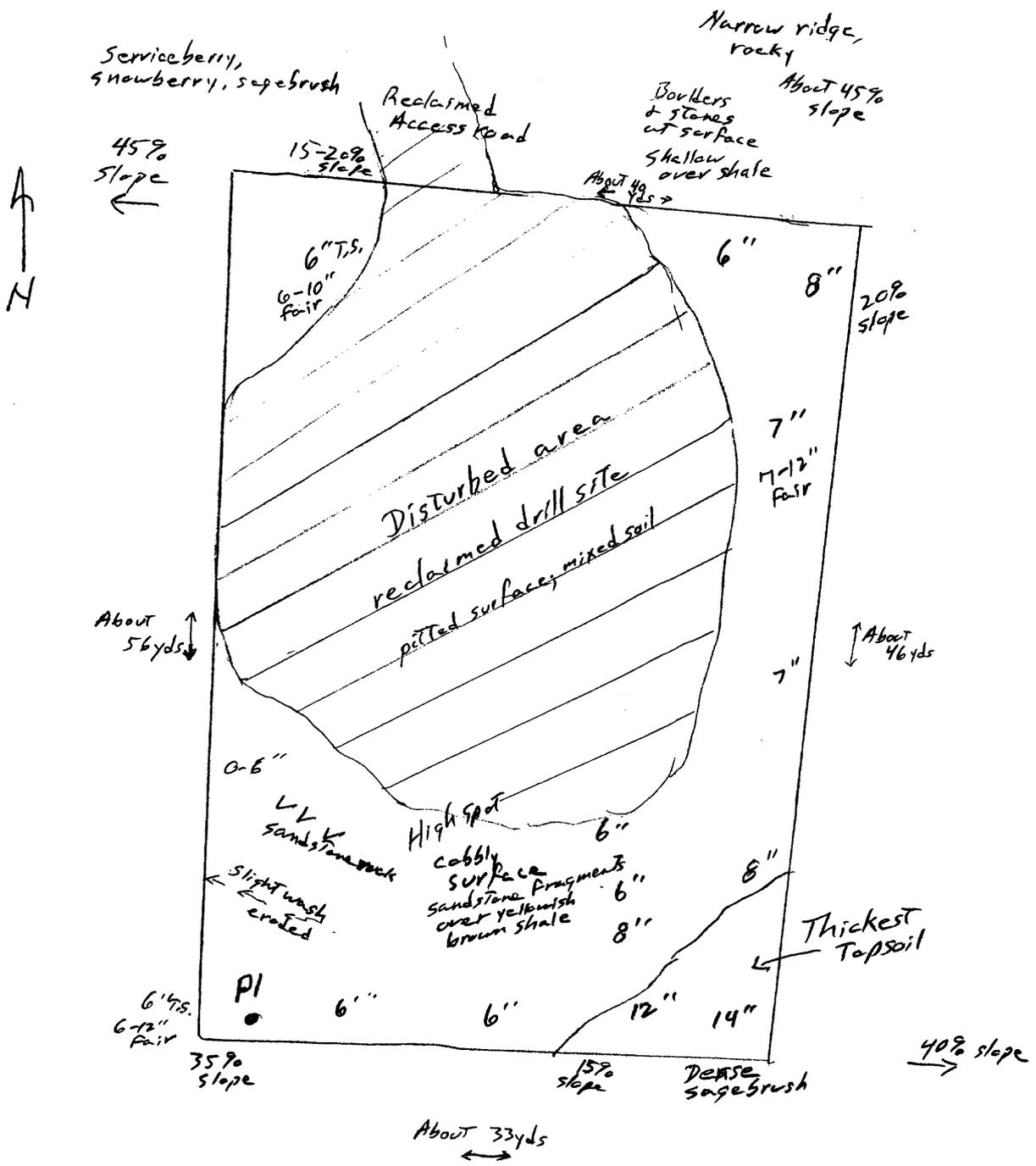
surface configuration near center

looking from south to north

G-16

Notes: DML
10/7/05

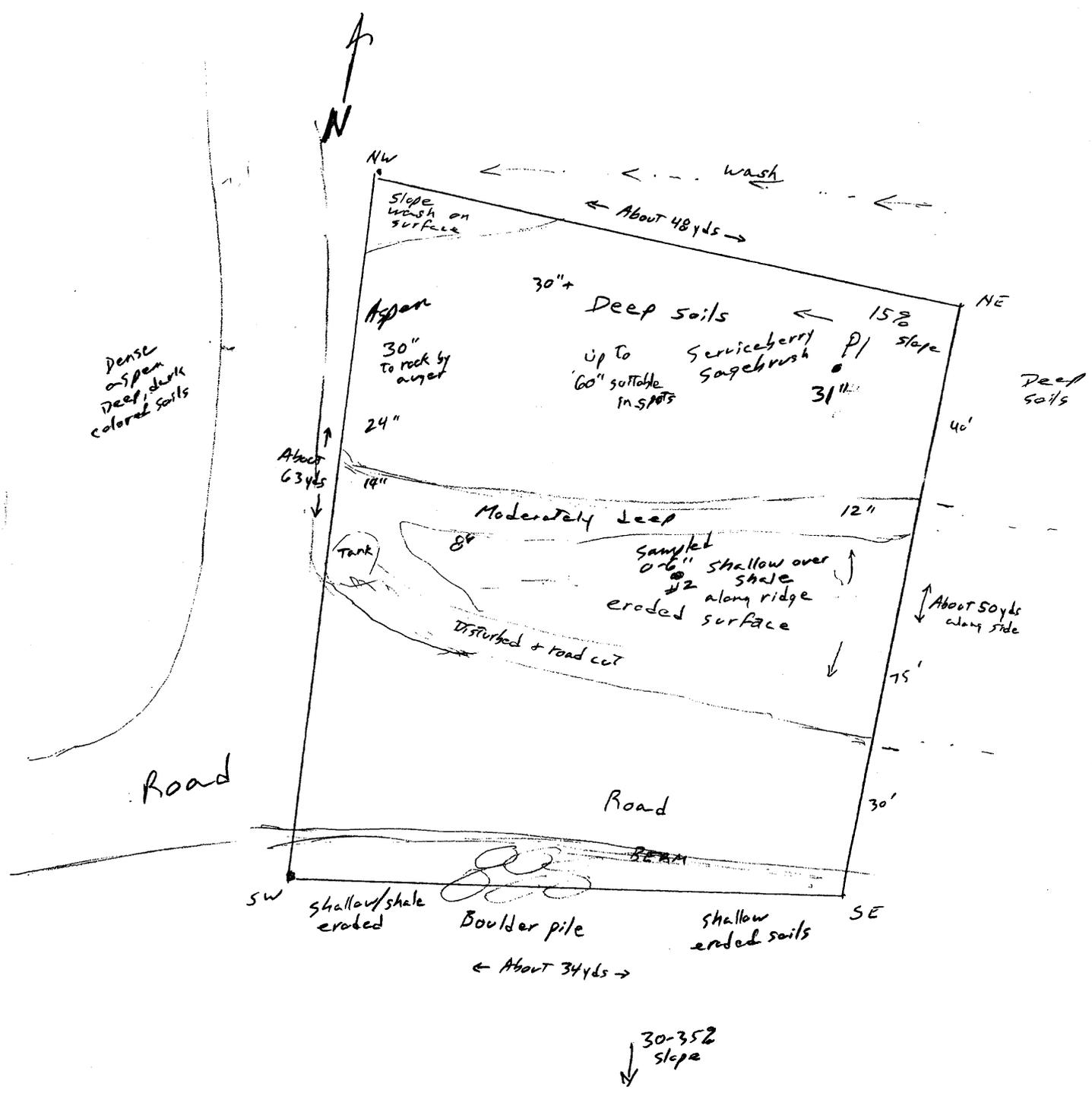
surface configuration looking E to West



Most of the area has weathered shale at 6 to 14 inches in depth

G-17

Notes: 10-3-05 DML



Field Soil Descriptions

Field Soil Profile Description Notations

This is a guide to assist in understanding the notations on the soil description forms. These are not all inclusive but are meant to apply to common situations in the mountains and foothills of central Utah.

Horizon:

Standard letter designations used for soil layers. Commonly used designations are:

A	Surface layer usually of dark color due to accumulation of organic matter; topsoil.
B	Altered soil layer, often associated with subsoil. BT – Increase in clay BK – Increase in carbonates BW – Color or structure change
C	Relatively unaltered parent materials from which the soils have formed.
R	Hard bedrock; as sandstone
CR	Soft bedrock; as shale

A "B" horizon may have dark colors and have high to moderate amounts of organic matter but be designated as a "B" horizon due to soil changes as noted above.

Depth:

Depth interval of the soil layer. Usually expressed in inches unless noted otherwise.

Color:

Dry and moist colors are based on the Munsell Soil Color Chart and give the hue, value, and chroma. Connotative color descriptions may be added.

Texture:

Texture and texture modifier abbreviations

S	Sand	SCL	Sandy	CB	Cobbly	GR	Gravelly
LS	Loamy Sand	CL	Clay Loam	CBV	Very Cobbly	GRV	Very Gravelly
SL	Sandy Loam	SICL	Silty Clay Loam	CBX	Extremely Cobbly	GRX	
L	Loam	SIC	Silty Clay	CN	Channery	SH	Shaley
SIL	Silt Loam	C	Clay	CNV	Very Channery		
SI	Silt			CNX	Extremely Channery		

Structure:

<u>Grade</u>	<u>Size</u>	<u>Type</u>	
W	Weak	PL	Platy
M	Moderate	GR	Granular
S	Strong	SBK	Subangular Blocky
		ABK	Angular Blocky
		PR	Prismatic
		W	Weak Massive
		S	Strong Massive
		SG	Single Grained

Consistency:	<u>Dry</u>		<u>Moist</u>		<u>Wet</u>	
	LO	Loose	LO	Loose	NS	Non Sticky
	SO	Soft	VFR	Very Friable	SS	Slightly Sticky
	SH	Slightly Hard	FR	Friable	S	Sticky
	H	Hard	FI	Firm	VS	Very Sticky
	VH	Very Hard	VFI	Very Firm	NP	Non Plastic
	EH	Extremely Hard	EFI	Extremely Firm	SP	Slightly Plastic
				P	Plastic	
				VP	Very Plastic	

Reaction:	<u>Effervescence (10% HCL)</u>	<u>pH</u>	<u>Reaction Class</u>	
		5.1 – 5.5	Strongly Acid	
		5.6 – 6.0	Moderately Acid	
	EO	Non-Effervescent	6.1 – 6.5	Slightly Acid
	SE	Slightly Effervescent	6.6 – 7.3	Neutral
	EM	Moderately Effervescent	7.4 – 7.8	Mildly Alkaline
	ES	Strongly Effervescent	7.9 – 8.4	Moderately Alkaline
EV	Violently Effervescent	8.5 – 9.0	Strongly Alkaline	
		> 9.0	Very Strongly Alkaline	

Horizon Boundaries:

Distinctness

- A Abrupt (<2 cm thick)
- C Clear (2 to 5 cm thick)
- G Gradual (5 to 15 cm thick)
- D Diffuse (>15 cm thick)

Topography

- S Smooth (the boundary is a plane with few or no irregularities)
- W Wavy (the boundary has undulations in which depressions are wider than they are deep).
- I Irregular (the boundary has pockets that are deeper than they are wide)
- B Broken (at least one of the horizons or layers separated by the boundary is discontinuous and the boundary is interrupted).

Rock Fragments:

Expressed in percent by volume by size.

GR	Gravel	BL	Boulders
CB	Cobbles	CN	Channers
ST	Stones	FL	Flagstone

Roots: Roots are described in terms of quantity and size. Quantity is given first followed by the size class.

<u>Quantity</u>		<u>Size</u>	
F	Few	VF	Very Fine
C	Common	F	Fine
M	Many	M	Medium
		CO	Course

Quantity classes of roots are defined in terms of numbers of each size per unit area. One (1) square centimeter for very fine and fine roots and one (1) square decimeter for medium and coarse roots.

Few: Less than 1 per unit area of the specified size
Common: 1 to 5 per unit area of the specified size
Many: more than 5 per unit area of the specified size

The size classes are:

Very Fine: Less than 1 mm in diameter
Fine: 1 to 2 mm in diameter
Medium: 2 to 5 mm in diameter
Coarse: 5 mm or larger in diameter
Roots larger than 10 mm in diameter may be described separately.

DEGAS DRILL HOLE SITE

Soil type *Similar to Tragic + Midfork*

File No. *G-15*

Area	<i>Pace Canyon, Dugout Canyon Mine</i>		Carbon Co., UT	Date	<i>10/10/55</i>	By:	<i>D. Larsen</i>	Stop No.	<i>P1</i>
Classification	<i>Loamy-skeletal, mixed, Typic Argibarell (Cryell)</i>								
Location	<i>Degas Borehole Site G-15, above road, North 1/2</i>			<i>SE 1/4, NE 1/4, S 19, T 135, R 13 E</i>					
N. veg. (or crop)	<i>Douglas-fir, maple, snowberry</i>						Climate		
Parent material	<i>Colluvium</i>						<i>Border Frigid/Cyclic USTic</i>		
Physiography	<i>Canyon slope</i>								
Relief	<i>Stage, single</i>			Drainage			<i>Well drained</i>		
Elevation	<i>~ 7600</i>			Gr. water			Stoniness		
Slope	<i>45%</i>			Moisture					
Aspect	<i>SE</i>			Root distrib.			% Clay *		
Erosion				% Coarse fragments *			% Coarser than V.F.S. *		
Permeability	<i>Moderate</i>								
Additional notes									

Fairly dense vegetation shaded spot

*Sampled 0-14
14-24*

*Surface 0-10% boulders
10% stone
10% cobble
10% gravel
in surface soil*

*Border line to skeletal and argillic
about 35% rock fragments*

* Control section average

Horizon	Depth	Color		Texture	Structure	Consistence			Reac-tion	Bound-ary	% Rock Frag-ments	Root Dist-ribution
		Dry	Moist			Dry	Moist	Wet				
<i>O</i>	<i>0-10</i>	<i>Look maple leaves and needles at surface Decomposing leaves, needles, & twigs</i>										
<i>A1</i>	<i>0-3</i>		<i>7.5YR 3/2</i>	<i>L</i>	<i>WGR</i>		<i>FR</i>	<i>S/P</i>	<i>em</i>	<i>CS</i>	<i>10% 5% 5%</i>	<i>M L.F</i>
<i>A2</i>	<i>3-10</i>		<i>10YR 7/3</i>	<i>L</i>	<i>MCA MFSBK</i>	<i>SH</i>	<i>FR</i>	<i>S/P</i>	<i>em</i>	<i>CW</i>	<i>"</i>	<i>Many F.M CC</i>
<i>AB</i>	<i>10-14</i>		<i>10YR 3/3-4/3</i>	<i>L- CL</i>	<i>"</i>	<i>SH</i>	<i>FR FI</i>	<i>S/P</i>	<i>CS</i>	<i>CW</i>	<i>"</i>	<i>"</i>
<i>BT</i>	<i>14-24</i>		<i>10YR 4/3</i>	<i>CL</i>	<i>MAF SBK</i>	<i>SH- H</i>	<i>FI</i>	<i>S/P</i>	<i>CS</i>		<i>10% 10% 10%</i>	<i>CF- M</i>
		<i>very stony (check frag)</i>										
		<i>7359 below</i>										

Note

Soil type

File No. *G-15*

Area	<i>Pace Canyon, Dugout Canyon Mine Carbon Co., UT</i>		Date	<i>10/7/65</i>	By:	<i>D. Larsen</i>	Stop No.	<i>P 3</i>
Classification	<i>Loamy-skeletal mixed, Pacific Argborall (Argborall)</i>							
Location	<i>SW portion of G-15, up on slope</i>				<i>SE 1/4, NE 1/4 S15, T13S, R13E</i>			
N. veg. (or crop)	<i>Maple, D-Fir</i>		Climate		<i>Frigid - near Coyle</i>			
Parent material	<i>Colluvium</i>							
Physiography	<i>Canyon slope, lower 1/3</i>							
Relief	<i>Single - steep</i>	Drainage	<i>Well drained</i>			Salt or alkali		
Elevation	<i>about 7600 feet</i>	Gr. water				Stoniness		
Slope	<i>45%</i>	Moisture						
Aspect	<i>SE</i>	Root distrib.				% Clay *		
Erosion		% Coarse fragments *				% Coarser than V.F.S. *		
Permeability	<i>Moderate</i>							
Additional notes								

* Control section average

Horizon	Depth	Color		Texture	Structure	Consistence			Reac-tion	Bound-ary	% Rock Frag-ments	Root Dist-ribution
		Dry	Moist			Dry	Moist	Wet				
<i>A1</i>	<i>0-5</i>		<i>10YA 3/2</i>	<i>L</i>	<i>MFGA</i>	<i>SH</i>	<i>FA</i>	<i>S/P</i>	<i>em</i>	<i>cw</i>	<i>20%</i>	
<i>A2</i>	<i>5-14</i>		<i>10YA 3/2-3/3</i>	<i>L</i>	<i>MMGA</i>	<i>SH</i>	<i>FA</i>	<i>S/P</i>		<i>cw</i>		
<i>A3</i>	<i>14-21</i>		<i>10YR 3/3</i>	<i>E</i>	<i>MFA-5Bk</i>	<i>H</i>	<i>F1</i>	<i>S/P</i>			<i>20%</i> <i>20%</i>	
<i>B</i>	<i>21-26</i>		<i>10YA 4/3</i>	<i>L-cl</i>		<i>H</i>	<i>F1</i>	<i>S/P</i>			<i>"</i>	
											<i>></i>	

Soil type Loze or Sanchert

File No. 617-P1

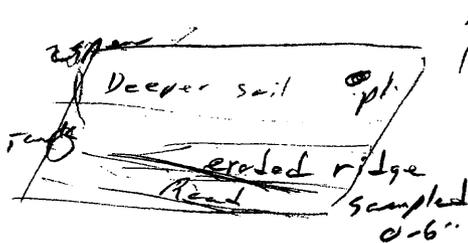
Area <u>Pace Canyon, Dugout Canyon Mine</u>	Carbon Co., UT	Date <u>10/3/65</u>	By: <u>D. Larsen</u>	Stop No.
Classification <u>fine-loamy, mixed, Pachic Gericryell or Pachic Argicryell</u>				
Location <u>Degas barabala site 617, NE edge</u>	<u>SE 1/4, S18, T13S, R13E</u>			
N. veg. (or crop) <u>Snowberry, service berry, sagebrush</u>	Climate <u>Cryic / Figid</u>			
Parent material <u>Sandstone and shale</u>	near border			
Physiography <u>Slight bench off from a ridge line</u>				
Relief <u>Mod steep</u>	Drainage	Salt or alkali		
Elevation <u>about 8200'</u>	Gr. water	Stoniness		
Slope <u>15%</u>	Moisture			
Aspect <u>WNW</u>	Root distrib.	% Clay*		
Erosion <u>Slight</u>	% Coarse fragments*	% Coarser than V.F.S.*		
Permeability <u>Moderate - Moderately slow</u>				

Additional notes Upper 6 inches has some slope wash with higher carbonates

Very sticky when wet below 14"

Rock fragments are sandstone

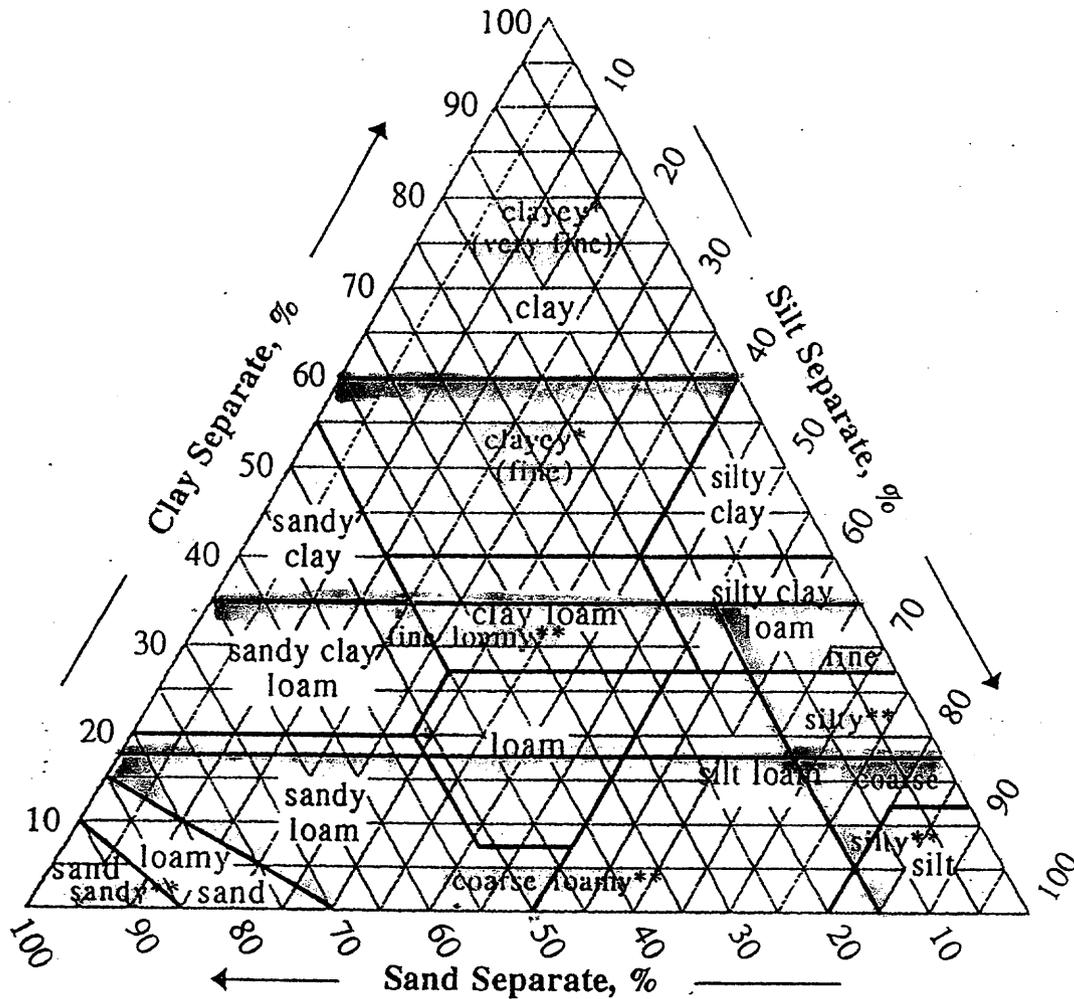
Augered below 31 inches



* Control section average

Horizon	Depth inches	Color		Texture	Structure	Consistence			Reaction	Boundary	% Rock Fragments	Root Distribution	Carb.
		Dry	Moist			Dry	Moist	Wet					
A	0-6	10YR 4/3 - 5/3	7.5YR 3/3 - 10YR 3/3	SIL-L	WEFB	SO-SH	FR	S/P	em	CS	5gr	mvh CF	
BT1	6-14		7.5YR 3/2	SICL-heavy SIL	MMSBK	SH	F1	S/P	eo	GS	"	cf	
BT2	14-31		"	SICL	SMSBK	SH	F1	VS/P	eo	"	"		
BT3	31-45		10YR 3/3 - 4/3 to 7.5YR 3/3	SICL			F1	VS/P		"	10gr		
BK	45-60		Overall slight reddish color between 7.5YR and 10YR	SICL			F1	VS/P	em-es				Few light spots

GUIDE FOR TEXTURAL CLASSIFICATION IN SOIL FAMILIES



- * Clay-size carbonate is treated as silt.
- ** Very fine sand (0.05 - 0.1 is treated as silt for family groupings; coarse fragments are considered the equivalent of coarse sand in the boundary between the silty and loamy classes.

COMPARISON OF PARTICLE SIZE SCALES

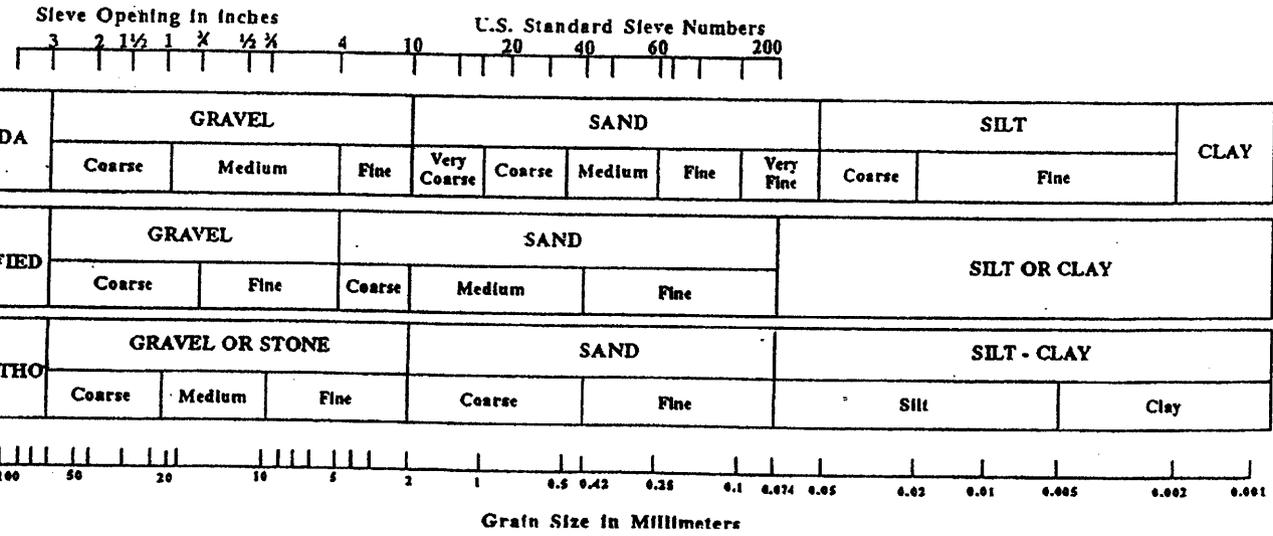
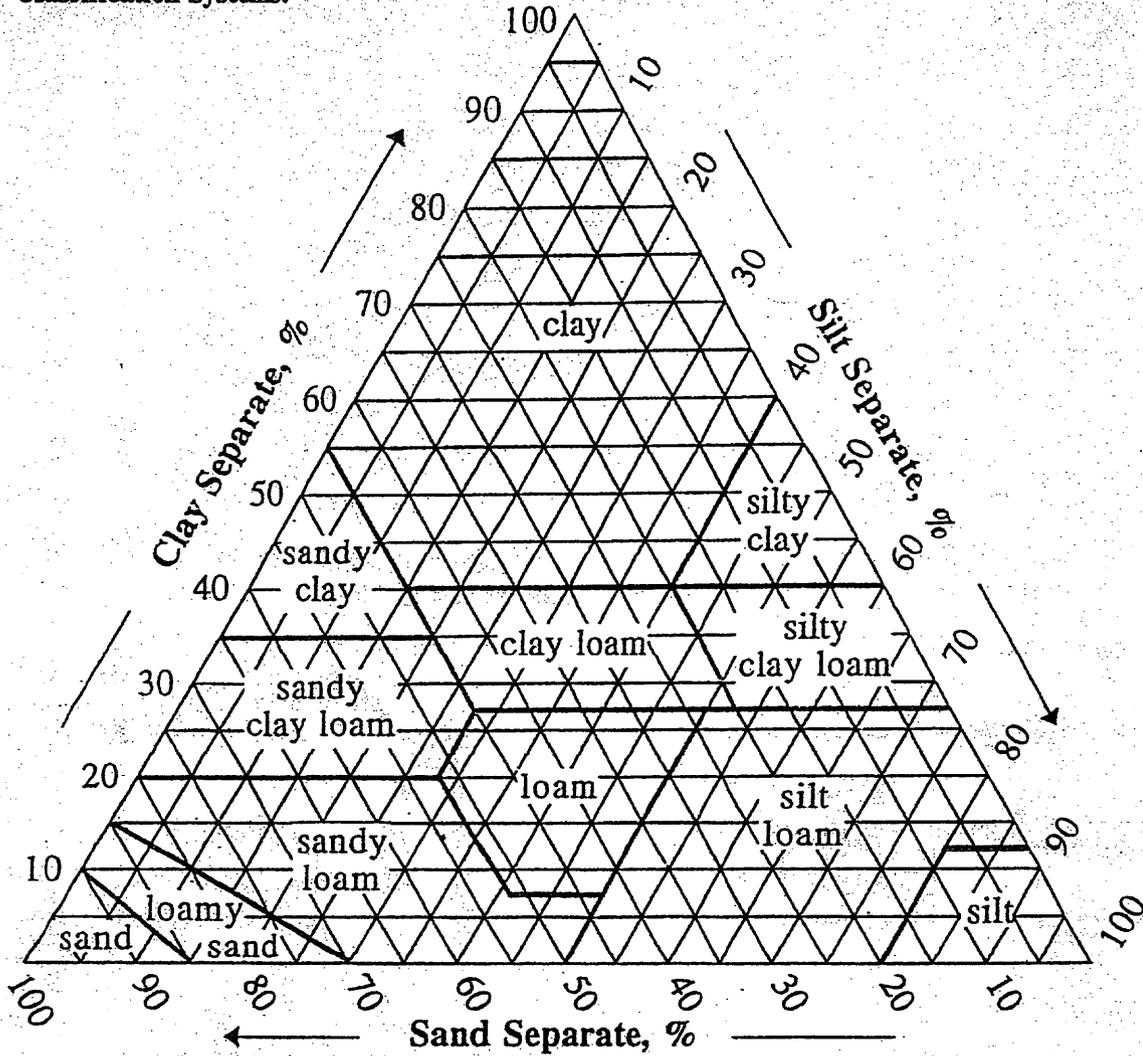
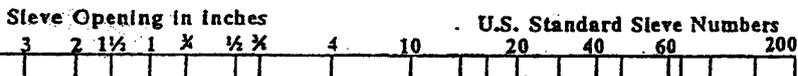


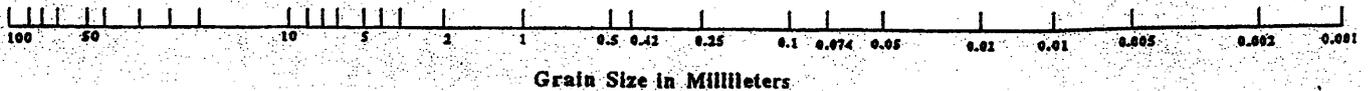
Exhibit 618-8. Texture Triangle and Particle-Size Limits of AASHTO, USDA, and Unified Classification Systems.



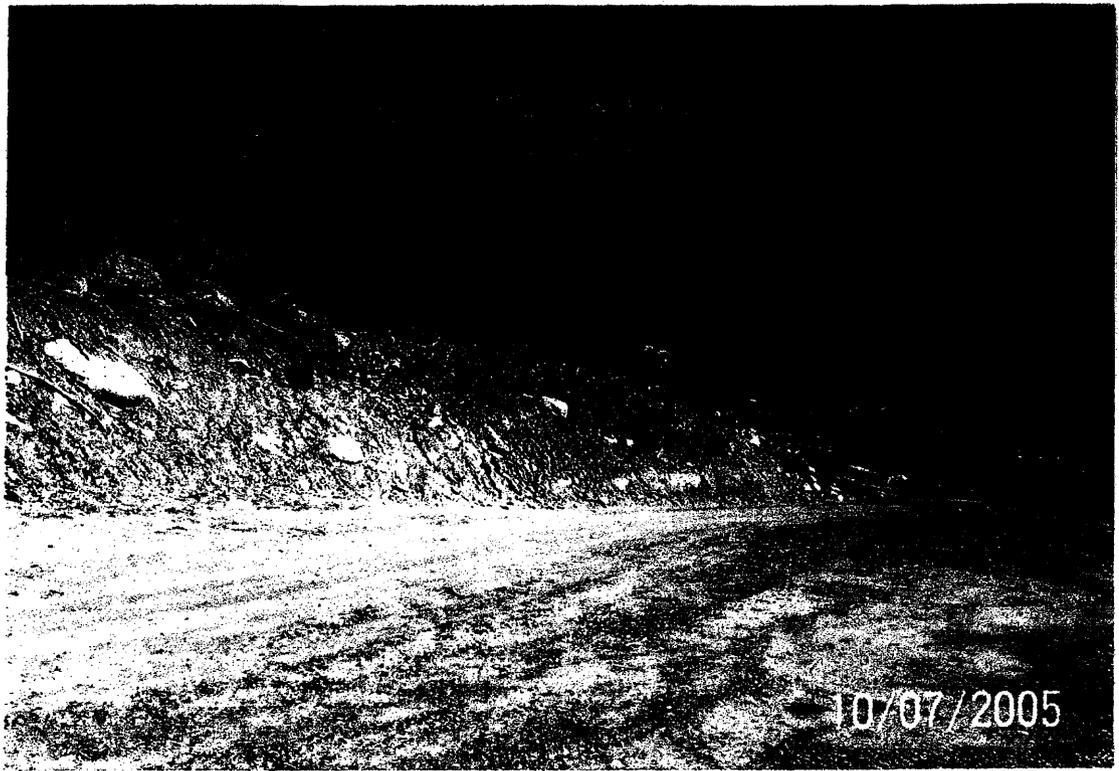
COMPARISON OF PARTICLE SIZE SCALES



USDA	GRAVEL			SAND					SILT		CLAY
				Very Coarse	Coarse	Medium	Fine	Very Fine			
UNIFIED	GRAVEL		SAND			SILT OR CLAY					
	Coarse	Fine	Coarse	Medium	Fine						
AASHTO	GRAVEL OR STONE			SAND		SILT - CLAY					
	Coarse	Medium	Fine	Coarse	Fine	Silt		Clay			

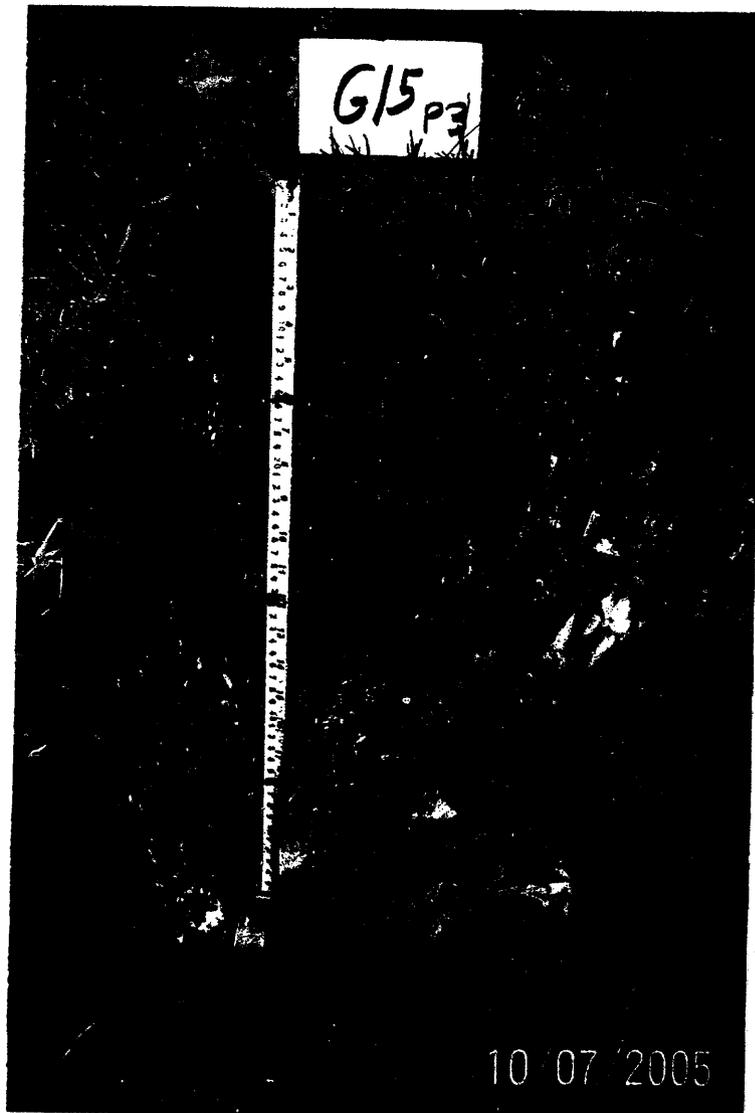
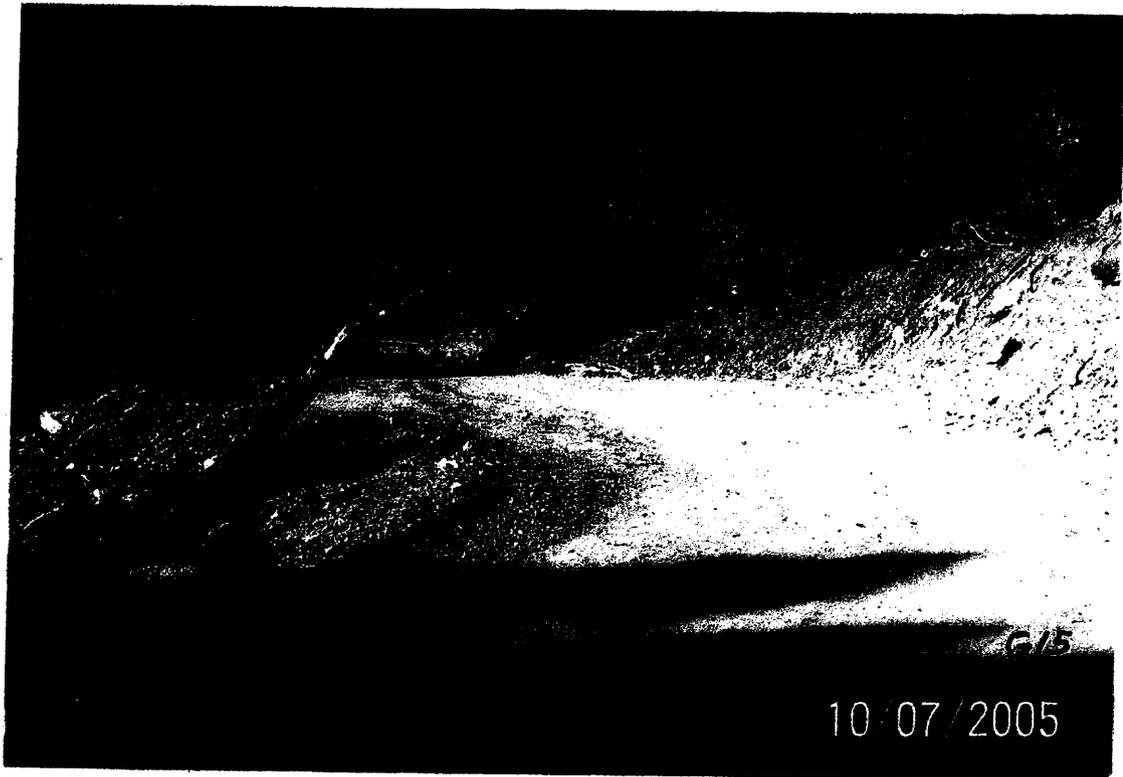


Site and Soil Photographs



G-15

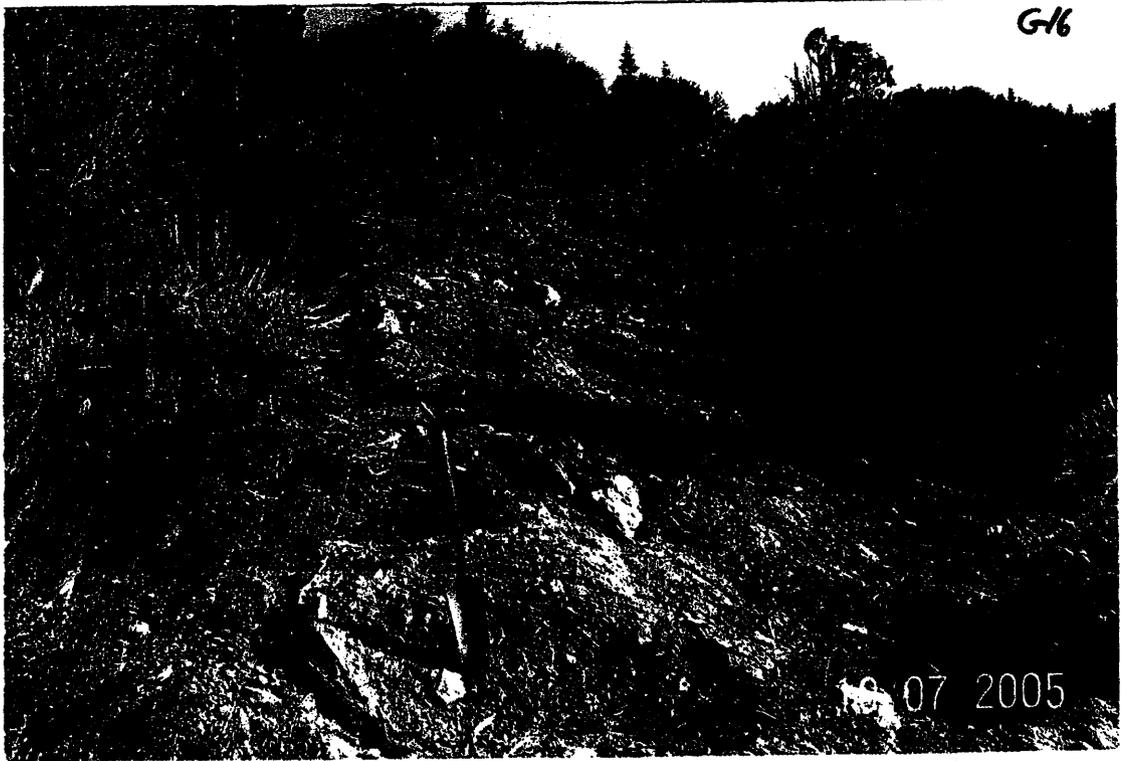




G-15



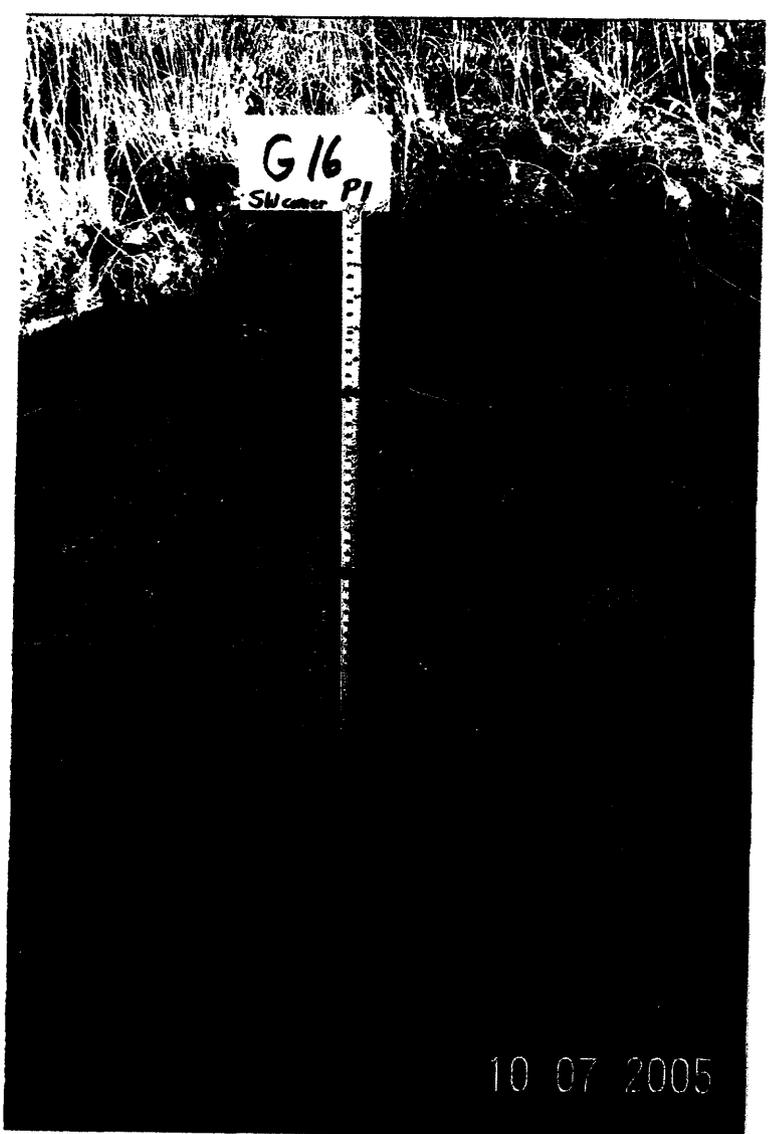
G-16





10 07 2005

G-16



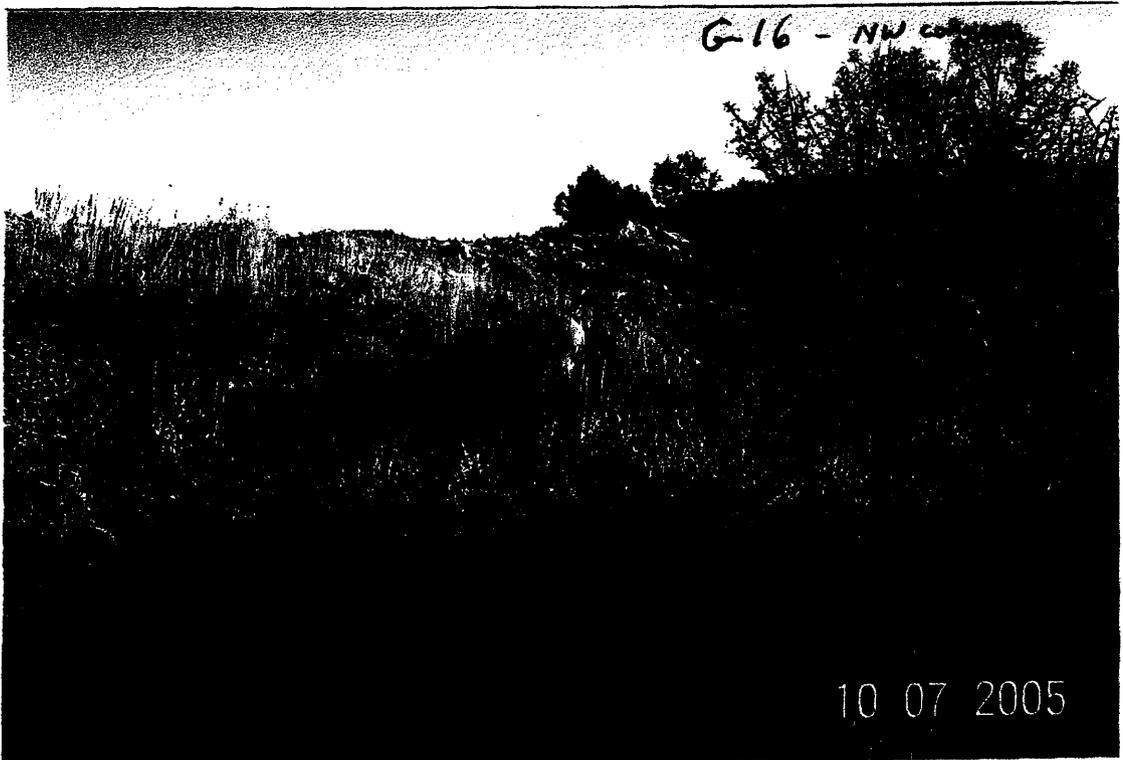
G16
SI center P1

10 07 2005



10 07 2005

G-16



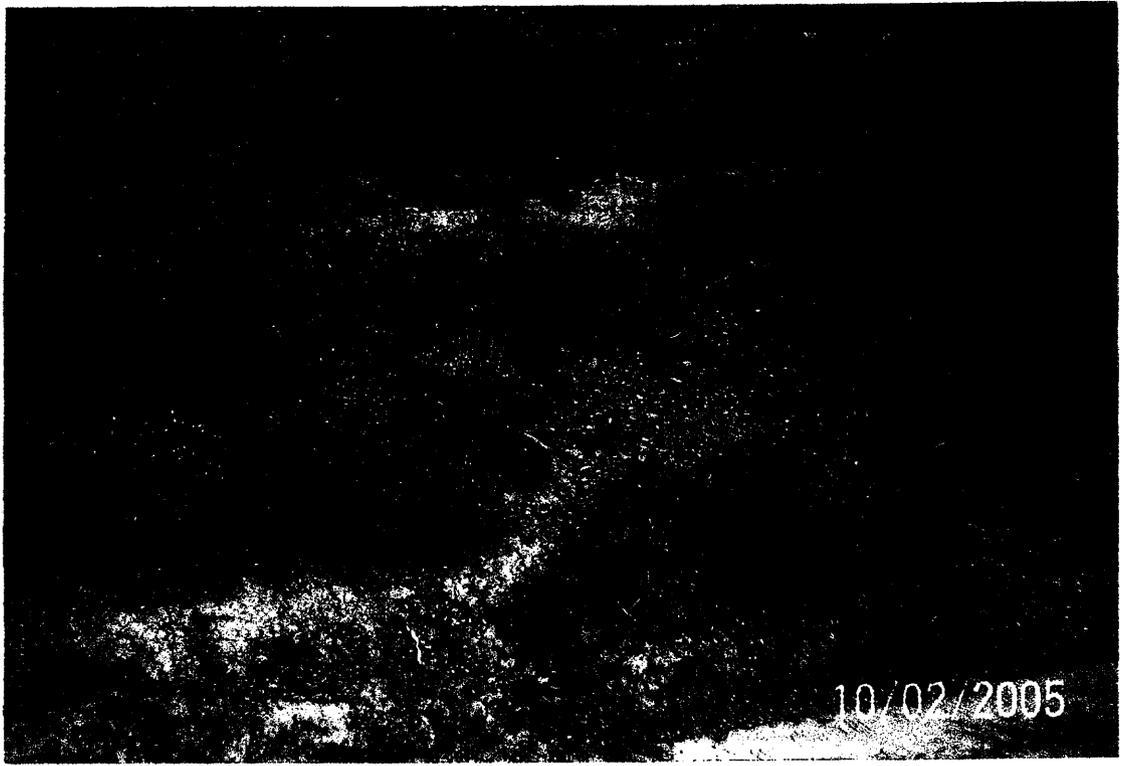
G-16 - NW corner

10 07 2005

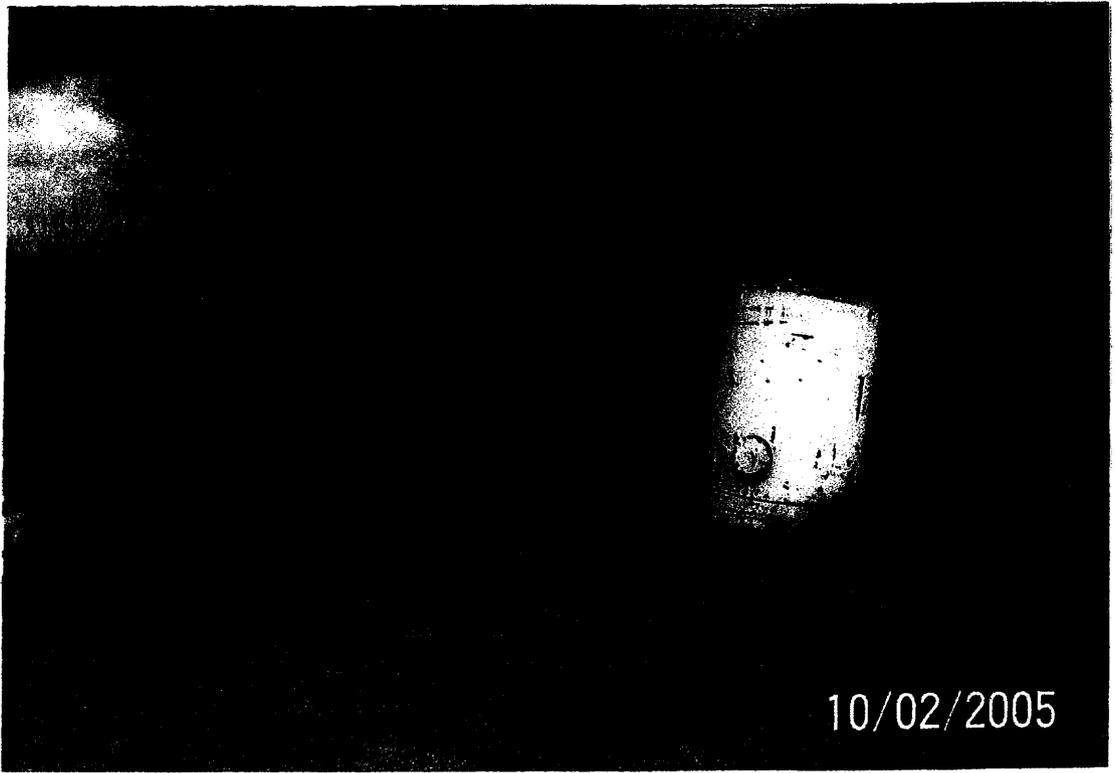


10/02/2005

G-17

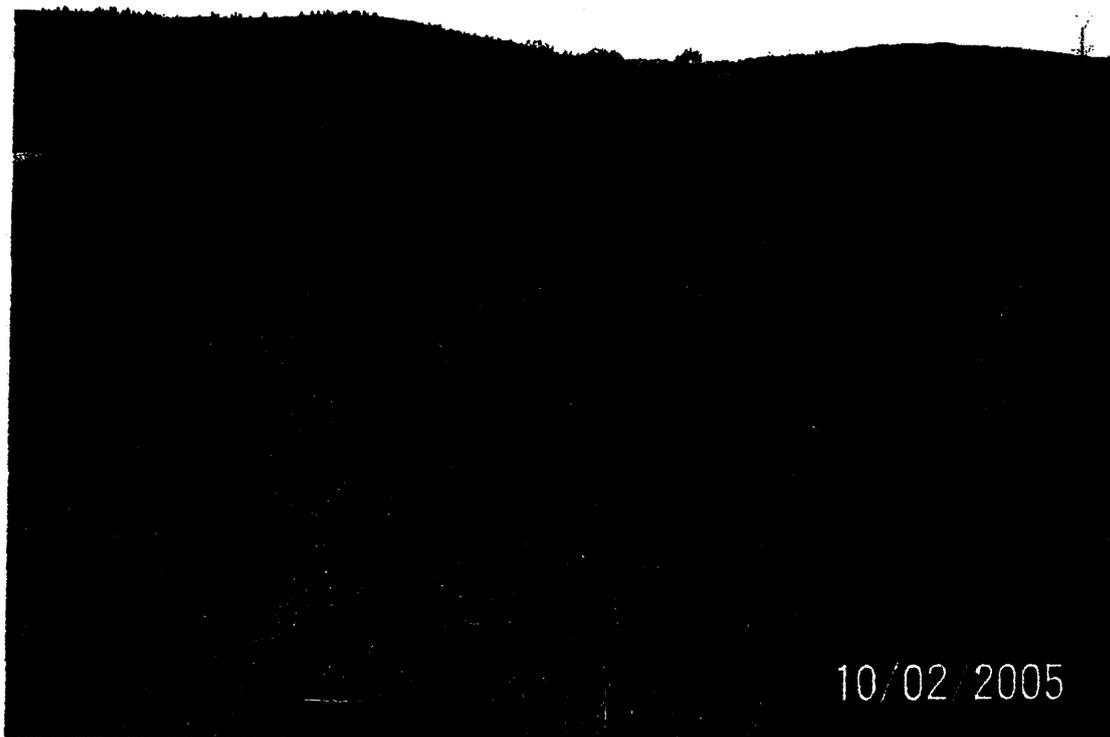


10/02/2005



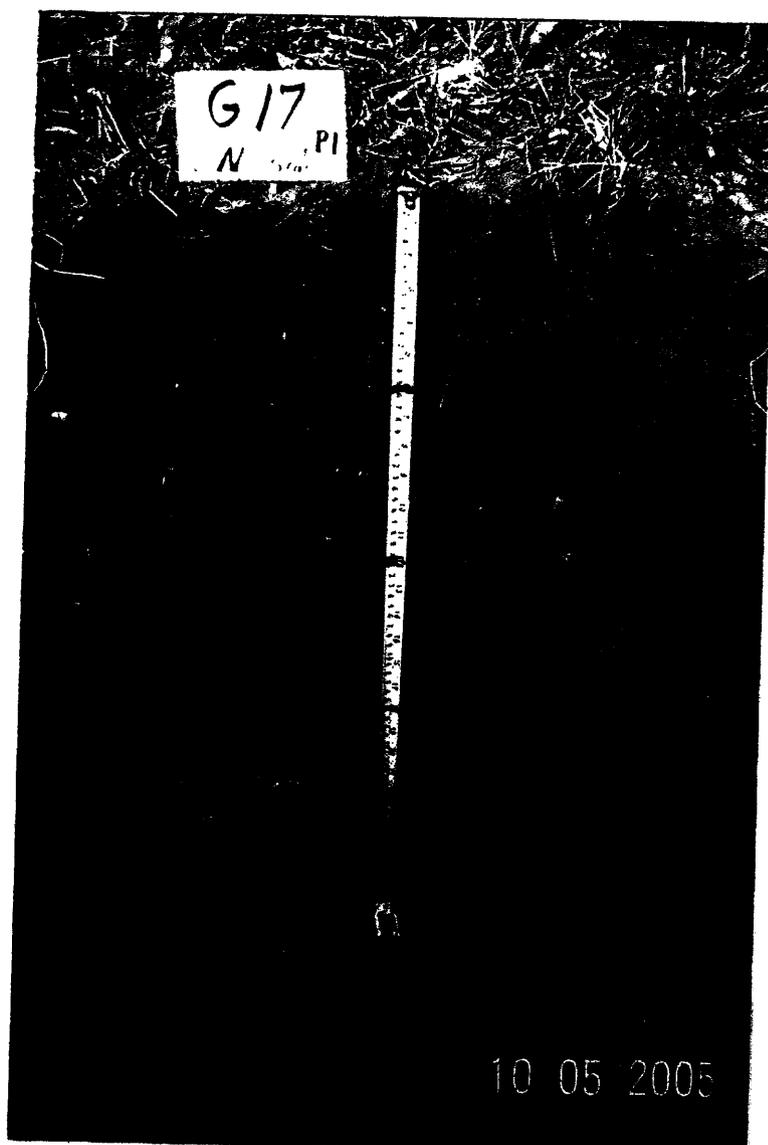
G-17





10/02/2005

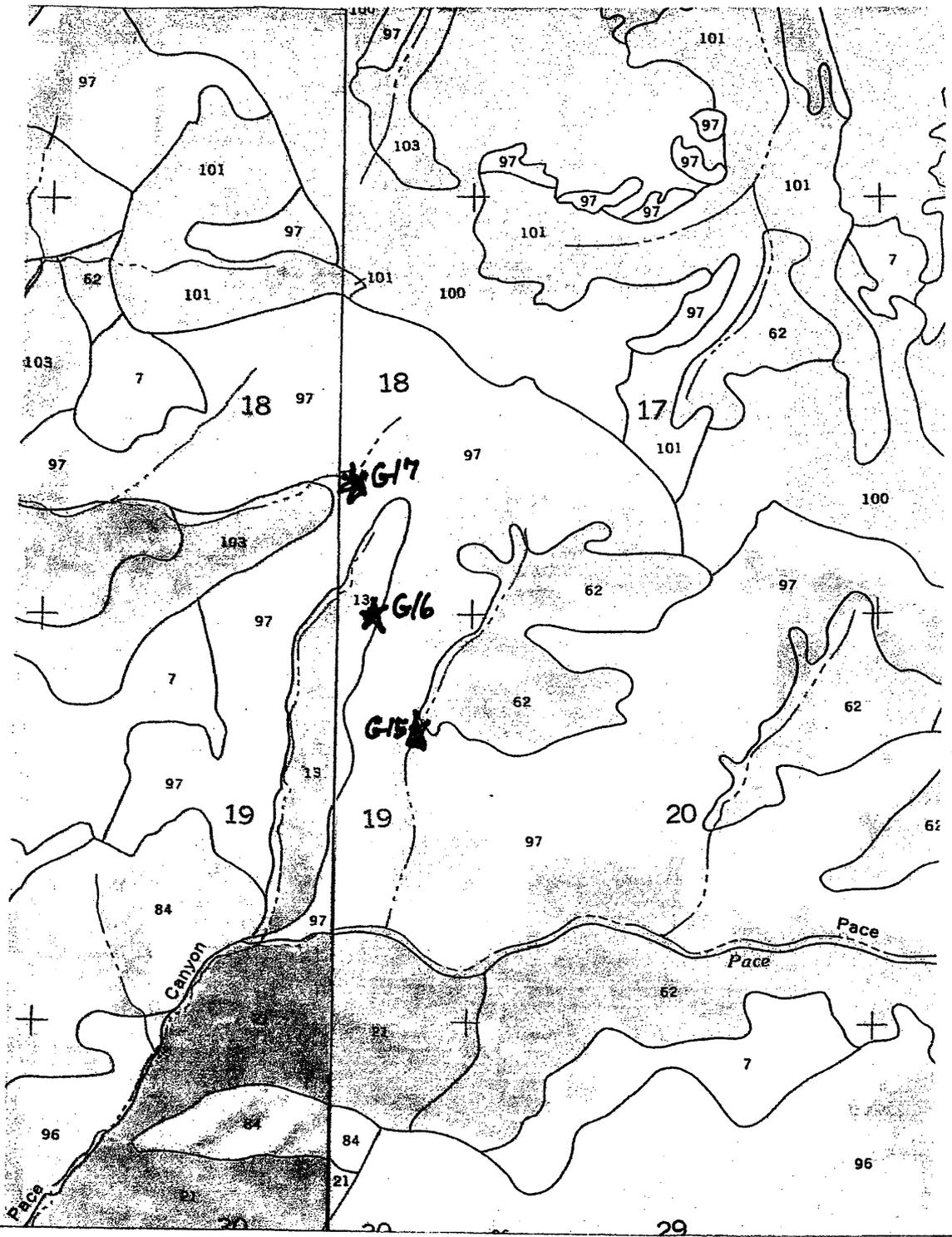
G-17



G17
N PI

10 05 2005

Maps
Location Map
&
General Soil Survey Map



Soil Survey of Carbon Area, Utah; USDA Soil Conservation Service, 1988

11—Cabba family, 40 to 70 percent slopes. This shallow, well drained soil is on mountain slopes. It is in the vicinity of Wattis and in the Deadman Canyon area. It formed in colluvium derived dominantly from sandstone and shale. Slope is mainly 40 to 70 percent, but it is 30 to 50 percent in about 25 percent of the unit. Slopes are 100 to 200 feet long, are concave or convex, and dominantly have south aspect. The present vegetation in most areas is mainly pinyon, juniper, Indian ricegrass, Salina wildrye, and birchleaf mountainmahogany. Elevation is 7,200 to 8,600 feet. The average annual precipitation is 14 to 16 inches, the average annual air

temperature is 42 to 45 degrees F, and the average freeze-free period is 80 to 120 days.

Typically, the surface layer is light yellowish brown extremely stony fine sandy loam about 2 inches thick. The underlying material to a depth of 15 inches is light yellowish brown gravelly loam over soft sandstone. Depth to sandstone ranges from 10 to 20 inches.

Included in this unit are about 10 percent soils that are similar to this Cabba family soil but have bedrock at a depth of 20 to 40 inches and about 5 percent Rock outcrop.

Permeability of this Cabba family soil is moderate. Available water capacity is about 1.5 to 3.0 inches. Water supplying capacity is 3.5 to 6.0 inches. Effective rooting depth is 20 to 40 inches. The organic matter content of the surface layer is 1 to 3 percent. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used as wildlife habitat, rangeland, and woodland and for mining operations.

The potential vegetation on the Cabba family soil includes an overstory of pinyon and Utah juniper with a canopy of 30 percent. The understory vegetation is 45 percent grasses, 10 percent forbs, and 45 percent shrubs. Among the important plants are birchleaf mountainmahogany, black sagebrush, Salina wildrye, and needleandthread.

The site index for pinyon and Utah juniper is 50. Average yield is 6 cords of wood per acre. The potential is poor for production of posts or Christmas trees. This unit is severely limited for the harvesting of wood products because of the steepness of slope and the hazard of erosion. If wood products are harvested, the slash should be left scattered on the surface to protect the soil from erosion.

This unit is not grazeable by livestock because of the steepness of slope.

This map unit is in capability subclass VIIIe, nonirrigated, and in the Upland Very Steep Stony Loam (Pinyon-Utah Juniper) woodland site.

26—Doney family, 50 to 70 percent slopes. This moderately deep, well drained soil is on mountain slopes. It is in the vicinity of Bruin Point and Price Canyon. It formed in residuum and colluvium derived dominantly from siltstone and shale. Slopes are 100 to 300 feet long, are slightly concave, and dominantly have south and west aspects. The present vegetation is mainly Salina wildrye, bluebunch wheatgrass, mountain big sagebrush, snowberry, and lupine. Elevation is 8,100 to 9,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 38 to 45 degrees F, and the average freeze-free period is 70 to 100 days.

Typically, the surface layer is brown stony loam about 4 inches thick. The subsoil is pale brown loam 11 inches thick. The substratum to a depth of 35 inches is light gray loam over shale. Depth to weathered shale ranges from 20 to 40 inches.

Included in this unit are about 10 percent Pathead extremely stony loam on side slopes, 5 percent Rottulee family loam in drainageways, and small areas of a Midfork family soil that has slopes of 50 to 70 percent and has north and east aspects, Rock outcrop that occurs as ledges, and Curecanti family soil in the Price Canyon area.

Permeability of the Doney family soil is moderate. Available water capacity is about 4.5 to 6.0 inches. Water supplying capacity is 7 to 11 inches. Effective rooting depth is 20 to 40 inches. The organic matter content of the surface layer is 1 to 3 percent. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used as wildlife habitat and rangeland.

The potential plant community on the Doney family soil is 60 percent grasses, 15 percent forbs, and 25 percent shrubs. Among the important plants are Salina wildrye, prairie junegrass, bluegrass, and snowberry.

This unit is not grazeable by livestock because of the steepness of slope and the hazard of erosion.

This map unit is in capability subclass VIIe, nonirrigated, and in the Mountain Very Steep Loam (Saline Wildrye) range site.

unit is on mountain slopes in the area of Price Canyon. Slopes are 40 to 70 percent, 300 to 400 feet long, and plane to concave. Elevation is 7,000 to 9,000 feet. The average annual precipitation is about 16 to 20 inches, the average annual air temperature is 38 to 45 degrees F, and the average freeze-free period is 60 to 100 days.

This unit is 30 percent Curecanti family loam, 50 to 70 percent slopes; 25 percent Pathead extremely bouldery fine sandy loam, 40 to 70 percent slopes; 25 percent Pathead extremely stony loam, 50 to 70 percent slopes; and 20 percent other soils. About 10 percent of the unit has slopes of 40 to 50 percent. The Curecanti family soil has southwest and southeast aspects and is along small stabilized drainageways, and the other soils are intermingled throughout the unit.

Included in this unit are about 10 percent Perma family soils in drainageways, 7 percent Midfork family soils that have slopes of 50 to 70 percent and are in the deeper drainageways, and small areas of Senchert family soils in concave areas.

The Curecanti family soil is very deep and well drained. It formed in colluvium derived dominantly from sandstone and shale. The present vegetation is mainly Gambel oak, snowberry, slender wheatgrass, and Sandberg bluegrass.

Typically, the upper part of the surface layer is dark grayish brown loam about 7 inches thick and the lower part is brown very stony loam about 8 inches thick. The subsurface layer is very pale brown very stony loam about 5 inches thick. The subsoil to a depth of 60 inches or more is pale brown very stony loam.

Permeability of the Curecanti family soil is moderate. Available water capacity is about 5.0 to 6.5 inches. Water supplying capacity is 8 to 12 inches. Effective rooting depth is 60 inches or more. The organic matter content of the surface layer is 3 to 5 percent. Runoff is rapid, and the hazard of water erosion is severe.

The Pathead extremely bouldery fine sandy loam is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone and shale. The present vegetation is mainly curleaf mountainmahogany, Salina wildrye, and Gambel oak.

Typically, the surface layer is pale brown extremely bouldery fine sandy loam about 4 inches thick. The underlying material to a depth of 38 inches is pale brown and very pale brown very stony fine sandy loam. Depth to hard sandstone ranges from 20 to 40 inches.

Permeability of this Pathead soil is moderate. Available water capacity is about 1.3 to 3.0 inches. Water supplying capacity is 4.0 to 8.5 inches. Effective rooting depth is 20 to 40 inches. The organic matter content of the surface layer is 1 to 3 percent. Runoff is rapid, and the hazard of water erosion is slight.

The Pathead extremely stony loam is moderately deep and well drained. It formed in colluvium derived dominantly from sandstone and shale. The present vegetation is mainly Salina wildrye, black sagebrush, and winterfat.

Typically, the surface layer is brown extremely stony loam about 3 inches thick. The underlying material to a depth of 26 inches is pale brown very cobbly loam. Sandstone is at a depth of 20 to 40 inches.

Permeability of this Pathead soil is moderate. Available water capacity is about 1 to 2 inches. Water supplying capacity is 3.5 to 5.5 inches. Effective rooting depth is 20 to 40 inches. The organic matter content of the surface layer is 1 to 3 percent. Runoff is rapid, and the hazard of water erosion is slight.

This unit is used as rangeland, wildlife habitat, and recreation areas.

The potential plant community on the Curecanti family soil is 35 percent grasses, 10 percent forbs, and 55

bouldery fine sandy loam is 35 percent grasses, 15 percent forbs, and 50 percent shrubs. Among the important plants are curleaf mountainmahogany, Salina wildrye, Utah serviceberry, and snowberry.

This soil is not grazeable by livestock because of the steepness of slope.

The potential plant community on the Pathead extremely stony loam is 60 percent grasses, 15 percent forbs, and 25 percent shrubs. Among the important plants are Salina wildrye, prairie junegrass, bluegrass, and snowberry.

This soil is not grazeable by livestock because of the steepness of slope and the hazard of erosion.

This map unit is in capability subclass Vile, nonirrigated. The Curecanti family soil is in the Mountain Very Steep Loam (Oak) range site. The Pathead very bouldery fine sandy loam is in the Mountain Very Steep Stony Loam (Curleaf Mountainmahogany) range site. The Pathead extremely stony loam is in the Mountain Very Steep Loam (Salina Wildrye) range site.

47—Guben-Rock outcrop complex. This map unit is on mountain slopes. It is in the Book Cliffs, north of Helper and west of the Green River. Slopes are 50 to 80 percent, 100 to 200 feet long, and plane to convex. The present vegetation is mainly Douglas-fir, serviceberry, birchleaf mountainmahogany, mockorange, and western wheatgrass. Elevation ranges from 5,000 to 9,500 feet but is dominantly 6,000 to 7,500 feet. The average annual precipitation is about 16 to 20 inches, the average annual air temperature is 38 to 45 degrees F, and the average freeze-free period is 60 to 100 days.

This unit is 55 percent Guben extremely bouldery fine sandy loam, 50 to 80 percent slopes; 20 percent Rock outcrop, and 25 percent other soils. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 12 percent Midfork family soils in concave areas and 10 percent Comodore very stony fine sandy loam, moist, intermingled throughout the unit. Also included are small areas of Perma family soils that have slopes of 60 to 80 percent.

The Guben soil is very deep and well drained. It formed in colluvium derived dominantly from sandstone and shale. Typically, the surface is covered with a mat of partially decomposed needles, twigs, and leaves about 0.5 inch thick. The surface layer is brown extremely bouldery fine sandy loam about 7 inches thick. The subsoil is brown very stony loam about 17 inches thick. The substratum to a depth of 60 inches or more is light brown very stony loam.

Permeability of the Guben soil is moderate. Available water capacity is about 3.5 to 5.0 inches. Water supplying capacity is 8.5 to 12.0 inches. Effective rooting depth is 60 inches or more. The organic matter content of the surface layer is 3 to 5 percent. Runoff is moderate, and the hazard of water erosion is slight.

Rock outcrop consists of areas of exposed bedrock, dominantly interbedded sandstone and shale. It occurs as ledges.

This unit is used as rangeland, wildlife habitat, woodland, and recreation areas.

The potential vegetation on the Guben soil includes an overstory of Rocky Mountain Douglas-fir and pinyon with a canopy of 50 percent. The understory vegetation is 40 percent grasses, 15 percent forbs, and 45 percent shrubs. Among the important plants are Salina wildrye, wheatgrass, birchleaf mountainmahogany, and snowberry.

This unit is severely limited for harvesting wood products because of the steepness of slope, the hazard of erosion, and stones and boulders on the surface.

This unit is not grazeable by livestock because of the steepness of slope.

The Guben soil is in capability subclass VIIe, nonirrigated, and in the Mountain Very Steep Stony Loam (Douglas-fir) woodland site. Rock outcrop is in capability subclass VIIIs. It is not placed in a woodland site.

115—Trag stony loam, 30 to 60 percent slopes.

This deep, well drained soil is on mountain slopes east and west of Pleasant Valley. It formed in colluvium and alluvium derived dominantly from sandstone and shale. Slopes are 200 to 300 feet long and are concave to convex. About 75 percent of the soil has slopes of 30 to 50 percent. The present vegetation in most areas is mainly mountain big sagebrush, bluebunch wheatgrass, bitterbrush, rabbitbrush, and lupine. Elevation is 7,600 to 7,900 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 36 to 40

degrees F, and the average freeze-free period is 60 to 80 days.

Typically, the surface layer is dark grayish brown stony loam about 10 inches thick. The subsoil is dark grayish brown clay loam about 26 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown and very pale brown clay loam.

Included in this unit are about 5 percent soils that are similar to the Trag soil but have a thin surface layer, 5 percent soils that are similar to this Trag soil but have a bouldery loam surface layer, 5 percent soils that are similar to this Trag soil but have 15 to 35 percent rock fragments in the subsoil, 5 percent Falcon stony sandy loam, and 5 percent Rock outcrop.

Permeability of this Trag soil is moderate. Available water capacity is about 9.0 to 10.5 inches. Water supplying capacity is 10 to 16 inches. Effective rooting depth is 60 inches or more. The organic matter content of the surface layer is 3 to 5 percent. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as rangeland and wildlife habitat.

The potential plant community on the Trag soil is 60 percent grasses, 10 percent forbs, and 30 percent shrubs. Among the important plants are Salina wildrye, bluegrass, mountain big sagebrush, and snowberry.

If the desirable forage plants are mostly depleted, brush management and seeding can be used to improve the rangeland vegetation. Suitable brush management practices include prescribed burning, chemical spraying, and mechanical treatment.

The suitability of this unit for rangeland seeding is poor because of the steepness of slope. Plants suitable for seeding include those native to this unit and intermediate wheatgrass, smooth brome, regar brome, slender wheatgrass, and alfalfa. The suitability of the unit for grazing is poor because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated, and in the Mountain Loam (Saline Wildrye) range site.

Inter-Mountain Laboratories, Inc.

Report ID: 010509546

Soil Analysis Report

Canyon Fuel Co
Dugout Mine -Canyon Fuel

P.O. Box 1029
Wellington, UT 84542

1633 Terra Avenue
Sheridan, WY 82801

Page 1 of 6

REC'D DEC - 5 2005

Client Project ID: Dugout Canyon
Date Received: 10/12/05

Set #010509546
Report Date: 11/28/05

Lab Id	Sample Id	Depth (Inches)	pH	Saturation %	EC @ 25°C dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	SAR	Sand %	Silt %	Clay %	Texture
010509546	G-15	0 - 14	7.6	48.8	0.70	3.65	1.96	0.09	0.05	49.0	29.0	22.0	LOAM
010509547	G-15	14 - 24	7.8	43.2	0.40	2.32	0.80	0.37	0.31	42.0	30.0	28.0	CLAY LOAM
010509548	G-16	0 - 6	7.5	74.2	0.53	3.87	0.39	0.08	0.05	38.0	36.0	26.0	LOAM
010509549	G-16	6 - 12	7.7	40.7	0.38	2.82	0.41	0.13	0.11	39.0	28.0	33.0	CLAY LOAM
010509550	G-16	20 - 26	7.9	47.7	0.28	1.93	0.32	0.22	0.20	12.0	53.0	35.0	SILTY CLAY LOA
010509551	G-17 EC	0 - 6	8.0	37.2	0.32	1.86	0.39	0.16	0.15	18.0	56.0	26.0	SILT LOAM
010509552	G-17 NE	0 - 15	7.4	59.4	0.54	3.45	0.65	0.07	0.05	34.0	40.0	26.0	LOAM

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Jerry Skelley
Inter-Mountain Laboratories

Inter-Mountain Laboratories, Inc.

Report ID: 010509546

1633 Terra Avenue
Sheridan, WY 82801

Soil Analysis Report

Canyon Fuel Co

Page 2 of 6

Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon

Set #010509546

Date Received: 10/12/05

Report Date: 11/29/05

Lab Id	Sample Id	Depth (Inches)	Very Fine Sand %	Field Capacity %	Wilts Point %	TOC %	Total Sulfur %	T.S. AB /1000t	Neutral. Pot. /1000t	T.S. ABP /1000t
010509546	G-15	0 - 14	19.1	27.7	14.2	1.5	0.01	0.31	176	176
010509547	G-15	14 - 24	17.6	24.3	14.5	0.9	0.01	0.31	268	268
010509548	G-16	0 - 6	23.5	47.0	24.6	4.4	0.01	0.31	51.9	51.5
010509549	G-16	6 - 12	31.8	26.2	15.5	0.6	0.01	0.31	302	302
010509550	G-16	20 - 28	7.60	28.3	17.2	0.3	0.01	0.31	398	398
010509551	G-17 EC	0 - 6	15.2	20.4	11.7	<0.1	<0.01	0.00	263	263
010509552	G-17 NE	0 - 15	20.3	42.4	21.9	2.5	0.01	0.31	39.1	38.8

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2Osoil= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shulley
 Inter-Mountain Soils Lab, Sheridan

Inter-Mountain Laboratories, Inc.

Report ID: 010509546

1633 Terra Avenue
Sheridan, WY 82801

Soil Analysis Report

Canyon Fuel Co

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Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon

Set #0105S09546

Date Received: 10/12/05

Report Date: 11/28/05

Lab Id	Sample Id	Depth (inches)	Boron ppm	Nitrogen Nitrate ppm	TKN %	Selenium ppm	Available Sodium meq/100g	Exchangeable Sodium meq/100g
0105S09546	G-15	0 - 14	0.44	<0.02	0.21	<0.02	0.06	0.06
0105S09547	G-15	14 - 24	0.17	<0.02	0.18	<0.02	0.05	0.03
0105S09548	G-16	0 - 6	0.52	<0.02	0.43	<0.02	0.05	0.04
0105S09549	G-16	6 - 12	0.23	0.36	0.27	<0.02	0.06	0.05
0105S09550	G-16	20 - 26	0.26	0.36	0.09	<0.02	0.07	0.06
0105S09551	G-17 EC	0 - 6	0.13	3.44	0.11	<0.02	0.06	0.06
0105S09552	G-17 NE	0 - 15	0.51	<0.02	0.20	<0.02	0.05	0.05

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSoils= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Joy Shulley
 Inter-Mountain Labs, Inc.

Inter-Mountain Laboratories, Inc.

Report ID: 010509546

Soil Analysis Report
Canyon Fuel Co
 Dugout Mine -Canyon Fuel
 P.O. Box 1029
 Wellington, UT 84542

1633 Terra Avenue
 Sheildan, WY 82801

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Client Project ID: Dugout Canyon
 Date Received: 10/12/05

Set #010509546
 Report Date: 11/28/05

Lab Id	Sample Id	Depth (Inches)	pH s.u.	Saturation %	EC @ 25°C dS/m	Calcium meq/L	Magnesium meq/L	Sodium meq/L	SAR	Sand %	Silt %	Clay %	Texture
Y105S09546	G-15	0 - 14	7.6	48.8	0.70	3.85	1.96	0.09	0.05	48.0	29.0	22.0	LOAM
Y105S09546D	G-15	0 - 14	7.6	47.9	0.70	3.99	2.03	0.11	0.06	48.0	29.0	23.0	LOAM

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, Pyrs= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Jerry Skelley
 Inter-Mountain Labs, Inc.

Inter-Mountain Laboratories, Inc.

Report ID: 010509546

1633 Terra Avenue
Sheridan, WY 82801

Soil Analysis Report

Canyon Fuel Co

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Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon

Date Received: 10/12/05

Set #0105SS09546

Report Date: 11/28/05

Lab Id	Sample Id	Depths (Inches)	Very Fine Sand %	Field Capacity %	Wilk Point %	TOC %	Total Sulfur %	T.S. AB /1000t	Neutral. Pot. /1000t	T.S. ABP /1000t
0105SS09546	G-15	0 - 14	19.1	27.7	14.2	1.5	0.01	0.31	176	176
0105SS09546D	G-15	0 - 14	16.0	28.4	14.0	1.5	0.01	0.31	176	175

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2O5of= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Jay Shulley
 Inter-Mountain Labs Sheridan

InterMountain Laboratories, Inc.

Report ID: 010509546

1633 Terra Avenue
Sheridan, WY 82801

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Soil Analysis Report

Canyon Fuel Co

Dugout Mine -Canyon Fuel

P.O. Box 1029

Wellington, UT 84542

Client Project ID: Dugout Canyon

Set #0105S09546

Date Received: 10/12/05

Report Date: 11/28/05

Lab Id	Sample Id	Depth (Inches)	Boron ppm	Nitrogen		TKN %	Selenium ppm	Available Sodium		Exchangeable Sodium meq/100g
				Nitrate ppm	<0.02			meq/100g	<0.01	
0105S09546	G-15	0 - 14	0.44	<0.02	0.21	<0.02	<0.02	0.06	<0.01	0.06
0105S09546D	G-15	0 - 14		<0.02	0.21	<0.02	<0.01	<0.01	<0.01	<0.01

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Peate Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonats-DTPA, AAO= Acid Ammonium Oxalate
 Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
 Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: Jay Shulley
 Inter Mountain Soils Lab Sheridan



Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

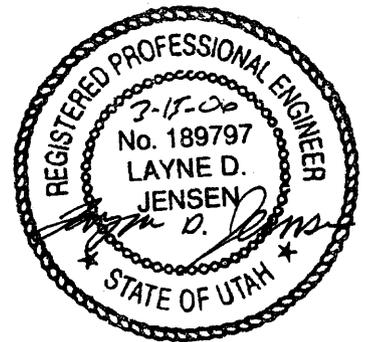
ATTACHMENT 2-2
TOPSOIL CALCULATIONS

add to the back of existing information

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 16, 2006

**ATTACHMENT 2-2
TOPSOIL CALCULATIONS**



G-13

The majority of this site has not been disturbed other than the disturbance associated with construction of the road.

The thickness of topsoil at the site has been identified to be between 8 and 28 inches. During reclamation approximately 15-18 inches of topsoil will be replaced. The average thickness of soil to be replaced is 16.5 inches.

$$\text{Area to be stripped of topsoil} = 42,447 \text{ ft}^2$$

$$\begin{aligned} \text{Topsoil volume} &= (42,447 \text{ ft}^2) \times (16.5''/12'' \text{ ft}) = 58,365 \text{ ft}^3 \\ &= 2,162 \text{ CY} \end{aligned}$$

Topsoil Stockpile Design

There is adequate space at the site so the stockpile can be built with 2:1 slopes.

<u>Elevation</u>	<u>Area (ft²)</u>	<u>Ave. Area (ft²)</u>	<u>Volume (ft³)</u>
7640	2402	3058	15,290
7645	3714	3944	19,720
7650	4174	4154	20,770
7655	4134	3577	<u>7,155</u>
7657	3021		62,935 ft ³

$$62,935 \text{ ft}^3 > 58,365 \text{ ft}^3 \therefore \text{OK}$$

G-14

This site has previously been disturbed by logging activities.

The topsoil thickness at the site ranges between 15-18 inches. During reclamation 12 to 15 inches of topsoil will be replaced. The average topsoil replacement thickness will be assumed to be 15 inches

Area to be stripped of topsoil = 33,356 ft²

Topsoil volume = (33,356 ft² × 15"/12"ft) = 41,695 ft³
= 1,544 CY

Topsoil Stockpile Design

There is adequate space at the site to allow the stockpile to be built with 2:1 slopes on relatively flat ground.

<u>Elevation (ft)</u>	<u>Area (ft²)</u>	<u>Avg Area (ft²)</u>	<u>Volume (ft³)</u>
0	120x60 = 7200		
1	6494	6847	6847
2	5824	6159	6159
3	5184	5504	5504
4	4576	4880	4880
5	4000	4288	4288
6	3456	3728	3728
7	2944	3200	3200
8	2464	2704	2704
9	2016	2240	2240
10	1600	1800	1800
11	1216	1408	1408
			<u>42,758 ft³</u>

42,758 ft³ > 41,695 ft³ ∴ OK

G-15

The majority of this site has not been disturbed. However, a significant portion of the site has been disturbed by previous road construction.

The thickness of topsoil at the site has been identified as 24". During reclamation 12" to 15" of topsoil will be replaced. I will assume a replacement depth of 15" for the design of the topsoil stockpile.

Area to be stripped = 31,870 ft²

Topsoil Volume = (31,870 ft² × 15"/12"/ft) = 39,838 ft³

Topsoil Stockpile Design

There is adequate space at the site so the stockpile can be built with 2:1 side slopes.

<u>Elevation</u>	<u>Area (ft²)</u>	<u>Ave. Area (ft²)</u>		<u>Volume (ft³)</u>
7530	1256	1463	×5	7315
7535	1671	2204	×5	11020
7540	2738	2577	×5	12885
7545	2415	2292	×4	9168
7549	2170			
				<u>40,388 ft³</u>

40,388 ft³ > 39,838 ft³ ∴ ok

G-16

This site has previously been disturbed by exploration activities. The site has been reclaimed. The same area will be re-disturbed. A road will be built to access the pad. The topsoil from the road will be windrowed adjacent to the road. The topsoil from the pad area will be pushed into a stockpile as shown on G-16 Figure 1.

As mentioned previously the site was disturbed and reclaimed. Enough of the reclaimed soil will be stockpiled to replace 12-15" of soil during reclamation. For the stockpile design a replacement depth of 15" will be assumed.

Topsoil Strip Area = 23,596 ft² Vol. = 23,596 ft² (15/12) = 29,495

Topsoil Stockpile Design

There is adequate space at the site for the stockpile to be constructed with 2:1 side slopes.

<u>Elevation</u>	<u>Area (ft²)</u>	<u>Ave Area (ft²)</u>	<u>Volume (ft³)</u>
8140	1152		
8145	2829	1991	9955
8148	3593	3211	9633
8150	2680	3136	6272
8152	1898	2289	4578
			<u>30,438 ft³</u>

30,438 ft³ > 29,495 ft³ ∴ OK

G-17

A portion of this site has been disturbed by road construction while the rest is undisturbed.

The thickness of topsoil at the site has been identified to be 15 inches. During reclamation 12" of topsoil will be replaced.

$$\text{Area to be stripped of topsoil} = 21,516 \text{ ft}^2$$

$$\text{Topsoil Volume} = 21,516 \text{ ft}^2 \left(\frac{12}{12}\right) = 21,516 \text{ ft}^3$$

Topsoil Stockpile Design

There is adequate space at the site to allow the Topsoil stockpile to be constructed with 2:1 side slopes.

<u>Elevation</u>	<u>Area (ft²)</u>	<u>Ave Area (ft²)</u>	<u>Volume (ft³)</u>
8215	2316		
		2613	13,062
8220	2909		
		2040	10,202
8225	1172		
			<u>23,264 ft³</u>

$$23,264 \text{ ft}^3 > 21,516 \text{ ft}^3 \therefore \text{OK}$$

CHAPTER 3
BIOLOGY

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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.

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**

Well No.	Productivity (lbs.) Per Acre
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*
Reference Areas	
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)	300
Mountain Brush/Snowberry (G-16 & G-17)	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 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.

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.

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).

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 HCl 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*
Plants			
Uinta Basin Hookless Cactus	<i>Sclerocactus glaucus</i>	T	No habitat available
Graham Beardtongue	<i>Penstemon grahamii</i>	C	No habitat available
Fish			
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
Birds			
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)
Mammals			
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

* 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 25th 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.

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 is Aspen/Conifer, the reference area for G-16 and G-17 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 and G-14 will be drilled post July 15th, 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-17 will be reclaimed in one phase.

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-17) 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 Ernsten, 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.

Table 3-2
Reclamation Seed Mix

<u>SPECIES</u>	<u># pls/acre</u>	<u># pls/sq. ft.**</u>
Grasses, Forbs, and Shrubs		
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.

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.

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 and G-17 have been previously disturbed. Sites G-2, G-3, G-5, and G-13 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 additional 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 outlined 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.

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.

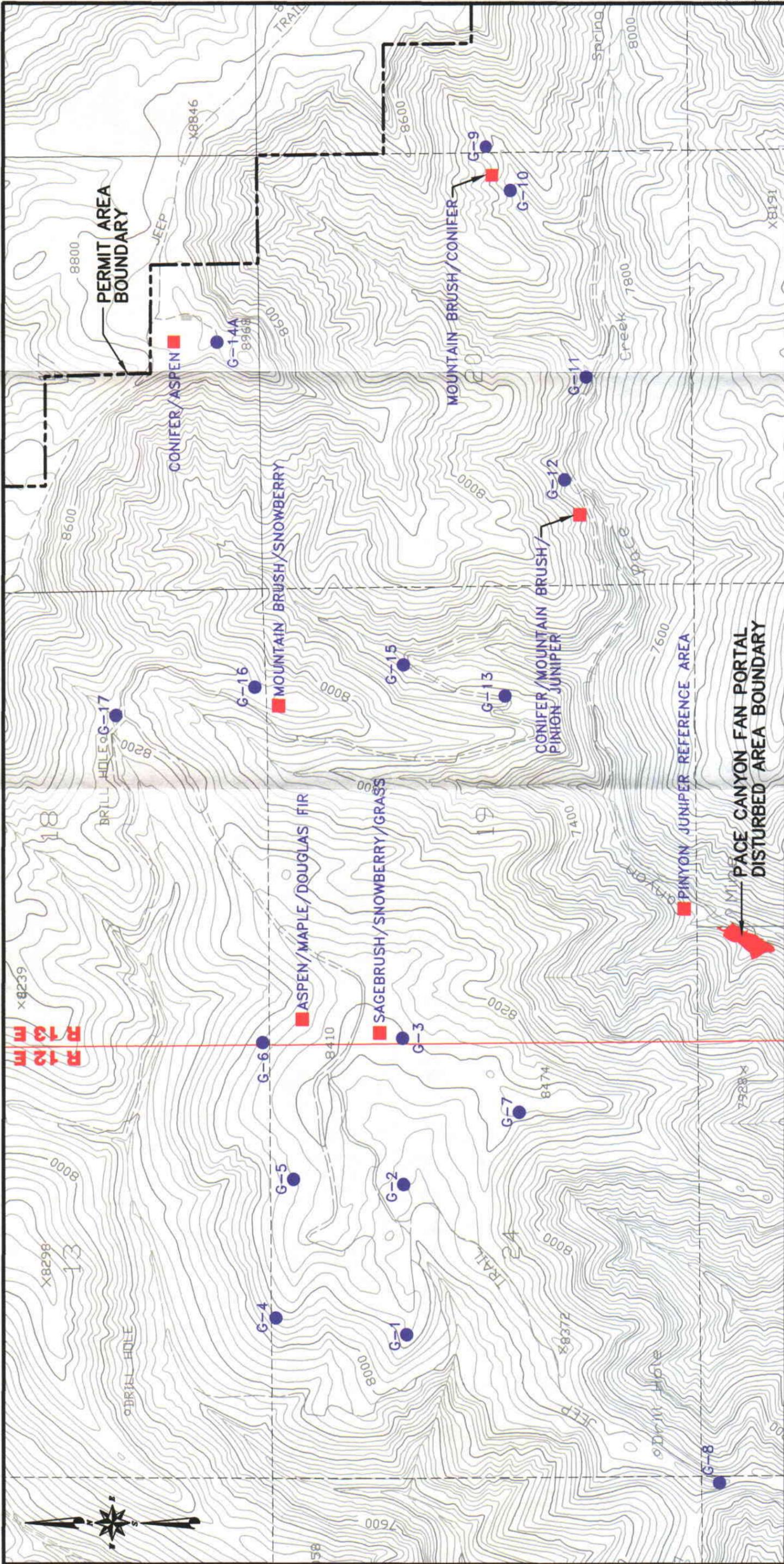
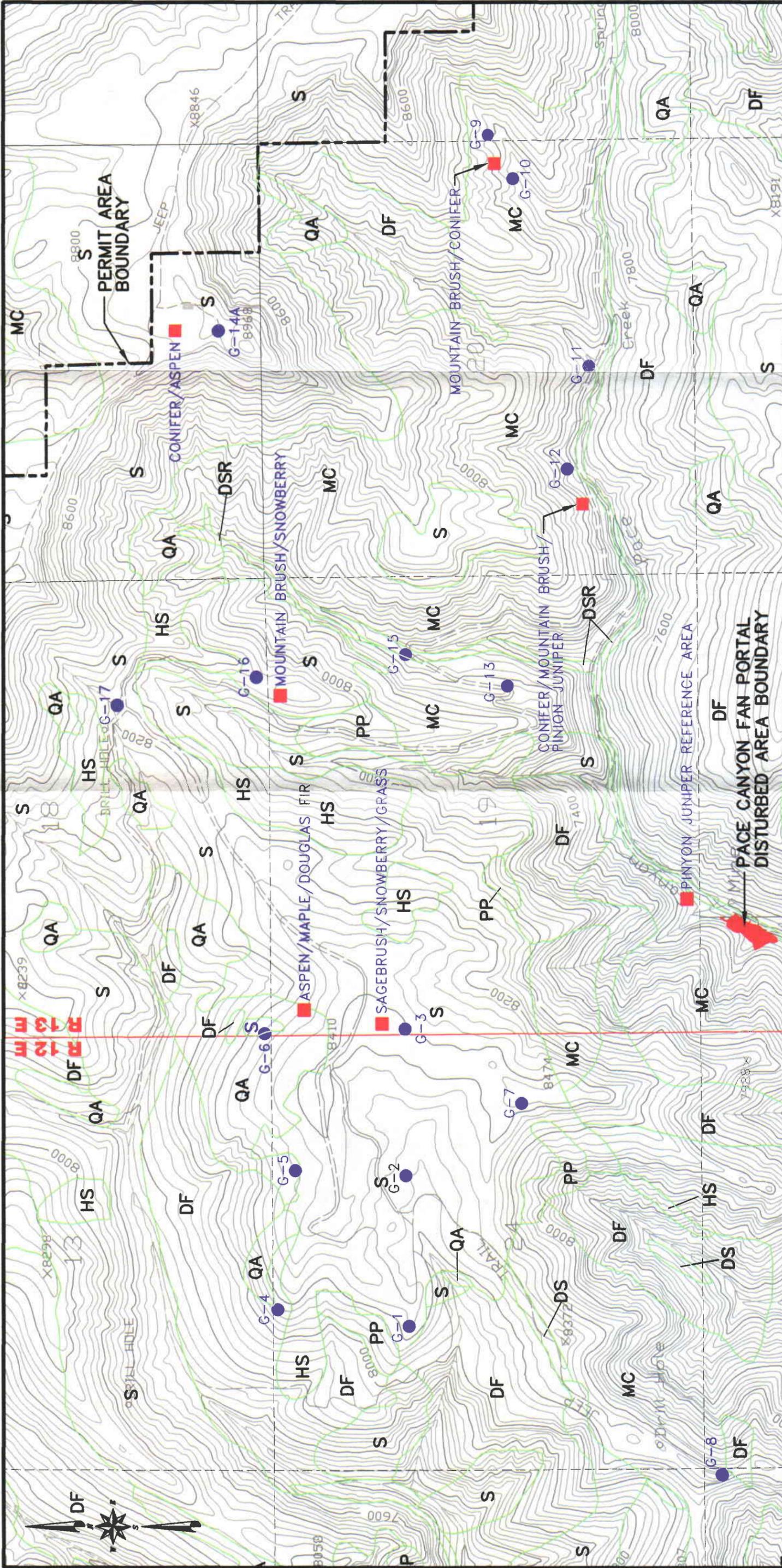


FIGURE 3-1. VEGETATION REFERENCE AREAS



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



FIGURE 3-2. ADJACENT VEGETATION



Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

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

add to the back of existing information

**VEGETATION OF THE
DE-GAS BOREHOLE SITES:
G-13, G-14, G-15, G-16, G-17
&
REFERENCE AREAS**

**FOR THE
DUGOUT CANYON MINE**



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March 2006



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INTRODUCTION

For the past few years Canyon Fuel Company has been constructing borehole drill sites as part of a de-gasification process to facilitate coal mining operations at the Dugout Canyon Mine.

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 these 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, 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-12, G-13, 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).

This document quantifies and describes boreholes sites G-13, G-14, G-15, G-16, G-17 and the reference areas chosen for future revegetation success standards. 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.

Like the earlier developed de-gas borehole sites, and in an attempt to minimize disturbance to the native plant communities in the area, Canyon Fuel pristine construction of the proposed new sites in areas where previous disturbance had already been caused by logging, road construction or other activities.

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. In those cases where the proposed new disturbances existed in areas that were previously disturbed by other activities, *attempts were made to choose the reference areas to represent the native plant communities that were present at the site prior to these perturbations.* Therefore, undisturbed plant communities have been chosen as the reference areas for de-gas borehole drill pads – even though the current condition of the proposed pad may be somewhat less than pristine.

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 (DOGGM). Quantitative and qualitative data were taken on the vegetation of the areas proposed for disturbance and their respective reference areas from July - September, 2005.

Proposed drill sites were surveyed, mapped and staked in the field by Canyon Fuel prior to the vegetation field work. The reference areas chosen were approximately one acre in size and were 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-13, G-14, G-15, G-16, G-17 & REFERENCE AREAS				
Waypoint Name	Zone	Easting	Northing	Notes
DUGG13	12	0543023	4392079	Borehole Site G-13
DUGG14	12	0544322	4393155	Borehole Site G-14
DUG14R	12	0544338	4393299	Reference Area for G-14
DUGG15	12	0543141	4392432	Borehole Site G-15
DUG12R	12	0543690	4391789	Reference Area for G-13, G-15 (plus G-12)
DUGG16	12	0543027	4393002	Borehole Site G-16
DUGG17	12	0542931	4393502	Borehole Site G-17
DUG16R	12	0542993	4392921	Reference Area for 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 areas. 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

With the values used for “t” and “d” above, the goal was to meet sample adequacy with 80% confidence within a 10% deviation from the true mean. In areas where sample viability was unnaturally high (e.g. previous disturbance sites), these parameters may sometimes prove to be too stringent.

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 respective 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

Borehole Site G-13

Borehole Site G-13 is the site of an undisturbed area that is mostly comprised of a **conifer plant community**, but is also somewhat transitional to a **pinyon-juniper community** (see *Color Photographs*). Accordingly, the overstory species present in the sample quadrats were Douglas fir (*Pseudotsuga menziesii*), Utah Juniper (*Juniperus osteosperma*) and Rocky Mountain juniper (*J. scopulorum*). The most common understory species were snowberry (*Symphoricarpos oreophilus*), Utah Juniper, and Douglas fir (Table 1).

The total combined living cover (overstory plus understory) was estimated at 73.00%, 51.00% of which was overstory and 22.00% understory cover (Table 2). The lifeform composition of the understory cover was comprised of 77.79% woody species, 13.63% forbs, and 8.58% grasses (Table 2). Total woody species density of G-13 was estimated at 1,353 individuals per acre. The species densities for all woody plants in the samples are shown on Table 3.

Because the reference area for the proposed disturbance here is shared with Borehole Site G-15 (and also G-12 in an earlier report), the reference area is described later in this report.

Borehole Site G-14

The **conifer/aspen community** of this proposed borehole site had previously been severely disturbed by logging activities (see *Color Photographs*). Many of the aspen trees (*Populus tremuloides*) were not harvested in this area, but were pushed down and left while the conifers were being logged. Still, the dominant living cover comes from the overstory of Douglas fir trees by a large margin (Table 4). Some of the other species present that were not as common by the cover or frequency measurements were muttongrass (*Poa fendleriana*), snowberry, heartleaf arnica (*Arnica cordifolia*), dandelion (*Taraxacum officinale*) and blue violet (*Viola adunca*). For a list of all the plant species present in the sample quadrats by cover and frequency, refer to Table 4.

The total living combined cover for G-14 was 48.25%, 27.00% of which came from overstory species and 21.25% from understory (Table 5). The composition of understory was nearly equally represented by each lifeform (Table 5). Woody species density was estimated at 633 individuals per acre and dominated by snowberry and Douglas fir (Table 6).

Reference Area for G-14

The reference area chosen to set future standards for revegetation success was another **conifer/aspen** plant community. Although there may have been previous logging in the area

where some Douglas fir trees were harvested, the disturbance to the native understory species and aspen trees was not nearly as great as those described for Borehole Site 14 above (see *Color Photographs*). Consequently, aspen trees in the overstory were even more common by cover and frequency than the Douglas fir trees (Table 7). Common understory species were snowberry, Douglas fir, muttongrass and heartleaf arnica.

Overstory was greater than the understory cover of the area comprising 50.50% and 27.25%, respectively (Table 8). Total combined living cover was estimated at 77.75%. Lifeform composition results for the understory cover consisted of 48.64% woody species, 28.66% forbs, and 22.71% grasses (Table 8). The total woody species density for this reference area was 2,176 individuals per acre and was dominated by aspen, snowberry, and Douglas fir (Table 9).

Borehole Site G-15

This proposed drill site was another area where previous disturbance has impacted the plant communities that currently exist there. Because of the various exposures, slopes, and proximity to the canyon's drainage patterns, the plant communities that existed prior to disturbances were probably **confer**, **maple** and the transitional zones between the two. This previous disturbances to the plant communities of the area were made by logging and road building activities (see *Color Photographs*). Accordingly, half of the sample quadrats were placed randomly in each disturbance type. (These data were combined for the summary tables, but if desired, could be separated by using the raw data set submitted in this report).

The most common species of the area were bigtooth maple (*Acer grandidentatum*), Douglas fir, and bindweed (*Convolvulus arvensis*). For a list of all species found in the sample quadrats by cover and frequency, refer to Table 10.

The total living understory cover of the area was 31.75%, whereas overstory cover was 20.00%. These two covers were summed to equal 51.75% (Table 11). Woody species dominated the composition at 48.08%, followed by forbs at 35.68% and grasses at 16.24% (Table 11). As a result of the aforementioned road building and logging activities, the total woody species density was only 384 plants per acre (Table 12).

Reference Area for G-13 and G-15

A reference area was chosen for Borehole Sites G-13 and G-15 (this is the same reference area used for G-12 in the previously mentioned November 2005 report). This reference area was located within transitional zones between **conifer, mountain brush, and pinyon-juniper communities**. As shown on Table 13, the most common plant species present in the sample quadrats were pinyon pine (*Pinus edulis*), Utah juniper, Douglas fir, serviceberry (*Amelanchier utahensis*), and Salina wildrye (*Elymus salinus*).

Overstory and understory total living covers were nearly equal at 31.00% and 32.40%, respectively. The combined total living cover was therefore 63.40% (Table 14). The woody species density for this reference area was 1,089 plants per acre (Table 15) with the most common

species here consisting of big sagebrush (*Artemisia tridentata*), serviceberry, curl-leaf mountain-mahogany (*Cercocarpus ledifolius*) and pinyon pine.

Borehole Site G-16

This proposed borehole site is partly within an area that had once been disturbed, followed by reclamation and revegetation techniques. The borehole site was also partly in an area where the plant community had never been significantly altered or disturbed. For this reason, the sample transects were placed using stratified random methods so that half of the samples were within the reclaimed (altered) community and half in the area that had never been altered or disturbed (this was a **mountain brush/snowberry community**). These data were then combined, but could be separated if desired in the future by using the raw data included in this report.

The most common species present in the sample quadrats were big sagebrush, snowberry, serviceberry, and slender wheatgrass (*Elymus trachycaulus*). For a list of species by cover and frequency, refer to Table 16.

Understory species dominated the living cover comprising 31.35% of the 36.25% combined total living cover; overstory was 5.00% (Table 17). In this community, grasses dominated the composition at 45.90% of the total living cover, followed by woody species at 34.53%, and forbs at 19.57% (Table 17). In the density measurements, the total number of woody plants per acre was estimated at 1,425 and was dominated by big sagebrush and snowberry (Table 18).

Borehole Site G-17

Like some of the previously described sites, some of this site has been disturbed previously by other activities. In this case, the proposed borehole site was located partly on a dirt road.

Because the previously disturbed part of this area was a road with virtually no vegetation, the sample transects were placed in the undisturbed areas, or a **mountain brush/snowberry community** where the disturbance would be extended for the drill pad. The most common plant species present in this area were snowberry, serviceberry and big sagebrush (Table 19).

The total combined living cover in this area was estimated at 65.75%. Understory total living cover was 50.50% of this combined cover, whereas overstory cover was 15.25% (Table 20).

Woody species dominated the cover as indicated by the composition calculations, or comprised 68.84% of it; forbs and grasses were nearly equally represented at 16.12% and 15.04%, respectively (Table 20). The woody species density was estimated at 4,652 individuals per acre (Table 21). As one might expect by observing the cover data, the density was dominated by snowberry and big sagebrush.

Reference Area for G-16 and G-17

The reference area chosen for future revegetation success standards of Borehole Sites G-16 and G-17 was located in close proximity to G-16. Another **mountain brush/snowberry community**, the most common species in this reference area were big sagebrush, Watson's

penstemon (*Penstemon watsonii*), snowberry and serviceberry (Table 22).

The total living combined cover was 64.50%, 57.00% was understory and 7.50% overstory (Table 23). Woody species dominated the composition at 54.44%, followed by forbs at 28.08% and grasses at 17.49% (Table 23). The woody species density was estimated at 5,137 plants per acres and was dominated by big sagebrush and snowberry (Table 24).

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 communities of the study areas. 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.

DISCUSSION & CONCLUSIONS

The plant communities that would be impacted by the proposed drill sites for construction of degasification boreholes have been sampled and described in this report. Additionally, reference areas were chosen to be used in the future for final revegetation success standards. The plant

communities of these reference areas were also sampled and the data sets were compared statistically to the proposed disturbed areas to test their appropriateness as success standards. In some cases, not only did the reference area meet the appropriate level of the proposed disturbance parameter, but the value exceeded the level needed. This difference was due to the current condition of the plant community proposed for the borehole drill site. As mentioned earlier in this report, when possible, Canyon Fuel deliberately chose drill sites that had previously been disturbed by other activities. Often in these cases, the proposed new disturbance would also be extended into native, undisturbed plant communities adjacent to the already disturbed area. Yet, the reference areas chosen to represent future standards were usually communities that had little or no previous disturbance. Consequently, the reference areas chosen for revegetation success standards are in-effect more demanding than they would have been if the standards were based on the existing conditions of the proposed de-gas drill sites. In other words, achieving these standards at the time of final revegetation would result in leaving the sites in better condition than they were prior to de-gas drill site construction. Based on conversations with representatives from Canyon Fuel, this design plan and final goal would be acceptable to them.

With the above comments in mind, the following results and conclusions have been assessed from the quantitative data. Fig. 1 and Fig. 2 present the results of the statistical tests that compare the proposed disturbed borehole sites with their respective reference areas.

When Borehole Site G-13 (*an undisturbed plant community*) was compared with the reference area (*an undisturbed plant community*) the results were insignificant for both cover and woody

species density.

When Borehole Site **G-14** (*a previously disturbed community*) was compared with its reference area (*virtually an undisturbed plant community*), the differences were statistically significant for both total living cover and woody species density.

Statistical comparisons of Borehole Site **G-15** (*a previously disturbed community*) with its reference area (*an undisturbed plant community*) were then made. In this case, the total living covers were not significantly different, but the woody species density of the reference area was greater than the borehole site.

Next, comparisons were made for cover and density of Borehole Site **G-16** (*a previously disturbed and reclaimed community*) and its reference area (*an undisturbed plant community*). In this case the differences for total living cover and woody species density were significantly greater in the reference area.

Finally, Borehole Site **G-17** (*transects were placed in the undisturbed portion plant community*) was compared to the reference area (*an undisturbed plant community*) the differences for total living cover and woody species density were not significant.

In conclusion, even though some of the tests comparing both woody species densities and total living covers of the proposed disturbed borehole sites with their respective reference areas

suggested some differences at statistically significant levels, the reference areas could still be appropriate. In all cases where the differences were significant, the reference area had the higher value. Without exception, reasons for the differences were probably due to current condition of the proposed disturbed plant community – or it had been disturbed previously by other activities. Therefore, to hold these sites to the standards of the reference area means that, once reclaimed and reseeded, if they meet the acceptance criteria of the reference area standards, the plant communities of the reclaimed drill sites will exceed their current condition.

Table 1: Dugout Mine Degas Site G-13. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Juniperus osteosperma</i>	8.00	12.39	35.00
<i>Juniperus scopulorum</i>	4.50	9.73	20.00
<i>Pseudotsuga menziesii</i>	38.50	21.80	95.00
UNDERSTORY			
TREES & SHRUBS			
<i>Artemisia tridentata</i>	0.85	2.78	10.00
<i>Juniperus osteosperma</i>	4.40	7.10	30.00
<i>Juniperus scopulorum</i>	2.50	10.90	5.00
<i>Mahonia repens</i>	1.75	6.57	10.00
<i>Pseudotsuga menziesii</i>	4.25	9.52	20.00
<i>Symphoricarpos oreophilus</i>	5.90	5.99	60.00
FORBS			
<i>Cryptantha flavoculata</i>	0.10	0.44	5.00
<i>Cynoglossum officinale</i>	0.25	1.09	5.00
<i>Erigeron sp.</i>	0.75	1.79	15.00
<i>Eriogonum sp.</i>	0.15	0.65	5.00
<i>Penstemon sp.</i>	0.25	1.09	5.00
GRASSES			
<i>Elymus salinus</i>	0.85	2.06	15.00

Table 2: Dugout Mine Degas Site G-13. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	51.00	22.67	20
Understory	22.00	12.88	20
Litter	49.65	17.23	20
Bareground	5.55	3.72	20
Rock	22.80	14.88	20
Overstory + Understory	73.00	26.05	20
% COMPOSITION			
Trees & Shrubs	77.79	32.50	20
Forbs	13.63	25.71	20
Grasses	8.58	23.80	20

Table 3: Dugout Mine Site G-13. Woody species densities.

Species	Individuals Per Acre
<i>Artemisia tridentata</i>	33.82
<i>Juniperus osteosperma</i>	253.69
<i>Juniperus scopulorum</i>	84.56
<i>Pseudotsuga menziesii</i>	338.25
<i>Symphoricarpos oreophilus</i>	642.67
TOTAL	1352.99

Table 4: Dugout Mine Degas Site G-14. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Abies concolor</i>	1.75	7.63	5.00
<i>Populus tremuloides</i>	1.75	7.63	5.00
<i>Pseudotsuga menziesii</i>	23.50	29.42	45.00
UNDERSTORY			
TREES & SHRUBS			
<i>Pachistima myrsinites</i>	0.25	1.09	5.00
<i>Pseudotsuga menziesii</i>	3.50	8.08	20.00
<i>Symphoricarpos oreophilus</i>	3.15	5.66	40.00
FORBS			
<i>Aquilegia caerulea</i>	0.45	1.36	10.00
<i>Arnica cordifolia</i>	1.65	2.78	30.00
<i>Epilobium sp.</i>	1.15	5.01	5.00
<i>Osmorhiza depauperata</i>	0.95	1.80	25.00
<i>Taraxacum officinale</i>	1.00	3.39	10.00
<i>Viola adunca</i>	1.00	2.00	20.00
GRASSES			
<i>Poa fendleriana</i>	8.15	9.54	60.00

Table 5: Dugout Mine Degas Site G-14. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	27.00	32.23	20
Understory	21.25	10.59	20
Litter	72.10	11.00	20
Bareground	5.15	4.93	20
Rock	1.50	1.07	20
Overstory + Understory	48.25	35.86	20
% COMPOSITION			
Trees & Shrubs	34.39	33.84	20
Forbs	30.37	32.55	20
Grasses	35.24	36.01	20

Table 6: Dugout Mine Site G-14. Woody species densities.

Species	Individuals Per Acre
<i>Abies concolor</i>	15.84
<i>Artemisia tridentata</i>	15.84
<i>Pachistima myrsinites</i>	47.51
<i>Populus tremuloides</i>	55.43
<i>Pseudotsuga menziesii</i>	237.56
<i>Rubus idaeus</i>	7.92
<i>Symphoricarpos oreophilus</i>	253.39
TOTAL	633.48

Table 7: Dugout Mine Degas Aspen/Douglas Fir Reference Area for G-14. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Abies concolor</i>	1.75	7.63	5.00
<i>Populus tremuloides</i>	25.75	20.93	65.00
<i>Pseudotsuga menziesii</i>	23.00	27.95	45.00
UNDERSTORY			
TREES & SHRUBS			
<i>Abies concolor</i>	0.50	2.18	5.00
<i>Mahonia repens</i>	0.75	1.79	15.00
<i>Populus tremuloides</i>	1.25	2.17	25.00
<i>Pseudotsuga menziesii</i>	4.25	11.21	20.00
<i>Rosa woodsii</i>	0.50	2.18	5.00
<i>Symphoricarpos oreophilus</i>	6.05	6.65	70.00
FORBS			
<i>Achillea millefolium</i>	1.40	2.03	35.00
<i>Aquilegia caerulea</i>	0.25	1.09	5.00
<i>Arnica cordifolia</i>	3.10	11.96	15.00
<i>Delphinium nelsonii</i>	0.25	1.09	5.00
<i>Epilobium sp.</i>	0.65	1.59	15.00
<i>Lupinus argenteus</i>	0.50	1.50	10.00
<i>Osmorhiza depauperata</i>	2.10	2.79	45.00
GRASSES			
<i>Poa fendleriana</i>	5.70	5.68	70.00

Table 8: Dugout Mine Degas Aspen/Douglas Fir Reference Area for G-14. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	50.50	13.68	20
Understory	27.25	13.83	20
Litter	65.05	12.89	20
Bareground	6.65	3.31	20
Rock	1.05	0.22	20
Overstory + Understory	77.75	16.84	20
% COMPOSITION			
Trees & Shrubs	48.64	35.66	20
Forbs	28.66	28.56	20
Grasses	22.71	24.47	20

Table 9: Dugout Mine Degas Aspen/Douglas Fir Reference Area for G-14. Woody species densities.

Species	Individuals Per Acre
<i>Abies concolor</i>	27.19
<i>Populus tremuloides</i>	870.16
<i>Pseudotsuga menziesii</i>	516.66
<i>Rosa woodsii</i>	108.77
<i>Symphoricarpos oreophilus</i>	652.62
TOTAL	2175.70

Table 10: Dugout Mine Degas Site G-15. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Acer grandidentatum</i>	10.50	20.85	25.00
<i>Pseudotsuga menziesii</i>	9.50	20.67	20.00
UNDERSTORY			
TREES & SHRUBS			
<i>Acer grandidentatum</i>	5.75	15.83	20.00
<i>Artemisia tridentata</i>	0.25	1.09	5.00
<i>Chrysothamnus nauseosus</i>	1.00	4.36	5.00
<i>Gutierrezia sarothrae</i>	2.00	7.65	10.00
<i>Juniperus scopulorum</i>	0.25	1.09	5.00
<i>Pseudotsuga menziesii</i>	6.75	9.52	35.00
<i>Symphoricarpos oreophilus</i>	1.50	3.91	15.00
FORBS			
<i>Artemisia dracunculus</i>	0.25	1.09	5.00
<i>Aster sp.</i>	1.25	5.45	5.00
<i>Convolvulus arvensis</i>	4.25	6.76	40.00
<i>Cynoglossum officinale</i>	2.25	4.02	60.00
<i>Taraxacum officinale</i>	1.00	3.39	10.00
<i>Viola adunca</i>	0.05	0.22	5.00
GRASSES			
<i>Poa fendleriana</i>	0.70	2.30	10.00
<i>Poa pratensis</i>	2.00	4.85	20.00
<i>Poa secunda</i>	2.25	7.15	10.00

Table 11: Dugout Mine Degas Site G-15. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	20.00	30.37	20
Understory	31.75	14.25	20
Litter	30.25	24.57	20
Bareground	24.00	22.34	20
Rock	14.00	15.62	20
Overstory + Understory	51.75	32.87	20
% COMPOSITION			
Trees & Shrubs	48.08	43.81	20
Forbs	35.68	38.39	20
Grasses	16.24	23.39	20

Table 12: Dugout Mine Degas Site G-15. Woody species densities.

Species	Individuals Per Acre
<i>Abies concolor</i>	
<i>Acer grandidentatum</i>	60.96
<i>Artemisia tridentata</i>	4.35
<i>Cercocarpus montanus</i>	4.35
<i>Chrysothamnus nauseosus</i>	43.54
<i>Gutierrezia sarothrae</i>	52.25
<i>Juniperus scopulorum</i>	4.35
<i>Pachistima myrsinites</i>	8.71
<i>Pseudotsuga menziesii</i>	95.79
<i>Rosa woodsii</i>	4.35
<i>Symphoricarpos oreophilus</i>	69.67
TOTAL	384.34

Table 13: Dugout Mine Degas Conifer/Mtn. Brush/Pinyon-Juniper Reference Area for G-13 & G-15 (and G-12*). Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	4.00	10.56	15.00
<i>Cercocarpus montanus</i>	0.75	3.27	5.00
<i>Juniperus osteosperma</i>	7.25	21.76	10.00
<i>Pinus edulis</i>	10.25	22.05	20.00
<i>Pseudotsuga menziesii</i>	8.75	19.99	20.00
UNDERSTORY			
TREES & SHRUBS			
<i>Amelanchier utahensis</i>	3.50	11.08	15.00
<i>Artemisia tridentata</i>	2.50	5.59	20.00
<i>Cercocarpus montanus</i>	3.50	7.76	20.00
<i>Chrysothamnus nauseosus</i>	0.40	1.74	5.00
<i>Gutierrezia sarothrae</i>	0.90	3.92	5.00
<i>Juniperus osteosperma</i>	3.75	9.86	15.00
<i>Opuntia polyacantha</i>	0.25	1.09	5.00
<i>Pinus edulis</i>	3.50	10.62	10.00
<i>Pseudotsuga menziesii</i>	5.75	16.68	15.00
<i>Symphoricarpos oreophilus</i>	2.45	5.05	25.00
FORBS			
<i>Cryptantha flavoculata</i>	0.10	0.44	5.00
GRASSES			
<i>Elymus salinus</i>	4.00	5.39	40.00
<i>Poa secunda</i>	0.80	2.38	15.00
<i>Stipa hymenoides</i>	1.00	2.55	15.00

* The reference area was also used in a previous study called *Vegetation of the De-gas Borehole Sites: G-11, G-12 & Reference Areas (November 2005)*.

Table 14: Dugout Mine Degas Conifer/Mtn. Brush/Pinyon-Juniper Reference Area for G-13 & G-15 (and G-12*). Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	31.00	30.19	20
Understory	32.40	14.96	20
Litter	21.60	15.83	20
Bareground	12.25	10.06	20
Rock	33.75	20.55	20
Overstory + Understory	63.40	34.81	20
% COMPOSITION			
Trees & Shrubs	77.37	24.72	20
Forbs	0.40	1.74	20
Grasses	22.23	25.02	20

Table 15: Dugout Mine Degas Reference Area for G-13 & G-15 (and G-12*). Woody species densities.

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	136.07
<i>Artemisia tridentata</i>	367.40
<i>Cercocarpus montanus</i>	149.68
<i>Gutierrezia sarothrae</i>	13.61
<i>Juniperus osteosperma</i>	108.86
<i>Opuntia polyacantha</i>	13.61
<i>Pinus edulis</i>	136.07
<i>Pseudotsuga menziesii</i>	95.25
<i>Symphoricarpos oreophilus</i>	68.04
TOTAL	1088.59

* The reference area was also used in a previous study called *Vegetation of the De-gas Borehole Sites: G-11, G-12 & Reference Areas (November 2005)*.

Table 16: Dugout Mine Degas Site G-16. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	5.00	15.65	15.00
UNDERSTORY			
TREES & SHRUBS			
<i>Amelanchier utahensis</i>	2.10	6.19	15.00
<i>Artemisia tridentata</i>	7.65	14.64	35.00
<i>Symphoricarpos oreophilus</i>	6.70	10.20	45.00
FORBS			
<i>Astragalus sp.</i>	0.65	2.01	10.00
<i>Cynoglossum officinale</i>	0.25	1.09	5.00
<i>Hedysarum boreale</i>	0.40	1.24	10.00
<i>Lupinus argenteus</i>	0.10	0.44	5.00
<i>Penstemon strictus</i>	0.10	0.44	5.00
<i>Penstemon watsonii</i>	2.40	5.70	25.00
GRASSES			
<i>Elymus lanceolatus</i>	1.20	3.03	20.00
<i>Elymus salinus</i>	0.75	2.38	10.00
<i>Elymus smithii</i>	2.60	5.09	30.00
<i>Elymus spicatus</i>	0.50	2.18	5.00
<i>Elymus trachycaulus</i>	3.60	8.93	30.00
<i>Poa pratensis</i>	1.50	3.91	15.00
<i>Stipa comata</i>	0.75	3.27	5.00

Table 17: Dugout Mine Degas Site G-16. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
TOTAL COVER			
Overstory	5.00	15.65	20
Understory	31.25	22.24	20
Litter	12.55	6.90	20
Bareground	43.75	25.83	20
Rock	12.45	8.97	20
Overstory + Understory	36.25	29.79	20
% COMPOSITION			
Trees & Shrubs	34.53	34.02	20
Forbs	19.57	27.53	20
Grasses	45.90	32.51	20

Table 18: Dugout Mine Degas Site G-16. Woody species densities.

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	71.27
<i>Artemisia tridentata</i>	890.86
<i>Cercocarpus montanus</i>	17.82
<i>Symphoricarpos oreophilus</i>	445.43
TOTAL	1425.38

Table 19: Dugout Mine Degas Site G-17. Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	13.50	22.53	40.00
<i>Populus tremuloides</i>	1.75	7.63	5.00
UNDERSTORY			
TREES & SHRUBS			
<i>Amelanchier utahensis</i>	5.50	8.50	35.00
<i>Artemisia tridentata</i>	8.25	12.77	40.00
<i>Populus tremuloides</i>	0.50	1.50	10.00
<i>Rosa woodsii</i>	0.50	1.50	10.00
<i>Symphoricarpos oreophilus</i>	19.75	10.89	95.00
FORBS			
<i>Achillea millefolium</i>	1.75	3.96	20.00
<i>Cynoglossum officinale</i>	0.75	1.79	15.00
<i>Linum lewisii</i>	0.10	0.44	5.00
<i>Lupinus argenteus</i>	3.50	5.72	35.00
<i>Penstemon watsonii</i>	1.40	2.18	30.00
<i>Taraxacum officinale</i>	0.75	1.79	15.00
GRASSES			
<i>Elymus trachycaulus</i>	2.25	4.02	25.00
<i>Poa pratensis</i>	5.50	6.50	50.00

Table 20: Dugout Mine Degas Site G-17. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
COVER			
Overstory	15.25	22.77	20
Understory	50.50	15.40	20
Litter	26.05	19.63	20
Bareground	21.60	18.01	20
Rock	1.85	2.08	20
Overstory + Understory	65.75	18.18	20
% COMPOSITION			
Trees & Shrubs	68.84	20.43	20
Forbs	16.12	16.79	20
Grasses	15.04	13.76	20

Table 21: Dugout Mine Degas Site G-17. Woody species densities.

Species	Individuals Per Acre
<i>Amelanchier utahensis</i>	523.40
<i>Artemisia tridentata</i>	1395.72
<i>Acer glabrum</i>	58.16
<i>Populus tremuloides</i>	116.31
<i>Rosa woodsii</i>	116.31
<i>Symphoricarpos oreophilus</i>	2442.51
TOTAL	4652.41

Table 22: Dugout Mine Degas Mtn. Brush/Sagebrush Reference Area for G-16 & G-17. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
<i>Amelanchier utahensis</i>	6.75	12.58	25.00
<i>Juniperus scopulorum</i>	0.75	3.27	5.00
UNDERSTORY			
TREES & SHRUBS			
<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
FORBS			
<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
GRASSES			
<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 23: Dugout Mine Degas Mtn. Brush/Sagebrush Reference Area for G-16 & G-17. Total cover, standard deviation and sample size.

	Mean Percent	Standard Deviation	Sample Size
COVER			
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
% COMPOSITION			
Trees & Shrubs	54.44	26.60	20
Forbs	28.08	17.03	20
Grasses	17.49	14.43	20

Table 24. Dugout Mine Degas Mtn. Brush/Sagebrush Reference Area for G-16 & G-17. Woody species densities.

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
TOTAL	5136.52

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

	\bar{x}	s	n	t	df	SL
Borehole Site G-13						
Proposed Disturbed:	73.00	26.05	20			
Reference Area:	63.40	34.81	20			
t-test				0.987	38	N.S.
Borehole Site G-14						
Proposed Disturbed:	48.25	35.86	20			
Reference Area:	77.75	16.84	20			
t-test				-3.330	38	p<.01
Borehole Site G-15						
Proposed Disturbed:	51.75	32.87	20			
Reference Area:	63.40	34.81	20			
t-test				-1.088	38	N.S.
Borehole Site G-16						
Proposed Disturbed:	36.25	29.79	20			
Reference Area:	64.50	19.49	20			
t-test				-3.549	38	p<.01
Borehole Site G-17						
Proposed Disturbed:	65.75	18.18	20			
Reference Area:	64.50	19.49	20			
t-test				0.210	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

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

	\bar{x}	s	n	t	df	SL
Borehole Site G-13						
<u>Proposed Disturbed:</u>	1352.99	956.01	20			
<u>Reference Area:</u>	1088.59	663.68	20			
t-test				1.016	38	N.S.
Borehole Site G-14						
<u>Proposed Disturbed:</u>	663.48	518.58	20			
<u>Reference Area:</u>	2175.40	1082.50	20			
t-test				-5.633	38	p<.001
Borehole Site G-15						
<u>Proposed Disturbed:</u>	348.34	466.67	20			
<u>Reference Area:</u>	1088.59	663.68	20			
t-test				-4.080	38	p<.001
Borehole Site G-16						
<u>Proposed Disturbed:</u>	1425.38	1865.35	20			
<u>Reference Area:</u>	5136.52	2140.91	20			
t-test				-5.845	38	p<.001
Borehole Site G-17						
<u>Proposed Disturbed:</u>	4652.41	2259.60	20			
<u>Reference Area:</u>	5136.52	2140.91	20			
t-test				-0.696	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
STUDY AREAS**



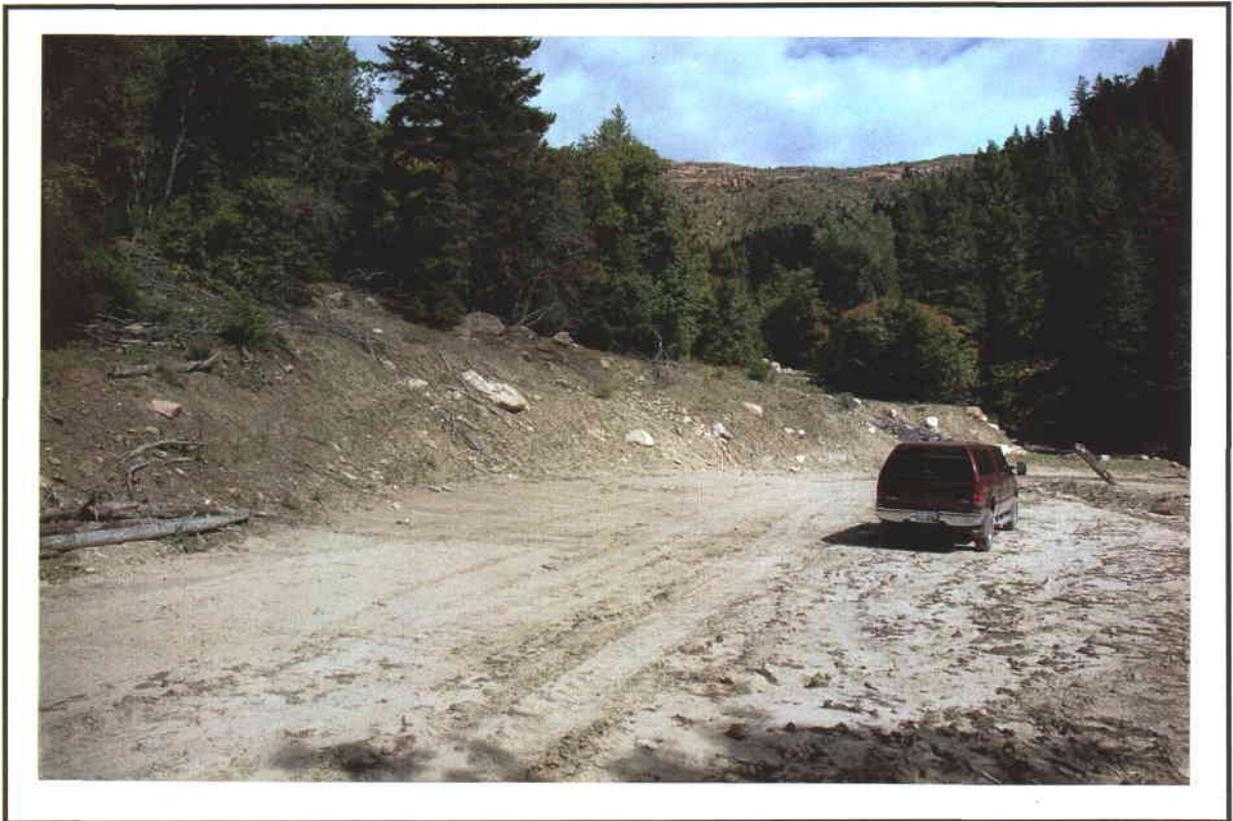
Borehole Site G-13



Borehole Site G-14



Reference Area for Site G-14



Borehole Site G-15



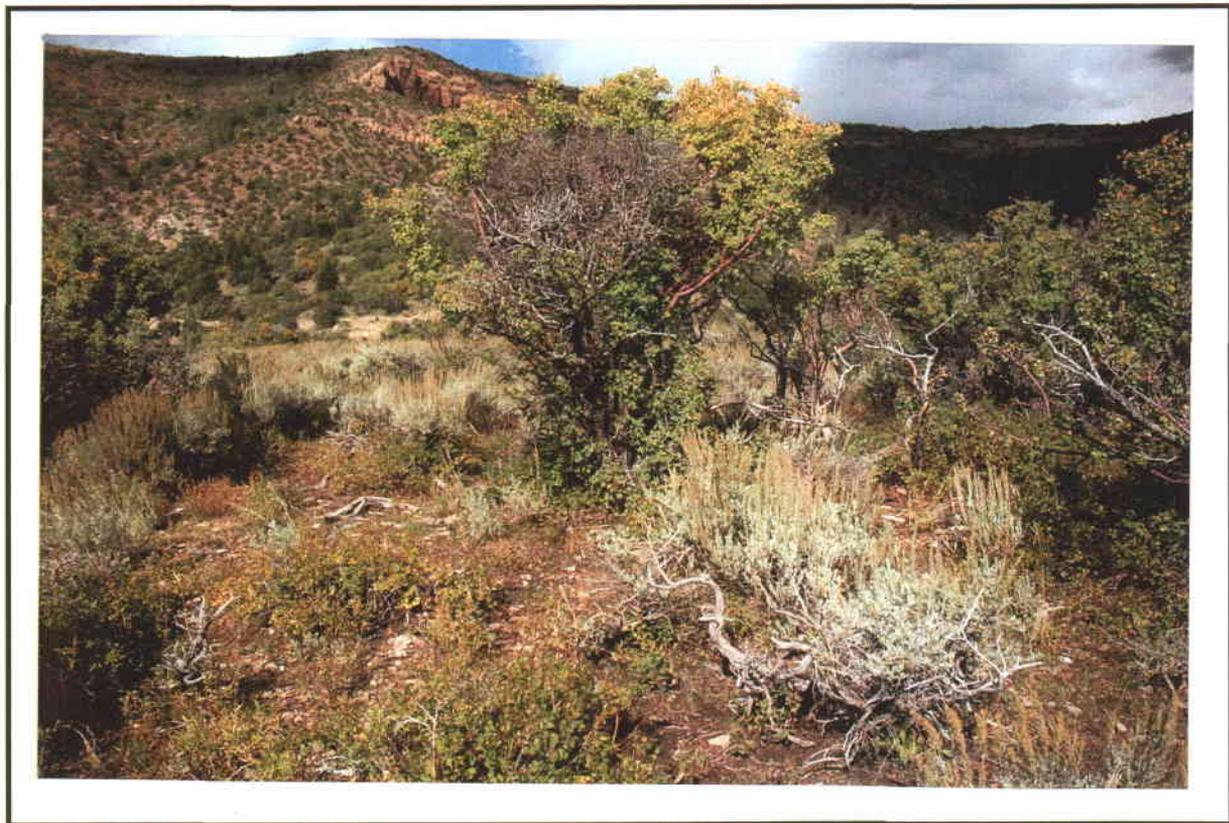
Reference Area for Site G-13/G-15 (G-12)



Borehole Site G-16



Borehole Site G-17



Reference Area for Site G-16/G-17

APPENDIX

(Raw Data)

P.D. Doug Fir/PJ

CANYON FUELS

Dugout Mine

Site G-13

Slope: 5-25 deg

Exposure: ENE

Sample Date: 12 July 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
OVERSTORY								
<i>Juniperus osteosperma</i>	10.00	0.00	20.00	0.00	40.00	35.00	20.00	20.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	35.00	70.00	15.00	40.00	40.00	35.00	30.00	50.00
UNDERSTORY								
SHRUBS								
<i>Artemisia tridentata</i>	0.00	0.00	0.00	5.00	0.00	12.00	0.00	0.00
<i>Juniperus osteosperma</i>	10.00	0.00	0.00	0.00	20.00	13.00	10.00	15.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Mahonia repens</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	25.00	0.00	0.00	10.00
<i>Symphoricarpos oreophilus</i>	15.00	8.00	20.00	0.00	0.00	0.00	5.00	0.00
FORBS								
<i>Cryptantha flavoculata</i>	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Erigeron sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Eriogonum sp.</i>	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00
<i>Penstemon sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES								
<i>Elymus salinus</i>	0.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER								
Overstory	45.00	70.00	35.00	40.00	80.00	70.00	50.00	70.00
Understory	25.00	15.00	20.00	10.00	45.00	25.00	15.00	35.00
Litter	39.00	80.00	40.00	29.00	45.00	40.00	50.00	40.00
Bareground	1.00	4.00	5.00	1.00	5.00	5.00	5.00	5.00
Rock	35.00	1.00	35.00	60.00	5.00	30.00	30.00	20.00
% COMPOSITION								
Shrubs	100.00	53.33	100.00	50.00	100.00	100.00	100.00	85.71
Forbs	0.00	0.00	0.00	50.00	0.00	0.00	0.00	14.29
Grasses	0.00	46.67	0.00	0.00	0.00	0.00	0.00	0.00
Overstory + Understory	70.00	85.00	55.00	50.00	125.00	95.00	65.00	105.00

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
15.00	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	35.00	15.00	0.00	0.00	15.00
0.00	50.00	80.00	10.00	55.00	40.00	20.00	50.00	75.00	15.00
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	0.00	50.00	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	35.00	0.00	0.00	0.00	0.00	15.00	0.00
10.00	5.00	5.00	5.00	10.00	0.00	15.00	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	0.00	0.00	0.00	0.00	0.00	0.00
5.00	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	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	5.00
15.00	50.00	80.00	10.00	55.00	75.00	35.00	50.00	75.00	30.00
15.00	10.00	5.00	40.00	20.00	30.00	15.00	50.00	25.00	5.00
65.00	45.00	85.00	25.00	35.00	45.00	65.00	40.00	65.00	65.00
10.00	5.00	5.00	5.00	20.00	5.00	5.00	5.00	5.00	5.00
10.00	40.00	5.00	30.00	25.00	20.00	15.00	5.00	5.00	25.00
66.67	50.00	100.00	100.00	50.00	100.00	100.00	100.00	100.00	0.00
33.33	50.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	25.00	0.00	0.00	0.00	0.00	100.00
30.00	60.00	85.00	50.00	75.00	105.00	50.00	100.00	100.00	35.00

CANYON FUELS
 Dugout Mine
 Site G-13
 Slope: 5-25 deg
 Exposure: ENE
 Sample Date: 12 July 2005

19.00	20.00	Mean	SDev	Freq	
					OVERSTORY
0.00	0.00	8.00	12.39	35.00	<i>Juniperus osteosperma</i>
25.00	0.00	4.50	9.73	20.00	<i>Juniperus scopulorum</i>
50.00	10.00	38.50	21.80	95.00	<i>Pseudotsuga menziesii</i>
					UNDERSTORY
					SHRUBS
0.00	0.00	0.85	2.78	10.00	<i>Artemisia tridentata</i>
0.00	20.00	4.40	7.10	30.00	<i>Juniperus osteosperma</i>
0.00	0.00	2.50	10.90	5.00	<i>Juniperus scopulorum</i>
0.00	0.00	1.75	6.57	10.00	<i>Mahonia repens</i>
0.00	0.00	4.25	9.52	20.00	<i>Pseudotsuga menziesii</i>
0.00	10.00	5.90	5.99	60.00	<i>Symphoricarpos oreophilus</i>
					FORBS
0.00	0.00	0.10	0.44	5.00	<i>Cryptantha flavoculata</i>
5.00	0.00	0.25	1.09	5.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.75	1.79	15.00	<i>Erigeron sp.</i>
0.00	0.00	0.15	0.65	5.00	<i>Eriogonum sp.</i>
0.00	0.00	0.25	1.09	5.00	<i>Penstemon sp.</i>
					GRASSES
0.00	0.00	0.85	2.06	15.00	<i>Elymus salinus</i>
					COVER
75.00	10.00	51.00	22.67		Overstory
5.00	30.00	22.00	12.88		Understory
70.00	25.00	49.65	17.23		Litter
5.00	5.00	5.55	3.72		Bareground
20.00	40.00	22.80	14.88		Rock
					% COMPOSITION
0.00	100.00	77.79	32.50		Shrubs
100.00	0.00	13.63	25.71		Forbs
0.00	0.00	8.58	23.80		Grasses
80.00	40.00	73.00	26.05		Overstory + Understory

Prev. Disturb Doug Fir/Aspen

CANYON FUELS

Dugout Mine

Site G-14

Slope: 7-10 deg

Exposure: N

Sample Date: 12 July 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
OVERSTORY								
<i>Abies concolor</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Populus tremuloides</i>	0.00	0.00	0.00	0.00	0.00	35.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	25.00	65.00	0.00	35.00	30.00	0.00	0.00
UNDERSTORY								
SHRUBS								
<i>Pachistima myrsinites</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	5.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00
FORBS								
<i>Aquilegia caerulea</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Arnica cordifolia</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
<i>Epilobium sp.</i>	0.00	23.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Osmorhiza depauperata</i>	0.00	2.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Taraxacum officinale</i>	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
<i>Viola adunca</i>	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
GRASSES								
<i>Poa fendleriana</i>	0.00	0.00	5.00	10.00	0.00	35.00	20.00	0.00
COVER								
Overstory	0.00	25.00	65.00	0.00	35.00	65.00	0.00	0.00
Understory	15.00	25.00	10.00	25.00	5.00	45.00	25.00	10.00
Litter	80.00	70.00	85.00	55.00	74.00	50.00	70.00	85.00
Bareground	4.00	4.00	4.00	19.00	20.00	4.00	3.00	4.00
Rock	1.00	1.00	1.00	1.00	1.00	1.00	2.00	1.00
% COMPOSITION								
Shrubs	66.67	0.00	50.00	0.00	100.00	0.00	0.00	0.00
Forbs	33.33	100.00	0.00	60.00	0.00	22.22	20.00	100.00
Grasses	0.00	0.00	50.00	40.00	0.00	77.78	80.00	0.00
Overstory + Understory	15.00	50.00	75.00	25.00	40.00	110.00	25.00	10.00

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
0.00	0.00	35.00	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	75.00	35.00	0.00	0.00	80.00	0.00	75.00	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	15.00	20.00	0.00	0.00	0.00
25.00	5.00	5.00	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	5.00	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	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	2.00	5.00	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	5.00	0.00	0.00	5.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	10.00	25.00	0.00	15.00	8.00	0.00	15.00	10.00
0.00	75.00	70.00	0.00	0.00	80.00	0.00	75.00	0.00	0.00
25.00	20.00	20.00	30.00	15.00	35.00	30.00	10.00	15.00	10.00
70.00	75.00	75.00	60.00	80.00	60.00	65.00	85.00	83.00	85.00
4.00	4.00	4.00	6.00	4.00	1.00	4.00	1.00	1.00	4.00
1.00	1.00	1.00	4.00	1.00	4.00	1.00	4.00	1.00	1.00
100.00	25.00	25.00	0.00	33.33	42.86	66.67	50.00	0.00	0.00
0.00	75.00	25.00	16.67	66.67	14.29	6.67	50.00	0.00	0.00
0.00	0.00	50.00	83.33	0.00	42.86	26.67	0.00	100.00	100.00
25.00	95.00	90.00	30.00	15.00	115.00	30.00	85.00	15.00	10.00

CANYON FUELS
 Dugout Mine
 Site G-205
 Slope: 7-10 deg
 Exposure: N
 Sample Date: 12 July 2005

19.00	20.00	Mean	SDev	Freq	
					OVERSTORY
0.00	0.00	1.75	7.63	5.00	<i>Abies concolor</i>
0.00	0.00	1.75	7.63	5.00	<i>Populus tremuloides</i>
0.00	50.00	23.50	29.42	45.00	<i>Pseudotsuga menziesii</i>
					UNDERSTORY
					SHRUBS
0.00	0.00	0.25	1.09	5.00	<i>Pachistima myrsinites</i>
0.00	30.00	3.50	8.08	20.00	<i>Pseudotsuga menziesii</i>
8.00	0.00	3.15	5.66	40.00	<i>Symphoricarpos oreophilus</i>
					FORBS
0.00	4.00	0.45	1.36	10.00	<i>Aquilegia caerulea</i>
0.00	3.00	1.65	2.78	30.00	<i>Arnica cordifolia</i>
0.00	0.00	1.15	5.01	5.00	<i>Epilobium sp.</i>
0.00	0.00	0.95	1.80	25.00	<i>Osmorhiza depauperata</i>
0.00	0.00	1.00	3.39	10.00	<i>Taraxacum officinale</i>
0.00	0.00	1.00	2.00	20.00	<i>Viola adunca</i>
					GRASSES
7.00	3.00	8.15	9.54	60.00	<i>Poa fendleriana</i>
					COVER
0.00	50.00	27.00	32.23		Overstory
15.00	40.00	21.25	10.59		Understory
80.00	55.00	72.10	11.00		Litter
4.00	4.00	5.15	4.93		Bareground
1.00	1.00	1.50	1.07		Rock
					% COMPOSITION
53.33	75.00	34.39	33.84		Shrubs
0.00	17.50	30.37	32.55		Forbs
46.67	7.50	35.24	36.01		Grasses
15.00	90.00	48.25	35.86		Overstory + Understory

CANYON FUELS
Dugout Mine
Site G-14 Reference Area
Aspen/Doug Fir

Slope: 6 deg

Exposure: NW

Sample Date: 5-9 July 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
OVERSTORY								
<i>Abies concolor</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Populus tremuloides</i>	45.00	20.00	45.00	0.00	40.00	50.00	0.00	25.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	50.00	20.00	0.00	60.00	0.00
UNDERSTORY								
SHRUBS								
<i>Abies concolor</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Mahonia repens</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Populus tremuloides</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	40.00	5.00
<i>Rosa woodsii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	5.00	0.00	5.00	2.00	0.00	15.00	0.00	5.00
FORBS								
<i>Achillea millefolium</i>	0.00	2.00	5.00	0.00	3.00	0.00	0.00	0.00
<i>Aquilegia caerulea</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Arnica cordifolia</i>	0.00	55.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Delphinium nelsonii</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Epilobium sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Lupinus argenteus</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Osmorhiza depauperata</i>	5.00	3.00	5.00	1.00	3.00	0.00	0.00	0.00
GRASSES								
<i>Poa fendleriana</i>	0.00	5.00	10.00	2.00	4.00	5.00	0.00	0.00
COVER								
Overstory	45.00	20.00	45.00	50.00	60.00	50.00	60.00	25.00
Understory	20.00	65.00	25.00	10.00	10.00	25.00	40.00	15.00
Litter	75.00	33.00	70.00	85.00	80.00	65.00	55.00	75.00
Bareground	4.00	1.00	4.00	4.00	9.00	9.00	4.00	9.00
Rock	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
% COMPOSITION								
Shrubs	50.00	0.00	20.00	20.00	0.00	60.00	100.00	100.00
Forbs	50.00	92.31	40.00	60.00	60.00	20.00	0.00	0.00
Grasses	0.00	7.69	40.00	20.00	40.00	20.00	0.00	0.00
Overstory + Understory	65.00	85.00	70.00	60.00	70.00	75.00	100.00	40.00

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35.00	0.00	25.00	0.00	35.00	0.00	35.00	0.00	0.00	55.00
0.00	70.00	25.00	50.00	0.00	55.00	0.00	75.00	55.00	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	5.00	0.00	5.00	0.00	5.00	0.00
0.00	5.00	0.00	0.00	0.00	5.00	5.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	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	17.00	5.00	0.00	5.00	5.00	15.00	5.00	0.00
0.00	0.00	0.00	5.00	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	0.00	0.00
0.00	0.00	0.00	2.00	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	0.00	0.00	3.00	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
10.00	0.00	0.00	0.00	5.00	5.00	5.00	0.00	0.00	0.00
15.00	0.00	18.00	15.00	0.00	5.00	5.00	0.00	5.00	15.00
70.00	70.00	50.00	50.00	35.00	55.00	35.00	75.00	55.00	55.00
40.00	15.00	35.00	30.00	25.00	25.00	25.00	15.00	50.00	15.00
58.00	75.00	55.00	60.00	65.00	70.00	65.00	80.00	40.00	75.00
1.00	9.00	9.00	8.00	9.00	4.00	9.00	4.00	9.00	9.00
1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
25.00	100.00	48.57	16.67	20.00	40.00	60.00	100.00	90.00	0.00
37.50	0.00	0.00	33.33	80.00	40.00	20.00	0.00	0.00	0.00
37.50	0.00	51.43	50.00	0.00	20.00	20.00	0.00	10.00	100.00
110.00	85.00	85.00	80.00	60.00	80.00	60.00	90.00	105.00	70.00

CANYON FUELS
 Dugout Mine
 Site G-205 Reference Area
 Aspen/Doug Fir
 Slope: 6 deg
 Exposure: NW
 Sample Date: 5-9 July 2005

19.00	20.00	Mean	SDev	Freq	
<hr/>					OVERSTORY
0.00	0.00	1.75	7.63	5.00	<i>Abies concolor</i>
50.00	55.00	25.75	20.93	65.00	<i>Populus tremuloides</i>
0.00	0.00	23.00	27.95	45.00	<i>Pseudotsuga menziesii</i>
<hr/>					UNDERSTORY
<hr/>					SHRUBS
0.00	0.00	0.50	2.18	5.00	<i>Abies concolor</i>
0.00	0.00	0.75	1.79	15.00	<i>Mahonia repens</i>
0.00	0.00	1.25	2.17	25.00	<i>Populus tremuloides</i>
0.00	0.00	4.25	11.21	20.00	<i>Pseudotsuga menziesii</i>
0.00	10.00	0.50	2.18	5.00	<i>Rosa woodsii</i>
7.00	25.00	6.05	6.65	70.00	<i>Symphoricarpos oreophilus</i>
<hr/>					FORBS
3.00	0.00	1.40	2.03	35.00	<i>Achillea millefolium</i>
0.00	0.00	0.25	1.09	5.00	<i>Aquilegia caerulea</i>
0.00	0.00	3.10	11.96	15.00	<i>Arnica cordifolia</i>
0.00	0.00	0.25	1.09	5.00	<i>Delphinium nelsonii</i>
5.00	0.00	0.65	1.59	15.00	<i>Epilobium sp.</i>
0.00	0.00	0.50	1.50	10.00	<i>Lupinus argenteus</i>
0.00	0.00	2.10	2.79	45.00	<i>Osmorhiza depauperata</i>
<hr/>					GRASSES
5.00	5.00	5.70	5.68	70.00	<i>Poa fendleriana</i>
<hr/>					COVER
50.00	55.00	50.50	13.68		Overstory
20.00	40.00	27.25	13.83		Understory
65.00	55.00	65.05	12.89		Litter
14.00	4.00	6.65	3.31		Bareground
1.00	1.00	1.05	0.22		Rock
<hr/>					% COMPOSITION
35.00	87.50	48.64	35.66		Shrubs
40.00	0.00	28.66	28.56		Forbs
25.00	12.50	22.71	24.47		Grasses
<hr/>					Overstory + Understory
70.00	95.00	77.75	16.84		

CANYON FUELS
 Dugout Mine
 Dist PSME/ACGR
 Site G-15

Slope: Variable (mostly S)

1 thru 10 Logged

Exposure: Variable

Sample Date: 13-14 Sept 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
<i>Acer grandidentatum</i>	0.00	0.00	60.00	0.00	0.00	20.00	40.00
<i>Pseudotsuga menziesii</i>	75.00	0.00	0.00	0.00	0.00	0.00	40.00
UNDERSTORY							
SHRUBS							
<i>Acer grandidentatum</i>	0.00	0.00	60.00	0.00	0.00	45.00	0.00
<i>Artemisia tridentata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chrysothamnus nauseosus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	25.00	0.00	0.00	20.00	15.00	25.00
<i>Symphoricarpos oreophilus</i>	10.00	15.00	0.00	0.00	0.00	0.00	0.00
FORBS							
<i>Artemisia dracunculus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Aster sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Convolvulus arvensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	10.00	5.00	0.00	0.00
<i>Taraxacum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Viola adunca</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
<i>Poa fendleriana</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Poa pratensis</i>	0.00	0.00	0.00	0.00	10.00	0.00	0.00
<i>Poa secunda</i>	0.00	0.00	0.00	30.00	0.00	0.00	0.00
COVER							
Overstory	75.00	0.00	60.00	0.00	0.00	20.00	80.00
Understory	10.00	40.00	60.00	40.00	40.00	65.00	25.00
Litter	75.00	25.00	30.00	50.00	35.00	15.00	65.00
Bareground	5.00	5.00	5.00	5.00	15.00	15.00	5.00
Rock	10.00	30.00	5.00	5.00	10.00	5.00	5.00
% COMPOSITION							
Shrubs	100.00	100.00	100.00	0.00	62.50	100.00	100.00
Forbs	0.00	0.00	0.00	25.00	12.50	0.00	0.00
Grasses	0.00	0.00	0.00	75.00	25.00	0.00	0.00
Overstory + Understory	85.00	40.00	120.00	40.00	40.00	85.00	105.00
Living + Litter + Rock	170.00	95.00	155.00	95.00	85.00	105.00	175.00

11-20 Road Disturbed

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
70.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	50.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	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	5.00	0.00	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	35.00	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	20.00	15.00	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	0.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00
0.00	0.00	0.00	5.00	5.00	0.00	5.00	0.00	25.00	5.00
0.00	0.00	0.00	0.00	5.00	0.00	0.00	5.00	0.00	15.00
0.00	0.00	0.00	0.00	0.00	15.00	5.00	0.00	0.00	0.00
0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4.00	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	20.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00
70.00	70.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.00	25.00	30.00	40.00	25.00	35.00	20.00	50.00	25.00	25.00
60.00	60.00	60.00	10.00	5.00	10.00	15.00	5.00	60.00	5.00
5.00	10.00	5.00	45.00	65.00	50.00	5.00	40.00	5.00	55.00
5.00	5.00	5.00	5.00	5.00	5.00	60.00	5.00	10.00	15.00
100.00	80.00	66.67	87.50	0.00	0.00	25.00	40.00	0.00	0.00
0.00	4.00	0.00	12.50	40.00	42.86	50.00	60.00	100.00	100.00
0.00	16.00	33.33	0.00	60.00	57.14	25.00	0.00	0.00	0.00
100.00	95.00	55.00	40.00	25.00	35.00	20.00	50.00	25.00	25.00
165.00	160.00	120.00	55.00	35.00	50.00	95.00	60.00	95.00	45.00

CANYON FUELS
 Dugout Mine
 Site G-15
 Slope: Variable
 Exposure: Variable
 Sample Date: 13-14 Sept 2005

18.00	19.00	20.00	Mean	SDev	Freq	
<hr/>						OVERSTORY
0.00	0.00	0.00	10.50	20.85	25.00	<i>Acer grandidentatum</i>
0.00	0.00	0.00	9.50	20.67	20.00	<i>Pseudotsuga menziesii</i>
<hr/>						UNDERSTORY
<hr/>						SHRUBS
0.00	0.00	0.00	5.75	15.83	20.00	<i>Acer grandidentatum</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	1.00	4.36	5.00	<i>Chrysothamnus nauseosus</i>
0.00	0.00	0.00	2.00	7.65	10.00	<i>Gutierrezia sarothrae</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Juniperus scopulorum</i>
0.00	0.00	0.00	6.75	9.52	35.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	0.00	1.50	3.91	15.00	<i>Symphoricarpos oreophilus</i>
<hr/>						FORBS
0.00	0.00	0.00	0.25	1.09	5.00	<i>Artemisia dracunculus</i>
0.00	0.00	0.00	1.25	5.45	5.00	<i>Aster sp.</i>
10.00	15.00	15.00	4.25	6.76	40.00	<i>Convolvulus arvensis</i>
0.00	0.00	5.00	2.25	4.02	60.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.00	1.00	3.39	10.00	<i>Taraxacum officinale</i>
0.00	0.00	0.00	0.05	0.22	5.00	<i>Viola adunca</i>
<hr/>						GRASSES
0.00	0.00	0.00	0.70	2.30	10.00	<i>Poa fendleriana</i>
5.00	0.00	0.00	2.00	4.85	20.00	<i>Poa pratensis</i>
0.00	0.00	0.00	2.25	7.15	10.00	<i>Poa secunda</i>
<hr/>						COVER
0.00	0.00	0.00	20.00	30.37		Overstory
15.00	15.00	20.00	31.75	14.25		Understory
10.00	5.00	5.00	30.25	24.57		Litter
25.00	50.00	65.00	24.00	22.34		Bareground
50.00	30.00	10.00	14.00	15.62		Rock
<hr/>						% COMPOSITION
0.00	0.00	0.00	48.08	43.81		Shrubs
66.67	100.00	100.00	35.68	38.39		Forbs
33.33	0.00	0.00	16.24	23.39		Grasses
<hr/>						Overstory + Understory
15.00	15.00	20.00	51.75	32.87		
<hr/>						Living + Litter + Rock
75.00	50.00	35.00	96.00	46.11		

CANYON FUEL
 Dugout Mine
 Site G-12, G-13, G-15 Reference Area
 Conifer/ Mtn. Brush/PJ

Slope: 35-38 deg

Exposure: SE

Sample Date: 5-9 July 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00
OVERSTORY								
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus osteosperma</i>	0.00	0.00	0.00	0.00	75.00	70.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	65.00	0.00	0.00	0.00	0.00	0.00	60.00	0.00
UNDERSTORY								
SHRUBS								
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Artemisia tridentata</i>	0.00	15.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Cercocarpus montanus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chrysothamnus nauseosus</i>	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Gutierrezia sarothrae</i>	0.00	0.00	18.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus osteosperma</i>	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00
<i>Opuntia polyacantha</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	35.00	0.00	0.00	0.00	0.00	0.00	70.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00	9.00
FORBS								
<i>Cryptantha flavoculata</i>	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES								
<i>Elymus salinus</i>	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Poa secunda</i>	0.00	0.00	0.00	0.00	0.00	5.00	0.00	1.00
<i>Stipa hymenoides</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
COVER								
Overstory	65.00	0.00	0.00	0.00	75.00	70.00	60.00	10.00
Understory	35.00	25.00	18.00	15.00	10.00	25.00	70.00	10.00
Litter	35.00	5.00	12.00	15.00	60.00	25.00	15.00	15.00
Bareground	5.00	15.00	15.00	20.00	5.00	5.00	5.00	5.00
Rock	25.00	55.00	55.00	50.00	25.00	45.00	10.00	70.00
% COMPOSITION								
Shrubs	100.00	92.00	100.00	66.67	50.00	80.00	100.00	90.00
Forbs	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00
Grasses	0.00	0.00	0.00	33.33	50.00	20.00	0.00	10.00
Overstory + Understory	100.00	25.00	18.00	15.00	85.00	95.00	130.00	20.00

9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00
35.00	0.00	0.00	0.00	0.00	0.00	35.00	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
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	30.00	0.00	45.00	0.00	0.00	0.00	80.00	50.00	0.00
40.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00
10.00	0.00	10.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	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	15.00	0.00	0.00	10.00	30.00
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	15.00	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	0.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.00	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	0.00	0.00	0.00	0.00	0.00
10.00	0.00	10.00	5.00	10.00	15.00	0.00	15.00	0.00	0.00
0.00	0.00	0.00	0.00	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	10.00	0.00
75.00	30.00	0.00	45.00	10.00	0.00	35.00	80.00	50.00	15.00
40.00	45.00	35.00	45.00	20.00	45.00	50.00	25.00	20.00	30.00
25.00	20.00	15.00	40.00	5.00	10.00	5.00	60.00	25.00	10.00
30.00	30.00	15.00	10.00	5.00	5.00	5.00	5.00	5.00	40.00
5.00	5.00	35.00	5.00	70.00	40.00	40.00	10.00	50.00	20.00
75.00	88.89	71.43	88.89	50.00	66.67	100.00	0.00	50.00	100.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.00	11.11	28.57	11.11	50.00	33.33	0.00	100.00	50.00	0.00
115.00	75.00	35.00	90.00	30.00	45.00	85.00	105.00	70.00	45.00

CANYON FUELS
 Dugout Mine
 Site G-12, G-13 Reference Area
 Conifer/ Mtn. Brush/PJ

Slope: 35-38 deg

Exposure: SE

Sample Date: 5-9 July 2005

19.00	20.00	Mean	SDev	Freq	
OVERSTORY					
0.00	0.00	4.00	10.56	15.00	<i>Amelanchier utahensis</i>
0.00	0.00	0.75	3.27	5.00	<i>Cercocarpus montanus</i>
0.00	0.00	7.25	21.76	10.00	<i>Juniperus osteosperma</i>
0.00	0.00	10.25	22.05	20.00	<i>Pinus edulis</i>
0.00	0.00	8.75	19.99	20.00	<i>Pseudotsuga menziesii</i>
UNDERSTORY					
SHRUBS					
0.00	0.00	3.50	11.08	15.00	<i>Amelanchier utahensis</i>
0.00	20.00	2.50	5.59	20.00	<i>Artemisia tridentata</i>
0.00	15.00	3.50	7.76	20.00	<i>Cercocarpus montanus</i>
0.00	0.00	0.40	1.74	5.00	<i>Chrysothamnus nauseosus</i>
0.00	0.00	0.90	3.92	5.00	<i>Gutierrezia sarothrae</i>
40.00	0.00	3.75	9.86	15.00	<i>Juniperus osteosperma</i>
0.00	0.00	0.25	1.09	5.00	<i>Opuntia polyacantha</i>
0.00	0.00	3.50	10.62	10.00	<i>Pinus edulis</i>
0.00	0.00	5.75	16.68	15.00	<i>Pseudotsuga menziesii</i>
0.00	0.00	2.45	5.05	25.00	<i>Symphoricarpos oreophilus</i>
FORBS					
0.00	0.00	0.10	0.44	5.00	<i>Cryptantha flavoculata</i>
GRASSES					
0.00	10.00	4.00	5.39	40.00	<i>Elymus salinus</i>
0.00	0.00	0.80	2.38	15.00	<i>Poa secunda</i>
0.00	0.00	1.00	2.55	15.00	<i>Stipa hymenoides</i>
COVER					
0.00	0.00	31.00	30.19		Overstory
40.00	45.00	32.40	14.96		Understory
10.00	25.00	21.60	15.83		Litter
10.00	10.00	12.25	10.06		Bareground
40.00	20.00	33.75	20.55		Rock
% COMPOSITION					
100.00	77.78	77.37	24.72		Shrubs
0.00	0.00	0.40	1.74		Forbs
0.00	22.22	22.23	25.02		Grasses
40.00	45.00	63.40	34.81		Overstory + Understory

CANYON FUELS

Dugout Mine

Site G-16

Reclaimed Undisturbed/AMUT/SYOR/ARTR

Slope: 1-8 deg

1 thru 10 Reclaimed

Exposure: Variable

Sample Date: 13-14 Sept 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	2.00	0.00	0.00	0.00
<i>Artemisia tridentata</i>	0.00	0.00	0.00	0.00	0.00	3.00	5.00
<i>Symphoricarpos oreophilus</i>	0.00	0.00	0.00	0.00	0.00	2.00	0.00
FORBS							
<i>Astragalus sp.</i>	0.00	5.00	8.00	0.00	0.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Hedysarum boreale</i>	3.00	0.00	0.00	0.00	0.00	0.00	5.00
<i>Lupinus argenteus</i>	2.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Penstemon strictus</i>	0.00	0.00	2.00	0.00	0.00	0.00	0.00
<i>Penstemon watsonii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
<i>Elymus lanceolatus</i>	0.00	3.00	0.00	13.00	0.00	3.00	5.00
<i>Elymus salinus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus smithii</i>	0.00	0.00	5.00	0.00	20.00	2.00	0.00
<i>Elymus spicatus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus trachycaulus</i>	0.00	2.00	0.00	0.00	0.00	0.00	0.00
<i>Poa pratensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Stipa comata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Overstory	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Understory	5.00	10.00	15.00	15.00	20.00	10.00	15.00
Litter	10.00	1.00	10.00	10.00	10.00	5.00	10.00
Bareground	75.00	70.00	60.00	60.00	60.00	75.00	60.00
Rock	10.00	19.00	15.00	15.00	10.00	10.00	15.00
% COMPOSITION							
Shrubs	0.00	0.00	0.00	13.33	0.00	50.00	33.33
Forbs	100.00	50.00	66.67	0.00	0.00	0.00	33.33
Grasses	0.00	50.00	33.33	86.67	100.00	50.00	33.33
Overstory + Understory	5.00	10.00	15.00	15.00	20.00	10.00	15.00

11-20 Undisturbed

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	10.00
0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	10.00	0.00	40.00	0.00	40.00	0.00
0.00	0.00	0.00	25.00	10.00	5.00	0.00	7.00	35.00	25.00
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	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	5.00	5.00	25.00	8.00	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	10.00	0.00	5.00	0.00	0.00	0.00
10.00	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	10.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	10.00	5.00	40.00	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	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00
0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	10.00
10.00	10.00	10.00	55.00	50.00	50.00	70.00	30.00	75.00	35.00
10.00	5.00	5.00	20.00	25.00	10.00	20.00	25.00	15.00	20.00
65.00	75.00	70.00	20.00	20.00	25.00	5.00	25.00	5.00	40.00
15.00	10.00	15.00	5.00	5.00	15.00	5.00	20.00	5.00	5.00
0.00	0.00	0.00	72.73	40.00	10.00	57.14	23.33	100.00	71.43
0.00	50.00	0.00	9.09	10.00	10.00	35.71	26.67	0.00	0.00
100.00	50.00	100.00	18.18	50.00	80.00	7.14	50.00	0.00	28.57
10.00	10.00	10.00	75.00	50.00	50.00	70.00	30.00	75.00	45.00

CANYON FUELS
 Dugout Mine
 Site G-16
 Reclaimed Undisturbed
 Slope: 1-8 deg
 Exposure: Variable
 Sample Date: 13-14 Sept 2005

18.00	19.00	20.00	Mean	SDev	Freq	
<hr/>						OVERSTORY
0.00	70.00	0.00	5.00	15.65	15.00	<i>Amelanchier utahensis</i>
<hr/>						UNDERSTORY
<hr/>						SHRUBS
0.00	25.00	0.00	2.10	6.19	15.00	<i>Amelanchier utahensis</i>
0.00	10.00	45.00	7.65	14.64	35.00	<i>Artemisia tridentata</i>
15.00	10.00	0.00	6.70	10.20	45.00	<i>Symphoricarpos oreophilus</i>
<hr/>						FORBS
0.00	0.00	0.00	0.65	2.01	10.00	<i>Astragalus sp.</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.00	0.40	1.24	10.00	<i>Hedysarum boreale</i>
0.00	0.00	0.00	0.10	0.44	5.00	<i>Lupinus argenteus</i>
0.00	0.00	0.00	0.10	0.44	5.00	<i>Penstemon strictus</i>
0.00	0.00	0.00	2.40	5.70	25.00	<i>Penstemon watsonii</i>
<hr/>						GRASSES
0.00	0.00	0.00	1.20	3.03	20.00	<i>Elymus lanceolatus</i>
0.00	0.00	0.00	0.75	2.38	10.00	<i>Elymus salinus</i>
0.00	0.00	0.00	2.60	5.09	30.00	<i>Elymus smithii</i>
0.00	0.00	0.00	0.50	2.18	5.00	<i>Elymus spicatus</i>
10.00	0.00	5.00	3.60	8.93	30.00	<i>Elymus trachycaulus</i>
5.00	0.00	15.00	1.50	3.91	15.00	<i>Poa pratensis</i>
0.00	0.00	0.00	0.75	3.27	5.00	<i>Stipa comata</i>
<hr/>						COVER
0.00	70.00	0.00	5.00	15.65		Overstory
30.00	45.00	65.00	31.25	22.24		Understory
15.00	5.00	20.00	12.55	6.90		Litter
50.00	5.00	10.00	43.75	25.83		Bareground
5.00	45.00	5.00	12.45	8.97		Rock
<hr/>						% COMPOSITION
50.00	100.00	69.23	34.53	34.02		Shrubs
0.00	0.00	0.00	19.57	27.53		Forbs
50.00	0.00	30.77	45.90	32.51		Grasses
<hr/>						
30.00	115.00	65.00	36.25	29.79		Overstory + Understory
<hr/>						

CANYON FUELS
 Dugout Mine
 Mtn Brush/Snowberry/Sage & Previous Dist
 Site G-17

Slope: W

Exposure: 10 deg

Sample Date: 13-14 Sept 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
<i>Amelanchier utahensis</i>	0.00	0.00	10.00	5.00	0.00	70.00	0.00
<i>Populus tremuloides</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
<i>Amelanchier utahensis</i>	5.00	10.00	0.00	0.00	0.00	10.00	25.00
<i>Artemisia tridentata</i>	20.00	20.00	10.00	0.00	0.00	0.00	15.00
<i>Populus tremuloides</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Rosa woodsii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	5.00	25.00	15.00	15.00	50.00	0.00	15.00
FORBS							
<i>Achillea millefolium</i>	0.00	5.00	0.00	10.00	0.00	0.00	0.00
<i>Cynoglossum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Linum lewisii</i>	2.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Lupinus argenteus</i>	0.00	0.00	0.00	10.00	0.00	0.00	5.00
<i>Penstemon watsonii</i>	3.00	0.00	5.00	0.00	5.00	0.00	5.00
<i>Taraxacum officinale</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
<i>Elymus trachycaulus</i>	0.00	10.00	0.00	0.00	5.00	0.00	0.00
<i>Poa pratensis</i>	15.00	0.00	10.00	5.00	5.00	0.00	0.00
COVER							
Overstory	0.00	0.00	10.00	5.00	0.00	70.00	0.00
Understory	50.00	70.00	40.00	40.00	65.00	10.00	65.00
Litter	13.00	24.00	49.00	48.00	14.00	85.00	25.00
Bareground	35.00	5.00	10.00	10.00	20.00	4.00	9.00
Rock	2.00	1.00	1.00	2.00	1.00	1.00	1.00
% COMPOSITION							
Shrubs	60.00	78.57	62.50	37.50	76.92	100.00	84.62
Forbs	10.00	7.14	12.50	50.00	7.69	0.00	15.38
Grasses	30.00	14.29	25.00	12.50	15.38	0.00	0.00
Overstory + Understory	50.00	70.00	50.00	45.00	65.00	80.00	65.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	45.00	20.00	45.00	0.00	0.00	0.00	65.00	0.00	0.00
0.00	0.00	0.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00
0.00	20.00	0.00	20.00	0.00	0.00	0.00	0.00	20.00	0.00
15.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	35.00
0.00	0.00	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	5.00	0.00
15.00	20.00	25.00	15.00	20.00	30.00	20.00	30.00	25.00	5.00
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	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	15.00	0.00	0.00	0.00	0.00	10.00	5.00	20.00
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	0.00	5.00	0.00	0.00	5.00
10.00	0.00	0.00	0.00	10.00	10.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	10.00	0.00	15.00	15.00	0.00
0.00	45.00	20.00	45.00	35.00	0.00	0.00	65.00	0.00	0.00
55.00	40.00	40.00	35.00	35.00	50.00	50.00	60.00	70.00	70.00
10.00	10.00	4.00	55.00	4.00	19.00	30.00	35.00	25.00	20.00
25.00	45.00	55.00	9.00	60.00	30.00	19.00	4.00	4.00	9.00
10.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
54.55	100.00	62.50	100.00	71.43	60.00	70.00	50.00	71.43	57.14
18.18	0.00	37.50	0.00	0.00	0.00	30.00	25.00	7.14	42.86
27.27	0.00	0.00	0.00	28.57	40.00	0.00	25.00	21.43	0.00
55.00	85.00	60.00	80.00	70.00	50.00	50.00	125.00	70.00	70.00

CANYON FUELS
 Dugout Mine
 Mtn Brush/Snowberry
 Site G-17
 Slope: W
 Exposure: 10 deg
 Sample Date: 13-14 Sept 2005

18.00	19.00	20.00	Mean	SDev	Freq	
<hr/>						OVERSTORY
0.00	10.00	0.00	13.50	22.53	40.00	<i>Amelanchier utahensis</i>
0.00	0.00	0.00	1.75	7.63	5.00	<i>Populus tremuloides</i>
<hr/>						UNDERSTORY
<hr/>						SHRUBS
0.00	0.00	0.00	5.50	8.50	35.00	<i>Amelanchier utahensis</i>
0.00	0.00	45.00	8.25	12.77	40.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Populus tremuloides</i>
0.00	0.00	0.00	0.50	1.50	10.00	<i>Rosa woodsii</i>
10.00	30.00	25.00	19.75	10.89	95.00	<i>Symphoricarpos oreophilus</i>
<hr/>						FORBS
15.00	0.00	0.00	1.75	3.96	20.00	<i>Achillea millefolium</i>
5.00	0.00	0.00	0.75	1.79	15.00	<i>Cynoglossum officinale</i>
0.00	0.00	0.00	0.10	0.44	5.00	<i>Linum lewisii</i>
0.00	0.00	0.00	3.50	5.72	35.00	<i>Lupinus argenteus</i>
0.00	0.00	0.00	1.40	2.18	30.00	<i>Penstemon watsonii</i>
0.00	5.00	0.00	0.75	1.79	15.00	<i>Taraxacum officinale</i>
<hr/>						GRASSES
0.00	0.00	0.00	2.25	4.02	25.00	<i>Elymus trachycaulus</i>
10.00	20.00	0.00	5.50	6.50	50.00	<i>Poa pratensis</i>
<hr/>						COVER
0.00	10.00	0.00	15.25	22.77		Overstory
40.00	55.00	70.00	50.50	15.40		Understory
8.00	18.00	25.00	26.05	19.63		Litter
50.00	25.00	4.00	21.60	18.01		Bareground
2.00	2.00	1.00	1.85	2.08		Rock
<hr/>						% COMPOSITION
25.00	54.55	100.00	68.84	20.43		Shrubs
50.00	9.09	0.00	16.12	16.79		Forbs
25.00	36.36	0.00	15.04	13.76		Grasses
<hr/>						
40.00	65.00	70.00	65.75	18.18		Overstory + Understory
<hr/>						

CANYON FUELS
 Dugout Mine
 AMUT/SYOR/ARTR
 Site G-16 & G-17 Reference Area

Slope: W

Exposure: 10 deg

Sample Date: 13-14 Sept 2005

	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	15.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	15.00	0.00
<i>Artemisia tridentata</i>	10.00	10.00	20.00	0.00	15.00	5.00	20.00
<i>Juniperus scopulorum</i>	0.00	0.00	0.00	5.00	0.00	0.00	0.00
<i>Symphoricarpos oreophilus</i>	0.00	15.00	5.00	5.00	0.00	20.00	0.00
FORBS							
<i>Astragalus sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Lupinus argenteus</i>	10.00	10.00	0.00	10.00	5.00	1.00	15.00
<i>Penstemon watsonii</i>	25.00	0.00	20.00	0.00	10.00	19.00	5.00
GRASSES							
<i>Elymus salinus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Elymus spicatus</i>	10.00	5.00	10.00	0.00	0.00	0.00	0.00
<i>Elymus trachycaulus</i>	0.00	0.00	0.00	0.00	0.00	0.00	10.00
<i>Poa pratensis</i>	0.00	0.00	0.00	20.00	15.00	5.00	0.00
<i>Poa secunda</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Overstory	0.00	0.00	0.00	15.00	0.00	0.00	0.00
Understory	55.00	40.00	55.00	40.00	45.00	65.00	50.00
Litter	25.00	8.00	15.00	40.00	10.00	15.00	20.00
Bareground	10.00	45.00	25.00	5.00	30.00	15.00	15.00
Rock	10.00	7.00	5.00	15.00	15.00	5.00	15.00
% COMPOSITION							
Shrubs	18.18	62.50	45.45	25.00	33.33	61.54	40.00
Forbs	63.64	25.00	36.36	25.00	33.33	30.77	40.00
Grasses	18.18	12.50	18.18	50.00	33.33	7.69	20.00
Overstory + Understory	55.00	40.00	55.00	55.00	45.00	65.00	50.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	25.00	0.00	35.00	0.00	40.00	0.00	20.00
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	70.00	5.00	30.00	5.00	10.00	0.00	0.00
50.00	35.00	45.00	0.00	35.00	0.00	10.00	10.00	20.00	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	35.00	15.00	45.00	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	5.00	0.00	5.00	0.00	0.00	10.00
15.00	15.00	15.00	5.00	15.00	0.00	5.00	0.00	25.00	10.00
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	0.00	0.00	0.00
0.00	10.00	10.00	0.00	5.00	0.00	5.00	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	15.00	25.00
0.00	0.00	0.00	25.00	0.00	35.00	0.00	40.00	0.00	20.00
70.00	70.00	70.00	75.00	70.00	65.00	50.00	65.00	60.00	45.00
15.00	15.00	25.00	20.00	25.00	19.00	20.00	30.00	20.00	15.00
10.00	10.00	4.00	4.00	4.00	15.00	15.00	1.00	15.00	35.00
5.00	5.00	1.00	1.00	1.00	1.00	15.00	4.00	5.00	5.00
71.43	50.00	64.29	93.33	64.29	100.00	60.00	100.00	33.33	0.00
21.43	28.57	21.43	6.67	28.57	0.00	20.00	0.00	41.67	44.44
7.14	21.43	14.29	0.00	7.14	0.00	20.00	0.00	25.00	55.56
70.00	70.00	70.00	100.00	70.00	100.00	50.00	105.00	60.00	65.00

CANYON FUELS
 Dugout Mine
 AMUT/SYOR/ARTR
 Site G-16 & G-17 Re
 Slope: W
 Exposure: 10 deg
 Sample Date: 13-14 Sept 2005

18.00	19.00	20.00	Mean	SDev	Freq	
<hr/>						OVERSTORY
15.00	0.00	0.00	6.75	12.58	25.00	<i>Amelanchier utahensis</i>
0.00	0.00	0.00	0.75	3.27	5.00	<i>Juniperus scopulorum</i>
<hr/>						UNDERSTORY
<hr/>						SHRUBS
0.00	0.00	5.00	7.00	16.16	35.00	<i>Amelanchier utahensis</i>
0.00	10.00	10.00	15.25	14.79	75.00	<i>Artemisia tridentata</i>
0.00	0.00	0.00	0.25	1.09	5.00	<i>Juniperus scopulorum</i>
55.00	0.00	10.00	10.50	15.96	50.00	<i>Symphoricarpos oreophilus</i>
<hr/>						FORBS
0.00	5.00	0.00	0.25	1.09	5.00	<i>Astragalus sp.</i>
0.00	5.00	0.00	4.05	4.60	55.00	<i>Lupinus argenteus</i>
5.00	15.00	10.00	10.70	7.89	80.00	<i>Penstemon watsonii</i>
<hr/>						GRASSES
0.00	0.00	0.00	0.25	1.09	5.00	<i>Elymus salinus</i>
10.00	0.00	0.00	2.00	3.67	25.00	<i>Elymus spicatus</i>
0.00	0.00	0.00	2.00	3.67	25.00	<i>Elymus trachycaulus</i>
0.00	0.00	0.00	2.25	5.36	20.00	<i>Poa pratensis</i>
0.00	5.00	5.00	2.50	6.22	20.00	<i>Poa secunda</i>
<hr/>						COVER
15.00	0.00	0.00	7.50	12.60		Overstory
70.00	40.00	40.00	57.00	12.08		Understory
15.00	10.00	10.00	18.60	7.52		Litter
5.00	45.00	5.00	15.65	13.13		Bareground
10.00	5.00	45.00	8.75	9.59		Rock
<hr/>						% COMPOSITION
78.57	25.00	62.50	54.44	26.60		Shrubs
7.14	62.50	25.00	28.08	17.03		Forbs
14.29	12.50	12.50	17.49	14.43		Grasses
<hr/>						
85.00	40.00	40.00	64.50	19.49		Overstory + Understory
<hr/>						

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

CHAPTER 4
LAND USE AND AIR QUALITY

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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.

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

CHAPTER 5
ENGINEERING

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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-17 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, 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-17) 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-17) 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-17).

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.

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-17).

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 and G-15.

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 and G-12 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). The new access roads will be classified as primary roads and will be maintained by the permittee (see Figure 5-14).

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). 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.

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.

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-12). 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-17) 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 and G-17 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.

542.700 Final Abandonment of Mine Openings and Disposal Areas

Degas drill holes G-9 thru G-17 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

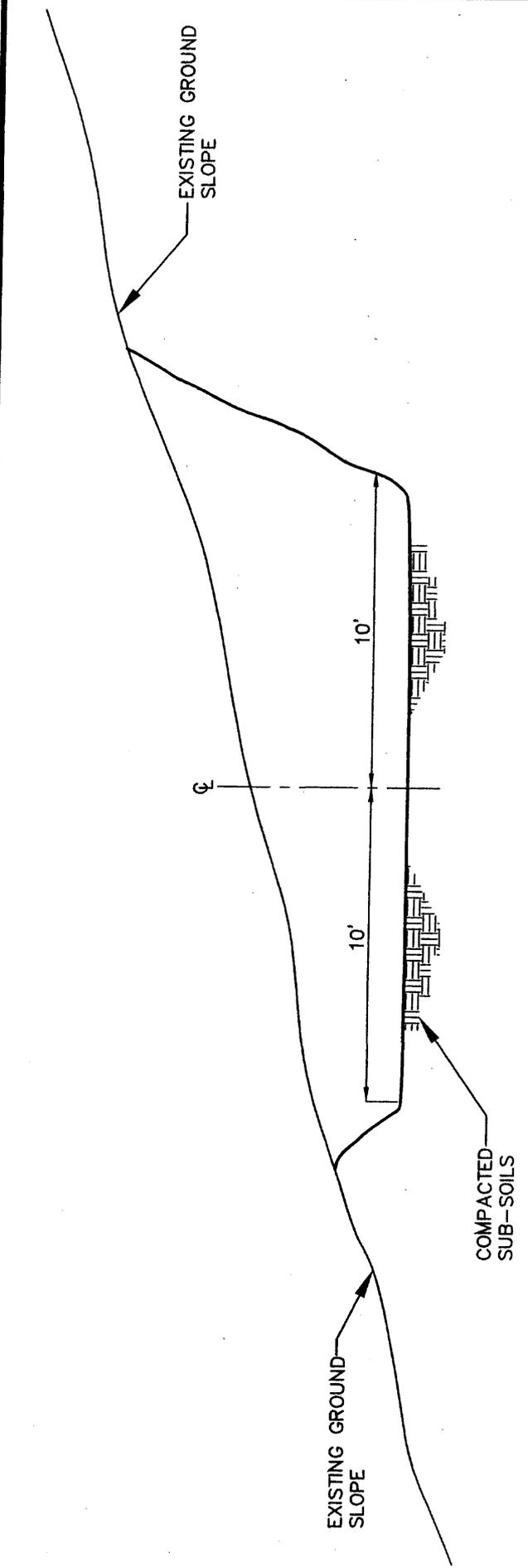
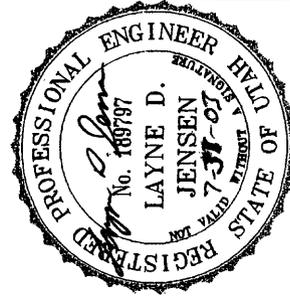
No surface mining and reclamation activities involving thick overburden will occur at the well sites.

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.



NOTE: THE ACCESS ROAD IS BELOW THE EXISTING SURFACE DUE TO TOPSOIL 7"-30" DEEP BEING REMOVED AND STOCKPILED PRIOR TO FINAL ROAD GRADING.

NOT TO SCALE

FIGURE 5-14. TYPICAL ACCESS ROAD CROSS SECTION

TYPICAL WELL DESIGN

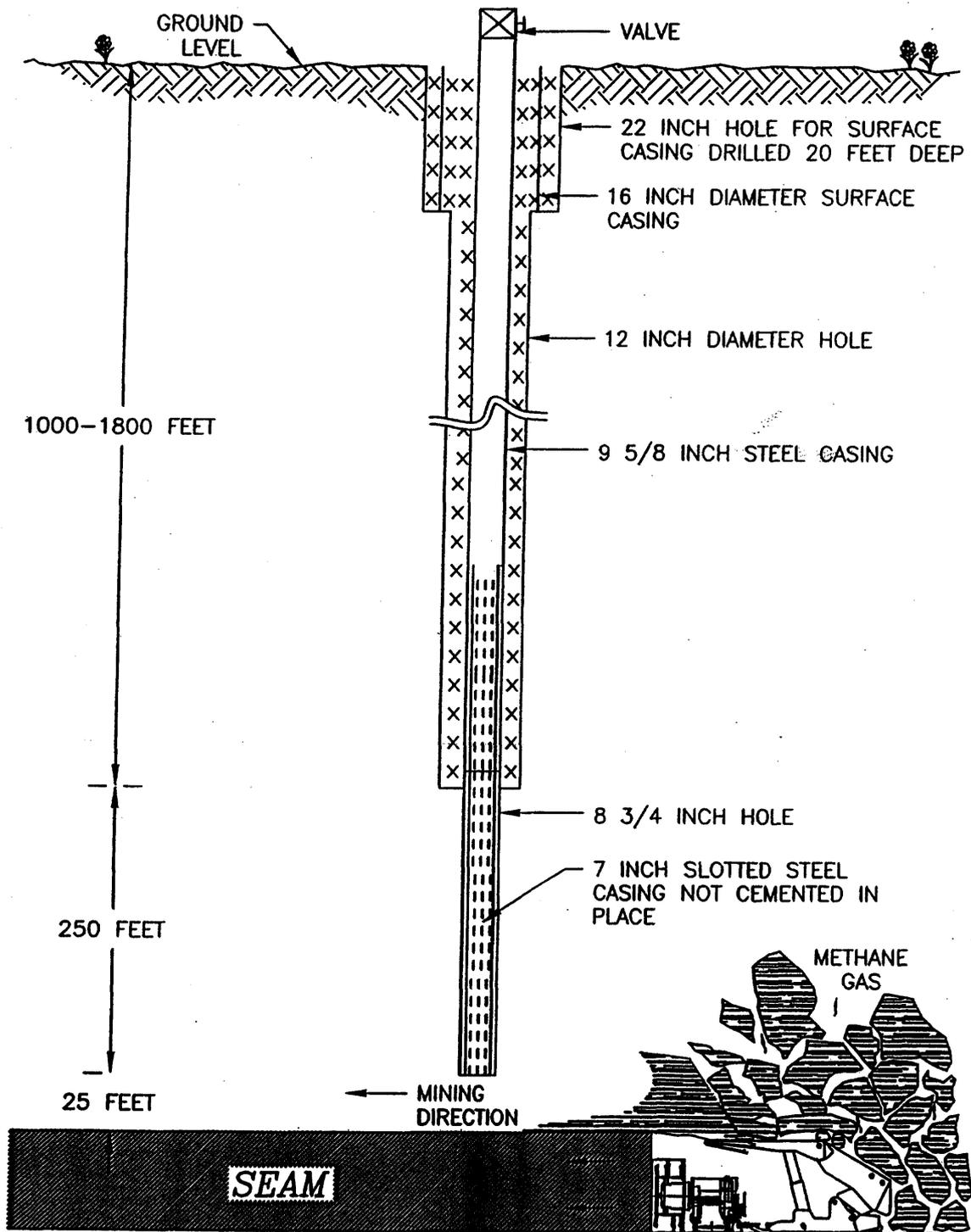


FIGURE 5-16. TYPICAL WELL DESIGN.

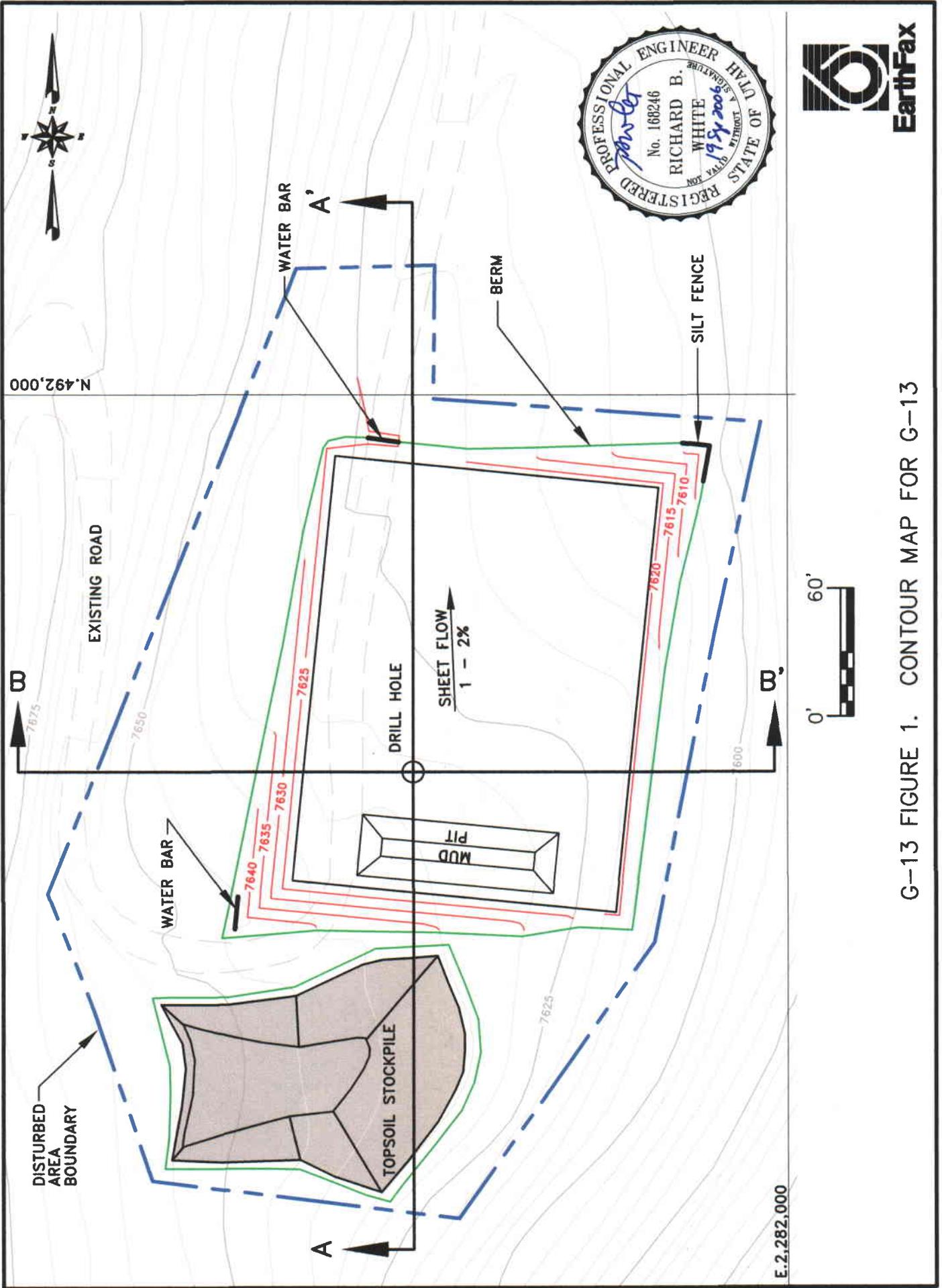
FIGURE 5-26
Reclamation Schedule - Wells G-3, G-4, G-6 thru G-17

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.			

Canyon Fuel Company, LLC
Dugout Canyon Mine

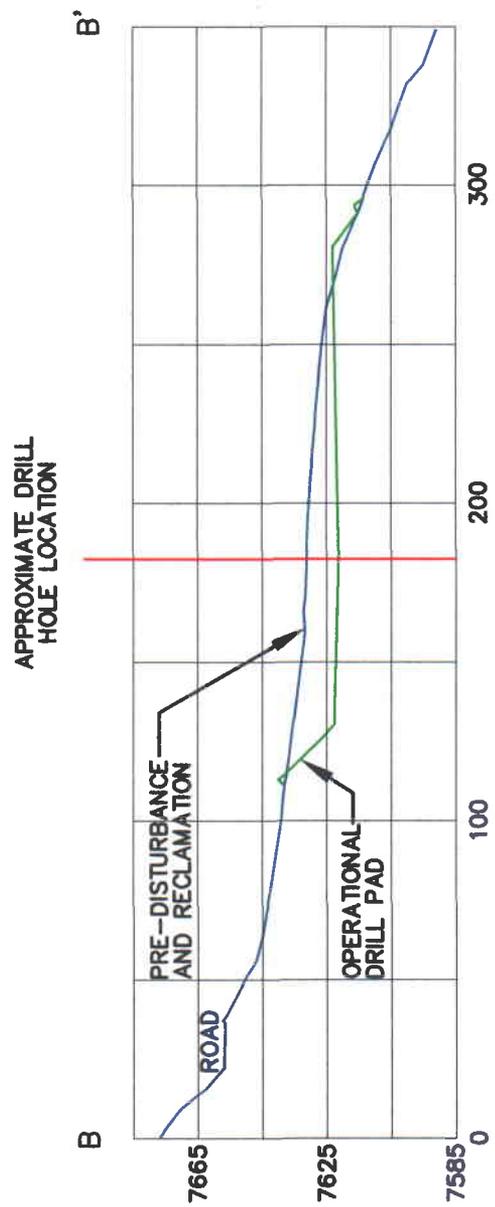
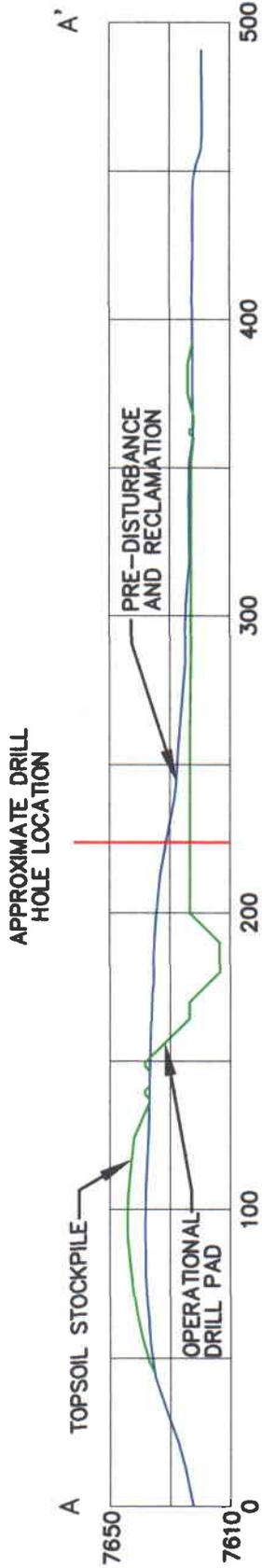
Methane Degassification Amendment
July 13, 2006

ATTACHMENT 5-1
Degas Wells G-8 thru G-17



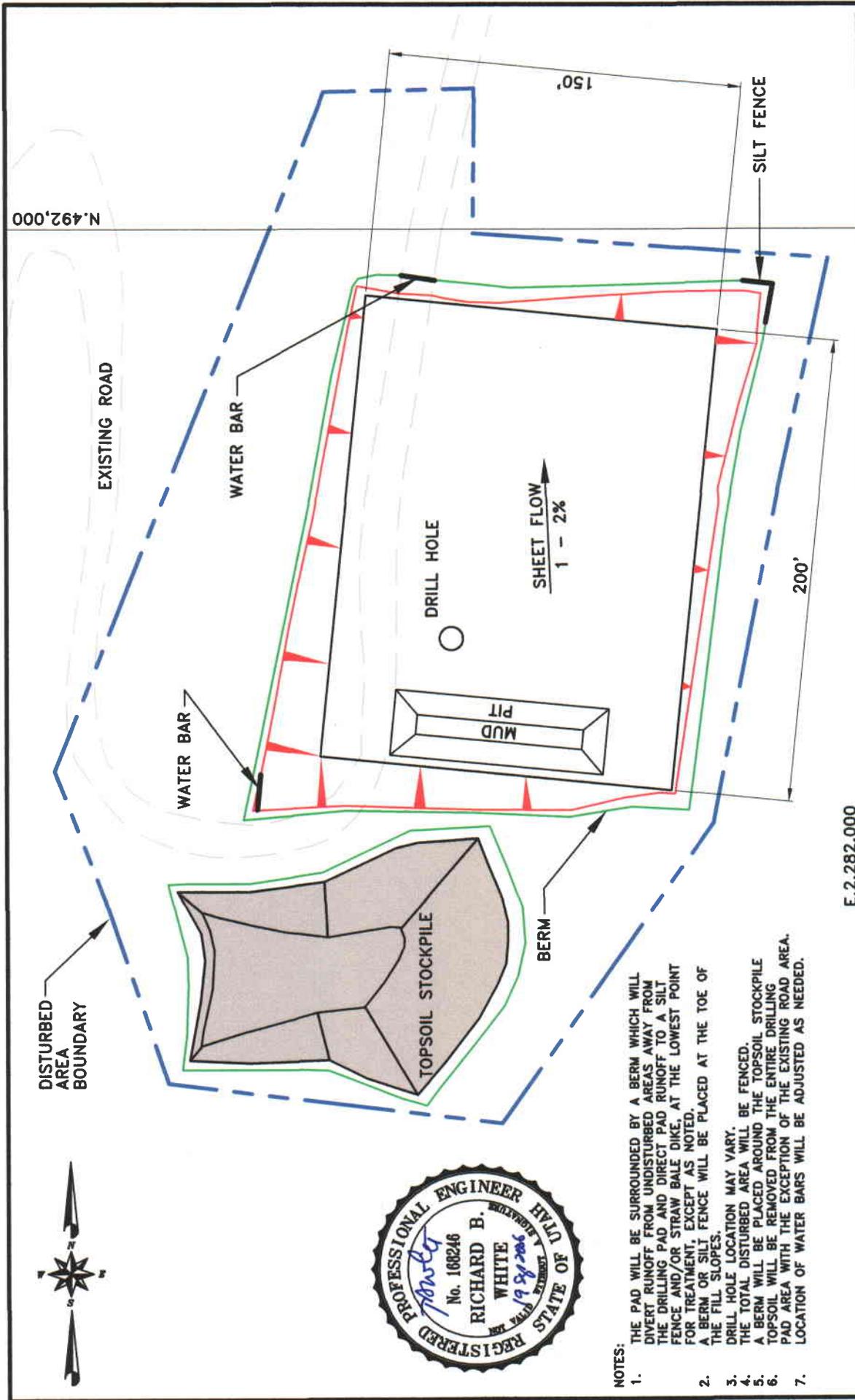
G-13 FIGURE 1. CONTOUR MAP FOR G-13





G-13 FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-13

G-13 FIGURE 3. LAYOUT MAP FOR G-13



E.2,282,000



- NOTES:
1. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIVERT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD AND DIRECT PAD RUNOFF TO A SILT FENCE AND/OR STRAW BALE DIKE, AT THE LOWEST POINT FOR TREATMENT, EXCEPT AS NOTED.
 2. A BERM OR SILT FENCE WILL BE PLACED AT THE TOE OF THE FILL SLOPES.
 3. DRILL HOLE LOCATION MAY VARY.
 4. THE TOTAL DISTURBED AREA WILL BE FENCED.
 5. A BERM WILL BE PLACED AROUND THE TOPSOIL STOCKPILE.
 6. TOPSOIL WILL BE REMOVED FROM THE ENTIRE DRILLING PAD AREA WITH THE EXCEPTION OF THE EXISTING ROAD AREA.
 7. LOCATION OF WATER BARS WILL BE ADJUSTED AS NEEDED.



E. 87,250.00

8855-

8870

SILT FENCE

OPERATIONAL CONTOURS

DISTURBED AREA BOUNDARY

A

BERM

N. 95,500.00

DRILL HOLE



8890

8895

SHEET FLOW
1
-0.2%

SILT FENCE

BERM

EXISTING ROAD

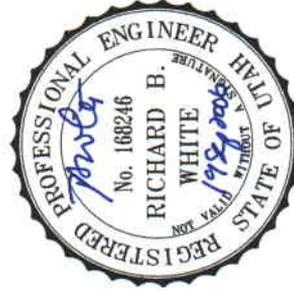
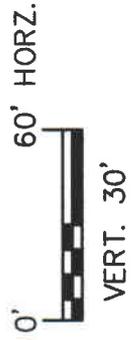
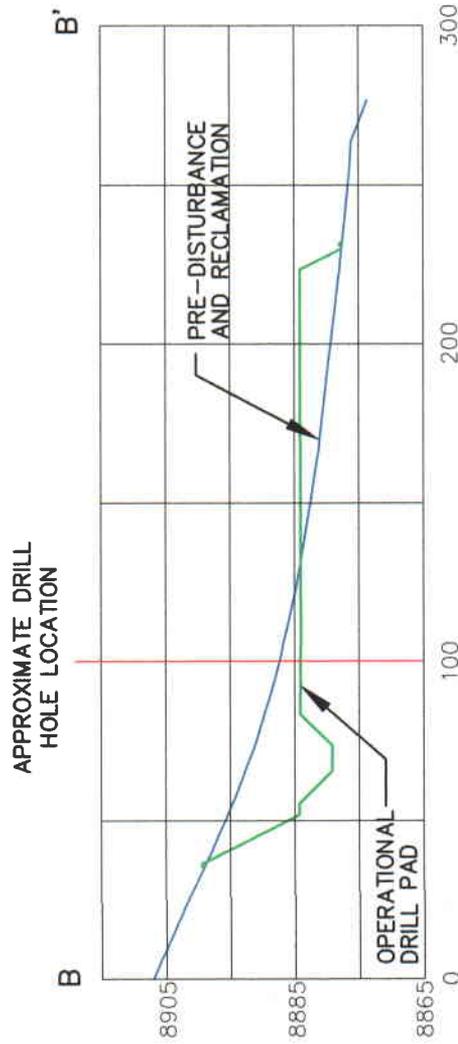
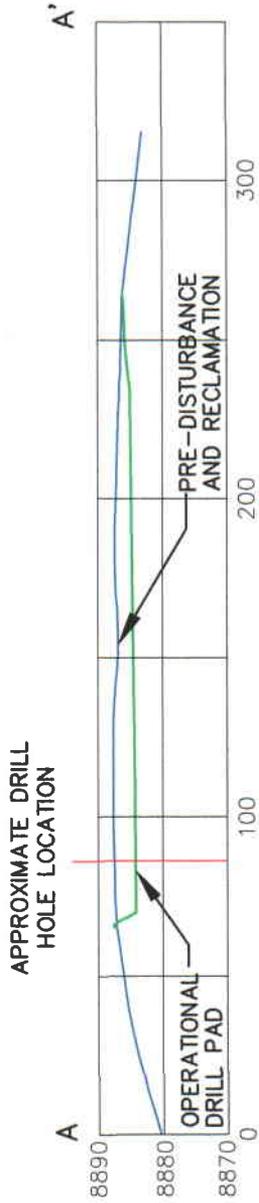
A

8905

8910

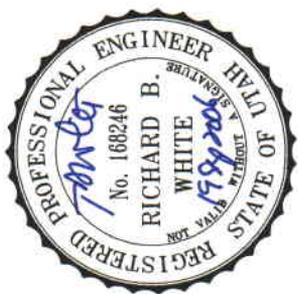
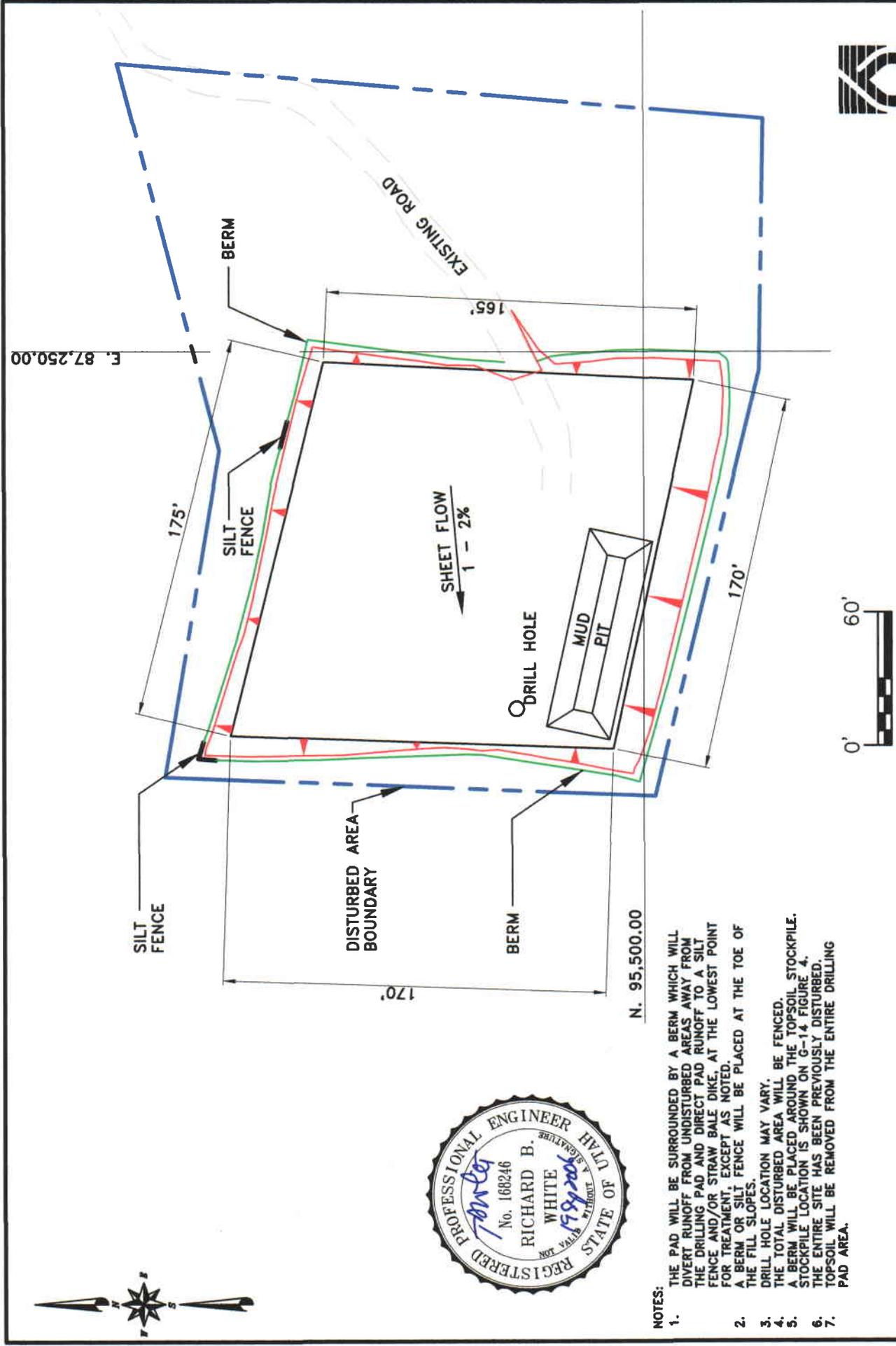


G-14A FIGURE 1. CONTOUR MAP FOR G-14

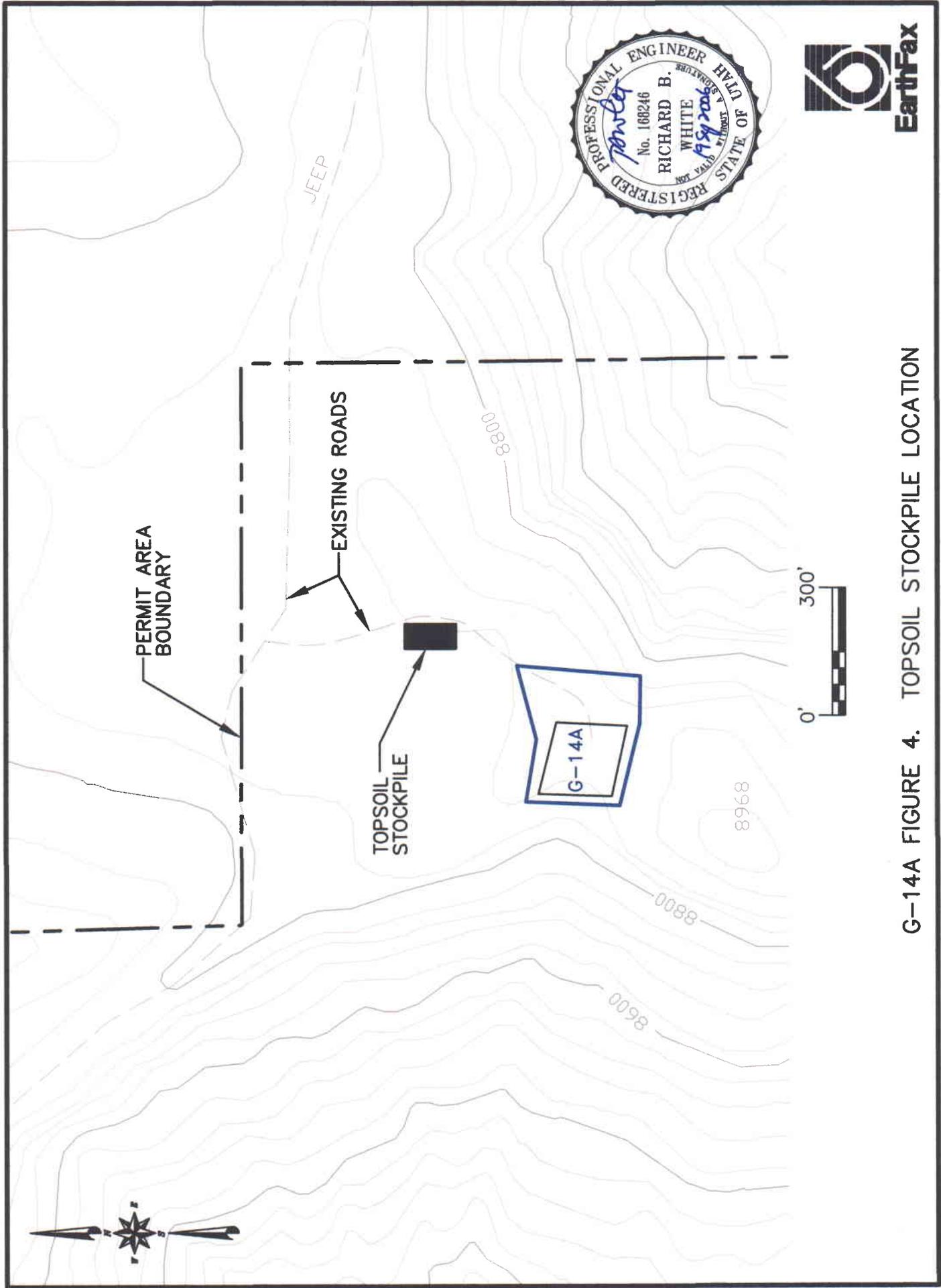


G-14A FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-14

G-14A FIGURE 3. APPROXIMATE DRILLING LAYOUT FOR G-14

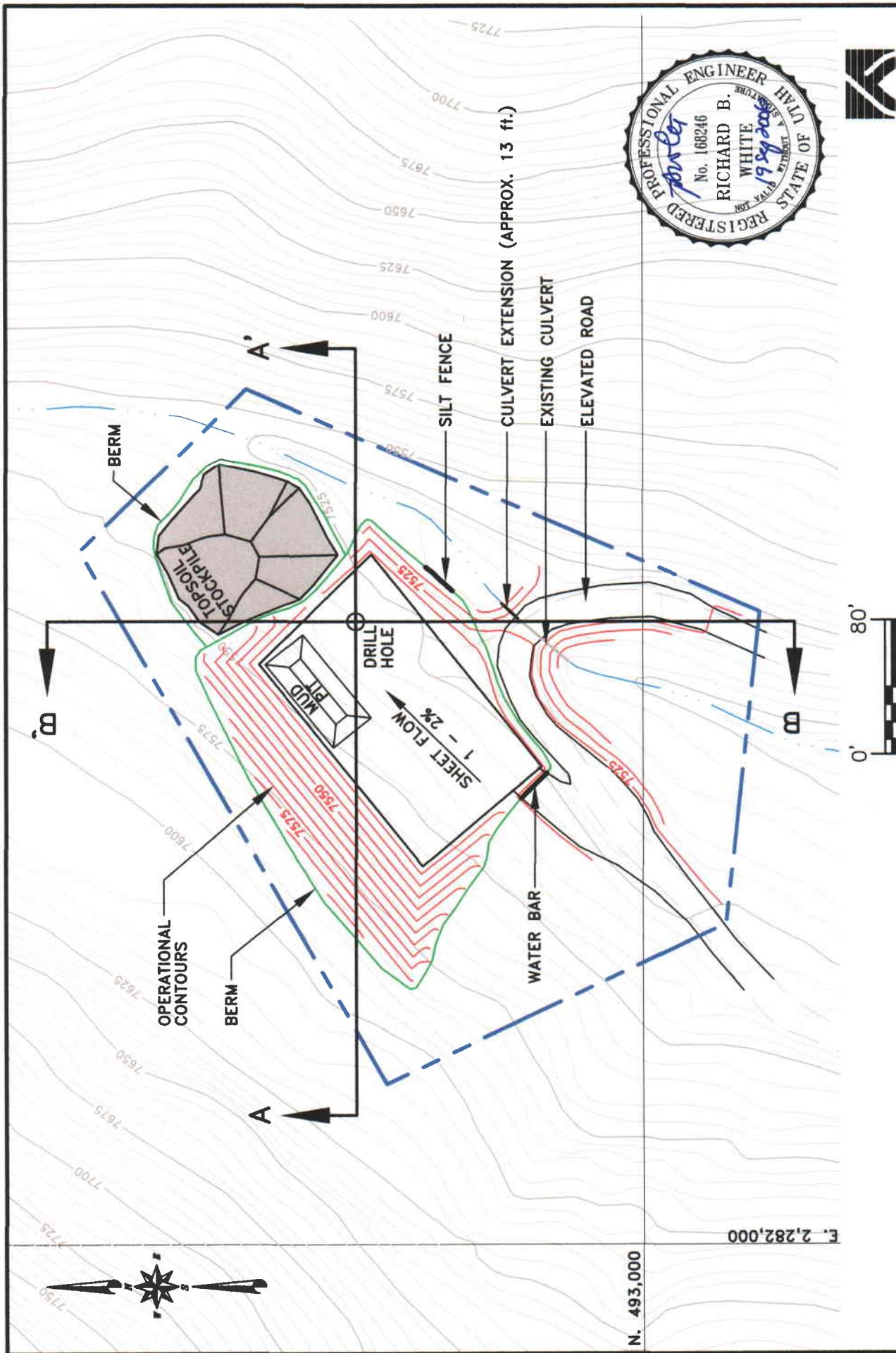


- NOTES:
1. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIVERT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD AND DIRECT PAD RUNOFF TO A SILT FENCE AND/OR STRAW BALE DIKE, AT THE LOWEST POINT FOR TREATMENT, EXCEPT AS NOTED.
 2. A BERM OR SILT FENCE WILL BE PLACED AT THE TOE OF THE FILL SLOPES.
 3. DRILL HOLE LOCATION MAY VARY.
 4. THE TOTAL DISTURBED AREA WILL BE FENCED.
 5. A BERM WILL BE PLACED AROUND THE TOPSOIL STOCKPILE. STOCKPILE LOCATION IS SHOWN ON G-14 FIGURE 4.
 6. THE ENTIRE SITE HAS BEEN PREVIOUSLY DISTURBED. TOPSOIL WILL BE REMOVED FROM THE ENTIRE DRILLING PAD AREA.
 - 7.

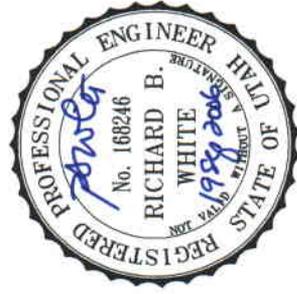
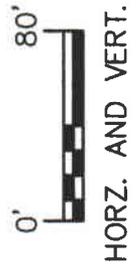
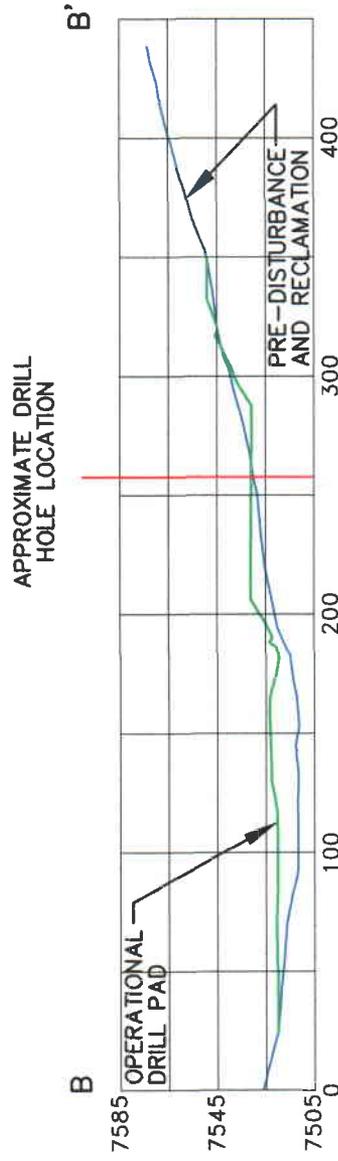
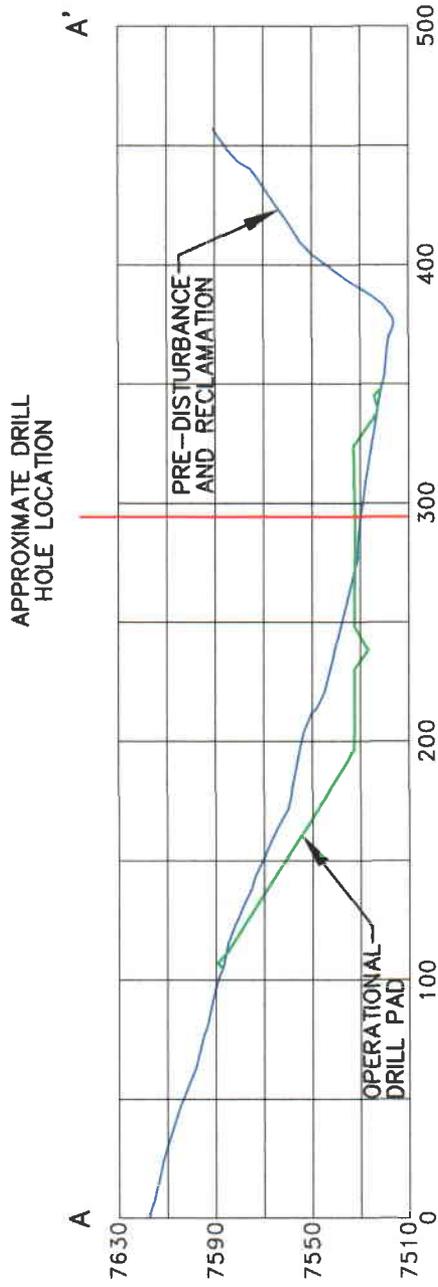


G-14A FIGURE 4. TOPSOIL STOCKPILE LOCATION





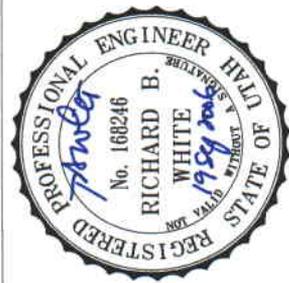
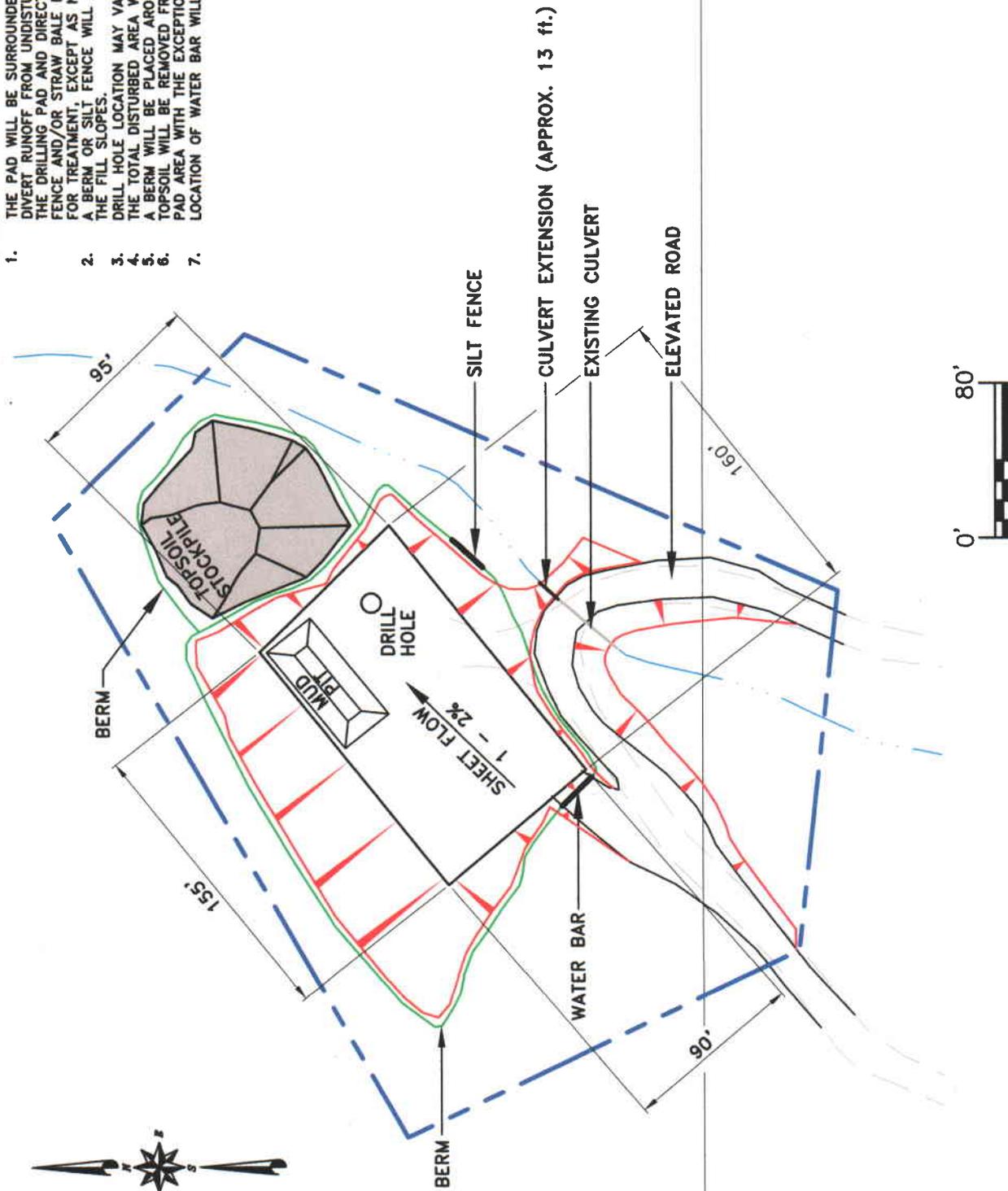
G-15 FIGURE 1. CONTOUR MAP FOR G-15



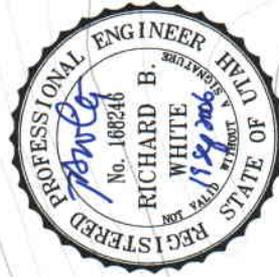
G-15 FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-15

NOTES:

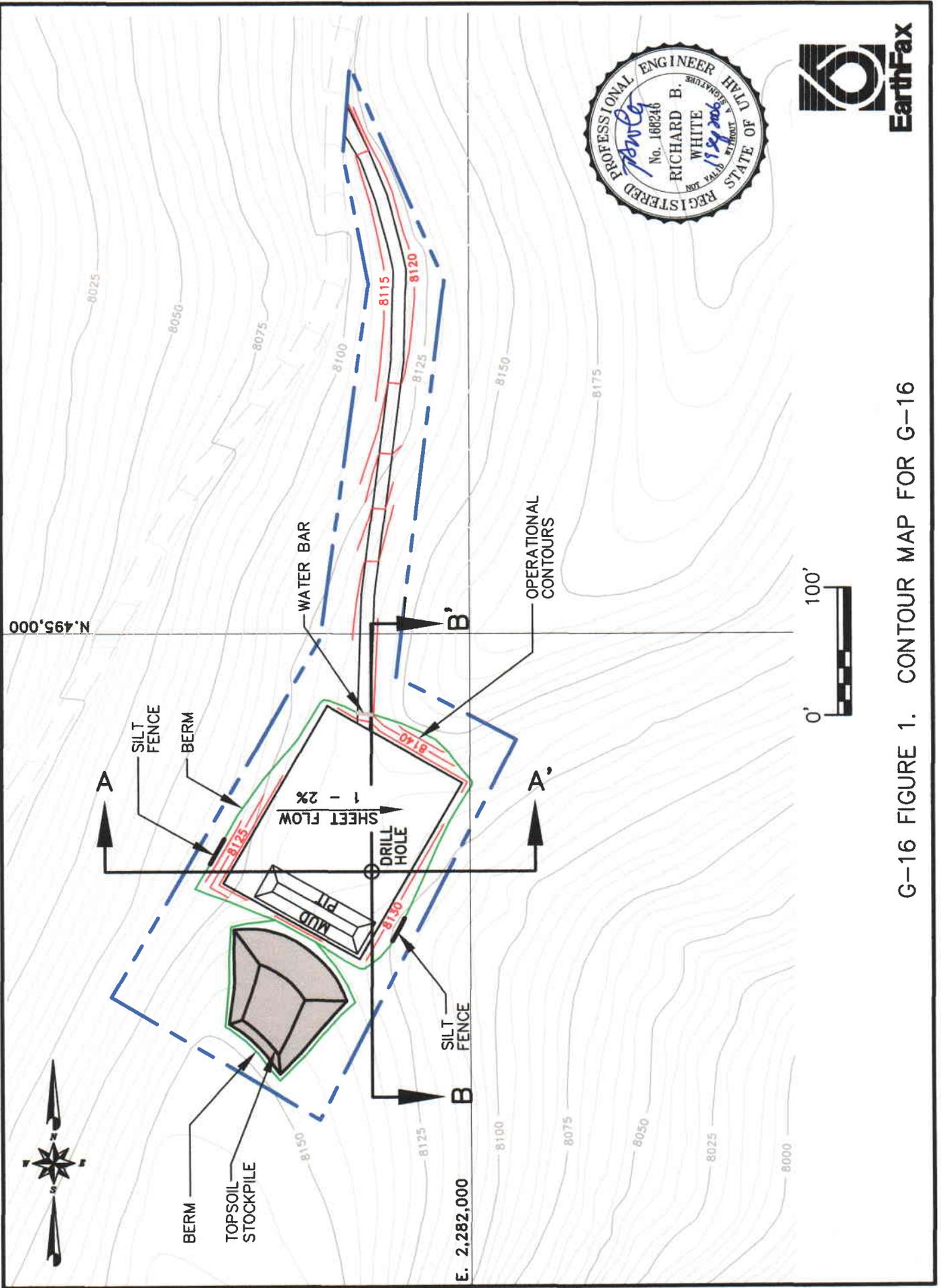
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6. TOPSOIL WILL BE REMOVED FROM THE ENTIRE DRILLING PAD AREA WITH THE EXCEPTION OF THE EXISTING ROAD AREA.
7. LOCATION OF WATER BAR WILL BE ADJUSTED AS NEEDED.

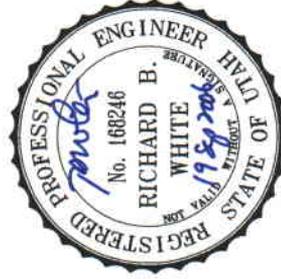
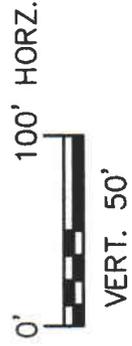
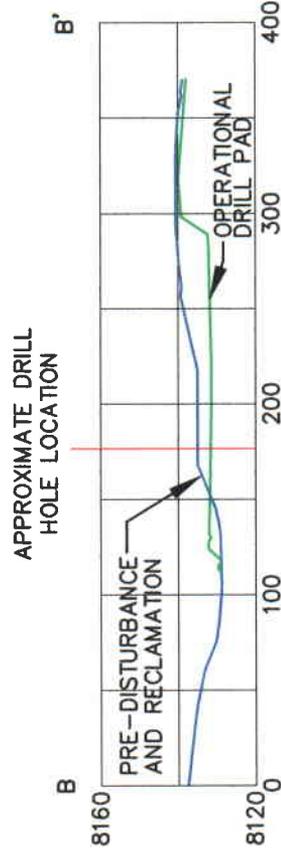
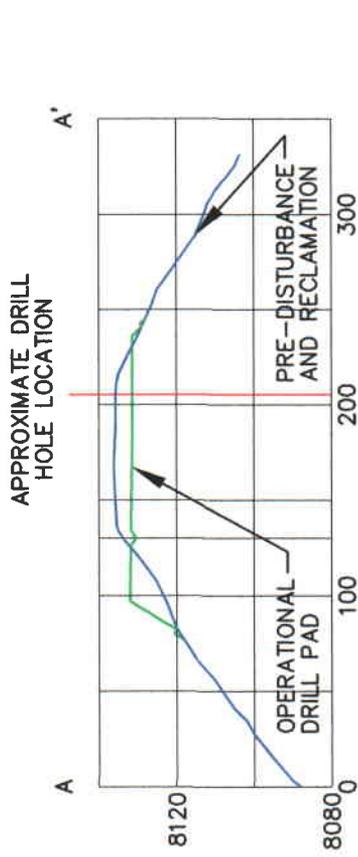


G-15 FIGURE 3. LAYOUT MAP FOR G-15

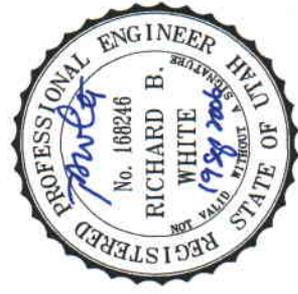


G-16 FIGURE 1. CONTOUR MAP FOR G-16

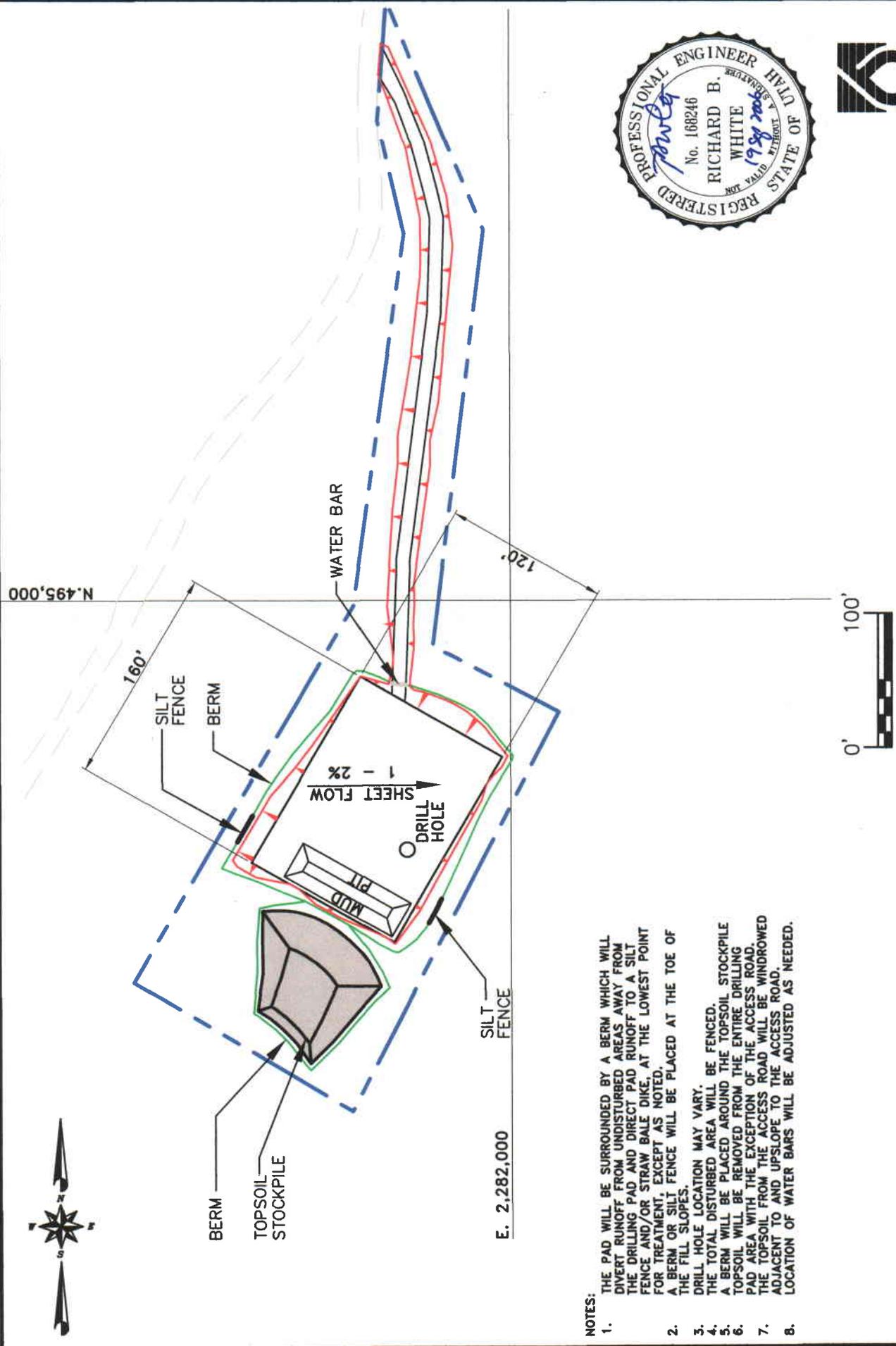




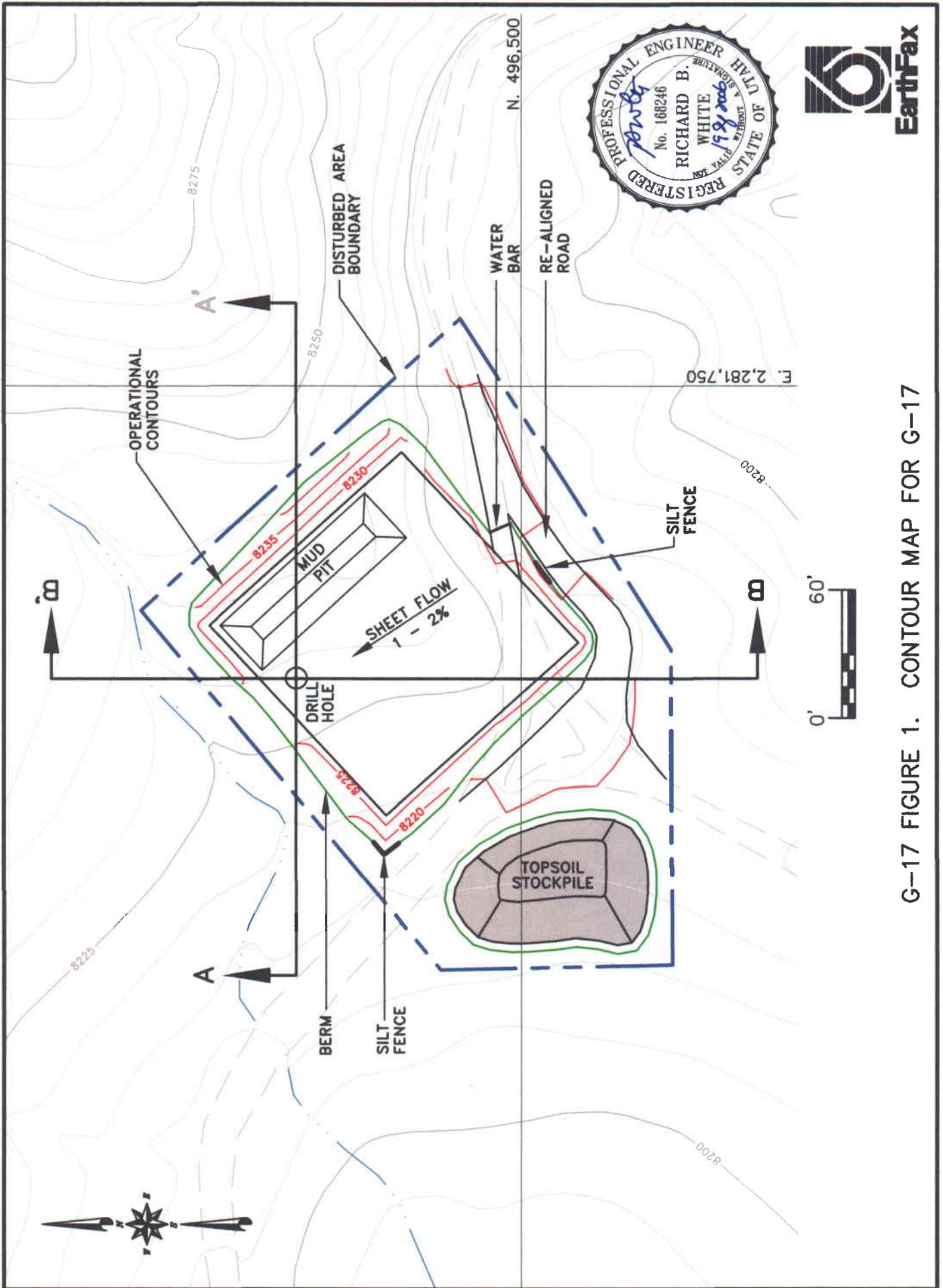
G-16 FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-16



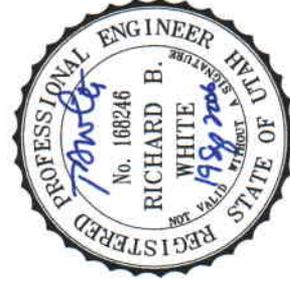
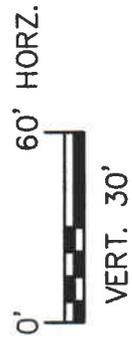
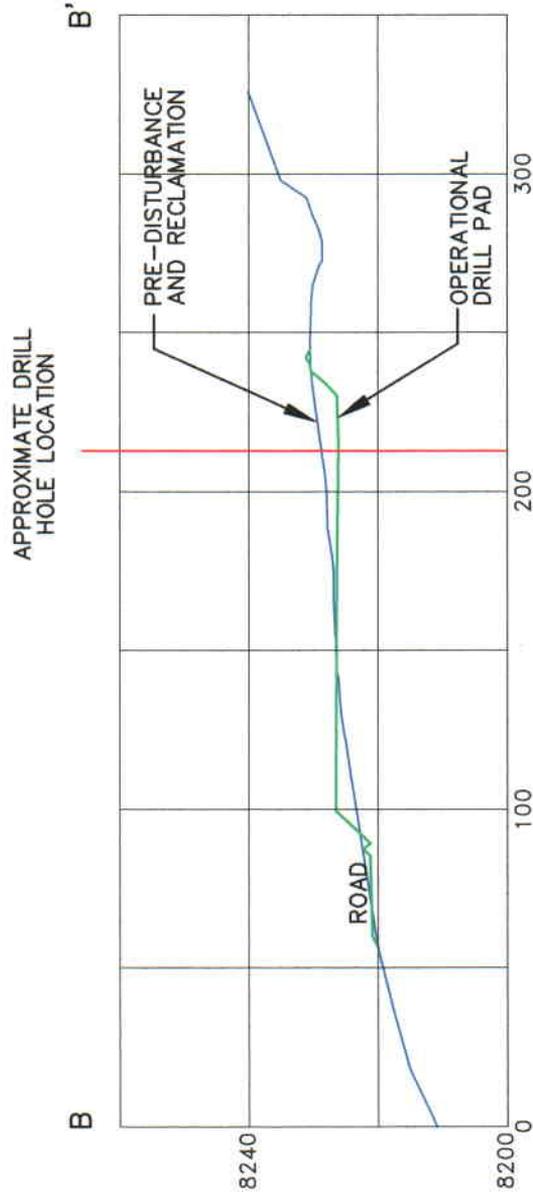
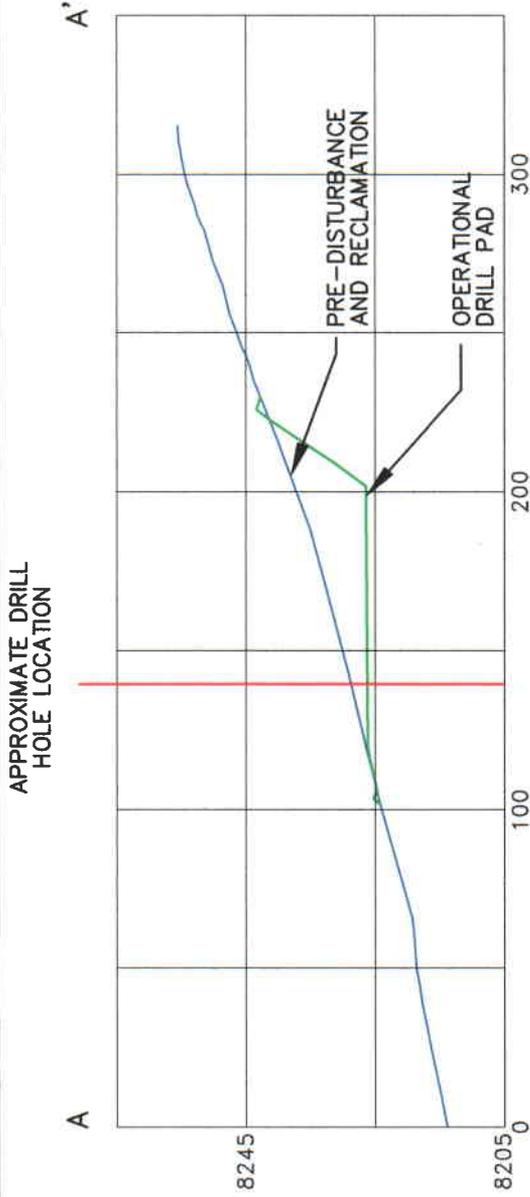
G-16 FIGURE 3. LAYOUT MAP FOR G-16



- NOTES:**
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 5. A BERM WILL BE PLACED AROUND THE TOPSOIL STOCKPILE.
 6. TOPSOIL WILL BE REMOVED AROUND THE ENTIRE DRILLING PAD AREA WITH THE EXCEPTION OF THE ACCESS ROAD.
 7. THE TOPSOIL FROM THE ACCESS ROAD WILL BE WINDROWED ADJACENT TO AND UPSLOPE TO THE ACCESS ROAD.
 8. LOCATION OF WATER BARS WILL BE ADJUSTED AS NEEDED.

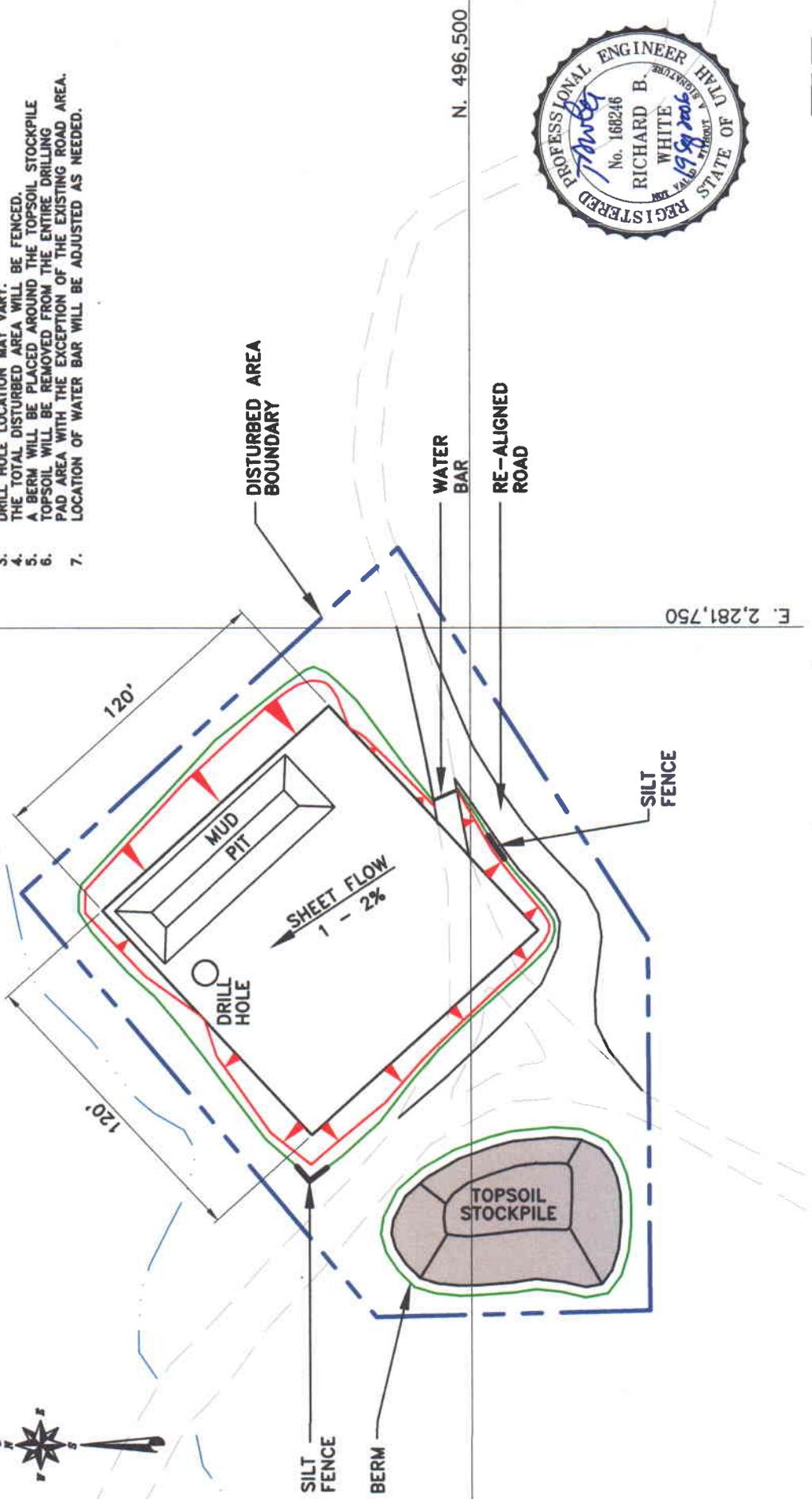


G-17 FIGURE 1. CONTOUR MAP FOR G-17

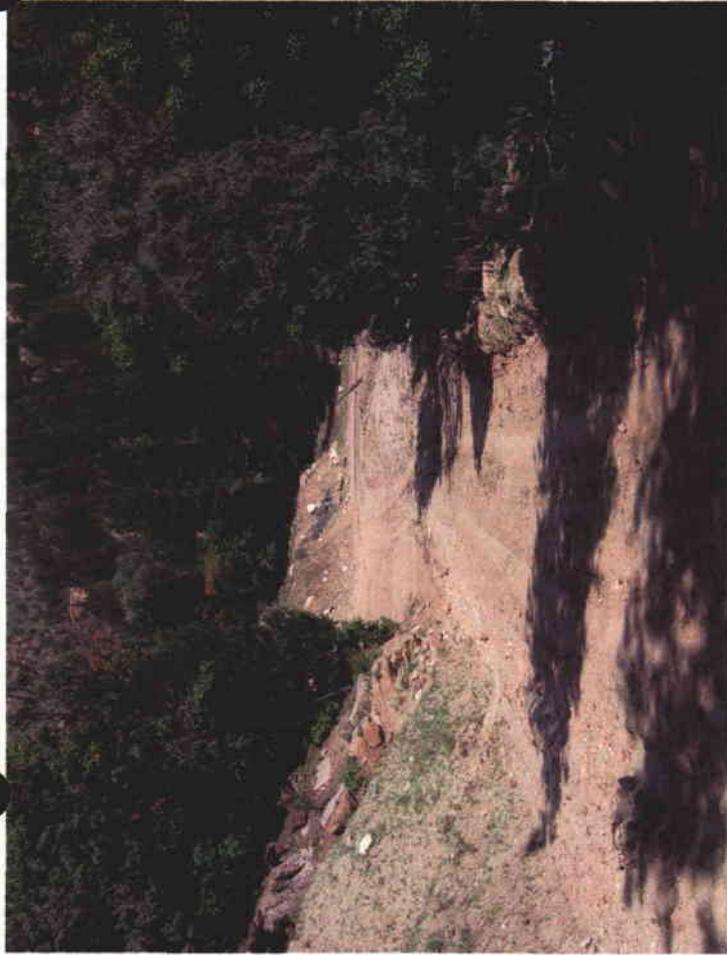


G-17 FIGURE 2. TYPICAL CROSS-SECTIONS FOR G-17

- NOTES:
1. THE PAD WILL BE SURROUNDED BY A BERM WHICH WILL DIVERT RUNOFF FROM UNDISTURBED AREAS AWAY FROM THE DRILLING PAD AND DIRECT PAD RUNOFF TO A SILT FENCE AND/OR STRAW BALE DIKE, AT THE LOWEST POINT FOR TREATMENT, EXCEPT AS NOTED.
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 7. LOCATION OF WATER BAR WILL BE ADJUSTED AS NEEDED.



G-17 FIGURE 3. LAYOUT MAP FOR G-17



Existing Access Road at Proposed
Well Site G-15
<<<<<<



Existing Access Road at
Proposed Well Site G-14 >>>

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

ATTACHMENT 5-2
Methane Degassification

Attachment 5-2

43 CFR Ch. 11, Subpart 3484.1 , (3)

“(3) All exploration drill holes must be capped with at least 5 feet of cement and plugged with a permanent plugging material that is unaffected by water and hydrocarbon gasses and will prevent the migration of gases and water in the drill hole under normal hole pressures. For exploration holes drilled deeper than stripping limits, the operator/lessee, using cement or other suitable plugging material approved by the authorized officer, shall plug the hole through the thickness of the coal beds or mineral deposits and through aquifers for a distance of at least 50 feet above and below the coal beds or mineral deposits and aquifers, or to the bottom of the drill hole. A lesser cap or plug may be approved by the authorized officer. Exploration activities shall be managed to prevent water pollution and mixing of ground and surface waters and ensure the safety of people, livestock and wildlife.”

Attachment 5-2

Methane and How it is Removed from a Mine.

Methane is the principal constituent of natural gas and is created through decomposition of organic matter. Methane is found throughout the world in various types of geologic formations. Coalbed methane is the name given to methane found in coal seams. It is formed during the process of transforming plant material into coal.

Coal mine methane is a subset of coalbed methane and is released from the coal seam during the process of coal mining/coal extraction. Coal mine methane is explosive and poses a danger to the mine and mine personnel. When the methane is in high volumes and concentrations, it limits the mine's productivity. By removing the coal mine methane, mine safety and productivity are improved. Methane can be contained in fractures and in pore space in the coal and may travel with the coal as it is removed and transported to the surface.

Methane is removed from underground coal mines by large ventilation fans and degassification systems (i.e., in-mine boreholes, surface boreholes, etc.). Degassification systems may remove methane in advance of mining, during mining activities or after mining has occurred.

When removed in advance of mining, the methane is drained through vertical boreholes drilled into the coal seam or horizontal boreholes within the seam or surrounding rock usually occurring years ahead of the mining activities. Degassification may also occur after mining has commenced, with gas being removed either before or after the coal is mined.

Dugout currently used a system of vertical surface boreholes and exhaustor-blowers to remove methane from the longwall gob. The holes are completed in the formation above the coal seam and not in the coal seam itself. When mining occurs, the formation above the coal seam fractures and releases methane that may be in the formation. In addition, methane is released from the coal seam during mining. The boreholes are used to collect the methane and remove it from the gob, thus, preventing the build up of methane to dangerous levels and reducing production delays.

Once the coal is removed, the roof collapses and debris from the strata around the empty coal seam fill the void. The debris is referred to as the gob, and the gob contains methane. Vertical and/or horizontal wells are drilled to either release or recover the gas within the gob.

Once mining of the area is complete and the area is sealed, methane can continue to be released from the gob and build up to pressures that can cause methane and other gob gases to leak into the current mine area. Both the gases behind the seals and the gas invading the working area are considered to be safety hazards by the Mine Safety and Health Administration. To prevent the buildup and leakage of methane and other gob gases, the operator plans to use the methane drainage wells to remove gob gases from the sealed areas.

Plugging and Reclaiming

The time line for reclaiming degas wells will be unique to each well. Factors which will contribute to the determination of when to plug and reclaim are as follows:

Timing of mining

Location of well in mining panel

Season of year

Access to site

Safety

With the mine misfortunes the last few years, it is evident to the operator that the benefits of leaving a surface access to gob area has more benefits than drawbacks. For that reason and for the reasons listed previously, the operator plans to leave one degas hole open in each panel. The surface will be reclaimed, the degas hole will be capped, but the hole will not be plugged until mining issues have been considered and resolved.

To date, wells G-2, G-5 and G-7 will remain open. G-2 is in the Gil-1 Panel, G-5 is in the Gil-2 Panel and G-7 is in the Gil-3 Panel.

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

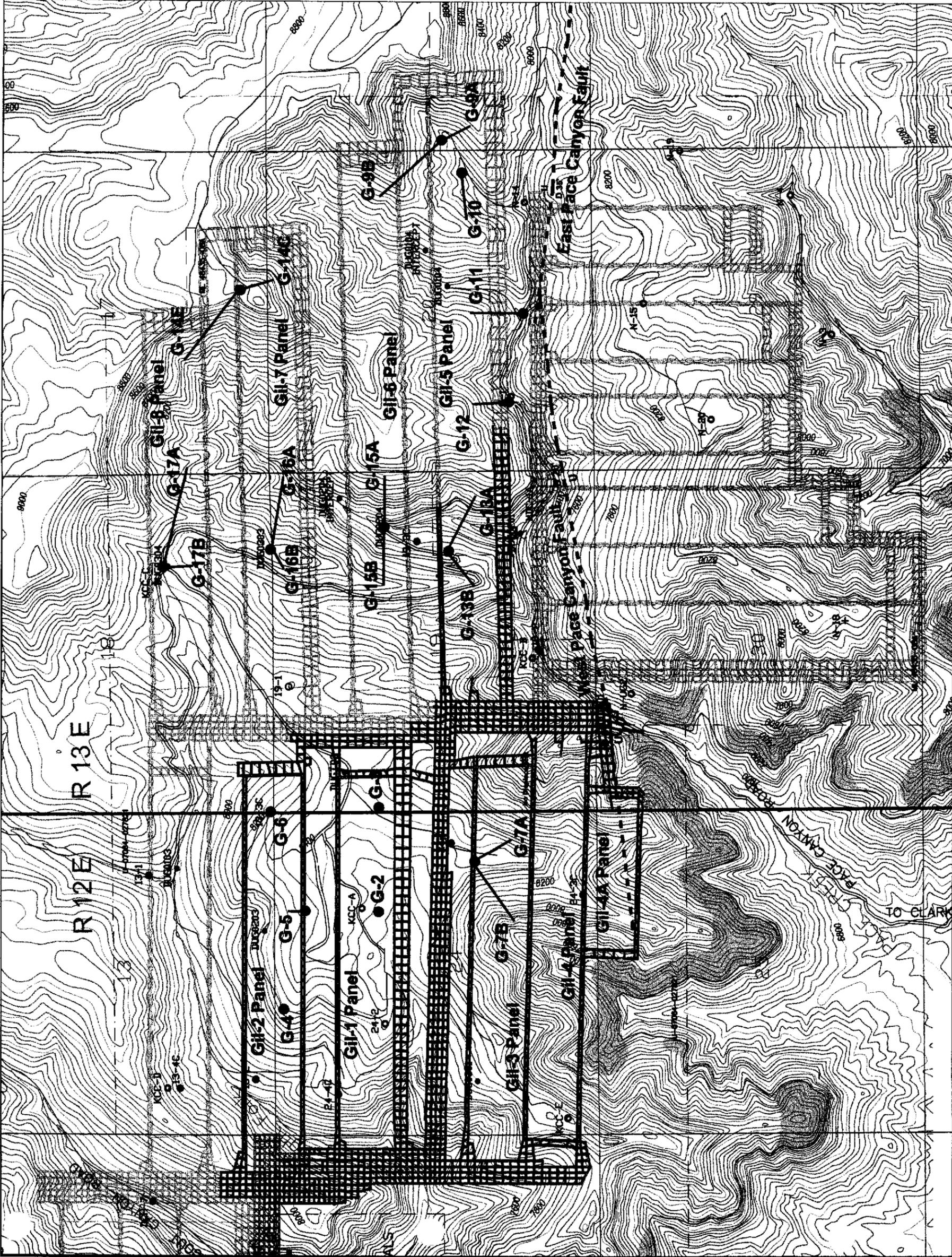


C Canyon Fuel Co., LLC.
Dugout Canyon Mine

Location of Methane
Drainage Wells

P.O. BOX 1829
WELLINGTON, UTAH 84644

DATE: 10-20-08



Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

ATTACHMENT 5-3
Land Owner Correspondence

February 16, 2006

Ms. Pamela Grubaugh-Littig
Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple
Suite 1210
Salt Lake City, UT 84114-5801

RE: Reclamation of Degas Well Sites G-11 and G-12

Dear Ms. Grubaugh-Littig:

Per a discussion with Dugout Canyon Mine, we the landowners of the property (Milton and Ardith Thayn Trust) affected by the construction of degas wells G-11 and G-12 request that the pad areas remain as constructed, with the following stipulations:

Once the use of the well sites is completed the mud pits will be filled and the area leveled,

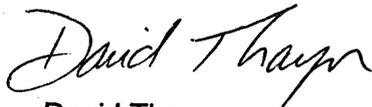
The topsoil will be replaced on the areas disturbed, except for the road areas,

The areas receiving topsoil will be seeded with native grasses, and

Topsoil storage areas will be pocked, gouged and then seeded.

We have alternative plans for the use of these areas. Please contact David Thayn at (435) 636-0220, if you have questions.

Sincerely,



David Thayn

Cc: Vicky S. Miller

MEMOS SENT TO THAYN TRUST AS NOTIFICATION OF PROPOSED ACTIVITIES

March 10, 2005

Subject: 2005 Drilling Activities on Thayn Lands

In 2005 the Dugout Canyon Mine currently plans to conduct exploration, de-gassing, and permitting activities on the Thayn Lands.

As many as two (2) exploration bore holes will be drilled on the Thayn Lands, see enclosed map. The current plan is to drill both holes from the same surface site due to surface access restrictions. In addition, Dugout would like to complete these holes as Methane Drainage Holes. This will save future costs, permitting efforts, and reduce surface disturbance. These holes will require grading of the access roads, preparation/building of the drill sites, and reclamation of the drill sites and roads as directed by the landowner and permit regulations. In addition, the drilling activities will require obtaining and hauling water from various streams and locations on the Thayn Lands, see map.

As many as nine (9) Methane Drainage Holes will be drilled to remove methane and other gases from the longwall panel gob areas, see map. As shown on the map several of these sites will have one or more holes drilled from the same site. This is due to limited surface access. Similar to the exploration drilling, these boreholes will require road grading/improvements, site building/preparation, reclamation, and water hauling. Permitting activities similar to those required for the exploration drilling will also be conducted in association with the degas drilling. It has not been determined if all nine (9) of the degas boreholes will be drilled or when. However, the G-7 hole may be drilled as early as May, 2005. The remaining holes, including the exploration holes, will be drilled later in the year depending on permitting and drill rig availability.

In conjunction with the exploration activities listed above, there will be permitting activities including, but not limited to, endangered plant and animal surveys, environmental assessment activities, and cultural surveys. All of these activities will be conducted by third party contractors and require no surface disturbance.

Associated with the degas activities will be the installation of one or more exhaustor-blower units on the degas sites to remove the gases from the mine. The number and duration of the installations are unknown at this time. While the exhaustor-blower units are in operation, the units will require frequent inspections to maintain the units. These inspections may range from daily to weekly depending on the effort required to maintain the units.

The Dugout Mine is planning to install a mine ventilation fan in the Pace Canyon. While the fan installation site is located on BLM surface, access to the fan site follows the main road access to the general area and crosses the Thayn Lands. The Dugout Mine currently expects to begin construction of the site in April 2005. These activities may include upgrades and enhancements to the access road that crosses Thayn Lands.

February 16, 2006

Subject: 2006 Dugout Canyon Mine Activities on Thayn Lands

In 2006 the Dugout Canyon Mine currently plans to conduct exploration, methane drainage, permitting activities, and other mining related activities on the Thayn Lands.

Exploration

As many as two (2) exploration bore holes will be drilled on the Thayn Lands, see enclosed map. The current plan includes drilling both holes from the same surface site due to surface access restrictions. In addition, Dugout will complete these holes as Methane Drainage Holes. These holes will require surveying, grading of the access roads, preparation/building of the drill sites, and reclamation of the drill sites and roads as directed by the landowner and permit regulations. In addition, the drilling activities will require obtaining and hauling water from various streams and locations on the Thayn Lands, see map.

Associated with exploration and as has been discussed with the land owner in 2005, Dugout will relocate a portion of a surface road used by various land owners and Dugout, see map. The road will be relocated from Conover Lands to Thayn Lands.

Methane Drainage

As many as eight (8), Methane Drainage Holes (2 are converted exploration holes) will be completed to remove methane and other gases from the longwall panel gob areas, see map. As shown on the map several of these sites will have one or more holes drilled from the same site due to limited surface access. Similar to the exploration drilling, these boreholes will require surveying, road grading/improvements, site building/preparation, reclamation, and water hauling. Permitting activities similar to those required for the exploration drilling will also be conducted in association with the degas drilling

Drilling of the methane drainage holes is expected to begin within the first two weeks of June.

In addition to drilling and installing methane drainage wells, Dugout will also be plugging and reclaiming a minimum of two (2) methane drainage wells—G3 and G6.

Permitting Activities

In conjunction with the exploration activities listed above, there will be permitting activities including, but not limited to, plant and animal surveys, environmental assessment activities, and cultural surveys. All of these activities will be conducted by third party contractors and require minimal surface disturbance (soil test pits).

In addition, Dugout is required by regulatory permits to conduct water monitoring surveys for both quantity and quality. The Dugout Canyon Mine will also conduct an annual stream geomorphology study of Pace Creek to determine if subsidence may impact the stream channel.

Miscellaneous Activities

The Dugout Mine will also be conducting the following activities:

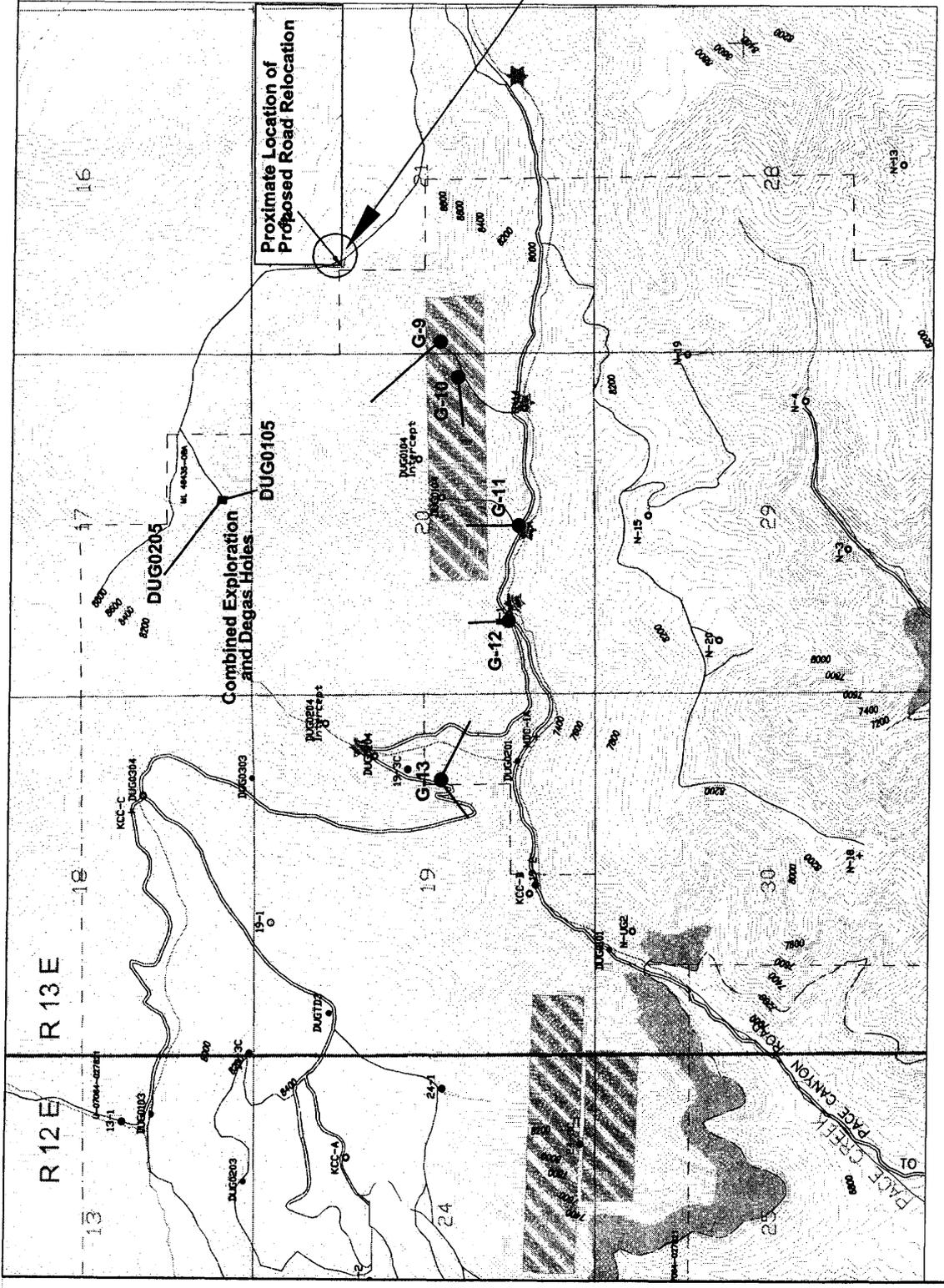
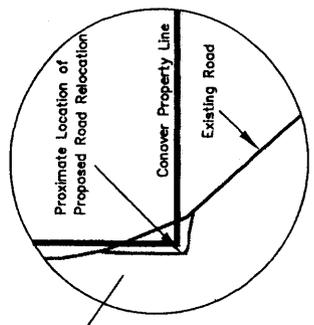
- Installation and monitoring of one or more exhaustor-blower units on the degas sites to remove the gases from the mine. The number and duration of the installations are unknown at this time.
- Fault investigations to determine the surface location and characteristics of several faults associated with the Dugout Canyon Mine. This may include digging trenches in select locations on existing roads. The locations are currently undecided, but will be approved by the land owner before digging commences.
- Monitoring and removing noxious weeds, in accordance with the existing land use agreement.
- Locating and surveying section corners and lease/property lines. This surveying may be completed either by private or government surveyors.
- Surveying subsidence monitoring points.

In addition, the attached map also identifies the areas where longwall mining will occur beneath the Thayn Lands.

EXPLANATION

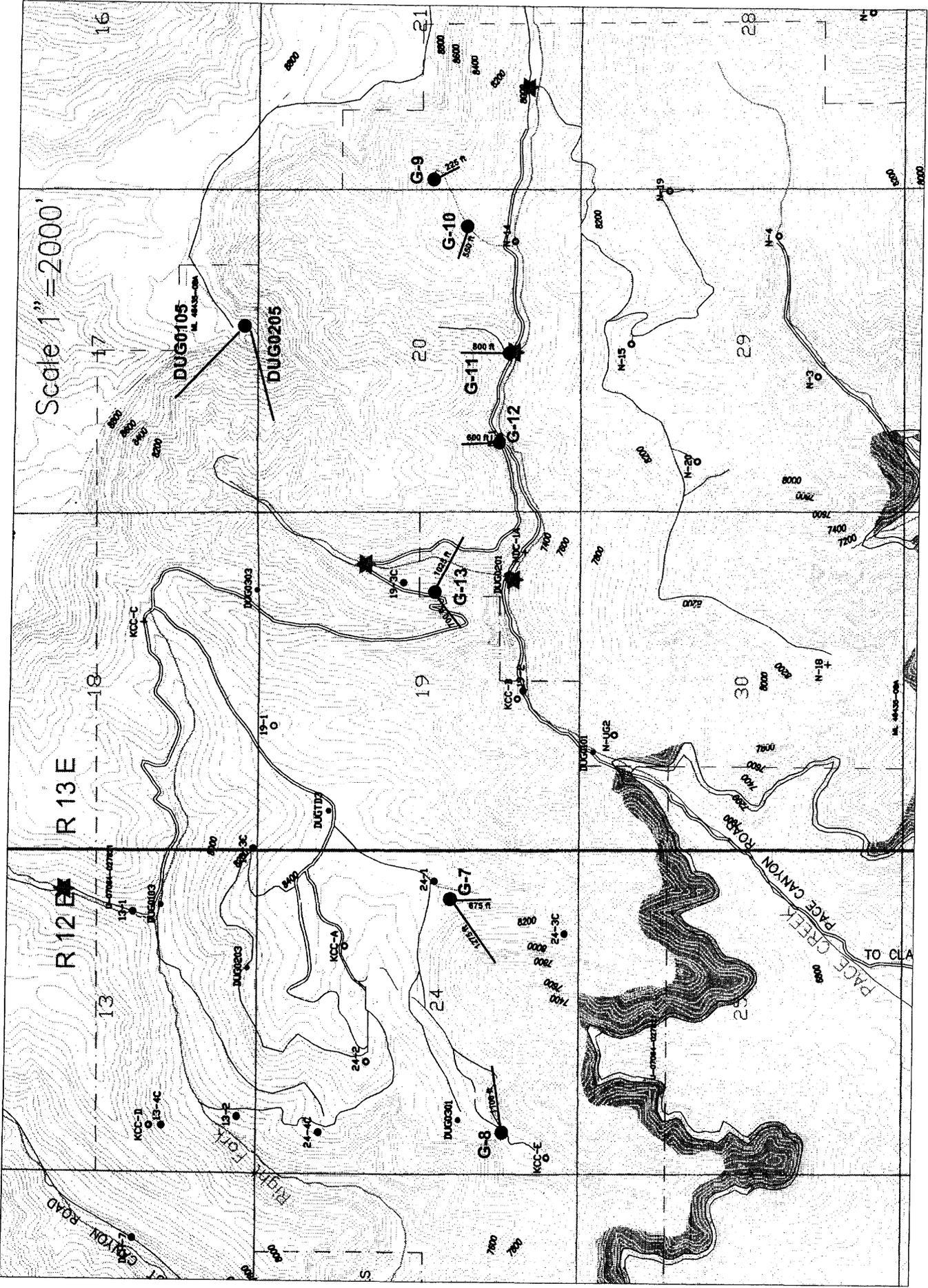
- Existing Road
- No Upgrade
- Existing Road Requires Upgrade
- Newly Constructed Road
- Trail
- Lease Boundary
- Degas Bore Holes
- Water Locations
- Burn
- 2006 Longwall Mining

Scale: 1" = 1500'



CF Canyon Fuel Co., LLC.
 Dugout Canyon Mine
 Thayne Lands
 Planned Activities in 2006
 04 MAY 1997
 WELLSBORO, PA 16742
 1997-10-20-2002

Scale 1" = 2000'



Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
July 13, 2006

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-17. Refer to Plate 1-4 in the M&RP for well locations.

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 and G-15 require buffer zone designation. Refer to Chapter 5, Attachment 5-1 for drawings of well sites G-8 through G-17.

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.

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.

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-3) and 5-26 (G-4 thru G-17).

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 13, 2006

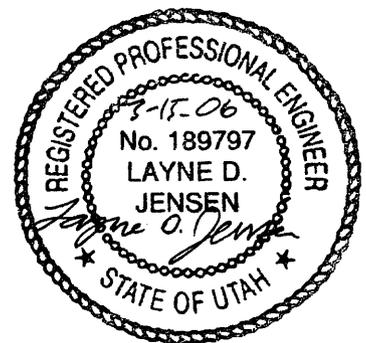
**ATTACHMENT 7-1
HYDROLOGY CALCULATIONS**

add to the back of existing information

Canyon Fuel Company, LLC
Dugout Canyon Mine

Methane Degassification Amendment
March 16, 2006

ATTACHMENT 7-1
HYDROLOGY CALCULATIONS



G-13

Rainfall Depth = 2.0" 10-yr 24-hr storm

According to Plate 2-1 the soil type is the Rottulee family which has a Hydrologic soil Classification of C

CN = 87 (Dirt Road) conservative estimate assuming No vegetative cover

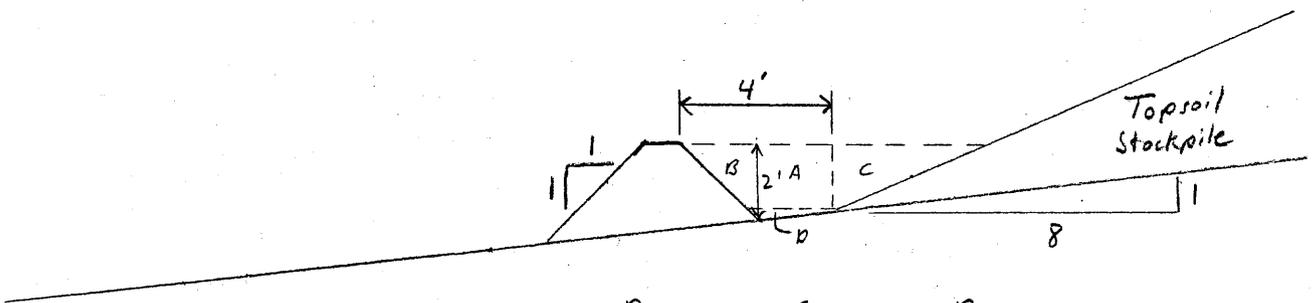
$$\text{Runoff Depth} = \frac{(P - 0.2S)^2}{P + 0.8(S)}$$

$$S = 1000/CN - 10 = 1000/87 - 10 = 1.49$$

$$\text{Runoff Depth} = \frac{2.0 - 0.2(1.49)^2}{2.0 + 0.8(1.49)} = \frac{2.897}{3.192} = 0.91"$$

$$\text{Topsoil Stockpile Area} = 12,973 \text{ ft}^2$$

$$\text{Runoff Volume} = (12,973 \text{ ft}^2) \cdot 0.91" / 12 \text{ in/ft} = 983.8 \text{ ft}^3$$



$$\text{Area} = (2 \times 1.75) + \frac{1}{2}(2 \times 2) + \frac{1}{2}(2 \times 4) + \frac{1}{2}(0.25 \times 2) = 9.75 \text{ ft}^2$$

The berm should be built on contour. The length of the berm detaining runoff is approximately 136' long. The toe of the berm should be at least two feet from the toe of the topsoil stockpile on the east side. The berms on the remaining sides may be closer and only 1' tall

$$\text{Containment volume} = (9.75 \text{ ft}^2)(136') = 1326 \text{ ft}^3 > 983.8 \text{ OK}$$

G-14

Rainfall Depth = 2.0" 10-yr 24-hr storm

According to Plate Z-1 the soil type is the Rottulec family which has a Hydrologic soil Classification of C

CN = 87 (Dirt Road) Conservative estimate assuming No Vegetative cover

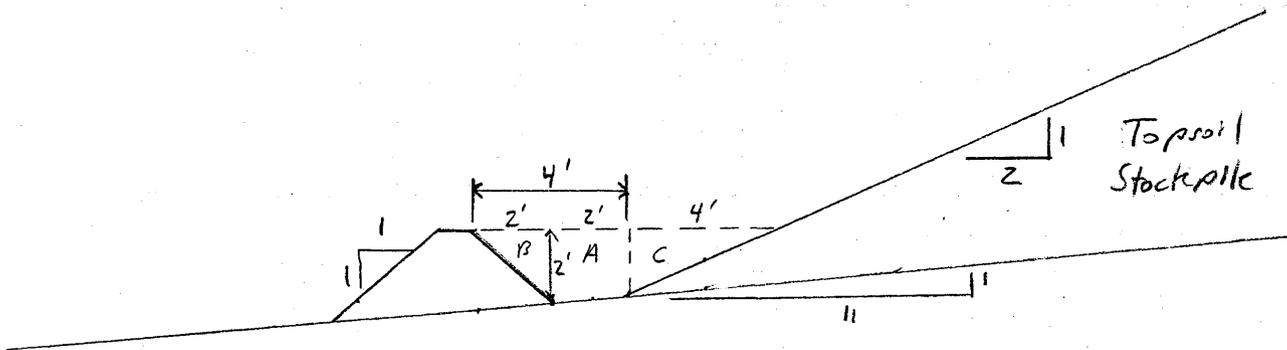
$$\text{Runoff Depth} = \frac{(P - 0.2S)^2}{P + 0.8(S)}$$

$$S = 1000 / \text{CN} - 10 = 1000 / 87 - 10 = 1.49$$

$$\text{Runoff Depth} = \frac{(2.0 - 0.2(1.49))^2}{2.0 + 0.8(1.49)} = \frac{2.897}{3.192} = 0.91''$$

$$\text{Topsoil Stockpile Area} = 8704 \text{ ft}^2$$

$$\text{Runoff Volume} = (8704 \text{ ft}^2) \left(\frac{0.91''}{12''/\text{ft}} \right) = 660.1 \text{ ft}^3$$



$$\text{Area} = (2' \times 2') + \frac{1}{2}(2' \times 2') + \frac{1}{2}(2' \times 4') = 10 \text{ ft}^2$$

The stockpile will be built on relatively flat ground. The west side of the pile will be slightly lower. On the west side the berm should be built on contour to maximize containment. The west side berm should be at least 2' tall and the toe of the berm should be at least 2' from the toe of the stockpile. The length of the berm on contour should be at least 70' long. Other than the west side the berm may be less than 2' tall.

$$\text{Containment volume} = (70' \times 10 \text{ ft}^2) = 700 \text{ ft}^3 > 660.1 \text{ ft}^3 \therefore \text{OK}$$

G-15

Rainfall Depth = 2.0" 10-yr 24-hr storm

According to Plate 2-1 the soil type is the Rottulce family which has a Hydrologic Soil Classification of C

CN = 87 (Dirt Road) Conservative estimate assuming No vegetative cover

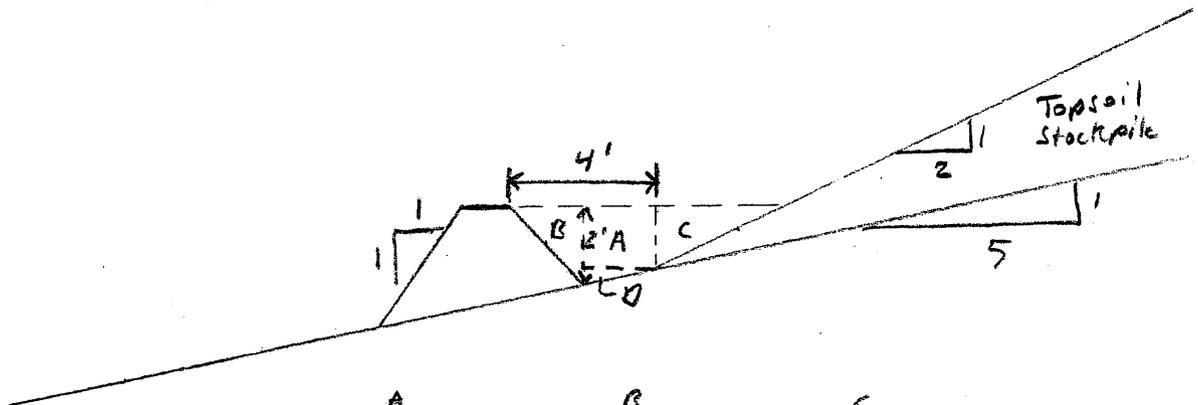
$$\text{Runoff Depth} = \frac{(P - 0.25)^2}{P + 0.8(S)}$$

$$S = 1000/CN - 10 = 1000/87 - 10 = 1.49$$

$$\text{Runoff Depth} = \frac{(2.0 - 0.2(1.49))^2}{2.0 - 0.8(1.49)} = \frac{2.897}{3.192} = 0.91"$$

$$\text{Topsoil Stockpile Area} = 8,216 \text{ ft}^2$$

$$\text{Runoff Vol.} = (8,216 \text{ ft}^2) \cdot 0.91 / 12 \text{ in/ft} = 623 \text{ ft}^3$$



$$\text{Area} = (2 \times 1.6) + \frac{1}{2}(2 \times 2) + \frac{1}{2}(1.6 \times 3.2) + \frac{1}{2}(0.4 \times 2) = 8.2 \text{ ft}^2$$

The berm should be built on contour at the toe of the stockpile. The length of the berm detaining runoff will be approximately 100' long. The toe of the berm should be at least 2' from the toe of the stockpile. The berms on the sides and upper part of the stockpile may be closer to the stockpile and only 1' tall.

$$\text{Containment Volume} = (8.2 \text{ ft}^2)(100') = 820 \text{ ft}^3 > 623 \text{ ft}^3 \therefore \text{OK}$$

G-16

Rainfall Depth = 2.0" 10-yr 24-hr storm

The site has been previously disturbed and reclaimed. The reclaimed soil is likely a mix of native soils with Hydrologic Soil group C and D. A hydrologic soil group of D will be assumed to be conservative

CN = 89 (Dirt road) very conservative since the pile will be brought and seeded.

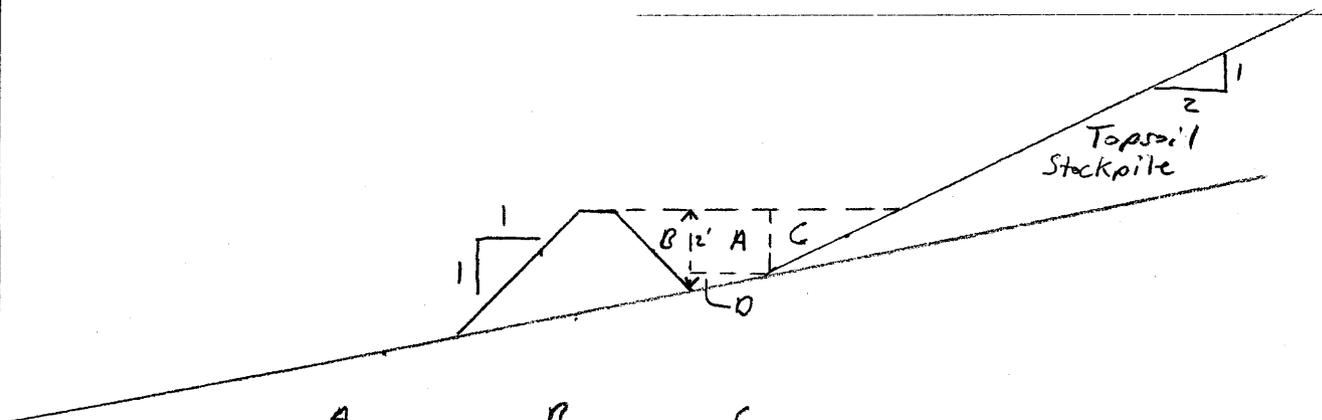
$$\text{Runoff Depth} = \frac{(P - 0.2S)^2}{P + 0.8(S)}$$

$$S = 1000/CN - 10 = 1000/89 - 10 = 1.24$$

$$\text{Runoff Depth} = \frac{(2.0 - 0.2(1.24))^2}{2.0 + 0.8(1.24)} = 1.03''$$

$$\text{Area within berm} = 8082 \text{ ft}^2$$

$$\text{Runoff Volume} = (8082 \text{ ft}^2) \times (1.03'' / 12''/\text{ft}) = 693.7 \text{ ft}^3$$



$$\text{Area} = (2 \times 1.6) + \frac{1}{2}(2 \times 2) + \frac{1}{2}(1.6 \times 3.2) + \frac{1}{2}(0.4 \times 2) = 8.2 \text{ ft}^2$$

The berm should be built on contour at the toe of the stockpile. The length of the berm detaining runoff will be approximately 90' long. The berm should be at least 2' from the toe of the stockpile and 2' high. The berms on the other sides may be shorter and closer to the stockpile

$$\text{Containment Volume} = (8.2 \text{ ft}^2)(90 \text{ ft}) = 738 \text{ ft}^3 > 693.7 \text{ ft}^3 \therefore \text{OK}$$

G-17

Rainfall Depth = 2.0" 10-yr 24-hr storm

According to Plate 2-1 the soil type is the Rottulce family which has a hydrologic soil classification of C

CN = 87 (Dirt Road) Conservative estimate assuming No vegetative cover

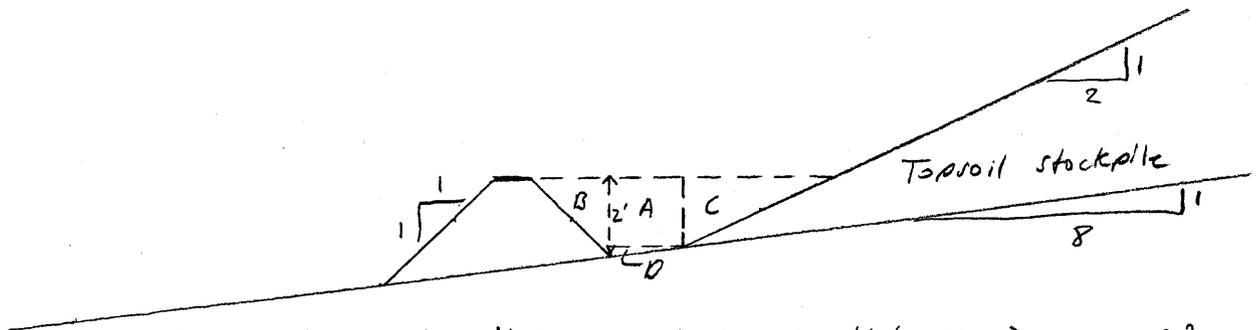
$$\text{Runoff Depth} = \frac{(P - 0.2S)^2}{P + 0.8(S)}$$

$$S = 1000/CN - 10 = 1000/87 - 10 = 1.49$$

$$\text{Runoff Depth} = \frac{(2.0 - 0.2(1.49))^2}{2.0 - 0.8(1.49)} = \frac{2.897}{3.192} = 0.91"$$

$$\text{Total stockpile area} = 5402 \text{ ft}^2$$

$$\text{Runoff Volume} = (5402 \text{ ft}^2) \cdot 0.91" / 12 \text{ in/ft} = 410 \text{ ft}^3$$



$$\text{Area} = (2 \times 1.75) + \frac{1}{2}(2 \times 2) + \frac{1}{2}(2 \times 4) + \frac{1}{2}(0.25 \times 2) = 9.75 \text{ ft}^2$$

The berm should be built on contour. The length of the berm detaining runoff will be approximately 50' in length. The toe of the berm should be at least 2' from the toe of the stockpile.

$$\text{Containment Volume} = (9.75)(50') = 487.5 \text{ ft}^3 > 410 \text{ ft}^3 \therefore \text{OK}$$

SILT FENCE DESIGN

To control sediment yield from the degas hole drilling pads a combination of berms and silt fences will be used. Berms will be placed around the entire drilling pad including the cut slopes and fill slopes. These berms will have two purposes. The first is to divert runoff from undisturbed areas from flowing onto the drilling pad. The second is to divert runoff from the drilling pad to one or more silt fences to be treated before discharge. These calculations will determine the minimum surface area of silt fence needed to handle a 10-year 24-hour storm event.

The peak flow calculations will be made assuming that the entire area within the berms has a curve number of 90. This value is from professional judgment taking into consideration that a dirt road in an area with hydrologic soil group D has a curve number of 89. Hence this should be a conservative estimate.

Silt fences are manufactured to have a wide variety of water flow rates. I have seen water flow rates as low as 4 gpm/ft² to flow rates as high as 35 gpm/ft². However, the typical water flow rate for silt fences is 10 gpm/ft². This design will be based on this typical water flow rate. Any silt fence used at the degas hole sites should have a water flow rate of approximately 10 gpm/ft².

Assuming a silt fence height of 2 ft a minimum length of silt fence will be specified based on the peak flow to be treated and the typical water flow rate of 10 gpm/ft².

G-11

Peak flow = 0.56 cfs = 251.3 gpm

Required silt fence surface area = $251 \text{ gpm} / 10 \text{ gpm/ft}^2 = 25.13 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $25.13 \text{ ft}^2 / 2 \text{ ft} = \mathbf{12.6 \text{ ft}}$

G-12

Peak flow = 0.48 cfs = 215.4 gpm

Required silt fence surface area = $215.4 \text{ gpm} / 10 \text{ gpm/ft}^2 = 21.54 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $21.54 \text{ ft}^2 / 2 \text{ ft} = \mathbf{10.8 \text{ ft}}$

Note: The minimum total length of silt fence required is the combined length of silt fence from multiple places at the site or a single silt fence depending on the sites configuration.

G-13

Peak flow = 1.08 cfs = 484.7 gpm

Required silt fence surface area = $484.7 \text{ gpm} / 10 \text{ gpm/ft}^2 = 48.47 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $48.47 \text{ ft}^2 / 2 \text{ ft} = \mathbf{24.2 \text{ ft}}$

G-14

Peak flow = 0.93 cfs = 417.4 gpm

Required silt fence surface area = $417.4 \text{ gpm} / 10 \text{ gpm/ft}^2 = 41.74 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $41.74 \text{ ft}^2 / 2 \text{ ft} = \mathbf{20.9 \text{ ft}}$

G-15

Peak flow = 0.81 cfs = 363.6 gpm

Required silt fence surface area = $363.6 \text{ gpm} / 10 \text{ gpm/ft}^2 = 36.36 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $36.36 \text{ ft}^2 / 2 \text{ ft} = \mathbf{18.2 \text{ ft}}$

Note: The minimum total length of silt fence required is the combined length of silt fence from multiple places at the site or a single silt fence depending on the sites configuration.

G-16

Peak flow = 0.67 cfs = 300.7 gpm

Required silt fence surface area = $300.7 \text{ gpm} / 10 \text{ gpm/ft}^2 = 30.07 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $30.07 \text{ ft}^2 / 2 \text{ ft} = \mathbf{15.0 \text{ ft}}$

G-17

Peak flow = 0.53 cfs = 237.9 gpm

Required silt fence surface area = $237.9 \text{ gpm} / 10 \text{ gpm/ft}^2 = 23.79 \text{ ft}^2$

Assuming a silt fence height of 2 ft.

Minimum total length of silt fence required = $23.79 \text{ ft}^2 / 2 \text{ ft} = \mathbf{11.9 \text{ ft}}$

Note: The minimum total length of silt fence required is the combined length of silt fence from multiple places at the site or a single silt fence depending on the sites configuration.

**Summary of Watershed Data
Degas Well Sites G-11 through G-12**

Degas Hole Area	Drainage Area (ac)	Curve Number	S (in)	Y (%)	I (ft)	L (hr)	Time of Conc. (hr)	Peak Flow (cfs)	Peak Flow (gpm)
G-11	0.49	90	1.111	32	190	0.010	0.017	0.56	251.3
G-12	0.42	90	1.111	30	205	0.011	0.019	0.48	215.4
G-13	0.95	90	1.111	19	385	0.024	0.040	1.08	484.7
G-14	0.83	90	1.111	12	370	0.029	0.049	0.93	417.4
G-15	0.71	90	1.111	32	330	0.016	0.027	0.81	363.6
G-16	0.59	90	1.111	16	240	0.018	0.030	0.67	300.7
G-17	0.47	90	1.111	13	260	0.021	0.035	0.53	237.9

Notes

- S = 1000/CN - 10
- Y = average watershed slope = (length of contour lines)(contour interval)/(watershed area)
- I = hydraulic length
- L = watershed lag = $(1.08(S+1)^{0.7}) / (1900(Y)^{0.5})$
- Time of Concentration + 1.67L
- Peak Flow is based on a 10-yr 24-hr storm event

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-11

INPUT SUMMARY

STORM :	WATERSHED :
Dist. = SCS Type II	Area = 0.49 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc. = 0.02 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.56 cfs (1.133 iph)
at time: 12.002 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-12

INPUT SUMMARY

STORM :	WATERSHED :
Dist. = SCS Type II	Area = 0.42 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc. = 0.02 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.48 cfs (1.131 iph)
at time: 12.000 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-13

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.95 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.04 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 1.08 cfs (1.123 iph)
at time: 12.005 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-14

INPUT SUMMARY

STORM :	WATERSHED :
Dist. = SCS Type II	Area = 0.83 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc. = 0.05 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.93 cfs (1.117 iph)
at time: 12.002 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-15

INPUT SUMMARY

STORM :	WATERSHED :
Dist.= SCS Type II	Area = 0.71 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc.= 0.03 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.81 cfs (1.128 iph)
at time: 12.002 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-16

INPUT SUMMARY

STORM :	WATERSHED :
Dist. = SCS Type II	Area = 0.59 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc. = 0.03 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.67 cfs (1.127 iph)
at time: 12.004 hrs

Triangular Hydrograph Calculations using

SCSHYDRO Program

Watershed I.D.:

G-17

INPUT SUMMARY

STORM :	WATERSHED :
Dist. = SCS Type II	Area = 0.47 acres
Depth = 2.00 inches	CN = 90.00
Duration = 24.0 hrs	Time conc. = 0.04 hrs

OUTPUT SUMMARY

Runoff depth: 1.094 inches
Initial abstr: 0.222 inches
Peak flow: 0.53 cfs (1.124 iph)
at time: 12.003 hrs

product

Prefabricated Silt Fence Structures for Sedimentation Control

Silt Fence Technical Data (All values are minimum average roll values)

PROPERTY	TEST METHOD	UNITS	SILT FENCE (100X) MINIMUM AVERAGE ROLL VALUES	ENVIROFENCE® (100X) MINIMUM AVERAGE ROLL VALUES
Grab Tensile Strength (machine direction)*	ASTM D 4632	N (lbs)	550 (124)	550 (124)
Grab Tensile Strength (cross-machine direction)*	ASTM D 4632	N (lbs)	550 (124)	550 (124)
Grab Tensile Elongation	ASTM D 4632	%	15/15	15/15
Mullen Burst Strength	ASTM D 3786	kPa (psi)	2060 (300)	2060 (300)
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	290 (65)	290 (60)
Permittivity	ASTM D 4491	sec ⁻¹	0.10	0.10
Water Flow Rate	ASTM D 4491	l/min/m ² (gal/min/ft ²)	405 (10)	405 (10)
Ultraviolet Stability	ASTM D 4355	%	70	70

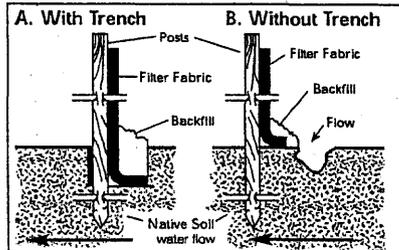
* Envirofence working strength is enhanced further by the incorporation of a polymeric mesh providing a tensile strength of 140 lbs/ft (typical) in both machine and cross machine directions.

Silt Fence Packaging

SILT FENCE TYPE	LENGTH m (ft)	FABRIC WIDTH m (ft)	POST LENGTH m (ft)	POST SPACING m (ft)	SHIPPING WEIGHTS kg (lbs)
Miraf® Silt Fence	30.5 (100)	0.9 (3)	1.22 (4)	2.5 (8.3)	23 (50)
	30.5 (100)	0.9 (3)	1.22 (4)	3.0 (10)	20 (45)
Miraf® Envirofence®	30.5 (100)	0.9 (3)	1.22 (4)	2.5 (8.3)	25 (55)
100CX (Fabric Only)	varies	0.9 (3)	—	—	varies
100X (Fabric Only)	100.6 (330)	0.9 (3)	—	—	12 (26)

Silt Fence Installation Guidelines

Toe-In Methods



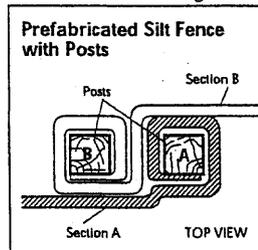
A. With Trench

- Excavate a 15.2 cm x 15.2 cm (6" x 6") trench along lower perimeter of site.
- Unroll silt fence one section at a time. Posts should be positioned on downstream side of fence.
- Drive post into ground and lay the toe-in fabric flap in bottom of trench. Backfill trench, and tamp ground as shown in diagram above.

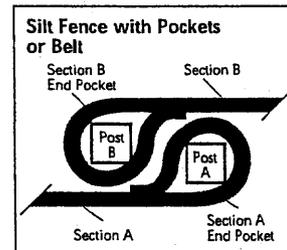
B. Without Trench

- Toe-in can also be accomplished by laying the fabric flap on untrenched ground and piling and tamping soil over the flap at the base of structure.

Joining Sections of Silt Fences



- Position posts to overlap as shown in diagram above, making certain that fabric folds around each post one full turn.
- Drive posts tightly together and secure tops of posts by tying off with cord or wire to prevent flow-through of built-up sediment at joint.



- Overlap posts as shown in previous section to prevent flow-through.
- Drive posts firmly together and tie off tops of posts to prevent separation.

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