Canyon Fuel Company, LLC
A Subsidiary of Bowie Resource Holdings, LLC

Dugout Canyon Mine
P.O. Box 1029
Wellington, Utah 84542
(435) 637-6360
Fax (435) 636-2897

February 17, 2017

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

Subject: Waste Rock Site Phase II Expansion, Dugout Canyon Mine, C/007/039,

Dear Mr. Haddock:

Canyon Fuel Company, LLC herby files application to modify the permit C/007/039. Enclosed please find a copy of the submittal to address the Refuse Pile Amendment, Phase II Expansion.

Should you have any questions please contact Bill King at (435) 636-2898 or David Spillman at (435) 636-2872.

Sincerely,

David Spillman

David G. Spillman, P.E.
Technical Services Manager

cc: Kirt Tatton
Chris Hansen
Bill King

APPLICATION FOR COAL PERMIT PROCESSING

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

Permittee: Canyon Fuel Company, LLC

Mine: Dugout Canyon Mine **Permit Number:** C/007/039

Title: Waste Rock Site Phase II Expansion

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

Dugout Mine is expanding the Waste Rock Site to allow for more capacity. This expansion is expected to take place in 2017.

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

☒ Yes ☐ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: 1.4 ☒ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☒ Yes ☐ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☒ Yes ☐ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☐ Yes ☒ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☒ Yes ☐ No 15. Does the application require or include soil removal, storage or placement?
☒ Yes ☐ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☒ Yes ☐ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☒ Yes ☐ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☒ Yes ☐ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☒ Yes ☐ No 21. Have reclamation costs for bonding been provided?
☐ Yes ☒ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach one (1) review copy of the application.

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

David Spillman
Print Name

David Spillman Engineering Manager 2-16-17
Sign Name, Position, Date

Subscribed and sworn to before me this 16th day of Feb, 2017

Mon S. Clau
Notary Public

My commission Expires: 11-7-19 , 20___}
Attest: State of UT } } ss:
County of Carbon

NOTARY PUBLIC
MONICA S. CLAUSING
Commission No. 686189
Commission Expires
NOVEMBER 07, 2019
STATE OF UTAH

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

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

Permittee: Canyon Fuel Company, LLC
Mine: Dugout Canyon Mine, Waste Rock Site **Permit Number:** C/007/039
Title: Waste Rock Site Phase II Expansion, page 1 of 2

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

Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐	☒	☐	Dugout M&RP, Chapter 1, Page 1-8, 1-9, 1-10, 1-11 (The degas well total acres is from Table 1-2 of the Methane Degassificatin Amendment for constructed sites only)
☐	☒	☐	Dugout M&RP, Chapter 1, Plate 1-4 (Permitted Acres increased, the Disturbed Acres decreased as degas sites that were never constructed were removed from the acreage table as referenced above
☐	☒	☐	Dugout M&RP, Chapter 5, Appendix 5-6, Replace entire appendix
☐	☒	☐	Dugout M&RP, Chapter 7, Appendix 7-6, UPDES Permit, Remove all old UPDES Permits and replace with updated UPDES permit
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 1, RA Figure 1-1A
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 1, RA Figure 1-1B
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 1, RA Plate 1-1
☒	☐	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 1, Attachment 1-1, Encroachment Document
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 2
☐	☐	☒	Dugout M&RP, Refuse Pile Amendment, Chapter 2, RA Table 2-2
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 2, RA Plate 2-1
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 2, RA Plate 2-2 (An as-built will be submitted upon completion of the Phase II expansion)
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 2, RA Attachment 2-2
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 3, Section 352, Page 3-13
☒	☐	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 3, Appendix 3-2, Raptor Survey "Confidential Binder"
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 4, RA Figure 4-1
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, RA Plate 5-1
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, RA Plate 5-1A
☒	☐	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, RA Plate 5-1B
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, RA Plate 5-2
☐	☐	☒	Dugout M&RP, Refuse Pile Amendment, Chapter 5, RA Plate 5-2A
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, RA Plate 5-3
☒	☐	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, Attachment 5-1
☒	☐	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, Attachment 5-2
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, Attachment 5-3
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 5, Attachment 5-5
☐	☒	☐	Dugout M&RP, Refuse Pile Amendment, Chapter 6, RA Figure 6-1

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

Permittee: Canyon Fuel Company, LLC
Mine: Dugout Canyon Mine, Waste Rock Site **Permit Number:** C/007/039
Title: Waste Rock Site Phase II Expansion, page 2 of 2

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

Add	Replace	Remove	DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7
☐ Add	☒ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Figure 7-1
☐ Add	☒ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Table 7-3
☐ Add	☒ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Table 7-4
☒ Add	☐ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Plate 7-1a
☒ Add	☐ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Plate 7-2a
☒ Add	☐ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Plate 7-3a
☒ Add	☐ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Plate 7-4a
☒ Add	☐ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Plate 7-5a
☒ Add	☐ Replace	☐ Remove	Dugout M&RP, Refuse Pile Amendment, Chapter 7, RA Attachment 7-7
☐ Add	☐ Replace	☐ Remove	
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	Received by Oil, Gas & Mining

Waste Rock Site Phase II Expansion

Dugout M&RP, Chapter 1

Pages 1-8, 1,9, 1-10 & 1-11

Plate 1-4

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

Section 30: Lot 1

Federal BLM Right-of-Way UTU-76601 - (10 acres) - Sept. 1998

T. 13S., R. 12 E., SLBM, Utah

Section 23: NE1/4NW1/4NW1/4SW1/4,N1/2NE1/4NW1/4SW1/4, SE1/4NW1/4NW1/4SW1/4

Fee land owned by CFC as described below: (800 acres)

T. 13 S., R. 12 E., SLBM, Utah

Section 16: All

Section 23: E1/2NW1/4; W1/2NE1/4

BLM Rt-of-Way UTU-77985 - (57.5 acres)

T13 S., R12E., SLBM, Utah

Section: 22: NE1/4SW1/4SW/4SE1/4, S1/2SW1/4SW1/4SE1/4, N1/2SE1/4SW1/4SE1/4, SE1/4NE1/4SW1/4SE1/4, S1/2NW1/4SE1/4SE1/4,SW1/4NE1/4SE1/4SE1/4, N1/2NE1/4SE1/4SE1/4

Section 23: NW1/4SW1/4NW1/4SW1/4, S1/2NW1/4NW1/4SW1/4, NE1/4NW1/4NW1/4SW1/4, N1/2NE1/4NW1/4SW1/4

Section 27: NE1/4SE1/4NE1/4NW1/4, S1/2SE1/4NE1/4NW1/4, SE1/4NE1/4NE1/4NW 1/4, W1/2 NW1/4NW1/4NE1/4

BLM Parcel (2.5 acres)

T13 S., R12E., SLBM, Utah

Section: 23: NW1/4NW1/4NW/4SW1/4

State Lease ML-48435-OBA - (2,560 acres)

T13 S., R13 E., SLBM, Utah

Section 17: W1/2W1/2SW1/4, W1/2E1/2W1/2SW1/4

Section 19: NE1/4SE1/4, S1/2SE1/4

Section 20: W1/2W1/2W1/2, W1/2E1/2W1/2W1/2

T13 S., R13 E., SLBM, Utah (Added to Permit Area in 2005, approximately 2,360 acres)

Section 17: E1/2SW1/4, SW1/4SE1/4, E1/2E1/2W1/2SW1/4

Section 20: E1/2W1/2, E1/2, E1/2E1/2W1/2W1/2

Section 21: SW1/4NW1/4, SW1/4

Section 28: NW1/4, N1/2SW1/4, SW1/4SW1/4

Section 29: All

Section 30: E1/2, E1/2W1/2

State Lease ML-50582-OBA - (320 acres)

T13 S., R13 E., SLBM, Utah

Section 16: W1/2

Waste Rock Storage Facility - Fee land owned by CFC

T. 14 S., R. 12 E., SLBM, Utah (Approximately ~~26.8~~ 28.2 acres)

Section 18: Portions of NE1/4, SW1/4 and SE1/4 of the NE1/4

All of Lease ML-42648, except the E1/2 of Section 8 and the NE1/4 of Section 17, is included within the Dugout Canyon Mine permit boundary. However, only the S1/2 SE1/4 of Section 9 from Lease ML-42649 is within the permit boundary. The ten acres described in UTU-76601 are also described in UTU-77985. The U.S. Department of Interior, Bureau of Land Management (BLM) right-of-way application UTU-76601 is included in Appendix 1-3.

The disturbed area encompasses 20.80 acres (Mine Facility area, including Gilson well pad and small substation), ~~39.7~~ 36.08 (G-2, G-5, G-6, G-7, G-9, G-10, G-11, G-12, G-13, G-14, G-15, G-16, G-17, G-18, G-19, G-22 (including access road), G-25, G-26, ~~G-29~~, G-30 and G-31 Degas Well), 14.25 acres (AMV Road) 0.85 (Topsoil Stockpile), 1.8 acres (Leach field/pipeline area), 2.7 acres (Pace Canyon Fan Facility) and ~~26.8~~ 28.2 acres (Refuse Pile area) totaling approximately ~~106.9~~ 104.68 acres. That acreage includes a pre- and post mining road with an area of 1.6 acres and 2.03 acres of undisturbed land within the mine facilities disturbed area and 11.2 acres within the refuse pile disturbed area.

The permit boundary encompasses approximately ~~9,568~~ 9,569 acres which includes the acreage as presented in the table below, also refer to Plate 1-1 and RA Plate 1-1 for additional information. Coal ownership acreage within the permit area includes approximately 2,941 acres of federal coal, approximately 5,800 acres of state coal, and ~~827~~ 828 acres of fee coal as shown in the table below (Plate 1-2 and RA1-1B). Approximately 745 acres which include the surface subsidence area, refuse pile and leach field areas will not be mined although their acreage is included in the surface and coal ownership acreage totals.

Acreage Table
(all acreage is approximate)

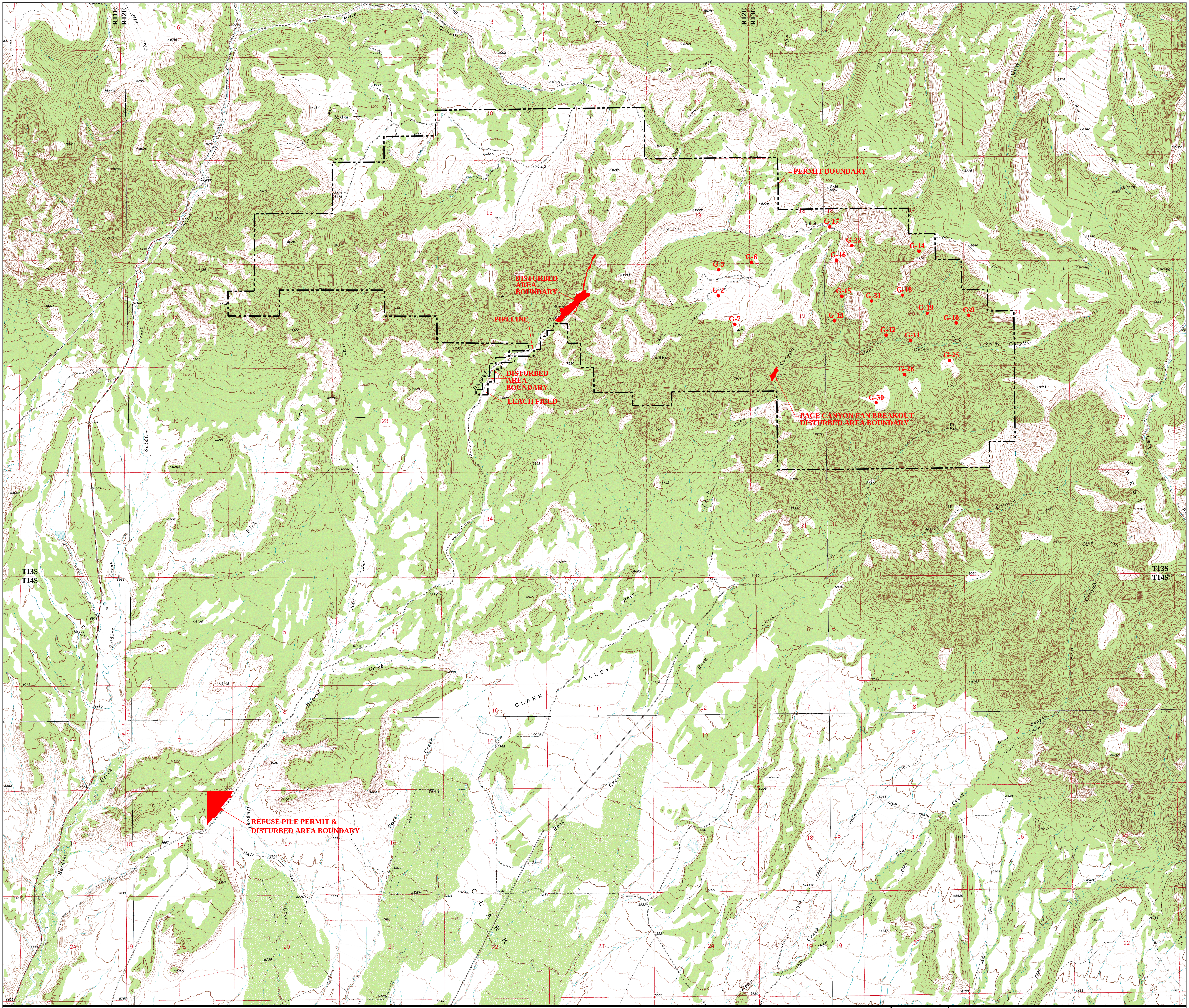
Disturbed Area	Acreage	**Surface Ownership**	Acreage	**Coal Ownership**	Acreage
Dugout Cyn. Facility	20.8	Federal	627	Federal	2941
Degas ~~(3/24/10)~~	~~39.7~~ 36.08	State of Utah	920	State	5800
AMV Road	14.25	Fee	~~8021~~ 8022	Fee	~~827~~ 828
Topsoil Stockpile	0.85				
Leachfield	1.8				
Fan Portal	2.7				
Refuse Pile	~~26.8~~ 28.2				
Total	~~106.9~~ 104.68		~~9568~~ 9569		~~9568~~ 9569
Acres of Land Within Permit Area under Lease and Fee Lands					
State Leases	Acres	Federal Leases	Acres	BLM	Acres
ML-42648	3160	U-07064-027821	2881	ROW UTU-76601	10
ML-42649	80			ROW UTU-77985	47.5
ML-48435-OBA	2560			Parcel	2.5

ML-50582-OBA	0	**Fee Acreage**	~~827~~ 828		
Total (Rounded)	5800		~~3708~~ 3709		60
Approximate Total Acreage within Permit Area	**5800+ ~~3708~~ 3709+60 = ~~9568~~ 9569**				

A legal description of the permit boundary includes:

T. 13 S., R. 12 E., SLBM, Utah

Section 9:	S1/2SE1/4
Section 10:	S1/2
Section 11:	S1/2
Section 13:	All
Section 14:	All
Section 15:	All
Section 16:	All
Section 17:	E1/2SW1/4; SE1/4
Section 20:	E1/2NW1/4; SW1/4NW1/4; N1/2NE1/4
Section 21:	N1/2NW1/4; NE1/4
Section 22:	N1/2; N1/2S1/2; Portion of N1/2NE1/4SE1/4SE1/4; Portion of SW1/4NE1/4SE1/4SE1/4; Portion of the S1/2NW1/4SE1/4SE1/4; Portion of SW1/4NE1/4SW1/4SE1/4; Portion of N1/2SE1/4SW1/4SE1/4; Portion of NE1/4SW1/4SW1/4SE1/4; Portion of S1/2SW1/4SW1/4SE1/4
Section 23:	NW1/4; NE1/4; SE1/4; NE1/4SW1/4; NW1/4NW1/4SW1/4; S1/2NE1/4NW1/4SW1/4;NW1/4SW1/4NW1/4SW1/4, E1/2SE1/4SW1/4
Section 24:	All
Section 25:	N1/2N1/2, N1/2SW1/4NW1/4
Section 26:	N1/2NE1/4, NE1/4SE1/4NE1/4
Section 27:	Portion of W1/2NW1/4NW1/4NE1/4 Portion of SW1/4NE1/4NE1/4NW1/4 Portion of E1/2SW1/4NE1/4NW1/4 Portion of SW1/4SW1/4NE1/4NW1/4



LEGEND

PERMIT AREA BOUNDARY

~~9,568~~ 9,569 PERMITTED ACRES

~~106.9~~ 104.68 DISTURBED ACRES

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

0' 2000'

REVISIONS	
DATE	BY
09/04/07	SC
10/02/07	SC
02/21/08	VSM
10/01/08	VSM/SWF
04/23/09	VSM/SWF
06/16/09	VSM/SWF
08/05/09	VSM/SWF
03/25/10	VSM/SWF
03/02/12	JKS
07/14/16	BK
7/25/16	BK/JKS
08/12/16	BK
12/17/16	BK

Canyon Fuel Company, LLC
Soldier Canyon & Dugout Canyon Mines

DUGOUT CANYON MINE PERMIT AREA

Dugout Canyon Mine

DRAWN BY: RR
APPROVED BY: VSM
DATE: FEBRUARY 26, 2003
FILE NAME: PLATE 1-4.DWG
SCALE: 1" = 2000'
DRAWING OR MAP NUMBER PLATE 1-4

Waste Rock Site Phase II Expansion

Dugout M&RP, Chapter 5

Appendix 5-6, Reclamation Bond

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

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Title page for reference only

APPENDIX 5-6

Reclamation Bond Estimate

Direct Costs				
Subtotal Demolition and Removal	$732,013		~~$728,253~~	
Subtotal Backfilling and Grading	$1,083,312		~~$1,049,995~~	
Subtotal Revegetation	$444,713		~~$435,566~~	
Direct Costs	$2,260,038		~~$2,213,814~~	
Indirect Costs				
Mob/Demob	$226,004	10.0%	~~$221,381~~	~~10.0%~~
Contingency	$113,002	5.0%	~~$110,691~~	~~5.0%~~
Engineering Redesign	$56,501	2.5%	~~$55,345~~	~~2.5%~~
Main Office Expense	$153,683	6.8%	~~$150,539~~	~~6.8%~~
Project Management Fee	$56,501	2.5%	~~$55,345~~	~~2.5%~~
Subtotal Indirect Costs	$605,691	26.8%	~~$593,301~~	~~26.8%~~
Total Reclamation Cost 2015 Dollars	$2,865,729		~~$2,807,115~~	
Escalation factor for 2015		0.012		~~0.012~~
Number of years to next review		5		~~5~~
Escalation	$176,120.00		~~$172,518~~	
Escalated Reclamation Cost to 2020	$3,041,849.23		~~$2,979,633~~	
Reclamation Cost (rounded to nearest $1,000)	$3,042,000.00		~~$2,980,000~~	
Bond Amount in 2009 Dollars	$3,550,000.00		~~$3,550,000~~	
Difference Between Cost Estimate and Bond	$508,000.00		~~$570,000.00~~	
Percent Difference	14.31%		~~16.06%~~	

$$\boxed{Escalated\$ = \left(\$ \times [1 + Rate]^{Years}\right)}$$

Demo Line Item Subtotals

Ref.	Description	Cost 2015 Dollars	
1	Mine Belt BC-1	$ 11,120	
2	Transfer Building	$ 22,460	
3	Feed Belt BC 2	$ 7,524	
4	Stack Tubes 2	$ 4,686	
5	Head House 1	$ 4,098	
6	Transfer Belt BC 2	$ 5,019	
7	Head House 2	$ 1,376	
8	Reclaim Tunnel	$ 38,640	
9	Reclaim Belt BC 4	$ 7,033	
10	Escape Tunnel 60 inch	$ 1,119	
11	Crusher Building	$ 18,507	
12	Truck Loadout Belt BC 5	$ 6,306	
13	Truck Loadout and Scale	$ 16,232	
14	Bathhouse	$ 76,623	
15	Substation	$ 2,281	
16	Power Lines and Poles	$ 2,828	
17	Retaining Wall	$ 891	
18	Gabion Wall	$ 21,314	
19	Pump House	$ 3,474	
20	Paved Road	$ 150,348	
21	Stream Culvert 72 inch	$ 28,588	
22	Water Tanks	$ 2,466	
23	Rock Dust Bin	$ 1,396	
24	Fuel Tank and Fuel Station	$ 1,830	
25	Holding Tank	$ 3,198	
26	Ventilation Fan	$ 1,714	
27	Magnet	$ 3,953	
28	Water System	$ 27,407	
29	Sewage System	$ 9,185	
30	Storage Containers (8)	$ 11,257	
31	Gilson Well	$ 2,901	
32	Switch House	$ 6,364	
33	Portals No	$ 28,326	
34	Storage & Bolts Bin	$ 2,955	
35	Storage Building	$ 2,183	
36	Sampling System	$ 1,270	
37	Stoker Storage Bin	$ 1,039	
38	Substation No 2	$ 2,524	
39	Gabion Baskets	$ 1,488	
40	Pace Fan Culvert	$ 1,691	
41	Pace Fan & Generators	$ 52,618	
42	Pace Fan Portal	$ 5,766	
43	Refuse Pile	$ 30,704	
44	Refuse Site	$ 18,223	~~14,463~~
45	Degas Well G2	$ 10,759	
46	Degas Well G-5	$ 7,972	
47	Degas Well G 6	$ 3,242	
48	Degas Well G-7	$ 6,109	
49	Degas Well G-9	$ 7,912	
50	Degas Well G-10	$ 8,143	
51	Degas Well G-11	$ 4,077	
52	Degas Well G-12	$ 5,783	
53	Degas Well G-13	$ 9,262	
54	Degas Well G-14	$ 7,463	
55	Degas Well G-15	$ 5,464	
56	Degas Well G-16	$ 7,385	
57	Degas Well G-17	$ 7,200	
58	Degas Well G-18	$ 15,158	
59	Degas Well G-19	$ 9,142	
60	Degas Well G-22 & Access Road	$ 15,993	
61	Degas Well G-25	$ 9,067	
62	Degas Well G-26	$ 8,441	
63	Degas Well G-30	$ 8,917	
64	Degas Well G-31	$ 18,881	
65	AMV Road	$ 47,689	
	Total	**$ 874,985**	~~871,225~~

Phase I & II Bond Release of Degas Wells Breakout

Description	Phase I Bond Release 60%	Phase II Bond Release 40%	Total
Degas Well G2	$ 6,455	$ 4,304	$ 10,759
Degas Well G-5	$ 4,783	$ 3,189	$ 7,972
Degas Well G 6	$ 1,945	$ 1,297	$ 3,242
Degas Well G-7	$ 3,665	$ 2,444	$ 6,109
Degas Well G-9	$ 4,747		$ 4,747
Degas Well G-10	$ 4,886	$ 3,257	$ 8,143
Degas Well G-11			
Degas Well G-12	$ 3,470	$ 2,313	$ 5,783
Degas Well G-13	$ 5,557	$ 3,705	$ 9,262
Degas Well G-14	$ 4,478	$ 2,985	$ 7,463
Degas Well G-15			
Degas Well G-16	$ 4,431		$ 4,431
Degas Well G-17			
Degas Well G-18	$ 9,095	$ 6,063	$ 15,158
Degas Well G-19	$ 5,485		$ 5,485
Degas Well G-22 & Access Road	$ 9,596		$ 9,596
Degas Well G-25	$ 5,440		$ 5,440
Degas Well G-26	$ 5,065		$ 5,065
Degas Well G-30	$ 5,350		$ 5,350
Degas Well G-31	$ 11,329	$ 7,552	$ 18,881
AMV Road	$ 10,086		$ 10,086
Total	**$ 105,863**	**$ 37,109**	**$ 142,972**

TOTAL with Phase I & II Bond Release Applied

Total with Phase I & II Bond Release	732,013	~~728,253~~

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
1	**Mine Belt BC-1**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						62800					CF		62800	CF	
	No interior Wall Deduct		02 41 16 13 0750	50%													0.5	31400		$ 8,792
	Structure's Vol. Demolished																	1163	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											52				TON				
	Truck's Capacity										12	16		3		CY Trips				
	Haulage										3.3					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									1.1		DAY		2	DAY	$ 1,382
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									8.8		HR		8.8	HR	$ 352
	Disposal Cost Steel																			
	Subtotal																			$ 10,526
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	CY						20					CY		20	CY	$ 275
	Concrete's Vol. Demolished																1.3	26	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													26	CY	$ 25
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						26					CY		26	CY	$ 59
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													26	CY	$ 235
	Subtotal																			$ 594
	Total																			**$ 11,120**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
2	**Transfer Building**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						104618					CF		104618	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	52309		$ 14,647
	Rubble's Weight (exclude steel)																	1937.37037	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											50				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										3.1					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									8		HR		8	HR	$ 320
	Disposal Cost Steel																			
	No interior Wall Deduct																			$ -
	Subtotal																			**$ 15,658**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						229					CY		229	CY	$ 3,149
	Concrete's Vol. Demolished																1.3	298	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													298	CY	$ 286
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. tri	31 23 23.20 3014	2.26	/CY						298					CY		298	CY	$ 673
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													298	CY	$ 2,694
	Subtotal																			**$ 6,802**
	Total																			**$ 22,460**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
3	**Feed Belt BC 2**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						47438					CF		47438	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	23719		$ 6,641
	Rubble's Weight (exclude steel)																	878.5	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											30				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										1.9					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.6		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									4.8		HR		4.8	HR	$ 192
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 7,524**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 7,524**

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
4	**Stack Tubes 2**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						158					CY		158	CY	$ 2,173
	Concrete's Vol. Demolished																1.3	205	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													205	CY	$ 197
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						205					CY		205	CY	$ 463
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													205	CY	$ 1,853
	Subtotal																			$ 4,686
	Total																			**$ 4,686**

NOTES

Assumes 6" thick concrete unreinforced slab

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
5	**Head House 1**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						23878					CF		23878	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	11939		$ 3,343
	Rubble's Weight (exclude steel)																	442.2	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											10				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.6					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.2		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									1.6		HR		1.6	HR	$ 64
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 4,098**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 4,098**

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
6	**Transfer Belt BC 2**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						30000					CF		30000	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	15000		$ 4,200
	Rubble's Weight (exclude steel)																	555.6	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											20				TON		20	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										1.3					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.4		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									3.2		HR		3.2	HR	$ 128
	Disposal Cost Steel																			
	Subtotal																			$ 5,019
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			**$ 5,019**

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
7	**Head House 2**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						4436					CF		4436	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	2218		$ 621
	Rubble's Weight (exclude steel)																	82.1	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											10				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.6					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.2		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	trhv	40.05	HR									1.6		HR		1.6	HR	$ 64
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 1,376**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			$ 1,376

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
8	**Reclaim Tunnel**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						18774					CF		18774	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	9387		$ 2,628
	Rubble's Weight (exclude steel)																	347.7	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											32				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										2					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.7		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									5.6		HR		5.6	HR	$ 224
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			$ 3,543
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	CY						1182					CY		1182	CY	$ 16,253
	Concrete's Vol. Demolished																1.3	1537	CY	$ -
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													1537	CY	$ 1,476
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						1537					CY		1537	CY	$ 3,474
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													1537	CY	$ 13,894
	Subtotal																			$ 35,097
	Total																			$ 38,640

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
9	**Reclaim Belt BC 4**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						35180					CF		35180	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	17590		$ 4,925
	Rubble's Weight (exclude steel)																	651.5	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											40				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										2.5					CY				
	Transportation Cost Steel Tru	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.8		DAY		1	DAY	$ 691
	Transportation Cost Steel Tru	Truck Driver, Heavy	TRHV	40.05	HR									6.4		HR		6.4	HR	$ 256
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 5,872**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	CY						39					CY		39	CY	$ 536
	Concrete's Vol. Demolished																1.3	51	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													51	CY	$ 49
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						51					CY		51	CY	$ 115
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													51	CY	$ 461
	Subtotal																			**$ 1,161**
	Total																			**$ 7,033**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Truck rental totaled for entire sheet

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
10	**Escape Tunnel 60 inch**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						2827					CF		2827	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	1413.5		$ 396
	Rubble's Weight (exclude steel)																	52.4	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											4				TON				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.3					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									0.8		HR		0.8	HR	$ 32
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			$ 1,119
	Total																			**$ 1,119**

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
11	**Crusher Building**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						93305					CF		93305	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	46652.5		$ 13,063
	Rubble's Weight (exclude steel)																	1727.9	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											100				TON		100	TON	
	Truck's Capacity	12 CY (16 Ton) Dump Truck									12	16		**3**		CY Trips				
	Haulage										6.3					CY				
	Transportation Cost Steel Tru	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									2.1		DAY		3	DAY	$ 2,073
	Transportation Cost Steel Tru	Truck Driver, Heavy	TRHV	40.05	HR									16.8		HR		16.8	HR	$ 673
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 15,809**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						91					CY		91	CY	$ 1,251
	Concrete's Vol. Demolished																1.3	118	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													118	CY	$ 113
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						118					CY		118	CY	$ 267
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													118	CY	$ 1,067
	Subtotal																			**$ 2,698**
	Total																			**$ 18,507**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
12	**Truck Loadout Belt BC 5**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						30899					CF		30899	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	15449.5		$ 4,326
	Rubble's Weight (exclude steel)																	572.2	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											20				TON		20	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										1.3					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.4		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									3.2		HR		3.2	HR	$ 128
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 5,145**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						39					CY		39	CY	$ 536
	Concrete's Vol. Demolished																1.3	51	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													51	CY	$ 49
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						51					CY		51	CY	$ 115
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													51	CY	$ 461
	Subtotal																			**$ 1,161**
	Total																			**$ 6,306**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
13	**Truck Loadout and Scale**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						74976					CF		74976	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	37488		$ 10,497
	Rubble's Weight (exclude steel)																	1388.4	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											50				TON		50	TON	
	Truck's Capacity										12	16		3		CY Trips				
	Haulage										3.1					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									8		HR		8	HR	$ 320
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 11,508**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						159					CY		159	CY	$ 2,186
	Concrete's Vol. Demolished																1.3	207	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													207	CY	$ 199
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						207					CY		207	CY	$ 468
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													207	CY	$ 1,871
	Subtotal																			**$ 4,724**
	Total																			**$ 16,232**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
14	**Bathhouse**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						416365					CF		416365	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	208182.5		$ 58,291
	Rubble's Weight (exclude steel)																	7710.5	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											107								
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										6.7					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									2.2		DAY		3	DAY	$ 2,073
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									17.6		HR		17.6	HR	$ 705
	Disposal Cost Steel																			
	Subtotal																			**$ 61,069**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						524					CY		524	CY	$ 7,205
	Concrete's Vol. Demolished																1.3	681	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													681	CY	$ 654
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						681					CY		681	CY	$ 1,539
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													681	CY	$ 6,156
	Subtotal																			**$ 15,554**
	Total																			**$ 76,623**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
15	**Substation**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						4000					CF		4000	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	2000		$ 560
	Rubble's Weight (exclude steel)																	74.1	CY	
	Truck's Capacity																			
	Haulage	`																		
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											50				TON		50	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										3.1					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton Payload	01 54 33 20 5300	691	/day									1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									8		HR		8	HR	$ 320
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			$ 1,571
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						24					CY		24	CY	$ 330
	Concrete's Vol. Demolished																1.3	31	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													31	CY	$ 30
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						31					CY		31	CY	$ 70
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													31	CY	$ 280
	Subtotal																			$ 710
	Total																			$ 2,281

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
16	**Power Lines and Poles**																			
	Structure's Demolition Cost	Dugout Power line	26 05 05 10 1900	19.6	/CLF	1937										CLF		19.37	CLF	$ 380
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$ 380**
	Power Poles																			
	Equipment 's Disposal Cost	Dugout Power Poles	02 41 13.80 0100	204	/EA										12	EA		12	EA	$ 2,448
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ 2,448**
	Total																			**$ 2,828**

NOTES

CLF=100 linear ft

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
17	**Retaining Wall**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						30					CY		30	CY	$ 413
	Concrete's Vol. Demolished																1.3	39	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													39	CY	$ 37
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						39					CY		39	CY	$ 88
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													39	CY	$ 353
	Subtotal																			$ 891
	Total																			**$ 891**

NOTES

Assumes 6" thick concrete unreinforced slab
4/23/15 Dugout states concrete retaining wall

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
18	**Gabion Wall**																			
	Structures Volume	Gabion Removal	02 41 13 90 1300	17.83	ea						880							880	ea	$ 15,690
	Demolition Time 60 CY/ DAY																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive	Truck Driver, Heavy	Trhv	40.05	HR									117		HR		117	HR	$ 4,686
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Hilfiker Mesh	Select Demo disposal loading and haul	02 41 19.19 5000	0.87	/CY													513	CY	$ 446
	Load Mesh into Dumpster	Front End Loader 3 CY	31 23 16 42 1601	0.96	/CY													513	CY	$ 492
	Disposal Cost Steel																			
	Subtotal																			**$ 21,314**
	Total																			**$ 21,314**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
19	**Pump House**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						2219					CF		2219	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	1109.5		$ 311
	Rubble's Weight (exclude steel)																	41.1	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											5				TON		5	TON	
	Truck's Capacity										12	16		3		CY Trips				
	Haulage										0.3					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									0.8		HR		0.8	HR	$ 32
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			$ 1,034
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						82					CY		82	CY	$ 1,128
	Concrete's Vol. Demolished																1.3	107	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													107	CY	$ 103
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						107					CY		107	CY	$ 242
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													107	CY	$ 967
	Subtotal																			$ 2,440
	Total																			**$ 3,474**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
20	**Paved Road**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Asphalt Demolition																			
	Demolition Cost	Pavement Removal 4-6"	02 41 13 17 5050	7.12	/SY					19500						SY		19500	SY	$ 138,840
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY						1273					CY		1273	CY	$ 11,508
	Subtotal																			$150,348
	Total																			**$150,348**

NOTES

4/23/15 Dugout is burying the concrete in place, no haul cost associated with demo

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
21	**Stream Culvert 72 inch**																			
	Excavate Culvert	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY	2350	12	12								CF		12533	CY	$ 12,032
	Backfill Culvert	Backfill structural 300 HP	31 23 23 14 5020	0.84	/CY	2350	12	12								CF		12533	CY	$ 10,528
	Structure's Vol. Demolished																	464.2	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											94				TON		94	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									5.9		DAY		6	DAY	$ 4,146
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									47		HR		47	HR	$ 1,882
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 28,588**
	Total																			**$ 28,588**

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
22	**Water Tanks**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						241					CF		241	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	120.5		$ 34
	Rubble's Weight (exclude steel)																	4.5	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											39				TON		39	TON	
	Truck's Capacity										12	16		3		CY Trips				
	Haulage										2.4					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.8		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									6.4		HR		6.4	HR	$ 256
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			$ 981
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						50					CY		50	CY	$ 688
	Concrete's Vol. Demolished																1.3	65	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													65	CY	$ 62
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						65					CY		65	CY	$ 147
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													65	CY	$ 588
	Subtotal																			$ 1,485
	Total																			**$ 2,466**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
23	**Rock Dust Bin**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						2265					CF		2265	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	1132.5		$ 317
	Rubble's Weight (exclude steel)																	41.9	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											5				TON		5	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.3					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									0.8		HR		0.8	HR	$ 32
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 1,040**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						12					CY		12	CY	$ 165
	Concrete's Vol. Demolished																1.3	15.6	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													15.6	CY	$ 15
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						15.6					CY		15.6	CY	$ 35
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													15.6	CY	$ 141
	Subtotal																			**$ 356**
	Total																			**$ 1,396**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
24	Fuel Tank and Fuel Station																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						3945					CF		3945	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	1972.5		$ 552
	Rubble's Weight (exclude steel)																	73.1	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											7				TON		7	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.4					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									0.8		HR		0.8	HR	$ 32
	Disposal Cost Steel																			
	Subtotal																			**$ 1,275**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						18.66					CY		18.66	CY	$ 257
	Concrete's Vol. Demolished																1.3	24.3	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													24.3	CY	$ 23
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						24.3					CY		24.3	CY	$ 55
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													24.3	CY	$ 220
	Subtotal																			**$ 555**
	Total																			**$ 1,830**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
25	**Holding Tank**																			
	Structure's Demolition Cost	Septic Tanks & Related Components	02 41 13 44 0600	2015	EA													1		$ 2,015
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel	On site disposal	02 41 16 17 4200	9.04	CY						50					CY		50	CY	$ 452
	Steel's Weight											2				TON		2	TON	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.1	51.76	HR		1	day	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									1		HR		1	HR	$ 40
	Disposal Cost Steel																			
	Subtotal																			**$ 3,198**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 3,198**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
26	**Ventilation Fan**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						6850					CF		6850	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	3425		$ 959
	Rubble's Weight (exclude steel)																	126.9	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											10				TON		10	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.6					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.2		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									1.6		HR		1.6	HR	$ 64
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 1,714**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 1,714**

NOTES

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
27	**Magnet**																			
	Structure's Demolition Cost	Steel Building Small	02 41 16 13 0500	0.3	CF						35					CF		35		
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	17.5		$ 5
																		0.6	CY	
	Rubble's Weight (exclude steel)	Truck Mounted Crane 55 ton	01 54 33 60 2600	76.8	HR										2	HR		2	HR	$ 154
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel	Dump Charges	02 41 19.20 0100	74	CY													35	CY	2590
	Steel's Weight											2				TON		2	TON	
	Truck's Capacity										12	16		3		CY Trips				
	Haulage										0.1					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.03		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									0.2		HR		0.2	HR	$ 8
	Disposal Cost Steel																			
	Subtotal																			$ 3,448
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						17					CY		17	CY	$ 234
	Concrete's Vol. Demolished																1.3	22.1	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													22.1	CY	$ 21
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						22.1					CY		22.1	CY	$ 50
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													22.1	CY	$ 200
	Subtotal																			$ 505
	Total																			**$ 3,953**

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
28	**Water System**																			
	Excavate Pipe	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY	8450	2	4								FT		2504	CY	$ 2,404
	Pipe Removal	Pipe removal	02 41 13.38 1700	2.71	/LF	8450										FT		8450		$ 22,900
	Backfill Trench	Backfill structural 300 HP	31 23 23 14 5020	0.84	/CY	8450	2	4								FT		2504	CY	$ 2,103
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$ 27,407**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 27,407**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
29	**Sewage System**																			
	Excavate Pipe	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY	2832	2	4								FT		839	CY	$ 805
	Pipe Removal	Pipe removal	02 41 13.38 1700	2.71	/FT	2832										FT		2832		$ 7,675
	Backfill Trench	Backfill structural 300 HP	31 23 23 14 5020	0.84	/CY	2832	2	4								FT		839	CY	$ 705
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$ 9,185**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 9,185**

NOTES

See Dugout Canyon Mine Leach Field Amendment pg 5-13 states sewer pipeline and leach field piping and concrete boxes will be left in place as part of the final reclamation.

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
30																				
	Storage Containers (8)																			
	Load, Transport, and Return Trip	Truck Mounted Crane 55 ton	01 54 33 60 2600	76.8	HR									16		HR		16		$ 1,229
	Structure's Demolition Cost	Mixed Materials Bld. Large	02 41 16 13 0100	0.3	/CF	40	10	10							8	EA		32000	CF	$ 9,600
	Structure's Vol. Demolished																0.35	415	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel	Building Construction Materials	02 41 19.19 0400	4	/CY							107						107	CY	$ 428
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 11,257
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			**$ 11,257**

NOTES

All Storage Containers will be salvaged

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
31	**Gilson Well**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						800					CF		800	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	400		$ 112
	Rubble's Weight (exclude steel)																	14.8	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											0.5				TON		0.5	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										1					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.3		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									2.4		HR		2.4	HR	$ 96
	Disposal Cost Steel																			
	Subtotal																			$ 899
	Plug Well Casing	Concrete Ready Mix 8000 PSI	03 31 13.35 0412	123	CY						3					CY		3	CY	$ 369
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ 369
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						55					CY		55	CY	$ 756
	Concrete's Vol. Demolished																1.3	71.5	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													71.5	CY	$ 69
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						71.5					CY		71.5	CY	$ 162
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													71.5	CY	$ 646
	Subtotal																			$ 1,633
	Total																			$ 2,901

NOTES

Assumes 6" thick concrete unreinforced slab

Assumes no interior walls

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
32	**Switch House**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						14400					CF		14400	CF	$ 4,032
	Structure's Vol. Demolished																	533.3	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											1				TON		1	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.1					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.03		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									0.2		HR		0.2	HR	$ 8
	Disposal Cost Steel																			
	Subtotal																			**$ 4,731**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						55					CY		55	CY	$ 756
	Concrete's Vol. Demolished																1.3	71.5	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													71.5	CY	$ 69
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						71.5					CY		71.5	CY	$ 162
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													71.5	CY	$ 646
	Subtotal																			**$ 1,633**
	Total																			**$ 6,364**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
33	**Portals No**																			
	Structure's Demolition Cost	Foundations <15"	Nielson '14	13.75	**CY**						34				5	EA		170	CY	$ 2,338
	Loading Cost																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Concrete Unit Masonry	Concrete Block, Back Up	04 22 10.14 1250	10.96	/SF						400				5	EA		2000	CY	$ 21,920
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY						90				5	EA		450	CY	$ 4,068
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ 28,326
	Total																			**$ 28,326**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
34	**Storage & Bolts Bin**																			
	Structure's Demolition Cost	LG Steel Bldg/include 20 mi haul	02 41 16 13 0020	0.28	/CF						3272					/CF		3272	/CF	$ 916
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.44		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	Trhv	40.05	HR									4		HR		4	HR	$ 160
	Disposal Cost Steel																			
	Subtotal																			**$ 1,767**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						39.99					CY		39.99	CY	$ 550
	Concrete's Vol. Demolished																1.3	52	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													52	CY	$ 50
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						52					CY		52	CY	$ 118
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													52	CY	$ 470
	Subtotal																			**$ 1,188**
	Total																			**$ 2,955**

NOTES

Assumes 6" thick slab concrete

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
35	**Storage Building**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF						2284					CF		2284	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	1142		$ 320
	Rubble's Weight (exclude steel)																	42.3	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											6				TON		6	TON	
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.4					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									0.8		HR		0.8	HR	$ 32
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 1,043**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						38.4					CY		38.4	CY	$ 528
	Concrete's Vol. Demolished																1.3	49.9	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													49.9	CY	$ 48
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						49.9					CY		49.9	CY	$ 113
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													49.9	CY	$ 451
	Subtotal																			**$ 1,140**
	Total																			**$ 2,183**

NOTES

Assumes 6" thick slab concrete

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
36	**Sampling System**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.14		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									1.1		HR		1.1	HR	$ 44
	Disposal Cost Steel																			
	Subtotal																			$ 735
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						18					CY		18	CY	$ 248
	Concrete's Vol. Demolished																1.3	23.4	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													23.4	CY	$ 22
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						23.4					CY		23.4	CY	$ 53
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													23.4	CY	$ 212
	Subtotal																			$ 535
	Total																			**$ 1,270**

NOTES

Assumes 6" thick slab concrete

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
37	**Stoker Storage Bin**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						35					CY		35	CY	$ 481
	Concrete's Vol. Demolished																1.3	45.5	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													45.5	CY	$ 44
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						45.5					CY		45.5	CY	$ 103
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													45.5	CY	$ 411
	Subtotal																			$ 1,039
	Total																			**$ 1,039**

NOTES

Assumes 6" thick slab concrete

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
38	**Substation No 2**																			
	Structure's Demolition Cost	Mixed Materials Bld. Large	02 41 16 13 0100	0.3	/CF						4000					CF		4000	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	2000		$ 600
	Rubble's Weight (exclude steel)																	74.1	CY	
	Truck's Capacity																			
	Haulage	`																		
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel	6000 gal. to 8000 gal. tank	02115 200 0310	232	Ea.										1	EA		1	EA	232
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			**$ 832**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						57					CY		57	CY	$ 784
	Concrete's Vol. Demolished																1.3	74.1	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													74.1	CY	$ 71
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						74.1					CY		74.1	CY	$ 167
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													74.1	CY	$ 670
	Subtotal																			**$ 1,692**
	Total																			**$ 2,524**

NOTES

Assumes 6" thick slab concrete

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
39	**Gabion Baskets**																			
	Excavate	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY						88					CY		88		$ 84
	Support	CLAB	Clab	37.6	HR									8		hr		8	hr	$ 301
	Disposal	On site disposal	02 41 16 17 4200	9.04	/CY						122					CY		122	CY	$ 1,103
	See Earthwork																			
	Subtotal																			**$ 1,488**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 1,488**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
40	**Pace Fan Culvert**																			
	Excavate Culvert	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY	585	3	8										520	CY	$ 499
	Backfill Culvert	Backfill structural 300 HP	31 23 23 14 5020	0.84	/CY	585	3	8										520	CY	$ 437
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight											8.5				ton				
	Truck's Capacity										12	16		**3**		CY Trips				
	Haulage										0.5					CY				
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.2		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									1.6		HR		1.6	HR	$ 64
	Disposal Cost Steel																			
	Subtotal																			$ 1,691
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			**$ 1,691**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
41	**Pace Fan & Generators**																			
	Structure's Demolition Cost	Steel Bld. Large	02 41 16 13 0020	0.28	/CF	25	25	12								CF		7500	CF	
	Structure's Vol. Demolished	No interior Wall Deduct	02 41 16 13 0750	50%													0.5	3750		$ 1,050
	Rubble's Weight (exclude steel)																	138.9	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									1		DAY		1	DAY	$ 691
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									8		HR		8	HR	$ 320
	Disposal Cost Steel																			
	No interior Wall Deduct																			
	Subtotal																			$ 2,061
	Equipment 's Disposal Cost																			
	Ducting	Mechanical equipment heavy	23 05 05.10 3600	780	/ton							35				ton		35	ton	$ 27,300
	Fan	Mechanical equipment heavy	23 05 05.10 3600	780	/ton							10				ton		10	ton	$ 7,800
	Hilfiker Mesh	Mechanical equipment heavy	23 05 05.10 3600	780	/ton							0.7				ton		0.7	ton	$ 546
	Portal plate liner	Mechanical equipment heavy	23 05 05.10 3600	780	/ton							1.2				ton		1.2	ton	$ 936
	Total steel weight											46.9								
	Transportation Cost Steel Truck	Truck dump 16 ton payload	01 54 33 20 5300	691	/day									0.6		DAY		0.6	DAY	$ 415
	Transportation Cost Steel Truck Drive	Truck Driver, Heavy	TRHV	40.05	HR									5		HR		5	HR	$ 200
	Subtotal																			$ 37,197
	Portal plate liner																			
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						70					CY		70	CY	$ 963
	Concrete's Vol. Demolished																1.3	91	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													91	CY	$ 87
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						91					CY		91	CY	$ 206
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													91	CY	$ 823
	Subtotal																			$ 2,079
	Generator Pad																			
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						128					CY		128	CY	$ 1,760
	Concrete's Vol. Demolished																1.3	166.4	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													166.4	CY	$ 160
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						166.4					CY		166.4	CY	$ 376
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													166.4	CY	$ 1,504
	Subtotal																			$ 3,800
	Fan Building																			
	Concrete Demolition																			
	Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						252					CY		252	CY	$ 3,465
	Concrete's Vol. Demolished																1.3	327.6	CY	
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY													327.6	CY	$ 314
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. rnd. trip	31 23 23.20 3014	2.26	/CY						327.6					CY		327.6	CY	$ 740
	Disposal Costs	On site disposal	02 41 16 17 4200	9.04	/CY													327.6	CY	$ 2,962
	Subtotal																			$ 7,481
	Total																			$ 52,618

NOTES

Assume 6" thick slab none reinforced concrete

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
42	**Pace Fan Portal**																			
	Structure's Demolition Cost	Foundations <15"	Nielson '14	13.75	/CY						90				1	EA		1	EA	$ 1,238
	Loading Cost	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY						150				1	EA		1	EA	$ 144
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Concrete Unit Masonry	Concrete Block, Back Up	04 22 10.14 1250	10.96	/SF						400				1	EA		400		$ 4,384
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Costs																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			**$ 5,766**
	Total																			**$ 5,766**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
43	**Refuse Pile**																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			$ -
	Erosion Control																			
	Riprap	Machine placed rip-rap slope protection	31 37 13 10 0100	52.9	CY						561					CY		561	CY	$ 29,677
	Polypropylene Mesh	Polypropylene mesh	31 25 14.16 0100	0.61	SY					1683						SY		1683	SY	$ 1,027
	Subtotal																			$ 30,704
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			**$ 30,704**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost	
44	**Refuse Site**																				
	See Earthwork also																				
		Fencing Barbed wire 3 strand	02 41 13 60 1600	1.4	/LF	4095	~~3250~~									FT	~~3250~~	4095	FT	$ 5,733	~~4550~~
	Remove Fence	Chain link remove 8'-10'	02 41 13 60 1700	3.05	/LF	4095	~~3250~~									FT	~~3250~~	4095	FT	$ 12,490	~~9913~~
	Subtotal																			**$ 18,223**	~~14463~~
	Equipment 's Disposal Cost																				
	Dismantling Cost																				
	Equipment 's Vol. Demolished																				
	Loading Costs																				
	Transport Costs																				
	Disposal Costs																				
	Subtotal																			$ -	
	Total																			**$ 18,223**	~~14463~~

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
45	**Degas Well G2**																			
	Grade and Backfill	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY						378					CY		378	CY	$ 363
	Fill in Mud Pit	Backfill Trench minimal Haul 2 1/4 CY	31 23 16 13 3080	1.8	/CY						1246					CY		1246	CY	$ 2,243
	Subtotal																			**$ 2,606**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						20					CY		20	CY	$ 2,460
	Subtotal																			**$ 2,460**
	Spread Topsoil	Front end loader 3 CY	31 23 16 42 1601	0.96	/CY						3104					CY		3104	CY	$ 2,980
	Subtotal																			**$ 2,980**
	Fence																			
	Remove Barbed Wire	Fencing Barbed wire 3 strand	02 41 13 60 1600	1.4	/LF	1200										FT		1200	FT	$ 1,680
	Subtotal																			**$ 1,680**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	per HR									16		hr		16	hr	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		hr		16	hr	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 10,759**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
46	**Degas Well G-5**																			
	Grading and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						818					CY		818	CY	$ 785
	Fill Mud Pit	Backfill Trench Minimal Haul 2 1/4 CY	31 23 16 13 3080	1.8	/CY						110					CY		110	CY	$ 198
	Plug well Casing	Concrete ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	$ 2,583
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	/CY						1909					CY		1909	CY	$ 1,833
	Remove Barbed Wire	Fencing Barbed wire 3 strand	02 41 13 60 1600	1.4	/LF	1100										LF		1100	LF	$ 1,540
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	per HR										16	HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR										16	HR		16	HR	$ 223
	Subtotal																			$ 7,972
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			$ -
	Total																			**$ 7,972**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
47	**Degas Well G 6**																			
	Grading and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96							682					CY		682	CY	$ 655
																CY				
	Fill Mud Pit	Backfill Trench Minimal Haul 2 1/4	31 23 16 42 1601	0.96	/CY						110					CY		110	CY	$ 106
	Plug Well Casing																			
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	/CY						792					CY		792	CY	$ 760
	Remove Barbed Wire	Fencing Barbed wire 3 strand	02 41 13 60 1600	1.4	/LF	860										LF		860	LF	$ 1,204
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	per HR									8		HR		8	HR	$ 405
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									8		HR		8	HR	$ 112
	Subtotal																			**$ 3,242**
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ -**
	Total																			**$ 3,242**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
48	**Degas Well G-7**																			
	Grading and Backfill	Frond End Loader 3 CY	31 23 16 42 1601	0.96	/CY						908					CY		908	CY	$ 872
	Fill Mud Pit	Backfill trench minimal haul 21/4 CY	31 23 16 42 1601	0.96	/CY						430					CY		430	CY	$ 413
	Plug Well Casing																			
	Spread Topsoil	Front End Loader	31 23 16 42 1601	0.96	/CY						2345					CY		2345	CY	$ 2,251
	Remove Barbed Wire	Fencing Barbed wire 3 strand	02 41 13 60 1600	1.4	/LF	1100										LF		1100	LF	$ 1,540
	Subtotal																			**$ 5,076**
	Foreman	Foreman Average, Outside	Foreman	50.65	hr									16		hr		16	hr	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		hr		16	hr	$ 223
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			**$ 1,033**
	Total																			**$ 6,109**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
49	**Degas Well G-9**																			
	Grading and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						575					CY		575	CY	$ 552
	Fill Mud Pit	Backfill Trench Minimal Haul 2 1/4 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Plug Well Casing	Concrete Ready Mix	03 31 13.35 0412	123	CY						21					CY		21	CY	$ 2,583
	Subtotal																			$ 3,548
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96							1574					CY		1574	CY	$ 1,511
	Subtotal																			$ 1,511
	Remove Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	per LF	1300										LF		1300	LF	$ 1,820
	Subtotal																			$ 1,820
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			$ 1,033
	Total																			**$ 7,912**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
50	**Degas Well G-10**																			
	Grading and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						922					CY				$ -
	Fill Mud Pit	Backfill Trench Minimal Haul 2 1/4 CY	31 23 16 42 1601	0.96	CY						622					CY		622	CY	$ 597
	Subtotal																			**$ 597**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	CY						21					CY		21	CY	$ 2,583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						2344					CY		2344	CY	$ 2,250
	Subtotal																			**$ 2,250**
	Remove Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1200										LF		1200	LF	$ 1,680
	Subtotal																			**$ 1,680**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 8,143**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
51	**Degas Well G-11**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						882					CY		882	CY	$ 847
	Fill in Mud Pit	Backfill Trench Minimal Haul 2 1/4 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,260**
	Plug Well Casing																			
	Subtotal																			**$ -**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						254					CY		254	CY	$ 244
	Subtotal																			**$ 244**
	Remove Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	CY	1100										FT		1100	FT	$ 1,540
	Subtotal																			**$ 1,540**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.92	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 4,077**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
52	**Degas Well G-12**																			
	Grading and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						429					CY		429	CY	$ 412
	Fill Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 825**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	CY						15					CY		15	CY	$ 1,845
	Subtotal																			**$ 1,845**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						563					CY		563	CY	$ 540
	Subtotal																			**$ 540**
	Remove Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	CY	1100										FT		1100	LF	$ 1,540
	Subtotal																			**$ 1,540**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 5,783**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
53	**Degas Well G-13**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1393					CY		1393	CY	$ 1,337
	Fill in Mud Pit	Backfill Trench Minimal Haul 2 1/4 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,750**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	CY						21					CY		21	CY	$ 2,583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						2162					CY		2162	CY	$ 2,076
	Subtotal																			**$ 2,076**
	Remove Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1300										LF		1300	LF	$ 1,820
	Subtotal																			**$ 1,820**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 9,262**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
54	**Degas Well G-14**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						429					CY		429	CY	$ 412
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 825**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	CY						21					CY		21	CY	$ 2,583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1544				1544	CY		1544	CY	$ 1,482
	Subtotal																			**$ 1,482**
	Remove Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1100										LF		1100	LF	$ 1,540
	Subtotal																			**$ 1,540**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 7,463**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
55	**Degas Well G-15**																			
	Grade and Backfill	Front end Loader 3 CY	31 23 16 42 1601	0.96	CY						1106					CY		1106	CY	$ 1,062
	Fill in Mud Pit	Front end Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,475**
	Plug Well Casing																			
	Subtotal																			**$ -**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1475					CY		1475	CY	$ 1,416
	Subtotal																			**$ 1,416**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1100										FT		1100	FT	$ 1,540
	Subtotal																			**$ 1,540**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 5,464**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
56	**Degas Well G-16**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						800					CY		800	CY	$ 768
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,181**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1092					CY		1092	CY	$ 1,048
	Subtotal																			**$ 1,048**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1100										LF		1100	LF	$ 1,540
	Subtotal																			**$ 1,540**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 7,385**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
57	**Degas Well G-17**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						756					CY		756	CY	$ 726
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,139**
	Plug well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						797					CY		797	CY	$ 765
	Subtotal																			**$ 765**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1200										LF		1200	LF	$ 1,680
	Subtotal																			**$ 1,680**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 7,200**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
58	**Degas Well G-18**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						6962					CY		6962	CY	$ 6,684
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 7,097**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						2195					CY		2195	CY	$ 2,107
	Subtotal																			**$ 2,107**
	Remove Barbed Wire Fence																			
		Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1300												1300	LF	$ 1,820
	Subtotal																			**$ 1,820**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									24		HR		24	HR	$ 1,216
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									24		HR		24	HR	$ 335
	Subtotal																			**$ 1,551**
	Total																			**$ 15,158**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
59	**Degas Well G-19**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1393					CY		1393	CY	$ 1,337
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,750**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						2037					CY		2037	CY	$ 1,956
	Subtotal																			**$ 1,956**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1300										LF		1300	LF	$ 1,820
	Subtotal																			**$ 1,820**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									16		HR		16	HR	$ 810
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									16		HR		16	HR	$ 223
	Subtotal																			**$ 1,033**
	Total																			**$ 9,142**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
60	**Degas Well G-22 & Access Road**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						7386					CY		7386	CY	$ 7,091
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 7,504**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						2103							2103	CY	$ 2,019
	Subtotal																			**$ 2,019**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	LF	1300										LF		1300	LF	$ 1,820
	Subtotal																			**$ 1,820**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									32		HR		32	HR	$ 1,621
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									32		HR		32	HR	$ 446
	Subtotal																			**$ 2,067**
	Total																			**$ 15,993**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
61	**Degas Well G-25**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1406					CY		1406	CY	$ 1,350
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,763**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1406					CY		1406	CY	$ 1,350
	Subtotal																			**$ 1,350**
	Fence																			
	Remove Barb Wire Fence	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	CY	1300										FT		1300	LF	$ 1,820
	Subtotal																			**$ 1,820**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									24		HR		24	HR	$ 1,216
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									24		HR		24	HR	$ 335
	Subtotal																			**$ 1,551**
	Total																			**$ 9,067**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
62	**Degas Well G-26**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1080					CY		1080	CY	$ 1,037
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,450**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1080					CY		1080	CY	$ 1,037
	Subtotal																			**$ 1,037**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	02 41 13 60 1600	1.4	CY	1300										LF		1300	LF	$ 1,820
	Subtotal																			**$ 1,820**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									24		HR		24	HR	$ 1,216
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									24		HR		24	HR	$ 335
	Subtotal																			**$ 1,551**
	Total																			**$ 8,441**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
63	**Degas Well G-30**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1479					CY		1479	CY	$ 1,420
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 1,833**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						1235					CY		1235	CY	$ 1,186
	Subtotal																			**$ 1,186**
	Fence																			
	Remove Barbed Wire	Fencing Barbed Wire 3 Strand	31 23 16 42 1601	0.96	LF	1300										LF		1300	LF	$ 1,248
	Subtotal																			**$ 1,248**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									32		HR		32	HR	$ 1,621
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									32		HR		32	HR	$ 446
	Subtotal																			**$ 2,067**
	Total																			**$ 8,917**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
64	**Degas Well G-31**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						8470					CY		8470	CY	$ 8,131
	Fill in Mud Pit	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						430					CY		430	CY	$ 413
	Subtotal																			**$ 8,544**
	Plug Well Casing	Concrete Ready Mix 8000 psi	03 31 13.35 0412	123	/CY						21					CY		21	CY	2583
	Subtotal																			**$ 2,583**
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						4624					CY		4624	CY	$ 4,439
	Subtotal																			**$ 4,439**
	Fence																			
	Remove Fencing	Barbed Wire 3 Strand	31 23 16 42 1601	0.96	LF	1300										LF		1300	LF	$ 1,248
	Subtotal																			**$ 1,248**
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR									32		HR		32	HR	$ 1,621
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR									32		HR		32	HR	$ 446
	Subtotal																			**$ 2,067**
	Total																			**$ 18,881**

NOTES

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
65	**AMV Road**																			
	Grade and Backfill	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						15207					CY		15207	CY	$ 14,599
	Subtotal																			$ 14,599
	Spread Topsoil	Front End Loader 3 CY	31 23 16 42 1601	0.96	CY						24374					CY		24374	CY	$ 23,399
	Subtotal																			$ 23,399
	Support																			
	Foreman	Foreman Average, Outside	Foreman	50.65	HR						150					HR		150	HR	$ 7,598
	4X4 Pickup	Equipment Rental	01 54 33 40 7200	13.95	/HR						150					HR		150	HR	$ 2,093
	Subtotal																			$ 9,691
	Subtotal																			$ -
	Total																			$ 47,689

NOTES

Earth Line Item Subtotals

Ref.	Description	COST 2015 Dollars	
1	Facilities Area 01	$ 420,784	
2	Facilities Area 02	$ 177,914	
3	Stream Channel 03	$ 48,919	
5	Refuse Pile 05	$ 423,065	~~389,748~~
6	Backfill Shaft	$ 12,630	
	Total	**$1,083,312**	~~**1,049,995**~~

Ref.	Description	Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	COST 2015 Dollars
	Dugout Mine															
1	**Facilities Area 01**															
	Cut and Fill at Mine Site															
	Equipment															
	Rough Grading															
	D9R Semi-U EROPS (9-37) (2H2015)	24400	125.2	0.1	55.4	345.62	1	345.62	$/HR	118169	CY	184	CY/HR	642.2	HR	$ 221,957
	Finished Grading															
	D9R Semi-U EROPS (9-37) (2H2015)	24400	125.2	0.1	55.4	345.62	1	345.62	$/HR	19926	CY	680	CY/HR	29.3	HR	$ 10,127
	825H ((6-12) (2H2015))	17710	97.6	0.1	55.4	273.45	1	273.45	$/HR	58490	CY	876	CY/HR	66.8	HR	$ 18,266
	CAT 345D L(10-20)(2nd2015)	16105	104.75	0.1	55.4	271.28	1	271.28	$/HR	10000	CY	308	CY/HR	32.5	HR	$ 8,817
	966H EROPS (9-26) (2nd2015)	8250	57.8	0.1	55.4	170.54	1	170.54	$/HR	8342	CY	204	CY/HR	40.9	HR	$ 6,975
	Support Personnel and Labor															
	CLAB				42.65	42.65	1	42.65	$/HR					642.2	HR	$ 27,390
	5,000 gal H2O truck Diesel (20-15) (2nd2015)	5280	45.8	0.1	43.3	126.68	1	126.68	$/HR					642.2	HR	$ 81,354
	Pickup Truck Crew 4x4 1 ton (20-16) (2nd2015)	325	17.6	0.1	43.3	64.69	1	11.57	$/HR					642.2	HR	$ 7,430
	Foreman Average, Outside					59.9	1	59.9	$/HR					642.2	HR	$ 38,468
	Subtotal															**$ 420,784**

Ref.		Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	COST 2015 Dollars
	Dugout Mine															
2	**Facilities Area 02**															
	Topsoil Distribution															
	Move topsoil															
	D9R Semi-U EROPS (9-37) (2H2015)	24400	125.2	0.1	55.4	345.62	1	345.62	$/HR	21460	CY	184	CY/HR	116.6	HR	$ 40,299
	Pocking Handled in Vegetation Section															
	966H EROPS (9-26) (2nd2015)	8250	57.8	0.1	55.4	170.54	1	170.54	$/HR	21460	CY	204	CY/HR	105.2	HR	$ 17,941
	6X4 70,000lbs 12-18 CY (20-11) (2nd2015)	4430	57.4	0.1	43.3	134.13	6	804.78	$/HR	21460	CY	204	CY/HR	105.2	HR	$ 84,663
	Support Personnel and Labor															
	CLAB					49	1	49	$/HR					116.6	HR	$ 5,713
	5,000 gal H2O truck Diesel (20-15) (2nd2015)	5280	45.8	0.1	43.3	126.68	1	126.68	$/HR					116.6	HR	$ 14,771
	Pickup Truck Crew 4x4 1 ton (20-16) (2nd2015)	325	17.6	0.1	43.3	64.69	1	64.69	$/HR					116.6	HR	$ 7,543
	Foreman Average, Outside					59.9	1	59.9	$/HR					116.6	HR	$ 6,984
	Subtotal															**$ 177,914**

Ref.		Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	COST 2015 Dollars
	Dugout Mine															
3	**Stream Channel 03**															
	Remove Culvert and Restore Channel															
	CAT 345D L(10-20)(2nd2015)	16105	104.75	0.1	55.4	271.28	1	271.28	$/HR	14400	CY	310	CY/HR	46.5	HR	$ 12,615
	CLAB					42.65	0.5	21.33	$/HR					46.5	HR	$ 992
	966H EROPS (9-26) (2nd2015)	8250	57.8	0.1	55.4	170.54	1	170.54	$/HR	1500	CY	204	CY/HR	7.4	HR	$ 1,262
	CLAB					42.65	0.5	21.33	$/HR					7.4	HR	$ 158
	6X4 70,000lbs 12-18 CY (20-11) (2nd2015)	4430	57.4	0.1	43.3	134.13	1	134.13	$/HR	7000	CY	50	CY/HR	140	HR	$ 18,778
	CLAB					49	0.5	24.5	$/HR					140	HR	$ 3,430
	Support															
							1									$ -
	5,000 gal H2O truck Diesel (20-15) (2nd2015)	5280	45.8	0.1	43.3	126.68	1	126.68	$/HR					46.5	HR	$ 5,891
	Pickup Truck Crew 4x4 1 ton (20-16) (2nd2015)	325	17.6	0.1	43.3	64.69	1	64.69	$/HR					46.5	HR	$ 3,008
	Foreman Average, Outside					59.9	1	59.9	$/HR					46.5	HR	$ 2,785
	Subtotal															**$ 48,919**

Ref.		Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	COST 2015 Dollars	
	Dugout Mine																
5	**Refuse Pile 05**																
	Cut and Fill Refuse Site																
	D9R Semi-U EROPS (9-37) (2H2015)	24400	125.2	0.1	55.4	345.62	1	345.62	$/HR	27556	CY	102	CY/HR	270.2	HR	$ 93,387	
	5,000 gal H2O truck Diesel (20-15) (2nd2015)	5280	45.8	0.1	43.3	126.68	1	126.68	$/HR					270.2	HR	$ 34,229	
							1										
	Foreman & 4X4 Pickup (20-16) (2nd2015)	325	17.6	0.1	50.65	72.04	1	72.04	$/HR					270.2	HR	$ 19,465	
	Doze On-site Subsoil/Topsoil																
	D8R Series II (9-37) (2nd2015)	16865	89.55	0.1	55.4	213.03	1	213.03	$/HR	<u>36700</u>	~~23060~~	480	CY/HR	76.5	HR	<u>$ 16,297</u>	~~10,225~~
	Borrow Area Soils																
	Trucking Soil																
	CAT 345D L(10-20)(2nd2015)	16105	104.75	0.1	55.4	271.28	1	271.28	$/HR	<u>63900</u>	~~57195~~	150	CY/HR	426	HR	<u>$ 115,565</u>	~~103,439~~
	6X4 70,000lbs 12-18 CY (20-11) (2nd2015)	4430	57.4	0.1	43.3	100.96	1.5	151.44	$/HR	<u>63900</u>	~~57195~~	150	CY/HR	426	HR	<u>$ 64,513</u>	~~57,744~~
	Doze Trucked Subsoil																
	D8R Series II (9-37) (2nd2015)	16865	89.55	0.1	55.4	213.03	1	213.03	$/HR	<u>63900</u>	~~57195~~	171	CY/HR	373.7	HR	<u>$ 79,609</u>	~~71,259~~
	Subtotal															**<u>$ 423,065</u>**	~~389,748~~

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Ref.		Equipment Cost	Hourly Operating Costs	Equipment Overhead	Operator's Hourly Wage Rate	Hourly Cost	Number of Men or Eq.	Total Eq. & Lab. Costs	Units	Quantity	Units	Production Rate	Units	Equip. + Labor Time/Dis.	Units	COST 2015 Dollars
	Pace Canyon Fan Portal															
6	**Backfill Shaft**															
	CAT 345D L(10-20)(2nd2015)	16105	104.75	0.1	55.4	271.28	1	271.28	$/HR	641	CY	216	CY/HR	3	HR	$ 814
	6X4 70,000lbs 12-18 CY (20-11) (2nd2015)	4430	57.4	0.1	43.3	100.96	3	302.88						3	HR	$ 909
	Backfill Portal															
	D8R Series II (9-37) (2nd2015)	16865	89.55	0.1	55.4	213.03	1	213.03	$/HR	331	CY	171	CY/HR	1.9	HR	$ 405
	Subsoil Placement															
	D8R Series II (9-37) (2nd2015)	16865	89.55	0.1	55.4	213.03	1	213.03	$/HR	4045	CY	90	CY/HR	44.9	HR	$ 9,565
	Doze On -site Topsoil															
	D8R Series II (9-37) (2nd2015)	16865	89.55	0.1	55.4	213.03	1	213.03	$/HR	2128	CY	480	CY/HR	4.4	HR	$ 937
	Subtotal															**$ 12,630**

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Vegetation Line Item Subtotals

Ref.	*Description*	*Cost 2015 Dollars*	
V-1	Dugout Mine Vegetation	$ 169,874	
V-2	Dugout Mine Refuse Pile	$ 124,681	~~115,534~~
V-3	Pace Canyon Fan Portal	$ 8,173	
V-4	Degas Well G2	$ 2,478	
V-5	Degas Well G5	$ 2,282	
V-6	Degas Well G6	$ 3,233	
V-7	Degas Well G7	$ 2,661	
V-8	Degas Well G9	$ 1,711	
V-9	Degas Well G10	$ 1,598	
V-10	Degas Well G11	$ 1,731	
V-11	Degas Well G12	$ 1,749	
V-12	Degas Well G13	$ 2,395	
V-13	Degas Well G14	$ 2,166	
V-14	Degas Well G15	$ 4,230	
V-15	Degas Well G16	$ 3,507	
V-16	Degas Well G17	$ 2,738	
V-17	Degas Well G-18	$ 3,801	
V-18	Degas Well G-19	$ 2,850	
V-19	Degas Well G-22 and Access Road	$ 9,769	
V-20	Degas Well G-25	$ 5,949	
V-21	Degas Well G-26	$ 3,270	
V-22	Degas Well G-30	$ 5,095	
V-23	Degas Well G-31	$ 3,886	
V-24	AMV Road	$ 74,885	
	Total	**$ 444,713**	~~**435,566**~~

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-1	**Dugout Mine Vegetation**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					14.56						AC		23490	CY	$ 9,866
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					14.56						AC		23490	CY	$ 22,550
	Subtotal																			**$ 32,416**
	Fence																			
	Silt Fence	Wire Reinforced Silt Fence 3'x 100', 4' T Po	Maxwell Quote	0.55	ft	6800										FT		6800	FT	$ 3,740
	Subtotal																			**$ 3,740**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					13.9						AC		605	MSF	$ 19,209
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					13.9						AC		13.9	AC	$ 7,318
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					13.9						AC		1	ton/AC	$ 8,799
	Tackifier	Tackifier	Tackifier	52.5	/AC					13.9						AC		13.9	AC	$ 730
	Transplant Area No 1																			
	Area																			
	Transplant Materials	Dugout Transplant Mix No 1	Dugout Transp 1	984.5	/AC					13.9						AC		13.9	AC	$ 13,685
	Transplant Labor	Bare root seedlings, 11" to 16" med. soil	32 93 43 10 0130	0.81	Ea										550	#/AC		7645	EA	$ 6,192
	Seed Mix No 2																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					2.45						AC		107	MSF	$ 3,397
	Hydro seed Material	Dugout Seed Mix No 2	Dugout Seed 2	414	/AC					2.45						AC		2.45	AC	$ 1,014
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					2.45						AC		1	ton/AC	$ 1,551
	Tackifier	Tackifier	Tackifier	52.5	/AC					2.45						AC		2.45	AC	$ 129
	Transplant Area No 2																			
	Area																			
	Transplant Materials	Dugout Transplant Mix #2	Dugout Transp 2	13,083	/AC					2.45						AC		2.45	AC	$ 32,052
	Transplant Labor	Bare root seedlings, 11" to 16" med. soil	32 93 43 10 0130	0.81	Ea										6500	#/AC		15925	EA	$ 12,899
	Subtotal																			**$ 106,975**
	Direct Vegetation																			**$ 143,131**
	Reseeding																			
	Assume 25% reveg rate																			**$ 26,744**
	Total																			**$ 169,874**

NOTE:

see maxwell supply quote

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost	
V-2	**Dugout Mine Refuse Pile**																				
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	/CY					17.79	~~16.34~~					AC	~~26362~~	28701	CY	$ 12,054	~~11,072~~
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					17.79	~~16.34~~					AC	~~26362~~	28701	CY	$ 27,553	~~25,308~~
	Subtotal																			**$ 39,607**	~~36,380~~
	Seed Mix No 1																				
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilize	32 92 19.14 5800	31.75	/MSF					17.79	~~16.34~~					AC	~~712~~	775	MSF	$ 24,606	~~22,606~~
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					17.79	~~16.34~~					AC	~~16.34~~	17.79	AC	$ 9,366	~~8,603~~
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					17.79	~~16.34~~					AC	~~15.6~~	15.6	ton/AC	$ 9,875	~~9,875~~
	Tackifier	Tackifier	Tackifier	52.5	/AC					17.79	~~16.34~~					AC	~~16.34~~	17.79	AC	$ 934	~~858~~
	Transplant Area No 1																				
	Area																				
	Transplant Materials	Dugout Transplant Mix No 1	Dugout Transp 1	984.5	/AC					17.79	~~16.34~~					AC	~~16.34~~	17.79	AC	$ 17,514	~~16,087~~
	Transplant Labor	Bare root seedlings, 11" to 16" med. soil	32 93 43 10 0130	0.81	Ea										400	#/AC	~~6536~~	7116	EA	$ 5,764	~~5,294~~
	Subtotal																			**$ 68,059**	~~63,323~~
	Reseeding																				
	Assume 25% reveg rate																			**$ 17,015**	~~15,831~~
	Total																			**$ 124,681**	~~115,534~~

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-3	**Pace Canyon Fan Portal**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					1.5						AC		2420	CY	$ 1,016
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					1.5						AC		2420	CY	$ 2,323
	Subtotal																			**$ 3,339**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					1.5						AC		65	MSF	$ 2,064
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					1.5						AC		1.5	AC	$ 790
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					1.5						AC		1.5	ton/AC	$ 950
	Tackifier	Tackifier	Tackifier	52.5	/AC					1.5						AC		1.5	AC	$ 79
	Subtotal																			**$ 3,883**
	Direct Vegetation																			**$ 7,222**
	Reseeding																			
	Assume 25% reveg rate																			**$ 951**
	Total																			**$ 8,173**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-4	**Degas Well G2**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.45						AC		726	CY	$ 305
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.45						AC		726	CY	$ 697
	Subtotal																			$ 1,002
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.45						AC		20	MSF	$ 635
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.45						AC		0.45	AC	$ 237
	Hay Mulch	Hay 1" material only	31 25 14.16 1200	633	TON					0.45						AC		0.45	ton/AC	$ 285
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.45						AC		0.45	AC	$ 24
	Subtotal																			$ 1,181
	Direct Vegetation																			$ 2,183
	Reseeding																			
	Assume 25% reveg rate																			$ 295
	Total																			**$ 2,478**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-5	**Degas Well G5**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.42						AC		678	CY	$ 285
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.42						AC		678	CY	$ 651
	Subtotal																			**$ 936**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.42						AC		18	MSF	$ 572
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.42						AC		0.42	AC	$ 221
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.42						AC		0.42	ton/AC	$ 266
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.42						AC		0.42	AC	$ 22
	Subtotal																			**$ 1,081**
	Direct Vegetation																			**$ 2,017**
	Reseeding																			
	Assume 25% reveg rate																			**$ 265**
	Total																			**$ 2,282**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-6	**Degas Well G6**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.59						AC		952	CY	$ 400
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.59						AC		952	CY	$ 914
	Subtotal																			**$ 1,314**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.59						AC		26	MSF	$ 826
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.59						AC		0.59	AC	$ 311
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.59						AC		0.59	ton/AC	$ 373
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.59						AC		0.59	AC	31
	Subtotal																			**$ 1,541**
	Direct Vegetation																			**$ 2,855**
	Reseeding																			
	Assume 25% reveg rate																			**$ 378**
	Total																			**$ 3,233**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-7	**Degas Well G7**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.49						AC		791	CY	$ 332
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.49						AC		791	CY	$ 759
	Subtotal																			**$ 1,091**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.49						AC		21	MSF	$ 667
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.49						AC		0.49	AC	$ 258
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.49						AC		1	ton/AC	$ 310
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.49						AC		0.49	AC	$ 26
	Subtotal																			**$ 1,261**
	Direct Vegetation																			**$ 2,352**
	Reseeding																			
	Assume 25% reveg rate																			**$ 309**
	Total																			**$ 2,661**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-8	**Degas Well G9**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.31						AC		500	CY	$ 210
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.31						AC		500	CY	$ 480
	Subtotal																			**$ 690**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.31						AC		14	MSF	$ 445
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.31						AC		0.31	AC	$ 163
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.31						AC		0.31	ton/AC	$ 196
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.31						AC		0.31	AC	$ 16
	Subtotal																			**$ 820**
	Direct Vegetation																			**$ 1,510**
	Reseeding																			
	Assume 25% reveg rate																			**$ 201**
	Total																			**$ 1,711**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-9	**Degas Well G10**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.29						AC		468	CY	$ 197
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.29						AC		468	CY	$ 449
	Subtotal																			$ 646
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.29						AC		13	MSF	$ 413
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.29						AC		0.29	AC	$ 153
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.29						AC		0.29	ton/AC	$ 184
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.29						AC		0.29	AC	$ 15
	Subtotal																			$ 765
	Direct Vegetation																			$ 1,411
	Reseeding																			
	Assume 25% reveg rate																			$ 187
	Total																			**$ 1,598**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-10	**Degas Well G11**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.32						AC		516	CY	$ 217
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.32						AC		516	CY	$ 495
	Subtotal																			$ 712
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.32						AC		14	MSF	$ 445
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.32						AC		0.32	AC	$ 168
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.32						AC		0.32	ton/AC	$ 203
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.32						AC		0.32	AC	$ 17
	Subtotal																			$ 816
	Direct Vegetation																			$ 1,528
	Reseeding																			
	Assume 25% reveg rate																			$ 204
	Total																			**$ 1,731**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-11	**Degas Well G12**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.32						AC		516	CY	$ 217
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.32						AC		516	CY	$ 495
	Subtotal																			**$ 712**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.32						AC		14	MSF	$ 445
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.32						AC		0.32	AC	$ 168
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.32						AC		0.32	ton/AC	$ 203
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.32						AC		0.32	AC	$ 17
	Subtotal																			**$ 833**
	Direct Vegetation																			**$ 1,545**
	Reseeding																			
	Assume 25% reveg rate																			**$ 204**
	Total																			**$ 1,749**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-12	**Degas Well G13**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.44						AC		710	CY	$ 298
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.44						AC		710	CY	$ 682
	Subtotal																			**$ 980**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.44						AC		19	MSF	$ 603
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.44						AC		0.44	AC	$ 232
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.44						AC		0.44	ton/AC	$ 279
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.44						AC		0.44	AC	$ 23
	Subtotal																			**$ 1,137**
	Direct Vegetation																			**$ 2,117**
	Reseeding																			
	Assume 25% reveg rate																			**$ 278**
	Total																			**$ 2,395**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-13	**Degas Well G14**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.4						AC		645	CY	$ 271
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.4						AC		645	CY	$ 619
	Subtotal																			**$ 890**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.4						AC		17	MSF	$ 540
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.4						AC		0.4	AC	$ 211
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.4						AC		0.4	ton/AC	$ 253
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.4						AC		0.4	AC	$ 21
	Subtotal																			**$ 1,025**
	Direct Vegetation																			**$ 1,915**
	Reseeding																			
	Assume 25% reveg rate																			**$ 251**
	Total																			**$ 2,166**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-14	**Degas Well G15**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.77						AC		1242	CY	$ 522
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.77						AC		1242	CY	$ 1,192
	Subtotal																			**$ 1,714**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.77						AC		34	MSF	$ 1,080
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.77						AC		0.77	AC	$ 405
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.77						AC		0.77	ton/AC	$ 487
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.77						AC		0.77	AC	$ 40
	Subtotal																			**$ 2,012**
	Direct Vegetation																			**$ 3,726**
	Reseeding																			
	Assume 25% reveg rate																			**$ 503**
	Total																			**$ 4,230**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-15	**Degas Well G16**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.64						AC		1033	CY	$ 434
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.64						AC		1033	CY	$ 992
	Subtotal																			$ 1,426
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.64						AC		28	MSF	$ 889
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.64						AC		0.64	AC	$ 337
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.64						AC		0.64	ton/AC	$ 405
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.64						AC		0.64	AC	$ 34
	Subtotal																			$ 1,665
	Direct Vegetation																			$ 3,091
	Reseeding																			
	Assume 25% reveg rate																			$ 416
	Total																			$ 3,507

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-16	**Degas Well G17**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.5						AC		807	CY	$ 339
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	/CY					0.5						AC		807	CY	$ 775
	Subtotal																			**$ 1,114**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	/MSF					0.5						AC		22	MSF	$ 699
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	/AC					0.5						AC		0.5	AC	$ 263
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.5						AC		0.5	ton/AC	$ 317
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.5						AC		0.5	AC	$ 26
	Subtotal																			**$ 1,305**
	Direct Vegetation																			**$ 2,419**
	Reseeding																			
	Assume 25% reveg rate																			**$ 320**
	Total																			**$ 2,738**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

REF.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-17	**Degas Well G-18**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.7						AC		1129	CY	$ 474
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					0.7						AC		1129	CY	$ 1,084
	Subtotal																			**$ 1,558**
	Seed Mix No !																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	MSF					0.7						AC		30	MSF	$ 953
	Hydro seed Material	Dugout Seed Mix No. 1	Dugout Seed 1	526.5	AC					0.7						AC		0.7	AC	$ 369
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	Ton					0.7						AC		0.7	Ton/AC	$ 443
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.7						AC		0.7	AC	$ 37
	Subtotal																			**$ 1,802**
	Direct Vegetation																			**$ 3,360**
	Reseeding																			
	Assume 25% reveg rate																			**$ 441**
	Total																			**$ 3,801**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

REF.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-18	**Degas Well G-19**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.52						AC		839	CY	$ 352
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					0.52						AC		839	CY	$ 805
	Subtotal																			$ 1,157
	Seed Mix No !																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	MSF					0.52						AC		23	MSF	$ 730
	Hydro seed Material	Dugout Seed Mix No. 1	Dugout Seed 1	526.5	AC					0.52						AC		0.52	AC	$ 274
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	Ton					0.52						AC		0.52	Ton/AC	$ 329
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.52						AC		0.52	AC	$ 27
	Subtotal																			$ 1,360
	Direct Vegetation																			$ 2,517
	Reseeding																			
	Assume 25% reveg rate																			$ 333
	Total																			**$ 2,850**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-19	**Degas Well G-22 and Access Road**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					1.79						AC		2888	CY	$ 1,213
	Pocking	Excavation Bulk Bank 3CY	31 23 16 42 1601	0.96	CY					1.79						AC		2888	CY	$ 2,772
	Subtotal																			**$ 3,985**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	MSF					1.79						AC		78	MSF	$ 2,477
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	AC					1.79						AC		1.79	AC	$ 942
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					1.79						AC		1.79	TON/AC	$ 1,133
	Tackifier	Tackifier	Tackifier	52.5	/AC					1.79						AC		1.79	AC	$ 94
	Subtotal																			**$ 4,646**
	Direct Vegetation																			**$ 8,631**
	Reseeding																			
	Assume 25% Reveg Rate																			**$ 1,138**
	Subtotal																			
	Total																			**$ 9,769**

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-20	**Degas Well G-25**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					1.8						AC		2904	CY	$ 1,220
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					1.8						AC		2904	CY	$ 2,788
	Subtotal																			**$ 4,008**
	Seed Mix No 1																			
	Hydro seed Equipment & Labor	Hydro Seeding, Mulch & Fertilize	32 92 19.14 5800	31.75	MSF					0.6						AC		26	MSF	$ 826
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.6						AC		0.6	TON/AC	$ 380
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	AC					0.6						AC		0.6	AC	$ 316
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.6						AC		0.6	AC	$ 32
	Subtotal																			**$ 1,553**
	Direct Vegetation																			**$ 5,561**
	Reseeding																			
	Assume 25% Reveg Rate																			**$ 388**
	Total																			**$ 5,949**

NOTE:

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Num	Unit	Swell Factor	Quantit	Unit	Cost
V-21	**Degas Well G-26**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.6						AC		968	CY	$ 407
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					0.6						AC		968	CY	$ 929
	Subtotal																			**$ 1,336**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	MSF					0.6						MSF		26	MSF	$ 826
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.6						TON/AC		0.6	AC	$ 380
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	AC					0.6						AC		0.6	AC	$ 316
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.6						AC		0.6	AC	$ 32
	Subtotal																			**$ 1,553**
	Direct Vegetation																			**$ 2,889**
	Reseeding																			
	Assume 25 % Reveg Rate																			**$ 380**
	Subtotal																			
	Total																			**$ 3,270**

NOTE:

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-22	**Degas Well G-30**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.93						AC		1500	CY	$ 630
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					0.93						AC		1500	CY	$ 1,440
	Subtotal																			**$ 2,070**
	Seed Mix No1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertiliz	32 92 19.14 5800	31.75	MSF					0.93						AC		41	MSF	$ 1,302
	Hay Mulch	Hay 1"	31 25 14.16 1200	633	TON					0.93						AC		0.93	Ton/AC	$ 589
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	AC					0.93						AC		0.93	AC	$ 490
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.93						AC		0.93	AC	$ 49
	Subtotal																			**$ 2,430**
	Direct Vegetation																			**$ 4,500**
	Reseeding																			
	Assume 25 % Reveg Rate																			**$ 595**
	Total																			**$ 5,095**

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-23	**Degas Well G-31**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					0.71						AC		1145	CY	$ 481
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					0.71					1.75	AC		1145	CY	$ 1,099
	Subtotal																			**$ 1,580**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	MSF					0.71					1.75	AC		31	MSF	$ 984
	Hay Mulch	Hay 1 "	31 25 14.16 1200	633	TON					0.71					1.75	AC		0.71	TON/AC	$ 449
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	AC					0.71					1.75	AC		0.71	AC	$ 374
	Tackifier	Tackifier	Tackifier	52.5	/AC					0.71						AC		0.71	AC	$ 37
	Subtotal																			**$ 1,844**
	Direct Vegetation																			**$ 3,424**
	Reseeding																			
	Assume 25 % Reveg Rate																			**$ 461**
	Subtotal																			
	Total																			**$ 3,886**

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
V-24	**AMV Road**																			
	Soil Preparation	Ripping	31 23 16.32 2820	0.42	BCY					13.72						AC		22135	CY	$ 9,297
	Pocking	Excavation Bulk Bank 3 CY	31 23 16 42 1601	0.96	CY					13.72						AC		22135	CY	$ 21,250
	Subtotal																			**$ 30,547**
	Seed Mix No 1																			
	Hydro seed Equipment and Labor	Hydro Seeding, Mulch & Fertilizer	32 92 19.14 5800	31.75	MSF					13.72						AC		598	MSF	$ 18,987
	Hydro seed Material	Dugout Seed Mix No 1	Dugout Seed 1	526.5	AC					13.72						AC		13.72	AC	$ 7,224
	Hay Mulch	Hay 1 "	31 25 14.16 1200	633	TON					13.72						AC		13.72	Ton/AC	$ 8,685
	Tackifier	Tackifier	Tackifier	52.5	/AC					13.72						AC		13.72	AC	$ 720
	Subtotal																			**$ 35,615**
	Direct Vegetation																			**$ 66,161.44**
	Subtotal																			
	Reseeding																			
	Assume 25 % Reveg Rate																			**$ 8,724**
	Total																			**$ 74,885**

NOTE:

Area reflects disturbed acreage as surveyed by Cody Ware of Ware Surveying

Waste Rock Site Phase II Expansion

Dugout M&RP, Chapter 7

Appendix 7-6, UPDES Permit

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

APPENDIX 7-6

UPDES Permit Applications

State of Utah
GARY R. HERBERT
Governor
SPENCER J. COX
Lieutenant Governor

Department of
Environmental Quality
Alan Matheson
Executive Director
DIVISION OF WATER QUALITY
Walter L. Baker, P.E.
Director

AUG 26 2015

CERTIFIED MAIL
(Return Receipt Requested)

William King, Environmental Engineer
Canyon Fuel Company, LLC-Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Dear Mr. King:

Subject: UPDES Permit UT0025593, Canyon Fuel Company, LLC-Dugout Canyon Mine

Enclosed is UPDES Permit No. UT0025593 for your facility. Copies of EPA form 3320-1, Discharge Monitoring Report (DMR) forms, for reporting and self-monitoring requirements as specified in the permit, can be sent via e-mail, if requested. This permit will become effective on September 1, 2015, subject to the right of appeal in accordance with the provisions of *Utah Administrative Code*, Section R317-9.

As the State agency charged with the administration of issuing UPDES Permits, we are continuously looking for ways to improve our quality of service to you. In effort to improve the State UPDES permitting process we are asking for your input. Since our customer permittee base is limited, your input is important. Please take a few moments to complete an online survey (Go to www.waterquality.utah.gov and click on the 'Give Feedback to DWQ' button on the left side of page.) The results will be used to improve our quality and responsiveness to our permittees and give us feedback on customer satisfaction. We will address the issues you have identified on an ongoing basis.

If you have any questions regarding this matter, please contact Ken Hoffman at (801) 536-4313 or kenhoffman@utah.gov.

Sincerely,

Kim Shelley, Manager
Surface Water Section

KS:KH:ph

Enclosures (4):
1. Fact Sheet, (DWQ-2014-0015861)
2. Waste Load Analysis, (DWQ-2014-016399)
3. Permit, (DWQ-2014-015862)
4. Antidegradation Review Form (DWQ-2015-006804)

cc: Amy Clark, EPA Region VIII (W/encl)
Brady Bradford, Southeastern Utah District Health Department
David Ariotti, DEQ District Engineer
Dana Dean, DOGM
Greg Sheehan, Utah Division of Wildlife Resources (w/o encl)
Chris Cline, U.S. Fish & Wildlife Services (w/o encl)
Jason Gipson, Chief, Utah Regulatory Office, U.S. Corps
Of Engineers (w/o encl)

DWQ-2015-009464

Permit No. UT0025593
Minor Industrial

STATE OF UTAH
DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
SALT LAKE CITY, UTAH

AUTHORIZATION TO DISCHARGE UNDER THE

UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM
(UPDES)

In compliance with provisions of the Utah *Water Quality Act, Title 19, Chapter 5, Utah Code Annotated ("UCA") 1953, as amended* (the *"Act"*),

CANYON FUEL COMPANY, LLC – DUGOUT CANYON MINE

is hereby authorized to discharge from its facility located near Wellington, Utah, with the outfalls located as indicated in this permit, to receiving waters named

Dugout Creek, Pace Creek and an unnamed tributary of Grassy Trail Creek (all tributaries to the Price and Colorado River systems)

in accordance with discharge points, effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective September 1, 2015.

This permit and the authorization to discharge shall expire at midnight, August 31, 2020.

Signed this 26 day of August 2015.

Walter L. Baker, P.E.
Director

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Definitions.

1. The "30-day (and monthly) average" is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.

2. The "7-day (and weekly) average" is the arithmetic average of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. The 7-day and weekly averages are applicable only to those effluent characteristics for which there are 7-day average effluent limitations. The calendar week which begins on Sunday and ends on Saturday, shall be used for purposes of reporting self- monitoring data on discharge monitoring report forms. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for that calendar week shall be included in the data for the month that contains the Saturday.

3. "Daily Maximum" ("Daily Max.") is the maximum value allowable in any single sample or instantaneous measurement.

4. A "grab" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

5. An "instantaneous" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.

6. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

7. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

8. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

9. "Director" means Director of the Utah Division of Water Quality.

10. "EPA" means the United States Environmental Protection Agency.

11. "Act" means the "*Utah Water Quality Act*".

12. "Best Management Practices" ("*BMPs*") means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. *BMPs* also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

13. "Coal pile runoff" means the rainfall runoff from or through any coal storage pile.

14. "*CWA*" means *The Federal Water Pollution Control Act*, as amended, by *The Clean Water Act of 1987.*

15. "Illicit discharge" means any discharge to a municipal separate storm sewer that is not composed entirely of storm water except discharges pursuant to a *UPDES* permit (other than the *UPDES* permit for discharges from the municipal separate storm sewer) and discharges from fire fighting activities, fire hydrant flushings, potable water sources including waterline flushings, uncontaminated ground water (including dewatering ground water infiltration), foundation or footing drains where flows are not contaminated with process materials such as solvents, springs, riparian habitats, wetlands, irrigation water, exterior building washdown where there are no chemical or abrasive additives, pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used, and air conditioning condensate.

16. "Landfill" means an area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application unit, surface impoundment, injection well, or waste pile.

17. "Point Source" means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharges. This term does not include return flows from irrigated agriculture or agriculture storm water runoff.

18. "Runoff coefficient" means the fraction of total rainfall that will appear at a conveyance as runoff.

19. "Section 313 water priority chemical" means a chemical or chemical categories which:

a. are listed at *40 CFR 372.65* pursuant to *Section 313* of *Title III* of the *Emergency Planning and Community Right-to-Know Act (EPCRA)* (also known as *Title III* of the *Superfund Amendments and Reauthorization Act (SARA)* of 1986);

b. are present at or above threshold levels at a facility subject to *EPCRA, Section 313* reporting requirements, and

c. meet at least one of the following criteria:

(1) are listed in *Appendix D* of *40 CFR 122* on either *Table II* (organic priority pollutants), *Table III* (certain metals, cyanides, and phenols) or *Table IV* (certain toxic pollutants and hazardous substances);

(2) are listed as a hazardous substance pursuant to *Section 311(b)(2)(A)* of the *CWA* at *40 CFR 116.4*; or

(3) are pollutants for which EPA has published acute or chronic toxicity criteria.

20. "Significant materials" includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under *Section 101(14)* of *CERCLA*; any chemical the facility is required to report pursuant to *EPCRA Section 313*; fertilizers; pesticides; and waste products such as ashes, slag and sludge that have the potential to be released with storm water discharges.

21. "Significant spills" includes, but is not limited to: releases of oil or hazardous substances in excess of reportable quantities under *Section 311* of the *Clean Water Act* (see *40 CFR 110.10* and *40 CFR 117.21*) or *Section 102* of *CERCLA* (see *40 CFR 302.4*).

22. "Storm water" means storm water runoff, snow melt runoff, and surface runoff and drainage.

23. "Waste pile" means any noncontainerized accumulation of solid, nonflowing waste that is used for treatment or storage.

24. "10-year, 24-hour precipitation event" means the maximum 24-hour precipitation event with a probable reoccurrence interval of once in 10 years. This information is available in *Weather Bureau Technical Paper No. 40*, May 1961 and *NOAA Atlas 2,* 1973 for the 11 Western States, and may be obtained from the National Climatic Center of the Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

B. Description of Discharge Points.

The authorization to discharge provided under this permit is limited to those outfalls specifically designated below as discharge locations. A discharge at any location not authorized under a UPDES permit is a violation of the *Act* and may be subject to penalties under the *Act*. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge may be subject to criminal penalties as provided under the *Act*.

Outfall Number	Location of Discharge Point(s)
001	Mine water discharge to Dugout Creek. Latitude 39° 41' 01", Longitude 110° 32' 44".
002	Sedimentation pond discharge to Dugout Creek. Latitude 39° 40' 56", Longitude 110° 32' 52".
003	Storage water discharge to Dugout Creek. Latitude 39° 41' 18", Longitude 110° 32' 29".
004	Sedimentation pond (waste rock site) discharge to an unknown tributary of Grassy Trail Creek. Latitude 39° 36' 40", Longitude 110° 36' 43".
005	Pace Canyon fan portal breakout, mine water discharge to Pace Creek. Latitude 39° 40' 17.772", Longitude 110° 30' 29.051".
006	Sediment trap culvert discharge to Pace Creek. Latitude 39° 40' 14.3553", Longitude 110° 30' 32.3161".
007	Sedimentation pond (waste rock site) discharge to an unknown tributary of Grassy Trail Creek. Latitude 39° 36' 42", Longitude 110° 36' 39".

C. Narrative Standard.

It shall be unlawful, and a violation of this permit, for the permittee to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste, or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures.

D. Specific Limitations and Self-monitoring Requirements.

1. Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfalls 001, 002, 003, 004, 005, 006, and 007. Such discharges shall be limited and monitored by the permittee as specified below:

	Effluent Limitations a/			
Parameter, Units	Maximum Monthly Average	Maximum Weekly Average	Daily Minimum	Daily Maximum
Total Effluent Flow, MGD, b/	2.0			Report
Total Iron, mg/L				1.1
Total Suspended Solids (TSS), mg/L	25	35		70
Total Dissolved Solids (TDS), mg/L, c/	Report			2,400
TDS, tons/day, c/				1.0
pH, Standard Units(SU)			6.5	9.0
Oil & Grease, mg/L, d/				10

mg/L – milligrams per liter; MGD – million gallons per day

Self-Monitoring and Reporting Requirements a/			
Parameter	Frequency	Sample Type	Units
Total Flow, b/	Continuous/Twice Monthly	Recorder/Measured	MGD
Total Iron	Twice Monthly	Grab	mg/L
TSS	Twice Monthly	Grab	mg/L
TDS, c/	Twice Monthly	Grab	mg/L & tons/day
pH	Twice Monthly	Grab	SU
Oil & Grease, d/	Twice Monthly	Visual, Grab	Yes/No, mg/L

There shall be no visible sheen or floating solids or visible foam in other than trace amounts upon any discharges and there shall be no discharge of any sanitary wastes at any time.

a/ See Definitions, *Part I.A*, for definition of terms.

b/ the maximum monthly average of 2.0 MGD apply to outfall 001 only. The remaining outfalls shall report the maximum monthly average upon discharging. Flows from outfalls 001 and 005 shall be from a continuous recorder. Flows from the remaining outfalls shall be from either a continuous recorder, or measured at least twice per month upon discharging. If the rate of discharge is controlled, such as from intermittent discharging outfalls, the rate and duration of discharge shall be reported.

c/ The TDS concentration from each of the outfalls shall not exceed 2400 mg/L as a daily maximum limit. No tons per day loading limit will be applied if the concentration of TDS in the discharge is equal to or less than 500 mg/L as a thirty-day average. However, if the 30-day average concentration exceeds 500 mg/L, then the permittee cannot discharge more than 1.0 ton per day as a sum from all discharge points. As previously determined by the Director, the permittee is not able to meet the 500 mg/L

30-day average or the 1.0 ton per day loading limit. The permittee is required to continue to participate in and/or fund a salinity offset project to include the TDS offset credits as appropriate.

The salinity-offset project shall include TDS credits on a ton-for-ton basis for which the permittee is over the 1.0 ton per day loading limit. The tonnage reduction from the offset project must be calculated by a method similar to one used by the NRCS, Colorado River Basin Salinity Control Forum, or other applicable agency.

If the permittee will be participating in the construction and implementation of a new salinity-offset project, then a project description and implementation schedule shall be submitted to the Director at least six (6) months prior to the implementation date of the project, which will then be reviewed for approval. The salinity offset project description and implementation schedule must be approved by the Director and shall be appended to this permit.

If the permittee will be funding any additional salinity-offset projects through third parties, the permittee shall provide satisfactory evidence to the Director that the required funds have been deposited to the third party within six (6) months of project approval by the Director. A monitoring and adjustment plan to track the TDS credits shall continue to be submitted to the Director for each monthly monitoring period during the life of this permit. Any changes to the monitoring and adjustment plan must be approved by the Director and upon approval shall be appended to this permit.

d/ Oil and grease monitoring shall initially be a visual test. If any oil and/or grease sheens are observed visually, or there is any other reason to believe that oil and/or grease may be present in the discharge, then a grab sample of the effluent must be immediately taken and this sample shall not exceed 10 mg/L.

2. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: at all outfalls prior to mixing with the receiving water.

3. Any overflow, increase in volume of a discharge or discharge from a bypass system caused by precipitation within a 24-hour period less than or equal to the 10-year, 24-hour precipitation event (or snow-melt of equivalent volume) at outfalls 002, 004, 006, and 007 may comply with the following limitation instead of the otherwise applicable limitations (for TSS) contained in Part I.D.1:

Effluent Characteristic	Daily Maximum
Settleable Solids	0.5 mL/L

In addition to the monitoring requirements specified under Part I.D.1., all effluent samples collected during storm water discharge events may also be analyzed for settleable solids. Such analyses shall be conducted by grab samples.

4. The operator shall have the burden of proof that the discharge or increase in discharge was caused by the applicable precipitation event described in Part I.D.3. The alternate limitations in Parts I.D.3 shall not apply to treatment systems that treat underground mine water only.

E. Storm Water Requirements. It has been determined that Dugout Mine has a regulated storm water discharge as per UAC R317-8-3.9., therefore, the following permit conditions governing storm water discharges apply.

1. Coverage of This Section.

a. Discharges Covered Under This Section. The requirements listed under this section shall apply to storm water discharges from Dugout Mine, subject to effluent limitations listed in Part I.D. of this permit.

1) Site Coverage. Storm water discharges from the following portions of Dugout may be eligible for this permit: haul roads (nonpublic roads on which coal or coal refuse is conveyed), access roads (nonpublic roads providing light vehicular traffic within the facility property and to public roadways), railroad spurs, sidings, and internal haulage lines (rail lines used for hauling coal within the facility property and to offsite commercial railroad lines or loading areas), conveyor belts, chutes, and aerial tramway haulage areas (areas under and around coal or refuse conveyor areas, including transfer stations), equipment storage and maintenance yards, coal handling buildings and structures, and inactive coal mines and related areas (abandoned and other inactive mines, refuse disposal sites and other mining-related areas on private lands).

2. Prohibition of Non-storm Water Discharges.

a. The following non-storm water discharges may be authorized by this permit provided the non-storm water component of the discharge is in compliance with this section; fire fighting activities; fire hydrant flushings; potable water sources including waterline flushings; drinking fountain water; irrigation drainage, lawn watering; routine external building washdown water where detergents or other compounds have not been used in the process; pavement washwaters where spills or leaks of toxic or hazardous materials (including oils and fuels) have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; uncontaminated compressor condensate; uncontaminated springs; uncontaminated ground water; and foundation or footing drains where flows are not contaminated with process materials such as solvents.

3. Storm Water Pollution Prevention Plan Requirements. Most of the active coal mining-related areas, described in paragraph 1 above, are subject to sediment and erosion control regulations of the U.S. Office of Surface Mining (OSM) that enforces the Surface Mining Control and Reclamation Act (SMCRA). OSM has granted

authority to the Utah Division of Oil Gas and Mining (DOGM) to implement SMCRA through State SMCRA regulations. All SMCRA requirements regarding control of erosion, siltation and other pollutants resulting from storm water runoff, including road dust resulting from erosion, shall be primary requirements of the pollution prevention plan and shall be included in the contents of the plan directly, or by reference. Where determined to be appropriate for protection of water quality, additional sedimentation and erosion controls may be warranted.

a. <u>Contents of Plan.</u> The plan shall include at a minimum, the following items:

   1) <u>Pollution Prevention Team.</u> Each plan shall identify a specific individual or individuals within the facility organization as members of a storm water Pollution Prevention Team that are responsible for developing the storm water pollution prevention plan and assisting the facility manager in its implementation, maintenance, and revision. The plan shall clearly identify the responsibilities of each team member. The activities and responsibilities of the team shall address all aspects of the facility's storm water pollution prevention plan.

   2) <u>Description of Potential Pollutant Sources.</u> Each plan shall provide a description of potential sources that may reasonably be expected to add significant amounts of pollutants to storm water discharges or that may result in the discharge of pollutants during dry weather from separate storm sewers draining the facility. Each plan shall identify all activities and significant materials that may potentially be significant pollutant sources. Each plan shall include, at a minimum:

      a) <u>Deadlines for Plan Preparation and Compliance</u>
      Dugout Mine shall prepare and implement a plan in compliance with the provisions of this section within 270 days of the effective date of this permit.

      b) <u>Keeping Plans Current</u>

      Dugout Mine shall amend the plan whenever there is a change in design, construction, operation, or maintenance, that has a significant effect on the potential for the discharge of pollutants to the waters of the State or if the storm water pollution prevention plan proves to be ineffective in eliminating or significantly minimizing pollutants from sources identified by the plan, or in otherwise achieving the general objectives of controlling pollutants in storm water discharges associated with the activities at the mine.

c) Drainage.

(1) A site map, such as a drainage map required for SMCRA permit applications, that indicates drainage areas and storm water outfalls. These shall include but not be limited to the following:

(a) Drainage direction and discharge points from all applicable mining-related areas described in paragraph 1.a (1). (Site Coverage) above, including culvert and sump discharges from roads and rail beds and also from equipment and maintenance areas subject to storm runoff of fuel, lubricants and other potentially harmful liquids.

(b) Location of each existing erosion and sedimentation control structure or other control measures for reducing pollutants in storm water runoff.

(c) Receiving streams or other surface water bodies.

(d) Locations exposed to precipitation that contain acidic spoil, refuse or unreclaimed disturbed areas.

(e) Locations where major spills or leaks of toxic or hazardous pollutants have occurred.

(f) Locations where liquid storage tanks containing potential pollutants, such as caustics, hydraulic fluids and lubricants, are exposed to precipitation.

(g) Locations where fueling stations, vehicle and equipment maintenance areas are exposed to precipitation.

(h) Locations of outfalls and the types of discharges contained in the drainage areas of the outfalls.

(2) For each area of the facility that generates storm water discharges associated with the mining-related

activity with a reasonable potential for containing significant amounts of pollutants, a prediction of the direction of flow, and an identification of the types of pollutants that are likely to be present in storm water discharges associated with the activity. Factors to consider include the toxicity of the pollutant; quantity of chemicals used, produced or discharged; the likelihood of contact with storm water; and history of significant leaks or spills of toxic or hazardous pollutants. Flows with a significant potential for causing erosion shall be identified.

d) Inventory of Exposed Materials. An inventory of the types of materials handled at the site that potentially may be exposed to precipitation. Such inventory shall include a narrative description of significant materials that have been handled, treated, stored or disposed in a manner to allow exposure to storm water method and location of onsite storage or disposal; materials management practices employed to minimize contact of materials with storm water runoff a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of any treatment the storm water receives.

e) Spills and Leaks. A list of significant spills and leaks of toxic or hazardous pollutants that occurred at areas that are exposed to precipitation or that otherwise drain to a storm water conveyance at the facility beginning 3 years prior to the effective date of this permit. Such list shall be updated as appropriate during the term of the permit.

f) Sampling Data. A summary of any existing discharge sampling data describing pollutants in storm water discharges from the portions of Dugout covered by this permit, including a summary of any sampling data collected during the term of this permit.

g) Risk Identification and Summary of Potential Pollutant Sources. A narrative description of the potential pollutant sources from the following activities: truck traffic on haul roads and resulting generation of sediment subject to runoff and dust generation; fuel or other liquid storage; pressure lines containing slurry, hydraulic fluid or other potential harmful liquids; and loading or temporary storage of acidic refuse or spoil. Specific potential pollutants shall be identified where known.

3) Measures and Controls. Dugout Mine shall develop a description of storm water management controls appropriate for the facility and implement such controls. The appropriateness and priorities of controls in a plan shall reflect identified potential sources of pollutants at Dugout Mine. The description of storm water management controls shall address the following minimum components, including a schedule for implementing such controls.

a) Good Housekeeping. Good housekeeping requires the maintenance of areas that may contribute pollutants to storm water discharges in a clean, orderly manner. These are practices that would minimize the generation of pollutants at the source or before it would be necessary to employ sediment ponds or other control measures at the discharge outlets. Where applicable, such measures or other equivalent measures would include the following: sweepers and covered storage to minimize dust generation and storm runoff; conservation of vegetation where possible to minimize erosion; watering of haul roads to minimize dust generation; collection, removal, and proper disposal of waste oils and other fluids resulting from vehicle and equipment maintenance; or other equivalent measures.

b) Preventive Maintenance. A preventive maintenance program shall involve timely inspection and maintenance of storm water management devices as well as inspecting and testing facility equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to surface waters, and ensuring appropriate maintenance of such equipment and systems. Where applicable, such measures would include the following: removal and proper disposal of settled solids in catch basins to allow sufficient retention capacity; periodic replacement of siltation control measures subject to deterioration such as straw bales; inspections of storage tanks and pressure lines for fuels, lubricants, hydraulic fluid or slurry to prevent leaks due to deterioration or faulty connections; or other equivalent measures.

c) Spill Prevention and Response Procedures. Areas where potential spills that can contribute pollutants to storm water discharges can occur, and their accompanying drainage points shall be identified clearly in the storm water pollution prevention plan. Where appropriate, specifying material handling procedures, storage requirements, and use of equipment such as diversion valves in the plan should be considered. Procedures for cleaning up spills shall be identified in the plan and made available to the appropriate personnel. The necessary equipment to implement a clean up shall be available to personnel.

d) Inspections. In addition to or as part of the comprehensive site evaluation required under paragraph 3.a.(4) of this section, qualified facility personnel shall be identified to inspect designated areas of the facility at appropriate intervals specified in the plan. The following shall be included in the plan:

(1) Active Mining-Related Areas and Those Inactive Areas Under SMCRA Bond Authority. The plan shall require quarterly inspections by the facility personnel for areas of the facility covered by pollution prevention plan requirements. This inspection interval corresponds with the quarterly inspections for the entire facility required to be provided by SMCRA authority inspectors for all mining-related areas under SMCRA authority, including sediment and erosion control measures. Inspections by the facility representative may be done at the same time as the mandatory inspections performed by SMCRA inspectors. Records of inspections of the SMCRA authority facility representative shall be maintained.

(2) Inactive Mining-Related Areas Not Under SMCRA Bond. The plan shall require annual inspections by the facility representative except in situations referred to in paragraph 3.a.(4)(d) below.

(3) Inspection Records. The plan shall require that inspection records of the facility representative and those of the SMCRA authority inspector shall be maintained. A set of tracking or follow-up procedures shall be used to ensure that appropriate actions are taken in response to the inspections.

e) Employee Training. Employee training programs shall inform personnel responsible for implementing activities identified in the storm water pollution prevention plan or otherwise responsible for storm water management at all levels of responsibility of the components and goals of the storm water pollution prevention plan. Training should address topics such as spill response, good housekeeping and material management practices. The pollution prevention plan shall identify periodic dates for such training.

f) Record keeping and Internal Reporting Procedures. A description of incidents (such as spills, or other discharges) along with other information describing the quality and quantity of storm water discharges shall be included in the plan required under this part. Inspections and maintenance activities shall be documented and records of such activities shall be incorporated into the plan.

g) Non-storm Water Discharges.

(1) Certification. The plan shall include a certification that the discharge has been tested or evaluated for the presence of non-storm water discharges such as drainage from underground portions of inactive mines or floor drains from maintenance or coal handling buildings. The certification shall include the identification of potential significant sources of non-storm water discharges at the site, a description of the results of any test and/or evaluation, a description of the evaluation criteria or testing method used, the date of any testing and/or evaluation, and the onsite drainage points that were directly observed during the test. Certifications shall be signed in accordance with Part IV.G.4. of this permit.

(2) Exceptions. Except for flows from fire fighting activities, authorized sources of non-storm water listed in Part I.E.2.a. that are combined with storm water discharges associated with industrial activity must be identified in the plan. The plan shall identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

(3) Failure to Certify. If Dugout Mine is unable to provide the certification required (testing or other evaluation for non-storm water discharges), the Director must be notified within 180 days after the effective date of this permit. If the failure to certify is caused by the inability to perform adequate tests or evaluations, such notification shall describe: the procedure of any test conducted for the presence of non-storm water discharges; the results of such test or other relevant observations; potential sources of non-storm water to the storm discharge lines; and why adequate tests for such storm discharge lines

were not feasible. Non-storm water discharges to waters of the State that are not authorized by a UPDES permit are unlawful, and must be terminated.

h) Sediment and Erosion Control. The plan shall identify areas that, due to topography, activities, or other factors, have a high potential for significant soil erosion, and identify structural, vegetative, and/or stabilization measures to be used to limit erosion and reduce sediment concentrations in storm water discharges. As indicated in paragraph I.E.3. above, SMCRA requirements regarding sediment and erosion control measures are primary requirements of the pollution prevention plan for mining-related areas subject to SMCRA authority. The following sediment and erosion control measures or other equivalent measures, should be included in the plan where reasonable and appropriate for all areas subject to storm water runoff:

(1) Stabilization Measures. Interim and permanent stabilization measures to minimize erosion and lessen amount of structural sediment control measures needed, including: mature vegetation preservation; temporary seeding; permanent seeding and planting; temporary mulching, matting, and netting; sod stabilization; vegetative buffer strips; temporary chemical mulch, soil binders, and soil palliatives; nonacidic road surfacing material; and protective trees.

(2) Structural Measures. Structural measures to lessen erosion and reduce sediment discharges, including: silt fences; earth dikes; straw dikes; gradient terraces; drainage swales; sediment traps; pipe slope drains; porous rock check dams; sedimentation ponds; riprap channel protection; capping of contaminated sources; and physical/chemical treatment of storm water.

i) Management of Flow. The plan shall contain a narrative consideration of the appropriateness of traditional storm water management practices (other than those as sediment and erosion control measures listed above) used to manage storm water runoff in a manner that reduces pollutants in storm water runoff from the site. The plan shall provide that the measures, which the permittee determines to be reasonable and appropriate, shall be implemented and maintained. Appropriate measures may include: discharge diversions; drainage/storm water conveyances; runoff dispersion; sediment control and collection; vegetation/soil stabilization; capping of contaminated sources; treatment; or other equivalent measures.

4) Comprehensive Site Compliance Evaluation. Qualified personnel shall conduct site compliance evaluations at intervals specified in the plan, but in no case less than once a year. Such evaluations shall provide:

a) Areas contributing to a storm water discharge associated with coal mining-related areas shall be visually inspected for evidence of, or the potential for, pollutants entering the drainage system. These areas include haul and access roads; railroad spurs, sidings, and internal haulage lines; conveyor belts, chutes and aerial tramways; equipment storage and maintenance yards; coal handling buildings and structures; and inactive mines and related areas. Measures to reduce pollutant loadings shall be evaluated to determine whether they are adequate and properly implemented in accordance with the terms of the permit or whether additional control measures are needed. Structural storm water management measures, sediment and erosion control measures, and other structural pollution prevention measures, as indicated in paragraphs 3.a.(3)(h) and 3.a.(3)(i) above and where identified in the plan, shall be observed to ensure that they are operating correctly. A visual evaluation of any equipment needed to implement the plan, such as spill response equipment, shall be made.

b) Based on the results of the evaluation, the description of potential pollutant sources identified in the plan, in accordance with paragraph 3.a.(2) of this section, and pollution prevention measures and controls identified in the plan, in accordance with paragraph 3.a.(3) of this section, shall be revised as appropriate within 2 weeks of such evaluation and shall provide for implementation of any changes to the plan in a timely manner. For inactive mines, such revisions may be extended to a maximum of 12 weeks after the evaluation.

c) A report summarizing the scope of the evaluation, personnel making the evaluation, the date(s) of the evaluation, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with paragraph 3.a.(4)(b) above shall be made and retained as part of the storm water pollution prevention plan for at least 3 years after the date of the evaluation. The report shall identify any incidents of noncompliance. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the storm water pollution prevention plan and this permit. The report shall be signed in accordance with Part IV.G.4. (Signatory Requirements) of this permit.

d) Where compliance evaluation schedules overlap with inspections required under 3.a.(3)(d), the compliance evaluation may be conducted in place of one such inspection. Where annual site compliance evaluations are shown in the plan to be impractical for inactive mining sites due to the remote location and inaccessibility of the site, site inspections required under this part shall be conducted at appropriate intervals specified in the plan, but, in no case less than once in 3 years.

4. <u>Numeric Effluent Limitations.</u> There are no additional numeric effluent limitations beyond those described in Part I.E. of this permit.

5. <u>Monitoring and Reporting Requirements.</u>

a. <u>Benchmark Analytical Monitoring Requirements.</u> Dugout Mine must monitor their storm water discharges associated with industrial activity at least quarterly (4 times per year) during years 2 and 4 of the permit cycle except as provided in paragraphs 5.a.(3) (Sampling Waiver), 5.a.(4) (Representative Discharge), and 5.a.(5) (Alternative Certification). Dugout Mine is required to monitor their storm water discharges for the pollutants of concern listed in Table E. below. Reports must be made in accordance with 5.b. (Reporting). In addition to the parameters listed in Table E. below, Dugout Mine must provide the date and duration (in hours) of the storm event(s) sampled; rainfall measurements or estimates (in inches) of the storm event that generated the sampled runoff; the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event; and an estimate of the total volume (in gallons) of the discharge sampled.

The results of benchmark monitoring are primarily for Dugout Mine's use to determine the overall effectiveness of the SWPPP in controlling the discharge of pollutants to receiving waters. Benchmark values are not viewed as permit limitations. An exceedance of a benchmark value does not, in and of itself, constitute a violation of this permit. While exceedance of a benchmark value does not automatically indicate a violation of a water quality standard has occurred, it does signal that modifications to the SWPPP or more specific pollution prevention controls may be necessary.

Table E.
Monitoring Requirements for Coal Mining Facilities

Pollutants of Concern	Cut-Off Concentration
Total Recoverable Aluminum	0.75 mg/L
Total Recoverable Iron	1.0 mg/L
Total Suspended Solids	100 mg/L

1) Monitoring Periods. Dugout Mine shall monitor samples collected during the sampling periods of: January through March, April through June, July through September, and October through December during the second and fourth years of this permit cycle.

2) Sample Type. A minimum of one grab sample shall be taken. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. The required 72-hour storm event interval is waived where the preceding measurable storm event did not result in a measurable discharge from the facility. The required 72-hour storm event interval may also be waived where Dugout Mine documents that less than a 72-hour interval is representative for local storm events during the season when sampling is being conducted. The grab sample shall be taken during the first 30 minutes of the discharge. If the collection of a grab sample during the first 30 minutes is impracticable, a grab sample can be taken during the first hour of the discharge, and the discharger shall submit with the monitoring report a description of why a grab sample during the first 30 minutes was impracticable. If storm water discharges associated with industrial activity commingle with process or nonprocess water, then where practicable permittees must attempt to sample the storm water discharge before it mixes with the non-storm water discharge.

3) Sampling Waiver.

a) Adverse Conditions. If Dugout Mine is unable to collect samples within a specified sampling period due to adverse climatic conditions, thus a substitute sample shall be collected from a separate qualifying event in the next monitoring period and the data submitted along with the data for the routine sample in that period. Adverse weather conditions that may prohibit the collection of samples include weather conditions that create dangerous conditions for personnel (such as local flooding, high winds, hurricanes, tornadoes, electrical storms, etc.) or otherwise make the collection of a sample impracticable (drought, extended frozen conditions, etc.).

b) Low Concentration Waiver. When the average concentration for a pollutant calculated from all monitoring data collected from an outfall during the second year monitoring is less than the corresponding value for that pollutant listed in Table E. under the column Monitoring Cut-Off Concentration, Dugout Mine may waive monitoring and reporting requirements for the fourth year monitoring period. Dugout Mine must submit to the Director, in lieu of the monitoring data, a certification that there has not been a significant change in industrial activity or the pollution prevention measures in area of the facility that drains to the outfall for which sampling was waived.

c) Inactive and Unstaffed Site. If Dugout Mine is unable to conduct quarterly chemical storm water sampling at an inactive and unstaffed site, the operator of the facility may exercise a waiver of the monitoring requirements as long as the facility remains inactive and unstaffed. Dugout Mine must submit to the Director, in lieu of monitoring data, a certification statement on the Storm Water Discharge Monitoring Report (SWDMR) stating that the site is inactive and unstaffed so that collecting a sample during a qualifying event is not possible.

4) Representative Discharge. If the facility has two or more outfalls that, based on a consideration of industrial activity, significant materials, and management practices and activities within the area drained by the outfall, discharge substantially identical effluents, Dugout Mine may test the effluent of one of such outfalls and report that the quantitative data also applies to the substantially identical outfall(s) provided that Dugout Mine includes in the storm water pollution prevention plan a description of the location of the outfalls and explains in detail why the outfalls are expected to discharge substantially identical effluents. In addition, for each outfall that Dugout Mine believes is representative, an estimate of the size of the drainage area (in square feet) and an estimate of the runoff coefficient of the drainage area [e.g., low (under 40 percent), medium (40 to 65 percent), or high (above 65 percent)] shall be provided in the plan. Dugout Mine shall include the description of the location of the outfalls, explanation of why outfalls are expected to discharge substantially identical effluents, and estimate of the size of the drainage area and runoff coefficient with the SWDMR.

5) Alternative Certification. Dugout Mine is not subject to the monitoring requirements of this section provided that certification is made for a given outfall or on a pollutant-by-pollutant basis in lieu of monitoring reports required under paragraph b. below, under penalty

of law, signed in accordance with Part IV.G.4. (Signatory Requirements). The Certification shall state that material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, industrial machinery or operations, or significant materials from past industrial activity that are located in areas of the facility within the drainage area of the outfall are not presently exposed to storm water and are not expected to be exposed to storm water for the certification period. Such certification must be retained in the storm water pollution prevention plan, and submitted to DWQ in accordance with Part II.D. of this permit. In the case of certifying that a pollutant is not present, Dugout Mine must submit the certification along with the monitoring reports required under paragraph b. below. If Dugout Miner cannot certify for an entire period, they must submit the date exposure was eliminated and any monitoring required up until that date. This certification option is not applicable to compliance monitoring requirements associated with effluent limitations.

b. <u>Reporting.</u> Dugout Mine shall submit monitoring results for each outfall associated with industrial activity [or a certification in accordance with Sections (3), (4), or (5) above] obtained during the second year reporting period, on Storm Water Discharge Monitoring Report (SWDMR) form(s) postmarked no later than the 31st day of the following March. Monitoring results [or a certification in accordance with Sections (3), (4), or (5) above] obtained during the fourth year reporting period shall be submitted on SWDMR form(s) postmarked no later than the 31st day of the following March. For each outfall, one signed SWDMR form must be submitted to the Director per storm event sampled. Signed copies of SWDMRs, or said certifications, shall be submitted to the Director at the address listed in Part II.D. of the permit.

c. <u>Visual Examination of Storm Water Quality.</u> Dugout shall perform and document a visual examination of a representative storm water discharge at the following frequencies: quarterly for active areas under SMCRA bond located in areas with average annual precipitation over 20 inches; semi-annually for inactive areas under SMCRA bond, and active areas under SMCRA bond located in areas with average annual precipitation of 20 inches or less; visual examinations are not required at inactive areas not under SMCRA bond.

1) <u>Visual Monitoring Periods.</u> Examinations shall be conducted in each of the following periods for the purposes of visually inspecting storm water runoff or snow melt: Quarterly-January through March; April through June; July through September; and October through December. Semi-annually—January through June and July through December.

2) Sample and Data Collection. Examinations shall be made of samples collected within the first 60 minutes (or as soon thereafter as practical, but not to exceed two hours) of when the runoff or snowmelt begins discharging. The examinations shall document observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution. The examination must be conducted in a well-lit area. No analytical tests are required to be performed on the samples. All such samples shall be collected from the discharge resulting from a storm event that is greater than 0.1 inches in magnitude and that occurs at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Where practicable, the same individual will carry out the collection and examination of discharges for the life of the permit.

3) Visual Storm Water Discharge Examination Reports. Visual examination reports must be maintained onsite in the pollution prevention plan. The report shall include the examination date and time, examination personnel, the nature of the discharge (i.e., runoff or snow melt), visual quality of the storm water discharge (including observations of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other obvious indicators of storm water pollution), and probable sources of any observed storm water contamination.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling Samples taken in compliance with the monitoring requirements established under *Part I* shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge. Sludge samples shall be collected at a location representative of the quality of sludge immediately prior to the use-disposal practice.

B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under *Utah Administrative Code ("UAC") R317-2-10*, unless other test procedures have been specified in this permit.

C. Penalties for Tampering. The *Act* provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. Reporting of Monitoring Results. Monitoring results obtained during the previous month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), post-marked no later than the 28th day of the month following the completed reporting period. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports including whole effluent toxicity (WET) test reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part IV.G)*, and submitted to the Director, Division of Water Quality at the following address:

original to: Department of Environmental Quality
Division of Water Quality
195 North 1950 West
PO Box 144870
Salt Lake City, Utah 84114-4870

E. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Additional Monitoring by the Permittee. If the permittee monitors any parameter more frequently than required by this permit, using test procedures approved under *UAC R317-2-10* or as otherwise specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated. Only those parameters required by the permit need to be reported.

G. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:

2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. A copy of this UPDES permit must be maintained on site during the duration of activity at the permitted location.

I. Twenty-four Hour Notice of Noncompliance Reporting.

1. The permittee shall (orally) report any noncompliance which may seriously endanger health or environment as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of circumstances. The report shall be made to the Division of Water Quality, (801) 536-4300, or 24 hour answering service (801) 536-4123.

2. The following occurrences of noncompliance shall be reported by telephone (801) 536-4123 as soon as possible but no later than 24 hours from the time the permittee becomes aware of the circumstances:

   a. Any noncompliance which may endanger health or the environment;

   b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See *Part III.G, Bypass of Treatment Facilities.)*;

   c. Any upset which exceeds any effluent limitation in the permit (See *Part III.H, Upset Conditions*.); or,

   d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit.

3. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

   b. The period of noncompliance, including exact dates and times;

   c. The estimated time noncompliance is expected to continue if it has not been corrected; and,

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

e. Steps taken, if any, to mitigate the adverse impacts on the environment and human health during the noncompliance period.

4. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Division of Water Quality, (801) 536-4300.

5. Reports shall be submitted to the addresses in *Part II.D, Reporting of Monitoring Results*.

J. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for *Part II.D* are submitted. The reports shall contain the information listed in *Part II.I.3*.

K. Inspection and Entry. The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the *Act*, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions. The *Act* provides that any person who violates a permit condition implementing provisions of the *Act* is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions of the Act is subject to a fine not exceeding $25,000 per day of violation; Any person convicted under *UCA 19-5-115(2)* a second time shall be punished by a fine not exceeding $50,000 per day. Except as provided at *Part III.G*, *Bypass of Treatment Facilities* and *Part III.H*, *Upset Conditions*, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Removed Substances. Collected screening, grit, solids, sludges, or other pollutants removed in the course of treatment shall be buried or disposed of in such a manner so as to prevent any pollutant from entering any waters of the state or creating a health hazard. Sludge/digester supernatant and filter backwash shall not directly enter either the final effluent or waters of the state by any other direct route.

G. Bypass of Treatment Facilities.

1. Bypass Not Exceeding Limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to 2. and 3. of this section.

2. Prohibition of Bypass.

   a. Bypass is prohibited, and the Director may take enforcement action against a permittee for bypass, unless:

      (1) Bypass was unavoidable to prevent loss of human life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance, and

      (3) The permittee submitted notices as required under section G.3.

   b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determines that it will meet the three conditions listed in sections G.2a. (1), (2) and (3).

3. Notice.

   a. Anticipated bypass. Except as provided above in section G.2. and below in section G. 3.b, if the permittee knows in advance of the need for a bypass, it shall submit prior notice, at least ninety days before the date of bypass. The prior notice shall include the following unless otherwise waived by the Director:

      (1) Evaluation of alternative to bypass, including cost-benefit analysis containing an assessment of anticipated resource damages:

      (2) A specific bypass plan describing the work to be performed including scheduled dates and times. The permittee must notify the Director in advance of any changes to the bypass schedule;

      (3) Description of specific measures to be taken to minimize environmental and public health impacts;

      (4) A notification plan sufficient to alert all downstream users, the public and others reasonably expected to be impacted by the bypass;

(5) A water quality assessment plan to include sufficient monitoring of the receiving water before, during and following the bypass to enable evaluation of public health risks and environmental impacts; and

(6) Any additional information requested by the Director.

b. Emergency Bypass. Where ninety days advance notice is not possible, the permittee must notify the Director, and the Director of the Department of Natural Resources, as soon as it becomes aware of the need to bypass and provide to the Director the information in section G.3.a.(1) through (6i) to the extent practicable.

c. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass to the Director as required under Part II.I., Twenty Four Hour Reporting. The permittee shall also immediately notify the Director of the Department of Natural Resources, the public and downstream users and shall implement measures to minimize impacts to public health and environment to the extent practicable.

H. Upset Conditions.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of paragraph 2. of this section are met. Director's administrative determination regarding a claim of upset cannot be judiciously challenged by the permittee until such time as an action is initiated for noncompliance.

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

a. An upset occurred and that the permittee can identify the cause(s) of the upset;

b. The permitted facility was at the time being properly operated;

c. The permittee submitted notice of the upset as required under Part II.I, Twenty-four Hour Notice of Noncompliance Reporting; and,

d. The permittee complied with any remedial measures required under Part III.D, Duty to Mitigate.

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of *The Water Quality Act of 1987* for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

J. Changes in Discharge of Toxic Substances. Notification shall be provided to the Director as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. One hundred micrograms per liter (100 ug/L);

    b. Two hundred micrograms per liter (200 ug/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/L) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

    c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(7)* or (10); or,

    d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. Five hundred micrograms per liter (500 ug/L);

    b. One milligram per liter (1 mg/L) for antimony:

    c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with *UAC R317-8-3.4(9)*; or,

    d. The level established by the Director in accordance with *UAC R317-8-4.2(6)*.

K. Industrial Pretreatment. Any wastewaters discharged to the sanitary sewer, either as a direct discharge or as a hauled waste, are subject to Federal, State and local pretreatment regulations. Pursuant to Section 307 of *The Water Quality Act of 1987*, the permittee shall comply with all applicable federal General Pretreatment Regulations promulgated at *40 CFR 403*, the State Pretreatment Requirements at

UAC R317-8-8, and any specific local discharge limitations developed by the Publicly Owned Treatment Works (POTW) accepting the wastewaters.

In addition, in accordance with *40 CFR 403.12(p)(1)*, the permittee must notify the POTW, the EPA Regional Waste Management Director, and the State hazardous waste authorities, in writing, if they discharge any substance into a POTW which if otherwise disposed of would be considered a hazardous waste under *40 CFR 261*. This notification must include the name of the hazardous waste, the EPA hazardous waste number, and the type of discharge (continuous or batch).

IV. GENERAL REQUIREMENTS

A. Planned Changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are not subject to effluent limitations in the permit. In addition, if there are any planned substantial changes to the permittee's existing sludge facilities or their manner of operation or to current sludge management practices of storage and disposal, the permittee shall give notice to the Director of any planned changes at least 30 days prior to their implementation.

B. Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit.

E. Duty to Provide Information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

F. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed by either a principal executive officer or ranking elected official

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described above and submitted to the Director, and,

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph IV.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Penalties for Falsification of Reports. The *Act* provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000.00 per violation, or by imprisonment for not more than six months per violation, or by both.

I. Availability of Reports. Except for data determined to be confidential under *UAC R317-8-3.2*, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of Director. As required by the *Act*, permit applications, permits and effluent data shall not be considered confidential

J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the permittee of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under the *Act*.

K. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. Severability. The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 20 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

N. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by *UCA 19-5-117*.

O. Water Quality-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. Water Quality Standards for the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.

2. A final wasteload allocation is developed and approved by the State and/or EPA for incorporation in this permit.

3. A revision to the current Water Quality Management Plan is approved and adopted which calls for different effluent limitations than contained in this permit.

P. Toxicity Limitation-Reopener Provision. This permit may be reopened and modified (following proper administrative procedures) to include whole effluent toxicity (WET) testing, a WET limitation, a compliance schedule, a compliance date, additional or modified numerical limitations, or any other conditions related to the control of toxicants if toxicity is detected during the life of this permit.

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 1

Figures: RA Figure 1-1A and 1-1B

RA Plate 1-1

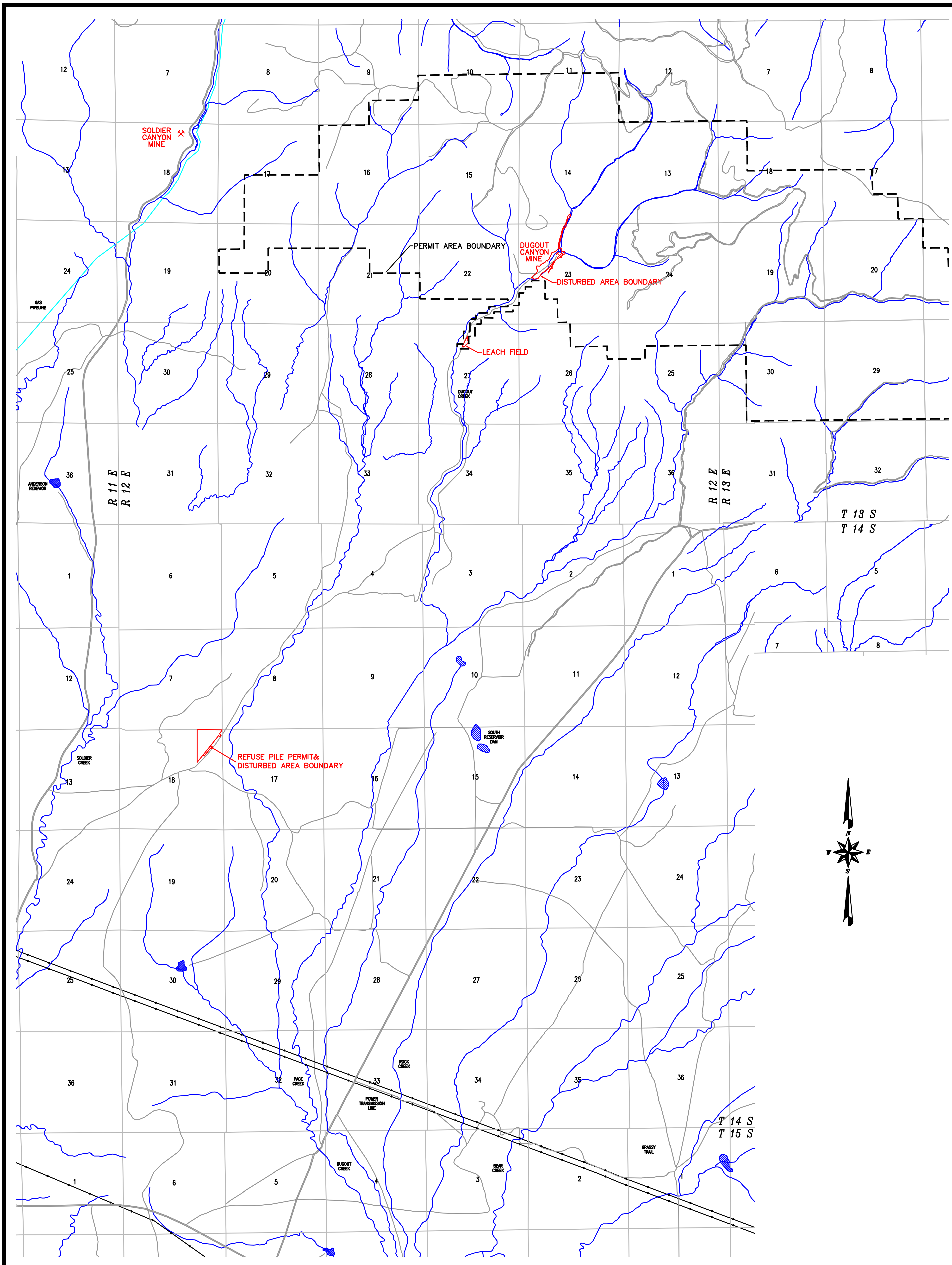
RA Attachment 1-1 (Encroachment Permit)

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only



NOTES:

REFUSE PILE IS LOCATED IN
SECTION 18, T14S R 12E

REVISIONS OR UP-DATES		
NO.	DATE	BY
1	01/06/03	RR
2	10/31/16	BK

FILENAME: RAFigure 1-1A.dwg

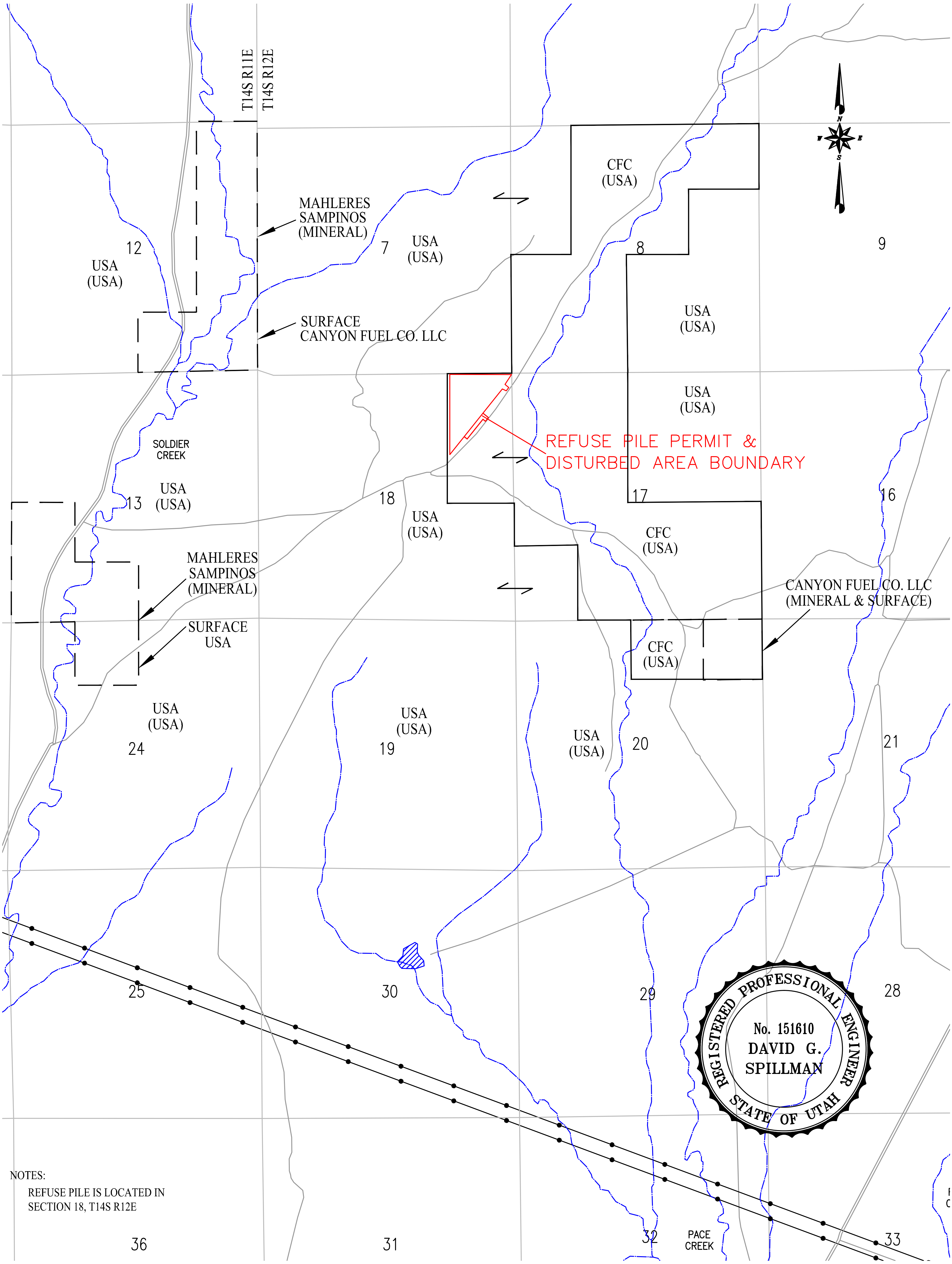
DATE:	08/26/02
DESIGNED BY:	VSM
DRAWN BY:	RR
CHECKED BY:	DGF
SCALE:	NTS

Canyon Fuel Company, LLC
Dugout Canyon Mine

REFUSE PILE LOCATION MAP

P.O BOX 1029
WELLINGTON, UTAH 84542

DRAWING OR MAP NUMBER
RA FIGURE 1-1A



NOTES:
REFUSE PILE IS LOCATED IN SECTION 18, T14S R12E

LEGEND:
SURFACE OWNERSHIP - UNITED STATES - USA
CANYON FUEL CO. LLC - CFC

COAL OWNERSHIP - UNITED STATES - (USA)

REVISIONS OR UP-DATES		
NO.	DATE	BY
1	10/31/16	BK

FILENAME: RAFigure 1-1B.dwg

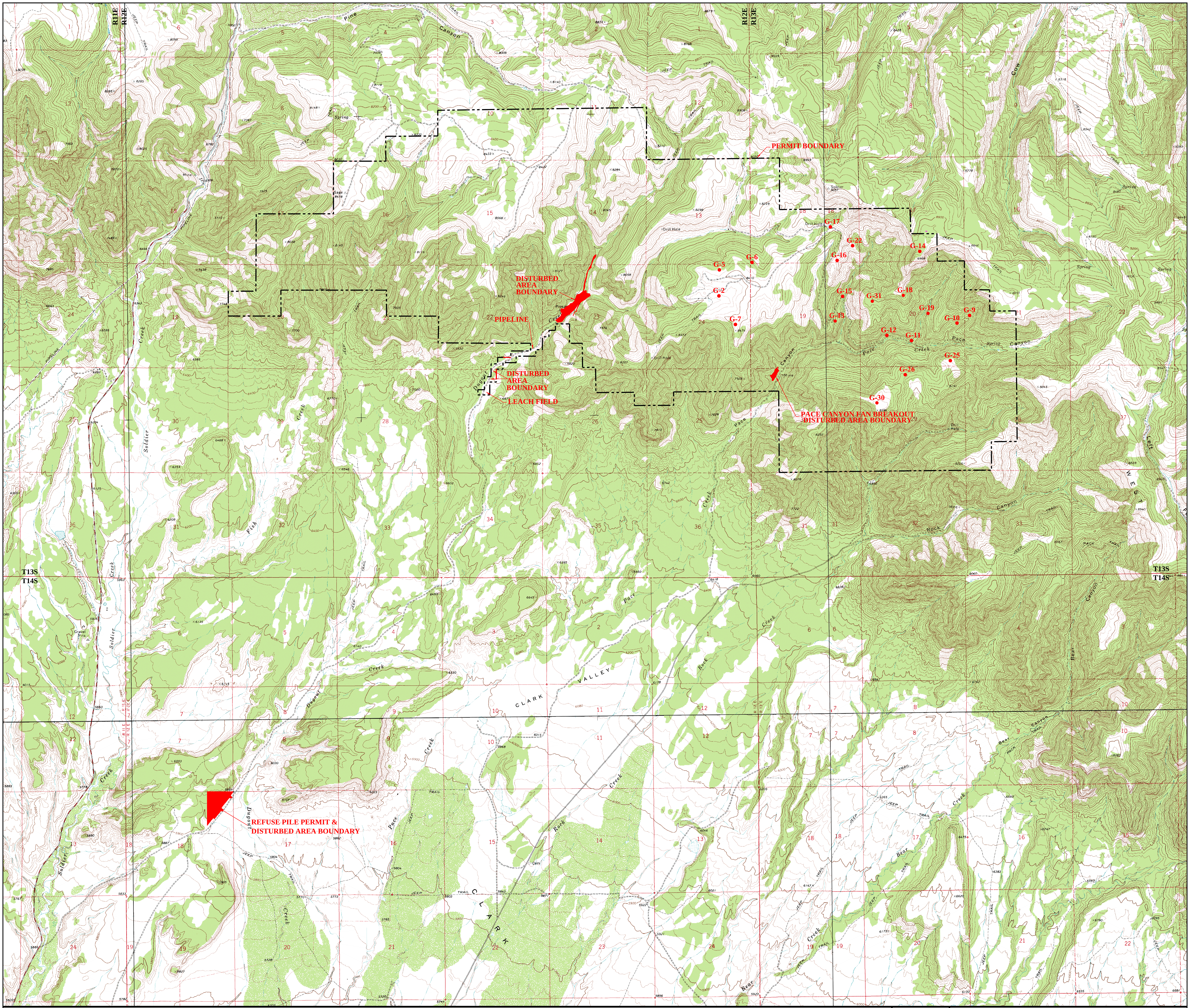
DATE:	01/06/03
DESIGNED BY:	VSM
DRAWN BY:	RR
CHECKED BY:	DGS
SCALE:	1" = 2000'

Canyon Fuel Company, LLC
Dugout Canyon Mine

REFUSE PILE
SURFACE AND COAL OWNERSHIP

P.O. BOX 1029
WELLINGTON, UTAH 84542

DRAWING OR MAP NUMBER
RA FIGURE 1-1B



REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

0' 2000'

REVISIONS	
DATE	BY
01/20/06	VSM
07/06/16	BK/JKS
07/22/16	JKS
07/25/16	JKS
10/28/16	TAJ

Canyon Fuel Company, LLC
Soldier Canyon & Dugout Canyon Mines

DUGOUT CANYON MINE PERMIT AREA

Dugout Canyon Mine

DRAWN BY: RR
APPROVED BY: VSM
DATE: OCTOBER 28, 2016
FILE NAME: RAPlate 1-1.DWG
SCALE: 1" = 2000'
DRAWING OR MAP NUMBER **RA PLATE 1-1**

Carbon County

Utah's Castle Country

Encroachment Permit

By acceptance under the terms and conditions outlined in the Permit Application and any other terms or conditions hereby attached to this document, Carbon County does hereby allow:

Name: Dave Spillman Effective Date April 4, 2016

Representing Dugout Canyon Mine

Address P.O. Box 1029 Wellington, Utah 84542

Telephone # 435-637-6360 Email Address

The right to utilize the surface for commercial purposes, excavate in an or around or place structures into Carbon County system roads under the allowances granted in this Class___1______ Permit under the authority of Ordnance #378, PASSED, ADOPTED, and ORDERED PUBLISHED the 16th day of November, 2005 by the CARBON COUNTY BOARD OF COMMISSIONERS.

Signed Daniel R Campbell Date April 6, 2016

This permit expires on: April 4, 2017

Acceptance by the Supervisor means once signed, undertaking by the Permittee is guaranteeing the completion of any improvements or construction proposed therein, in conformance to the specifications and terms set forth by the Supervisor and or contained in the application or additional attached documents. This permit creates an agreement that upon failure to do so, the County or other competent contractor assigned to do so by the County may complete the same to its satisfaction and charge the costs thereof to the Applicant.

A Class 1 Encroachment means encroachments on County roadways by connections of residential driveways or private or other roadways, parking areas, or other structures affecting or altering the shoulder of the Existing County Roadway, or by installation of cattle guards.

A Class 2 Encroachment means grading, construction, reconstruction, surfacing or resurfacing, alignment or realignment, excavation, boring or jetting, obstruction, removal of materials, vibroseising, Heavy Haulage, as defined in the ordinance or disproportionate use exceeding the normal function or use of County roads for commercial purposes, including extraordinary use

A Class 3 Encroachment means excavating, boring, jetting, cutting of pavement or other disturbance by utilities within County road right-of-way for the purpose of installing, repairing or maintaining cables, pipelines, or other Utility structures buried within the roadway or right-of-way

An annual Blanket Permit means an Encroachment Permit issued for a period of one calendar year, *based upon a written plan*, to Applicant (s) who, of necessity, may make numerous Encroachment Permits. The Annual Blanket Permit is designed to alleviate the necessity of securing a performance and completion bond for each Encroachment Permit.

Applicant is required to supply Maps, plats or engineering drawings displaying the current locations in pertinent views of Utility lines within the County right-of-way to be affected by the proposed Encroachment and the proposed alignment of any new or replacement Lines or pipelines for which the Permit is requested. Applicant is also required to supply a waiver for all liability for damage to its Lines by the County or by other utilities whose existing Lines are located within the vicinity of the proposed new or replacement line
Each Applicant, as a condition of the release of the bond is required to notify blue stakes according to proper procedure, and provide acceptable g.p.s. location information to the Carbon County GIS department sufficient to maintain Utility and drainage mapping current.

Carbon County

Utah's Castle Country

Class 1 Encroachment Permit Application

For use on encroachments on County roadways by connections of residential driveways or private or other roadways, parking areas, or other structures affecting or altering the shoulder of the Existing County Roadway, or by installation of cattle guards.

Application Approved : ☐ **No** ☒ **Yes** **By:** Daniel R Campbell **Application Fee:** No Fee

All applications shall be accompanied by a non-refundable application fee in the amount set forth in the most current Fee Schedule.

***If Refused, Reason for refusal:** __________

****Annual Blanket Permit:** ☐ **No** ☐ **Yes:** ***Attach Written Plan and Conditions Agreement***

Name: Dave Spillman **Telephone #** (435) 636-2872

Address: P.O. Box 1029, Wellington, Utah 84542

Business Representing: Dugout Canyon Mine **Telephone #** (435) 637-6360

Address: P.O. Box 1029, Wellington, Utah 84542

Location of the proposed Encroachment. (Please give address if possible GIS Coordinates are also acceptable for open lands locations): Dugout Canyon Road, 39° 36'45.25"N, 110° 36'33.98"W.

Describe the proposed Encroachment:

Please see attached letter for a description of the proposed project.

Purpose:

Dimensions of materials to be used:

Will Begin: 2016 **Expect to be completed:** 2017

Does Applicant propose to use fungicide, pesticide, herbicide or any chemical or other road surface treatment? ☑ **No** ☐ **Yes:** (*Applicant will supply MSDS sheet with application and comply with manufacturer application requirements.)*

Type of treatment:

Rate and Method of application:

Supervisor remarks or additional information: (Attach additional information if needed.)

All fill material must be wet and compacted, 1ft. engineered 4" or 3" minus roadbase, capped with 6" of 3/4 or 1" roadbase for approach must be minimum of 20ft. from edge of asphalt if at any time large equipment or heavy truck traffic use this approach aprons and approach must be paved with a minium of 6" hotmix asphalt must extend minimum of 20ft. in lenght from the edge of existing asphalt. Dugout Canyon Mine will aslo provide all signage for intersection and stop sign etc. Dugout will also install and maintain.

Bond Requirement amount and copy: See Attached

*****Release Date:** Upon Phase III Reclamation

Liability Insurance Company: National Union Fire, Lexington Insurance Company, Apollo Insurance

Policy # GL 6576428

(Attach copy of the policy)

Signed: David Spillman **Title:** Engineering Manager

Authorized Agent for:: **Date:** 2/25/16

PLEASE READ:

Once signed by Applicant and accepted by the Supervisor, the Applicant, now Permittee is guaranteeing the completion of any improvements or construction proposed therein, in conformance to the specifications set forth by the Supervisor and or contained in this application. This application creates an agreement that upon failure to do so, the County or other competent contractor assigned to do so by the County may complete the same to its satisfaction and charge the costs thereof to the Applicant/Permittee.

*The Supervisor shall within ten (10) working days either grant the application or deny it. The Supervisor shall, when needed confer with Planning and Zoning and any other affected agencies during preliminary phases of the review of this application. If he denies the application, he shall return it to the Applicant and set forth in writing his reasons for doing so. The Applicant may submit an amended application at any time thereafter

**An annual Blanket Permit means an Encroachment Permit issued for a period of one calendar year, *based upon a written plan*, to Applicants who, of necessity, would otherwise need numerous Encroachment Permits. The Annual Blanket Permit is designed to alleviate the necessity of securing a performance and completion bond for each Encroachment Permit.

***Each Applicant, as a condition of the release of the bond is required to notify blue stakes according to proper procedure, and provide acceptable g.p.s. location or center line information to the Carbon County GIS department sufficient to maintain Utility, roadway and drainage mapping current

Canyon Fuel
Company, LLC
A Subsidiary of Bowie Resource Holdings, LLC

Dugout Canyon Mine
P.O. Box 1029
Wellington, Utah 84542
(435) 637-6360
Fax (435) 636-2897

February 25, 2016

Carbon County Planning Department
751 E 100 N Suite # 2600
Price, UT 84501

Re: Carbon County Encroachment Permit Application

Dear Mr. Levanger:

Canyon Fuel Company, LLC is looking to expand the Dugout Waste Rock Site located at the NE ¼ of the NE ¼ of Section 18, T14S, R12E. The site is located approximately 6.5 miles southwest of the Dugout Canyon Mine adjacent to the Carbon County road accessing the mine. The currently approved Dugout Canyon Mine mining permit number is C/007/039, the MSHA ID number is 1211-UT-09-01890-01. This expansion will require an additional sediment pond (Sedimentation Pond-2) and sediment pond access road (Sedimentation Pond-2 Access Road). Canyon Fuel Company is the current land owner of the property where the refuse pile is constructed.

A proper sized culvert (UC-3) will be placed in the drainage ditch along the country road at the point the access road intersects the county road. A sign will be placed along the access road that will define ownership and permit numbers for the site. Access to the site upon completion will be controlled with a locked gate arrangement. Enclosed are maps that show the location and layout of the proposed sedimentation pond-2 and sedimentation pond-2 access road.

The sedimentation pond-2 access road will be a temporary access road. This road will be approximately 12 feet wide and will be constructed on compacted subsoil. The road will have a uniform grade of 2% within the site. All temporary roads will be reclaimed and seeded with the permanent reclamation seed mix upon reclamation. The storm water runoff and sedimentation conveyance system for the sedimentation ponds have been designed to safely convey site runoff as specified in the Utah Administrative Code Titles R645-301-742 and 751.

The sedimentation pond-2 and sedimentation pond-2 access road will be within 100 feet of Carbon County's Dugout Canyon Road. Use of Carbon County's Dugout Canyon Road to access the Waste Rock Site Sediment pond access road will not require the county road to be relocated or closed. The approximate coordinates where the sedimentation pond-2 access road intersects the Carbon County, Dugout Canyon Road are 39° 36'45.25"N, 110° 36'33.98"W.

The proposed culvert will be placed in the drainage ditch to adequately convey the runoff from the Carbon County road borrow ditch under the new sedimentation pond-2 access road. This runoff will ultimately discharge to the natural drainage under the county road. Specific design information for the culvert is provided.

DOGM rule R645-300-121.150 addresses mining activity within 100 feet of a public road right-of-way. Written approval is required from the government agency that has jurisdiction over the public road before DOGM will approve the permit.

Approval is requested from Carbon County to use the Dugout Canyon Road to access the proposed access road and pond.

Best Regards,

David G. Spillman, P.E.
Technical Service Manager

Enclosures: Refuse Pile Location Maps,

CC: K. Tatton, C. Hansen and B. King

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 2

RA Chapter 2

RA Table 2-2

Plates: RA Plate 2-1 & 2-2

RA Attachment 2-2

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

CHAPTER 2

SOILS

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CHAPTER 2

SOILS

210 INTRODUCTION

This chapter and associated appendices address the data required for the refuse pile site for the Dugout Canyon Mine. The M&RP and this document contain pertinent information relating to identification, management, and reclamation activities associated with the soil resources present in the disturbed area of the Dugout Canyon Mine. The soil studies were conducted in accordance with the Utah Division of Oil, Gas, and Mining guidelines that were in effect at the time each study was conducted. The site specific soil survey conducted for this permit application was conducted in accordance with the standards set by the National Cooperative Soil Survey and analyzed according to Table 1 of the Division's "Guidelines for the Management of Topsoil and Overburden for Underground and Surface Coal Mining" (Leatherwood and Duce, 1988).

220 ENVIRONMENTAL DESCRIPTION

The site is located at an elevation of about 5,900 feet on a well-drained bench (pediment) composed of gravelly to stony alluvial deposits, which overlie the Mancos Shale formation. Pinyon-Juniper, sagebrush, and various grasses are the dominant vegetation in the area. Climatological information is provided in RA Attachment 7-3~~5~~.

221 Prime Farmland Investigation

Refer to a letter included in RA Attachment 3-1, which states that the area of the Dugout Canyon Road cannot be considered as prime farmland and the refuse pile area is immediately adjacent to the road.

222 Soil Survey

222.100 Soils Map

A description of the soils within the refuse pile area on an Order III soil survey level can be found in the SCS "Soil Survey of the Carbon County Area" (Jensen, 1988). A copy of the soil descriptions from the Order III survey has been included in Appendix S-5 of RA Attachment 2-1. Information pertaining to the soils associated with the construction of the sediment pond emergency spillway is included in RA Attachment 2-1. ~~once the data was collected and reported by soil scientist Dan Larsen. No disturbance to the spillway area soils will occur until the information has been collected for incorporation into the attachment, including soil descriptions and estimated salvage quantities.~~

An Order I soil survey was conducted of the refuse pile site in September 1999. Descriptions of the site soils are derived from ten pit locations and twenty-two soil samples. Based on the soil descriptions and other site observations, thirteen soil map units have been identified. The map units are shown on RA Plate 2-1 and in RA Attachment 2-1. The locations of the soil test pits excavated during the survey are shown on Map SM-1, RA Attachment 2-1.

222.200 Soil Identification

Following is a list of the soils found in the general area of the storage area as mapped by the SCS (Jensen, 1988).

Map Unit	Soil Identification
33	Gerst-Badland-Rubbleland complex, 15 to 50 percent slopes,
48	Haverdad loam, 1 to 8 percent slopes,
49	Haverdad loam, alkali, 0 to 3 percent slopes,
50	Haverdad loam, moist, 1 to 5 percent slopes,
66	Mivida gravelly fine sandy loam, 3 to 8 percent slopes
113	Strych stony loam, 3 to 15 percent slopes.

The SCS descriptions for the soils are included in Appendix S-5 of Attachment 2-1.

222.300 Soil Description

The description of the soils is based on the following information: taxonomic classification, horizon name and depth, color, texture (percent sand, silt, and clay), consistence, structure, percent rock fragments and organic matter, saturation, pH, EC, SAR, and solubility of calcium, magnesium, and sodium. This information is included in the soil test pit logs in RA Attachment 2-1, Appendix S1 and the lab data sheets included in RA Attachment 2-1, Appendix S3 of this submittal. RA Table 2-1 presents a summary of the soil unit features. The description of soils outside the disturbed area boundary has been taken from the SCS (Jensen, 1988).

The site has gravelly and cobbly soils of the Strych series over much of the area (Jensen, 1988). The project area is primarily disturbed with little evidence of natural soils in place. Original surface soils were stripped by previous site activities. Therefore, the natural soils are basically lacking except at the edges of the site and outside the disturbed area boundary. The remaining soil materials generally consist of coarse alluvium of varying thickness covering the Mancos Shale. In some places the shale is at or near the surface.

222.400 Soil Productivity

The data obtained from soil testing are provided in Appendix S3 of RA Attachment 2-1. A table showing depth and the number of samples taken from each backhoe pit location (Soil Pits DCW1 through DCW10) can be found in Appendix S3.

A summary of the soil testing results and ratings are provided below:

PH - All samples rated good, with a range of 6.9 to 7.8.

% Saturation - 17 samples rates good (25.1 to 45.3) and 5 samples rated fair (21.6 to 24.9).

Electrical Conductivity - 17 samples rates good (0.038 to 1.93 umhos/cm) and 5 samples rated fair (2.12 to 4.68 umhos/cm).

Sodium Adsorption Ratio - 20 sampled rated good (0.56 to 3.71) and 2 samples rated fair (4.64 and 6.03).

Texture - 12 samples rated good (loam and sandy clay loam) and 10 samples rated fair (clay loam and silty clay loam)

Available Water Capacity - 6 samples rated good (0.11 to 0.14 inches per inch) and 16 samples rated fair (0.05 to 0.10 inches per inch)

Boron - All samples rated good (0.05 to 0.50 ppm)

Selenium - All samples rated good (0.02 ppm or less)

Acid/Base Potential - All samples rated good (90.0 to 282 0 T/1000 tons)

Tests not used in the UDOGM rating criteria indicated low phosphorus, nitrogen, and sulfur levels. Calcium carbonate content is relatively high, with a range of 9.3 to 26.9 percent. Organic matter is low although there are pockets of woody materials in various sample locations. The soils were determined to be acceptable for use in site reclamation.

A summary of the sediment pond spillway soil testing results and ratings for four samples are: pH - samples rated good, with a range of 7.5 to 7.6; % Saturation - samples rates good (26 to 35.4); Electrical Conductivity - samples rated good (0.40 to 0.58 umhos/cm); Sodium Adsorption Ratio - samples rated good (0.53 to 1.05); Texture - samples rated good (sandy loam and sandy clay loam); Available Water Capacity - samples rated good; Boron - samples rated good (0.21 to 0.31 ppm); Selenium - samples rated good (less than 0.02 ppm) and Acid/Base Potential - All samples rated good (115 to 150 t/1000 tons).

223 Soil Characterization

Daniel M. Larsen, Professional Soil Scientist, performed the soil survey described in this chapter and included as RA Attachment 2-1, in accordance with the standards of the National Cooperative Soil Survey.

224 Substitute Topsoil

All soil resources to be removed from the refuse pile site qualify as growth media but not as topsoil. However, CFC may use selected overburden materials as a substitute or supplement to the salvaged soil.

If necessary for reclamation of the refuse pile, substitute topsoil/growth medium will be salvaged from a borrow area approximately 3/4 mile southeast of the refuse pile. The borrow area is located on lands owned by the permittee (Portions of the E1/2 NE1/4 SW1/4, W1/2 SE1/4, Section 17, T14S R12E). The borrow area has sufficient soil, in addition to the soils previously salvaged or available for salvage at the refuse site to cover the refuse pile with 4 feet of material. Refer to Section 233 and RA Attachment 2-3 for additional information.

Prior to salvaging soil to cover the waste at the refuse pile, 12- inches of soil will be salvaged from the borrow area to be used to reclaim the borrow area. This soil will be stockpiled in berms around the area to be salvaged. An additional 24 to 40 inches of soil will then be salvaged from the borrow area and transported to the refuse pile site to be used as cover over the waste in preparation for reclamation.

At the borrow site the southwestern quarter will be salvaged first, followed by the northwestern quarter (SB1 thru SB5, Figure 2, RA Attachment 2-3). Only the quantity of soil necessary for reclamation will be removed from the borrow area, thus if sufficient substitute soil is available from these areas, the area containing sites SB6 thru SB9 shown on Figure 2 will remain intact and undisturbed. The soil salvage will be between gullies, the boundary of the borrow area on the southern, eastern and western edges are gullies as drawn on Figure 2, including a gully running through the middle of the borrow area site separating samples sites SB1 thru SB5 from sites SB6 thru SB9 (Figure 2, RA Attachment 2-3).

230 OPERATION PLAN

231 General Requirements

231.100 Removing and Storing Soil Methods

The refuse pile area has been the site of activities since the early 1900's. At the time of the initial disturbances, topsoil was apparently not salvaged; however during the excavation of gravel in 1998 - 1999 some soil was salvaged. These salvaged soils will be included in the soil stockpiles for the refuse pile (RA Plate 5-1). The methods described for soil salvage herein will be followed when removing and storing soil resources currently in-place.

Soil salvage will take place at the beginning of site use for all areas within the disturbed area boundary to be used immediately. ~~There is no disturbance planned for the areas designated as H and J on RA Plate 2-1 except for the area to be disturbed for the construction of the sediment pond emergency spillway. Topsoil and subsoil will be salvaged and stockpiled from the area disturbed during the construction of the spillway.~~ The removal of salvaged soils will include all horizons~~, except in soils salvage areas H and J~~ (RA Plate 2-1)~~. where no salvage of soils is currently planned except as state above~~. These materials will be stored in graded stockpiles and seeded to promote surface stabilization or utilized on site for contemporaneous reclamation. The seed mix to be used will be the interim seed mix described in Chapter 3, Section 341.200. At the time of the 1999 Soil and Geotechnical Surveys, the area designated a "L" in the soil survey was described as being a pile of gravel (on top of the soil), the gravel has since been removed from the site (2002). The soils available for salvage in area "L" are assumed to be similar to those in area "M". As recommended by the Division under R645-310-232.500 of the October 24, 2002 Technical Analysis two piles have been created, one stockpile for topsoil and the second for subsoils. Areas D, E, F plus areas K and G designated on RA Plate 2-1 will be salvaged and placed in the topsoil pile. The majority of the salvaged topsoil come from the G and F soil units noted on the soils map. The remainder of the areas to be salvaged will be placed in the subsoil stockpile. Daniel M. Larsen, Professional Soil Scientist was on site during the salvage operations and determined in which pile the salvaged soils were placed.

The operator will endeavor to remove and store as much soil as possible in the designated stockpiles, thereby maximizing the protection of the soil resources of the site. The salvaged soil will be treated in compliance with R614-201-234.300.

231.200 Suitability of Topsoil Substitutes/Supplements

See Section 233.200.

231.300 Testing of Topsoil Handling and Reclamation Procedures Regarding Revegetation

See Sections 232 through 234 and Section 240.

231.400 Construction, Modification, Use, and Maintenance of Topsoil Storage Piles

See Section 234.

232 Topsoil and Subsoil Removal

232.100 Topsoil Removal and Segregation

Due to the disturbed nature of the site area, all available soil materials will be removed and stockpiled, since the soil resource is limited on the site (refer to Section 231.100). RA Plate 2-1 shows the areas of soils to be stripped and the approximate depth ranges for each soil. ~~RA Table 2-2 presents an estimate of the soil materials that are available for salvage from each of the soil units within the disturbed area.~~ Supporting calculations are presented in RA Attachment 2-2. The estimate is based on an average of the recommendations of Mr. Larsen's soils report presented in RA Attachment 2-1. During the actual salvaging activities, efforts will be made to maximize the soil volume to be salvaged.

A professional soil scientist will be on-site during soil salvage operations to monitor and supervise salvage activities for the purpose of maximizing soil salvage volumes, quantities and to determine medium to be left in place (i.e. gravel, boulders). Should a professional soil scientist be unavailable, a professional with knowledge and experience in soil salvage (i.e. UDOGM Soil Reclamation Specialist) will be used. This commitment also applies to soil salvage from the borrow area.

232.200 Poor Topsoil

The soils on the site have been classified as fair to good for sustaining vegetation. Therefore, all available soil materials will be removed and stockpiled.

232.300 Thin Topsoil

Soil that is less than 6 inches thick will be removed with the immediately underlying unconsolidated materials and the mixture will be treated as salvageable soil.

232.400 Minor Disturbances Not Requiring Topsoil Removal

Small Structures. Soil will not be removed prior to construction that would result in only minor disturbances. Such construction activity includes work on small structures such as signs, fence lines, and etc.

Vegetation. The operator will not remove soil for minor disturbances where such activity will destroy vegetation or cause erosion.

232.500 Subsoil Segregation

The soil horizons will be removed and stockpiled together during the construction of the site, as described in Section 234.

232.600 Timing

Soil removal will take place after all vegetation that could interfere with soil salvage has been removed.

232.700 Topsoil and Subsoil Removal Under Adverse Conditions

Due to the disturbed nature of the site, soil horizons will be removed together, except where natural conditions render operations hazardous or detrimental to soils outside the disturbed area.

Conventional Machines. In localities 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.

Substitute Topsoil. Importing of substitute topsoil may be required depending upon the final height of the refuse pile, refer to Sections 224, 233 and 242.

233 Topsoil Substitutes and Supplements

233.100 Overburden Materials Supplementing and/or Replacing Topsoil

Selected overburden materials may be used below the salvaged soils during reclamation operations, if sufficient soil materials are not available for the proposed reclamation activities. Where overburden materials are used, the operator commits to demonstrating to the Division prior to salvaged soil emplacement that the overburden materials are non-toxic, non-acid forming, and non-combustible. Refer to Section 536.200 discussion of waste sampling/testing.

The mixing of coal waste and subsoil is discussed in Section 242 and RA Attachment 2-2.

233.200 Suitability of Topsoil Substitutes and Supplements

The description of the substitute topsoil from the borrow area is based on the following information: taxonomic classification, horizon name and depth, color, texture (percent sand, silt, and clay), consistence, structure, percent rock fragments and organic matter, saturation, pH, EC, SAR, and solubility of calcium, magnesium, and sodium. This information in the soil test pit logs and the lab data sheets are included in RA Attachment 2-3 of this submittal.

The material from the borrow area will be available should there be a need for supplemental topsoil/growth medium to reclaim the refuse pile. The analysis of the soil test pit samples indicate that the physical and chemical properties are comparable to the soils salvaged at the refuse pile site. The substitute topsoil/growth medium will be left in place and be utilized only if needed for reclamation of the refuse pile site.

The depth and number of samples taken from each backhoe pit location (Soil Pits SB1 through SB9) can be found in RA Attachment 2-3 on the laboratory soil analysis report. The soil pit locations are shown on Figure 2, RA Attachment 2-3. Photographs of the pits and borrow area are located in RA Attachment 2-3.

A summary of the borrow area soil testing results and ratings are provided below:

PH - Samples rated from mildly alkaline to moderately alkaline, with a range of 7.6 to 8.4.
% Saturation - 42 samples rated good (25 to 46.4) and 1 sample in SB8 rated fair (23.8).
Electrical Conductivity - 24 samples rates good (0.22 to 1.90 umhos/cm) and 14 samples rated fair (2.12 to 4.83 umhos/cm) and 5 samples rated poor (5.39 to 12.2 umhos/cm).
Texture - 41 samples rated good (loam, sand loam and sandy clay loam) and 2 samples rated fair (silt loam and silty clay loam)
Boron - 36 samples rated good (0.12 to 0.45 ppm), 7 samples rated fair (0.51 to 1.14 ppm)
Selenium - 34 samples rated good (0.02 ppm or less), 9 samples rated fair (0.04 to 0.28)
Acid/Base Potential - All samples rated good (124 to 197 T/1000 tons).

Borrow Area Soil Salvage Procedures - The soil borrow area will only be impacted during the short period during which the refuse pile is being reclaimed. The top 12-inches of soil from the borrow area will be removed/salvaged and placed as berms surrounding the salvage area. Once the salvage of soil to reclaim the waste rock site has been completed, the soil from the borrow area stored in the berms will be replaced, deep gouged, mulched and seeded. These activities should insure adequate revegetation potential at the borrow area.

Refer to Section 224 ~~and RA Table 2-2~~ for addition information about the borrow area.

233.300 Physical and Chemical Analyses

Topsoil substitutes and supplements may be used for the refuse site area. The laboratory soil analysis report for the borrow area is included in RA Attachment 2-3.

The rate of sampling for the overburden beneath the soil will be sampled as discussed in Section 536.200.

Certification of Reclamation Topsoil Suitability. The borrow area substitute topsoil was certified by an approved laboratory in accordance with at least one of the following: Soil Conservation Service published data and technical guides, state agricultural agency, Tennessee

Valley Authority, BLM - USFS published data, physical and chemical analyses results, field-site trials, or greenhouse tests.

233.400 Testing of Substitute Topsoil

Only the substitute topsoil used in lieu of, or in conjunction with, on-site overburden and soil will be tested as described in Section 233.300.

234 Topsoil Storage

Soils salvaged from the site will be stockpiled on the site. Refer to Plates RA 5-1 and 7-1 for the stockpile location. ~~The estimated volumes of soil to be stockpiled are presented in RA Table 2-2.~~

234.100 Topsoil Stockpiling

Soil removed will be stockpiled for later use in reclamation operations when it is impractical to promptly redistribute the materials on regraded areas. Refer to Plates RA 5-1 and 7-1 for the location of the soil storage area. Because the soil salvage quantities are estimated, the actual contours and corresponding cross-sections are approximate. The final soil stockpiles will be reflected in the as-built drawings for the site. RA Plate 2-2 will reflect as-built drawings of the stockpiles soils.

It is anticipated that the piles will be constructed in horizontal lifts of 1.5 to 2.0 feet. Tracked equipment will be used to reduce compaction. The stockpiles will be graded to a maximum slope of 2:1, where space is available a slope of 3:1 and seeded to promote surface stabilization. The interim reclamation seed mix described in Chapter 3, Section 341.200 will be used for this purpose.

The stockpiles will be kept isolated from the main area of the refuse site to protect the material from contaminants and unnecessary compaction that would interfere with vegetation. A sign will be installed on the stockpiles to identify ~~one as a~~ topsoil storage areas and ~~the second as the~~ subsoil storage areas. The stockpiles will be protected from wind and water erosion by being revegetated with a quick growing vegetative cover (interim seed mix) and by installing berms around the stockpiles to help trap sediment coming off the stockpiles. The boulders designated in area “K” (RA Plate 2-1) will be stockpiled separately from the soils salvaged from the refuse site. The boulders will either be placed along the perimeter of the substitute topsoil pile, access road, on top of the subsoil pile or will be transported to the rock stockpile at the Dugout/Soldier Canyon Mine topsoil stockpile adjacent to the Soldier Canyon Road.

234.200 Stockpiled Topsoil

Stable Stockpile Site. Stockpiled materials will be placed on a stable site as described in Section 234.100.

Protection from Contaminants and Compaction. Stockpiled soil will be protected from contaminants and unnecessary compaction. To protect the soil from contaminants and unnecessary compaction that could interfere with vegetation, the stockpiles will be isolated from the main refuse pile area (Section 234.100). A sign designating "topsoil" will be installed on the stockpile.

The stockpile will be constructed in such a manner as to allow equipment access around the base of the stockpiles for repair of the surfaces and diversion structures as needed.

Furthermore, berms will be constructed around the stockpiles to further separate the soils from the materials stored on the site. The berm will be constructed as specified in Chapter 7.

Wind and Water Erosion Protection. The stockpiles will be protected from wind and water erosion by prompt establishment and maintenance of a vegetative cover. Berms will be constructed around the stockpiles to help trap sediment runoff from the stockpiles. Refer to Section 242 .100 for additional protection information.

Topsoil Redistribution. A limited quantity of stockpiled soil may be distributed on the refuse pile to determine the quantity of soil cover necessary to meet revegetation reclamation requirements. The remainder of the stockpiled soil will not be moved until redistributed during 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 refuse pile operations may be temporarily redistributed upon approval by the Division and modification of this M&RP.

Host Site. Soil relocation may occur provided that such action does not permanently adversely affect soil of the host site.

Topsoil Suitability. Stockpiled soil relocation may occur provided the material is retained in a condition more suitable for redistribution than if stockpiled.

240 RECLAMATION PLAN

241 General Requirements

Reclamation of the site (soil redistribution, amendments, and stabilization) is discussed in Sections 242, 243, and 244, respectively.

242 Soil Redistribution

242.100 Soil Redistribution Practices

The stored soil will be redistributed after re-contouring of the site has occurred during reclamation activities. The refuse pile will be covered with a minimum depth of the following; 1 foot of equally blended coal waste and subsoil, approximately 2.6 feet of subsoil and approximately 0.4 feet of cover the refuse pile is 117,403 ~~91,720~~ CY.

The topsoil extracted from southern expansion will be used to provide contemporaneous reclamation and will provide additional soil to the current topsoil stockpiles. Topsoil pile #3 will be added and stored in subsoil pile's #2 location. The subsoil extracted from southern expansion will be used to provide contemporaneous reclamation and will add additional soil to the current subsoil stockpile #1. The subsoil pile #2 will be used for contemporaneous reclamation. The contemporaneous reclamation will commence on the northeastern area of the refuse pile and will continue to the southern end of the pile as needed. See RA Plate 2-2 for more details.

There are currently topsoil and subsoil stockpiles located in the northeastern and southwestern portions of the site. Aero-Graphics, Inc. surveys estimated the volume in each stockpile as:

~~Topsoil Stockpiles volume = 8,549 CY~~
Topsoil Stockpile #1 volume =5,612CY (Existing) + 4,088CY (Phase II Expansion) = 9,700CY
Topsoil Stockpile #2 volume = 2,937 CY (Existing)
Topsoil Stockpile #3 volume = 4,426 CY (Phase II Expansion Addition)
Contemporaneous Reclamation Topsoil volume = 3,086 CY (From Phase II Expansion)
Total Available Topsoil volume = 9,700 CY+2,937 CY+4,426 CY+3,086 CY = 20,149 CY

~~Subsoil Stockpile Volume = 11,964 CY~~
Subsoil Stockpile #1 volume = 9,211 CY (Existing) + 2,920 CY (Phase II Expansion) = 12,131 CY
Contemporaneous Reclamation Subsoil volume = 23,933 CY (From Phase II Expansion)
Total Available Subsoil volume = 12,131 CY+23,933 CY = 36,064 CY

Total anticipated cover material ~~currently~~ available in the stockpiles or contemporaneously reclaimed is estimated to be 56,213 ~~20,513~~ CY.

~~During reclamation the berms and embankments that create the perimeter ditches and sediment pond will be pulled back to blend the undisturbed areas into the reclaimed refuse pile. The process will generate approximately 2,947 CY of additional cover material. The total available cover material at the refuse site is 23,460 CY~~.

To reduce the volume of imported cover material the bottom foot of cover material will be a blend of coal waste and subsoil. Equal portions of coal waste and subsoil will be used to create this blended cover material. Thus, the volume of available cover material may be increased by 14,675 ~~11,465~~ CY of subsoil (see RA Attachment 2-2) to a total of 70,888 ~~34,925~~ CY.

The total volume of material required to cover the pile minus the available cover material equals the volume ~~Volume~~ of cover material to be imported = 117,403 – 70,888 = 46,515 ~~91,720 – 34,925 = 56,795~~ CY (see RA Attachment 2-2)

Summary of Volumes

Volume of material needed to obtain 4 feet of cover = 117,403 ~~91,720~~ CY
Total cover material available at the site = 56,213 ~~23,460~~ CY
Vol. of coal waste blended with sub-soil to produce the first foot of cover = 14,675 ~~11,465~~ CY
Vol. of subsoil blended with coal waste to produce the first foot of cover = 14,675 ~~11,465~~ CY
Volume of subsoil and topsoil anticipated ~~needed~~ to cover the pile = 102,728 ~~80,255~~ CY
Volume of cover material to be imported from borrow site = 46,515 ~~56,795~~ CY

Soils will be handled when they are in a loose or friable condition.

Contemporaneous Reclamation: In the future, the applicant may decide to demonstrate that two feet of cover material over the refuse pile is sufficient to meet reclamation standards for bond release. Additional information and clarification of the project will be provided at that time. An area on the refuse pile will receive reclamation treatments contemporaneously to justify the decrease of required cover soils from four feet to two feet for final reclamation.

During the southern expansion, contemporaneous reclamation will occur on the northeastern potion of the refuse pile. A two feet cover test plot will be designated in this area. See RA Plate 2-2 for the location.

Soil Thickness: The topsoil will be distributed to the disturbed areas illustrated on ~~Figure~~ RA Plate 5-1.

Currently, it is planned that the refuse pile portion of the site be covered with approximately 48 inches of soil. Based on the proposed pile configuration this will require about 117,403 ~~91,720~~ CY of soil. The remainder of the site area, not used for refuse storage will be covered with approximately 6 inches of substitute topsoil. Calculations of the soil cover volumes are presented in RA Attachment 2-2. ~~Soils in the area designated as H and J (approximately 11.2 acres) are not currently planned for salvage, except in the area of the pond spillway (RA Plate 2-1).~~

Compaction. To prevent compaction of topsoil, soil-moving equipment will refrain from unnecessary operation over spread soil. Front-end-loaders and other wheel-mounted equipment may be used to transport and dump soil. However, to minimize compaction, only track-mounted equipment (e.g. bulldozers, trackhoes) will be used to spread the soil. The soil will be loosened prior to seeding as described in Section 341.200.

Erosion. Care will be exercised to ensure the stability of soil on graded slopes to guard against erosion during and after soil application. Erosion control measures will include but not be limited to extreme surface roughening (also known as pocking and gouging). The addition of erosion control matting will be placed along the pile slopes as needed. A 10 foot wide terrace will be placed along the southern slope of the refuse pile at approximately 5,925 feet elevation with a 10-foot variance to allow for adjustments to tie into disturbed ditches. The terrace will provide a means to convey runoff and aid in sediment control.

242.200 Regrading

Since the site has been disturbed by previous activities and will be used to permanently store coal mine waste, the area will not be returned to the original geometric configuration. Prior to soil redistribution, the disturbed area will be graded to meet the proposed final reclamation topography (RA Plate 5-2~~3~~).

The surface of the refuse pile will be left in a roughened state and in addition will be ripped prior to the application of soil. After the 1st lift of subsoil is placed, the surface of the refuse pile will be ripped again to a depth of approximately 12 inches in an effort to promote root penetration and to mix the top layer of the refuse with the subsoil. Refer to Section 341.200 for further discussion of roughening methods.

The second type of surface consists of roads, perimeter ditches, etc. which may be compacted through their use. The surface will be ripped to a depth of approximately 1.5 to 2 feet with a ripper-equipped tractor or other appropriate equipment where possible to reduce surface compaction, to assure soil adherence, and promote root penetration. Following the ripping of the soils and the application of stockpiled soils, extreme roughening techniques will be applied. A backhoe or trackhoe will be used to create microbasins with a minimum depth of 18" and the width of the bucket. Soil removed to form the microbasins will be dropped approximately 2 to 3 feet above the microbasin onto the soil surface.

242.300 Topsoil Redistribution on Impoundments and Roads

The sedimentation ponds and embankments will be breached and reclaimed with the other surface disturbed areas. Similarly, reclamation of abandoned roads will also follow the same technique as for other disturbed areas.

243 Soil Nutrients and Amendments

Soil nutrients and amendments may be applied to the redistributed soil as necessary, to establish the vegetative cover. The type and rate of application will be determined just prior to contemporaneous and final reclamation activities based on analyses of samples collected from the stockpiled soil materials. The soils will, at a minimum, be tested for pH, EC, total carbon, SAR, phosphorus, nitrate-nitrogen, and water holding capacity.

In the event that the topsoil/subsoil piles are moved adjacent to the Dugout Canyon Road in conjunction with the pile expansion, organic matter will be incorporated into topsoil/subsoil piles when the soils are relocated. Vegetation growing on the piles was incorporated into the topsoil/subsoil piles as they were relocated. The future type and rate of application will be determined by the applicant and UDOGM reclamation specialists prior to moving the soils during reclamation activities.

244 Soil Stabilization

244.100 Protection and Stabilization of Surface Areas

Reclaimed areas will be stabilized to control erosion by application of one or combinations of a mulch, extreme surface roughening, or other appropriate methods. Rills and gullies will be regraded (Refer to Section 244.300). Seeding will be accomplished using BTCA methods suitable for reclamation. These methods may include, but not necessarily limited to: application of seeds, and mulch with a long fiber tackifier. Refer to Section 341.200 for a discussion of the seeding and the incorporation of straw/hay into the soil. Additional and more detailed discussions regarding soil protection during and after final reclamation can be found in Chapter 5 of this submittal. Methods of revegetation to be employed at final reclamation at this site are discussed in more detail in Chapter 3.

244.200 Mulch Application

Mulch will be applied as discussed previously in this chapter and for a further discussion of revegetation practices to be utilized, see Chapter 3 of the approved M&RP.

244.300 Rills and Gullies

Postmining Land Use and Revegetation. Rills and gullies that disrupt the postmining land use or reestablishment of vegetative cover will be regraded and seeded. CFC will fill, regrade, or otherwise stabilize any rills or gullies deeper than nine (9) inches that form in areas that have been regraded and soiled. The areas adjacent to any rills or gullies, which have been filled, regraded or otherwise stabilized, will be reseeded or stabilized accordingly.

Water Quality. Rills and gullies that contribute to the degradation of stream quality will be regraded and be seeded.

250 PERFORMANCE STANDARDS

251 Topsoil, Subsoil, and Topsoil Supplements Management

Topsoil, subsoil, and topsoil supplements shall 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.

REFERENCES:

Jensen, E. H., and Borchert, J. W., 1988. Soil Survey of Carbon Area, Utah. Soil Conservation Service, United States Department of Agriculture, Washington D.C.

Leatherwood, J., and Duce, D., 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining.

RA TABLE 2-1

SOIL MAP UNIT FEATURES

Map Unit Symbol	Material	Depth to Shale	Texture	Rock Fragments (%)	Average pH
A	Shale	0 - 6"	Clay loam, silty clay loam	5 - 15	7.5
B	Gravelly Alluvium over Shale	20 - 40"	Loam, clay loam	20 - 60	7.3
C	Gravelly to Stony Alluvium	40 - 100"	Loam, clay loam, sandy clay loam	20 - 60	7.3
D	Non-gravelly Alluvium, some wind blown material	40 - 100"	Loam, clay loam, sandy clay loam	5 - 15	7.5
E	Gravelly Alluvium, small amount of refuse with coal on surface	40 - 100"	Clay loam, loam	15 - 45	7.5
F	Non-gravelly Alluvium (topsoil storage)	40 - 100"	Clay loam, sandy clay loam	5 - 15	7.0
G	Alluvium and woody materials	40 - 100"	Clay loam, sandy clay loam	15 - 30	7.3
H	Relatively Non-gravelly Alluvium (undisturbed)	60 - 100"	Loam, clay loam, sandy clay loam	5 - 25	7.4
I	Cobbly and Gravelly Alluvium	40 - 100"	Sandy clay loam, clay loam	25 - 65	7.5
J	Gravelly to Stony Alluvium over Shale	10 - 40"	Silty clay loam, clay loam, sandy clay loam	10 - 60	7.5
K	Boulders	-*	-	-	-
M	Shale with thin layer of Gravelly Alluvium	4 - 20"	Silty clay loam, sandy clay loam	5 - 40	7.5

*Refer to RA Plate 2-1 for description.

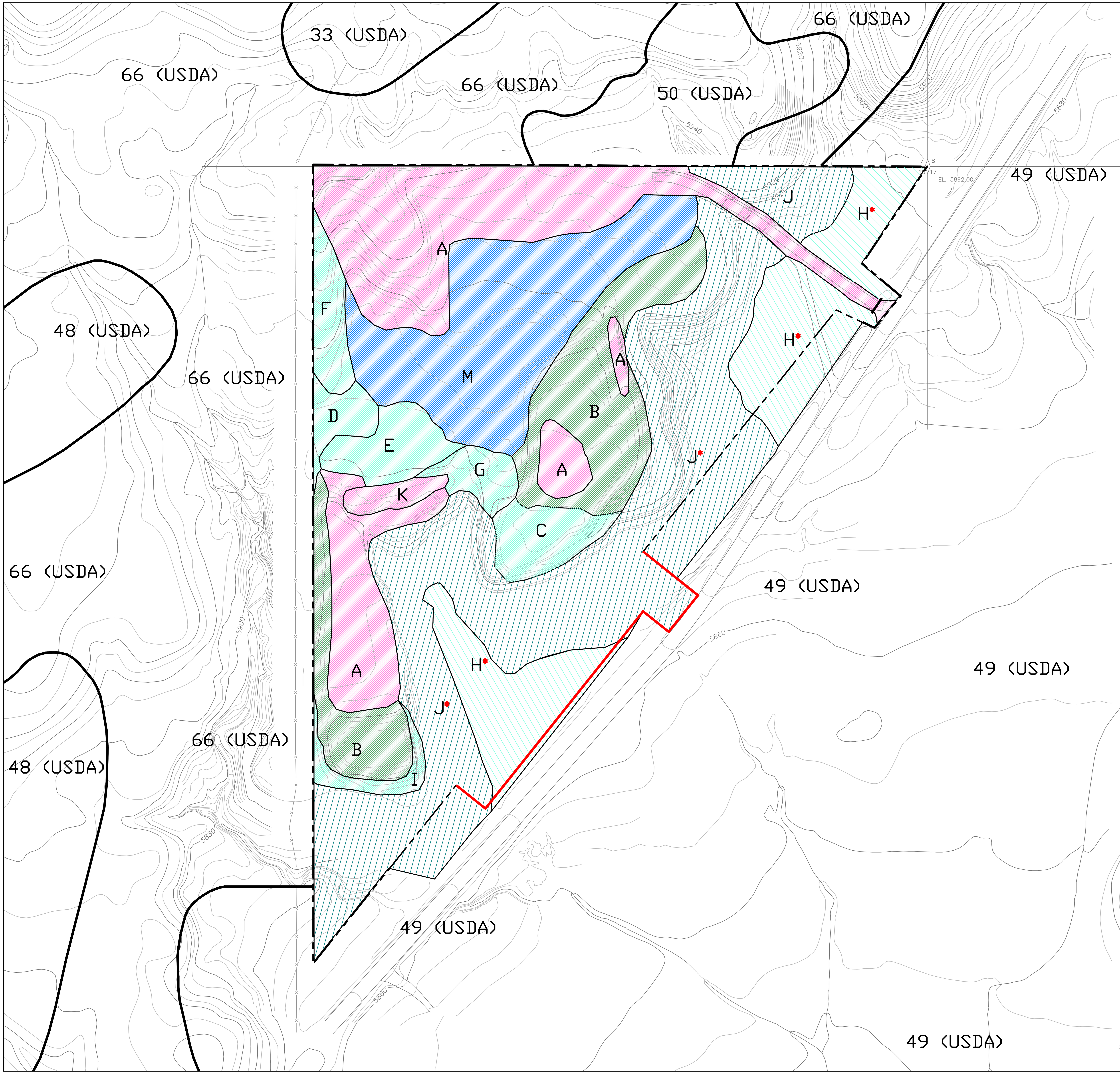
RA TABLE 2-2

SOIL SAVLAGE VOLUMES

AREA	VOLUME ANTICIPATED (CY)	VOLUME SALVAGED APPROXIMATE (CY)	
		Topsoil	Subsoil
A	4719		1,787
B	15,559		3,549
C	5,467		2,778
D	2,957	2,083	
E	4,616	1,313	1,066
F	3,393	2,423	
G	2,603	2,595	
I	2,356		
K	206		407
M	5,116		2,084
H & J (Spillway)		135	293
TOTAL	46,992 CY	8,549 CY	11,964 CY

Soil Borrow Area (approximate available soil) 106,000 CY

*Exact Subsoil and Topsoil volumes are found on RA Plate 2-2



LEGEND

A	Shallow soils on shale and exposed shale
B	Moderately deep gravelly soils over shale
C	Deep gravelly soils
D	Deep non-gravelly soils
E	Deep gravelly soils, mixed surface and subsoils; some coal
F	Deep relatively non-gravelly; salvaged soils
G	Mixed woody materials and gravelly soils
H	Deep, relatively non-gravelly soils; undisturbed
I	Deep cobbly soils; Strych series
J	Shallow and moderately deep cobbly soils over shale; undisturbed
K	Boulders, soil under boulder similar to "A"
M	Shallow soils over shale and moderately deep gravelly soils
33 (USDA)	Gerst – Badland – Rubble Land Complex, 15 to 50% Slopes
48 (USDA)	Haverdad Loam, 1 to 8% Slopes
49 (USDA)	Haverdad Loam, Alkali, 0 to 3% Slopes
50 (USDA)	Haverdad Loam, Moist, 1 to 5% Slopes
66 (USDA)	Mivida Gravelly fine Sandy Loam, 3 to 8% Slopes

SALVAGE QUANTITY (POTENTIAL)

0–6 inch salvage area

4–20 inch salvage area

20–40 inch salvage area

40–100 inch salvage area

DISTURBED AREA BOUNDARY AND PERMIT AREA BOUNDARY

~~* NOTE:~~
~~AREAS H AND J ARE NOT CURRENTLY PLANNED FOR SALVAGE OR DISTURBANCE (EXCEPT FOR SEDIMENT POND SPILLWAY, PLATE 5-1).~~

USDA Source:
Soil Survey of Carbon Area, Utah, 1988
U. S. Dept of Agriculture Soil Conservation Service.

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

0' 100'

PROJECT AREA LOCATED ENTIRELY WITHIN
SEC. 18, T. 14 S., R. 12 E., SLBM

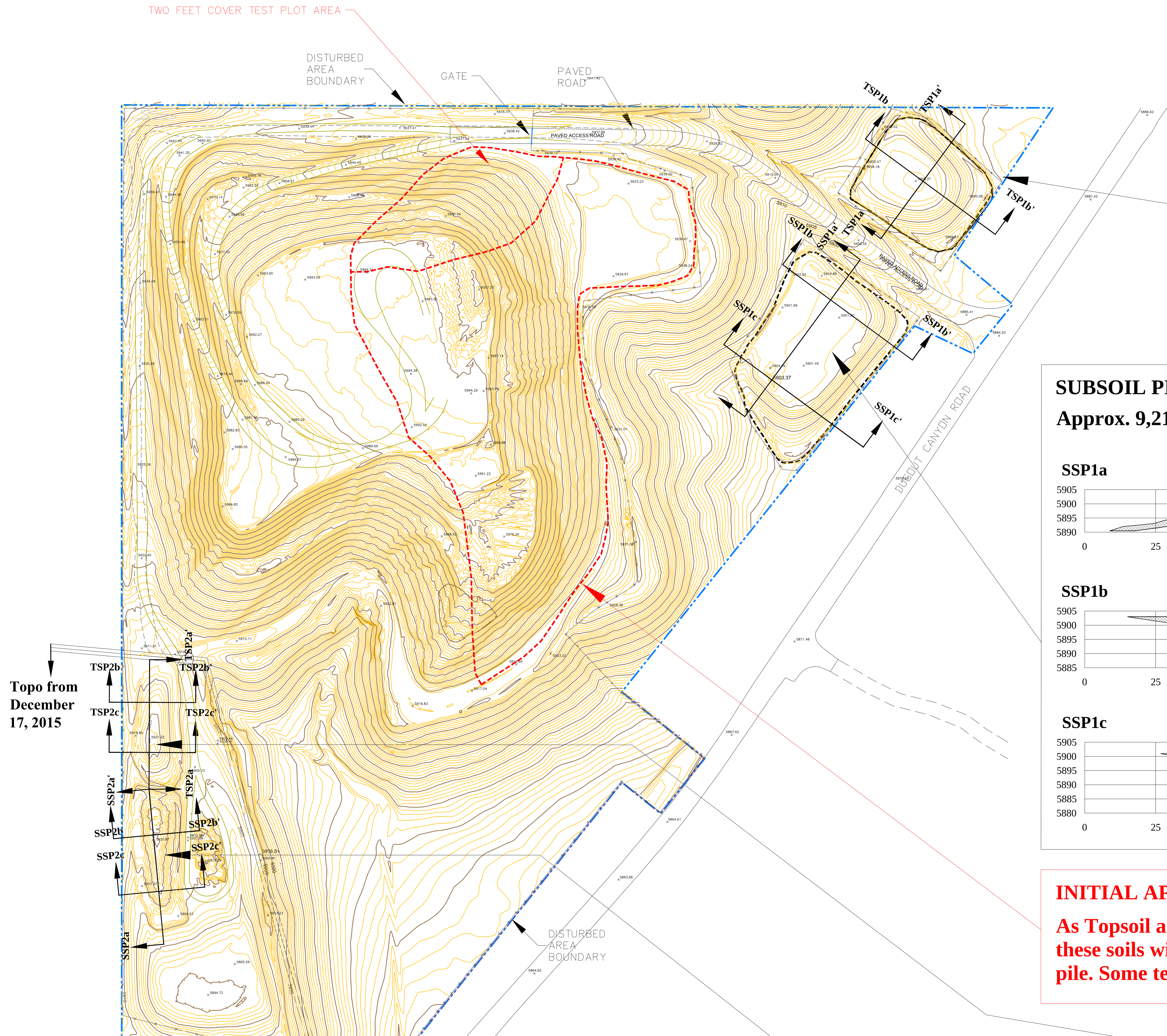
REVISION	
DATE	BY
01/07/03	RR
10/28/16	TAJ
12/28/16	BK

Canyon Fuel Company, LLC
Dugout Canyon Mine

SOILS MAP

Dugout Canyon Mine

DRAWN BY: SWF/TJS	DATE: FEB 2002 (EarthFax.ctb)	SCALE: 1"=100'
APPROVED BY: VSM	FILE NAME: RAPLATE 2-1.DWG	DRAWING OR MAP NUMBER RA PLATE 2-1

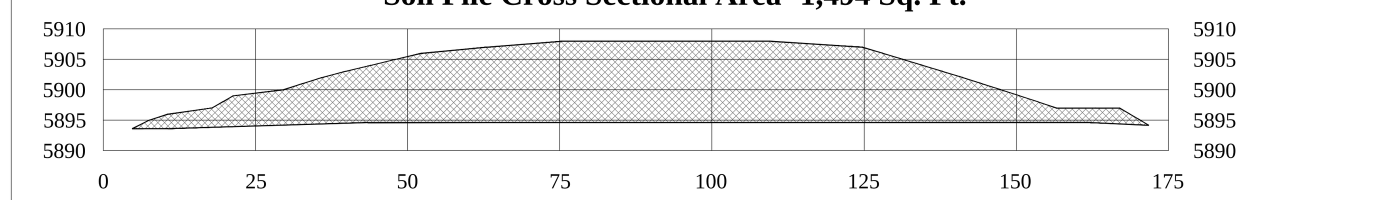


TOPSOIL PILE #1 STORAGE AREA

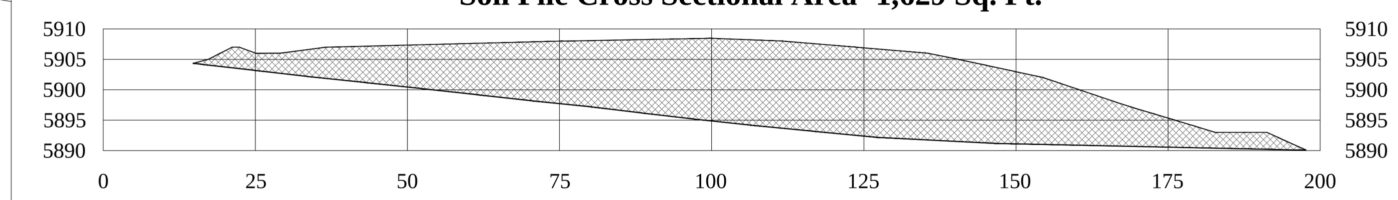
Base Topo - Olympus Aerial Survey
Dated June 9, 2008
Operational Topo - Aero-Graphics, Inc. Survey
Dated May 6, 2009

Approx. 5,612 Cu. Yd. (Will be expanded to approx. 9,700 Cu. Yd.)

TSP1a Soil Pile Cross Sectional Area- 1,494 Sq. Ft. **TSP1a'**



TSP1b Soil Pile Cross Sectional Area- 1,629 Sq. Ft. **TSP1b'**

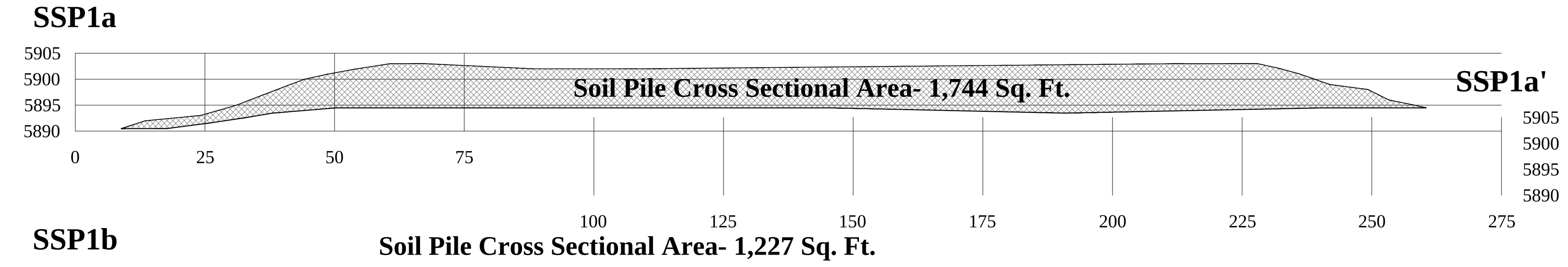


SUBSOIL PILE #1 STORAGE AREA

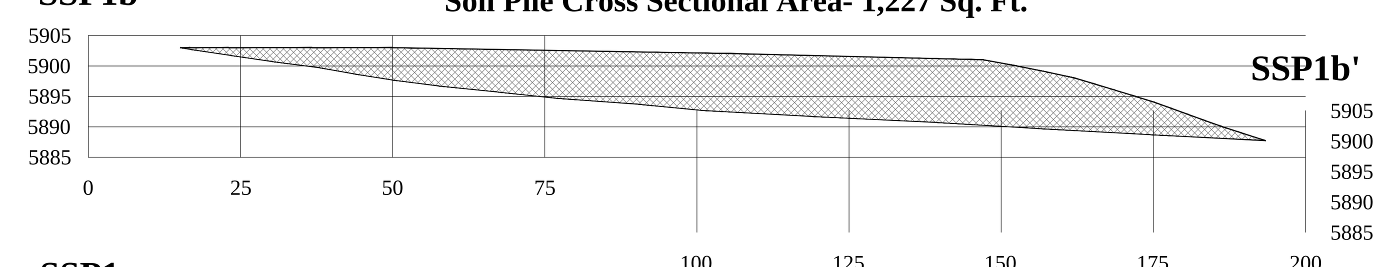
Base Topo - Olympus Aerial Survey
Dated June 9, 2008
Operational Topo - Aero-Graphics, Inc. Survey
Dated May 6, 2009

Approx. 9,211 Cu. Yd. (Will be expanded to approx 12,131 Cu. Yd.)

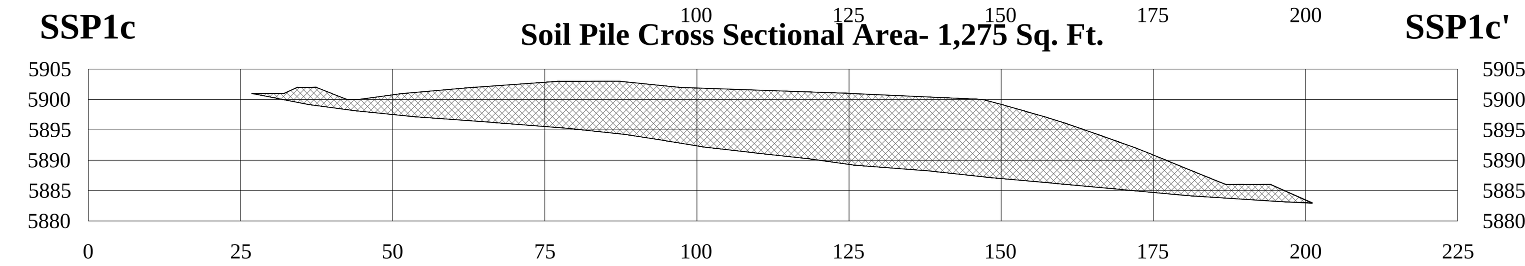
SSP1a Soil Pile Cross Sectional Area- 1,744 Sq. Ft. **SSP1a'**



SSP1b Soil Pile Cross Sectional Area- 1,227 Sq. Ft. **SSP1b'**



SSP1c Soil Pile Cross Sectional Area- 1,275 Sq. Ft. **SSP1c'**



INITIAL APPROXIMATE CONTEMPORANEOUS RECLAMATION AREA

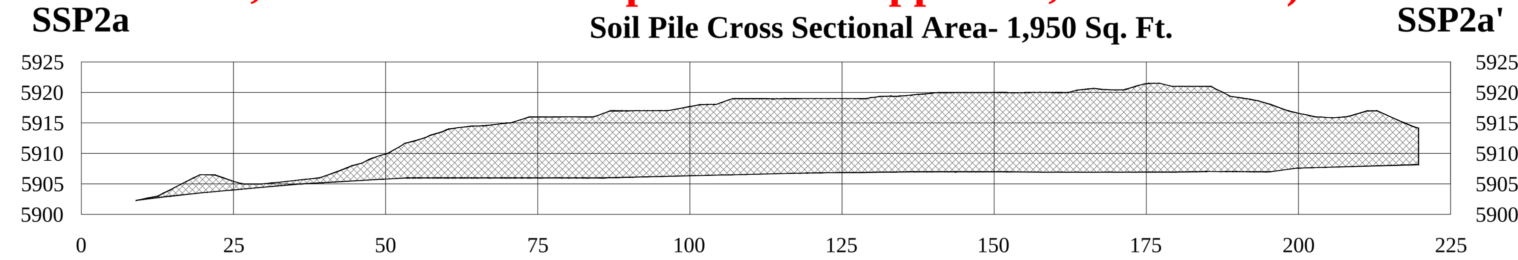
As Topsoil and Subsoil are removed from the southern expansion area of the refuse pile these soils will be contemporaneously reclaimed in the northeastern portion of the refuse pile. Some temporary storage of topsoil and subsoil may occur.

SUBSOIL PILE #2 STORAGE AREA

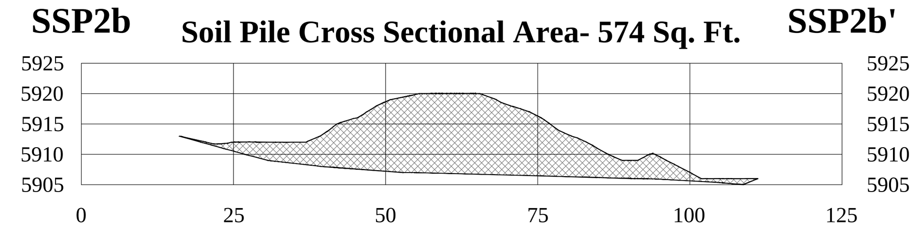
Base Topo - Aero-Graphics, Inc. Survey
Dated November 14, 2014
Operational Topo - Aero-Graphics, Inc. Survey
Dated December 17, 2015

Approx. 2,753 Cu. Yd. (Will be used for contemporaneous reclamation, new location of Topsoil Pile #3 approx. 4,426 Cu. Yd.)

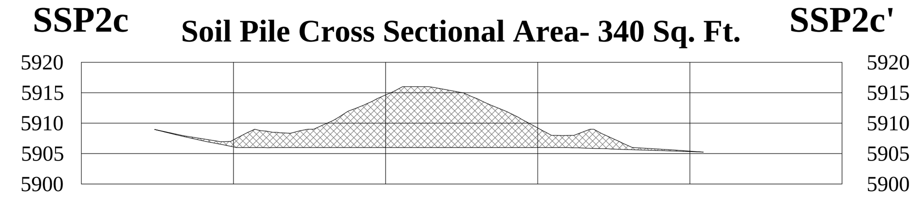
SSP2a Soil Pile Cross Sectional Area- 1,950 Sq. Ft. **SSP2a'**



SSP2b Soil Pile Cross Sectional Area- 574 Sq. Ft. **SSP2b'**



SSP2c Soil Pile Cross Sectional Area- 340 Sq. Ft. **SSP2c'**

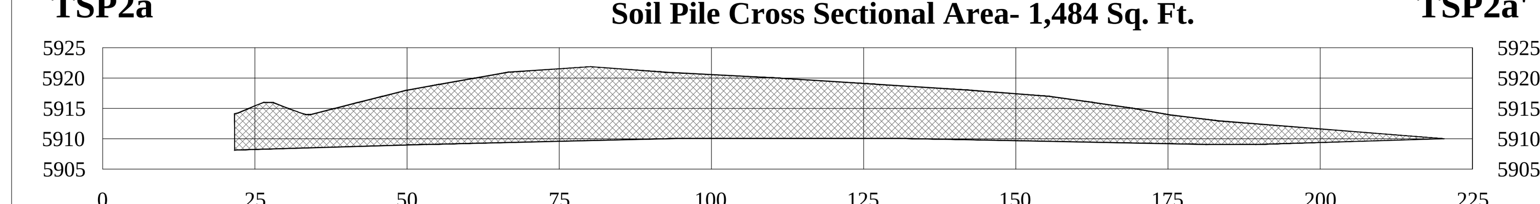


TOPSOIL PILE #2 STORAGE AREA

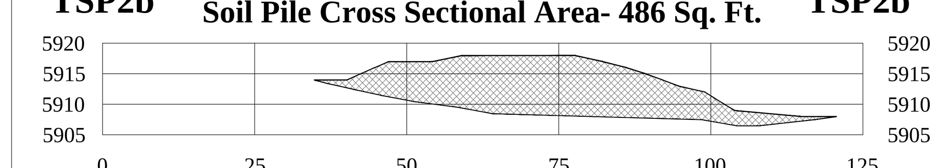
Base Topo - Olympus Aerial Survey
Dated June 9, 2008
Operational Topo - Aero-Graphics, Inc. Survey
Dated May 6, 2009 & December 17, 2015

Approx. 2,937 Cu. Yd.

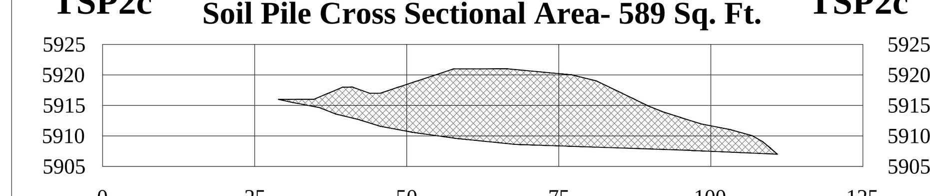
TSP2a Soil Pile Cross Sectional Area- 1,484 Sq. Ft. **TSP2a'**



TSP2b Soil Pile Cross Sectional Area- 486 Sq. Ft. **TSP2b'**



TSP2c Soil Pile Cross Sectional Area- 589 Sq. Ft. **TSP2c'**



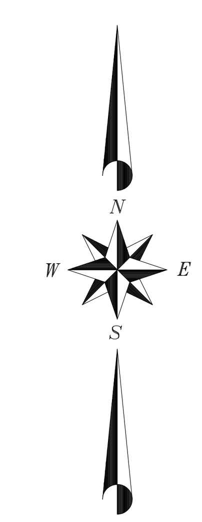
CROSS SECTIONS
SCALE: 1" = 25'

LEGEND

- DISTURBED AREA BOUNDARY AND PERMIT AREA BOUNDARY
- 5900 / 5895 OPERATIONAL CONTOURS
- CROSS-SECTION LOCATIONS
- FENCE LINE

NOTES

1. REFER TO RA PLATE 5-1 FOR MORE SURFACE DETAIL. THIS DETAIL WILL INCLUDE THE EXTENT OF THE PHASE II EXPANSION AND THE EXPANSION OF THE NORTHEAST TOPSOIL AND SUBSOIL STOCKPILES.
2. SUBSOIL STOCKPILE #1 AND TOPSOIL STOCKPILES #1 VOLUMES ILLUSTRATED WERE CALCULATED BY AERO-GRAPHICS, INC.- MAY 06, 2009.
3. TOPSOIL STOCKPILE #2 VOLUME ILLUSTRATED WAS ORIGINALLY CALCULATED BY AERO-GRAPHICS, INC.- MAY 06, 2009. SOME ADDITIONAL VOLUME WAS ADDED TO THE SOUTHERN END OF THIS STOCKPILE DURING THE PHASE I EXPANSION. THIS ADDITIONAL VOLUME WAS CALCULATED BY AERO-GRAPHICS, INC.- DECEMBER 17, 2015.
4. SUBSOIL STOCKPILE #2 WILL BE USED FOR CONTEMPORANEOUS RECLAMATION. TOPSOIL STOCKPILE #3 IS PROPOSED AND WILL BE PLACED IN SUBSOIL PILE'S #2 LOCATION.
5. THE INITIAL CONTEMPORANEOUS RECLAMATION AREA IS APPROXIMATELY 4.5 ACRES. DURING PLACEMENT OF SOIL, TOPSOIL & SUBSOIL MAY BE TEMPORARILY STOCKPILED AT THE TOP OF THE REFUSE PILE, BERMS. SILT FENCES, OR OTHER CONTROLS WILL BE USED TO RETAIN SEDIMENT FROM THE TEMPORARY STOCKPILES.



100' 50' 0' 100' 200' 300'

PROJECT AREA LOCATED ENTIRELY WITHIN
SEC. 18, T. 14 S., R. 12 E., SLBM
CONTOUR INTERVAL: 1'

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

REVISION	
DATE	BY
3/2015	TAJ
2/2016	DGS/JSE
10/2016	TAJ
12/2016	BK

Canyon Fuel Company, LLC
Dugout Canyon Mine

SOIL STOCKPILES
(AS BUILT)

Dugout Canyon Mine

DRAWN BY: STV/TAJ	DATE: March 10, 2015	SCALE: 1" = 100'	
APPROVED BY: DGS	FILE NAME: RAPlate 2-2.DWG	DRAWING OR MAP NUMBER	RA PLATE 2-2

RA ATTACHMENT 2-2
SOIL VOLUME CALCULATIONS

Reclamation Soil Thickness
Dugout Refuse Pile Site

The Refuse Pile is to be covered with 1 foot of equally blended coal waste and subsoil, approximately 2.6 feet of subsoil and approximately 0.4 feet of topsoil, to obtain a total depth of cover on the pile of 4 feet. The volumes of subsoil and topsoil needed to cover the pile are discussed below.

Area covered by the refuse pile= ~~548,552~~ 736,810 ft^2

To obtain the surface area to be covered by soil the above area must be adjusted to account for the 2:1 slopes of the refuse pile. A 2:1 slope increases the surface area by 11.8%.

Slope area = ~~393,449~~ 471,724 ft^2
Area of flatter space on top of the pile = ~~179,231~~ 265,086 ft^2
Adjusted slope area= 1.118 x ~~393,449~~ 471,724 ft^2 = ~~439,876~~ 527,387 ft^2
Adjusted surface area of the pile to be covered= ~~619,107~~ 792,473 ft^2

The refuse pile will be covered with 4 feet of cover material. The cover material will consist of topsoil, subsoil, and a blend of coal waste and subsoil.

The volume of material needed to cover the refuse pile= ~~91,720~~ 117,403 CY

Available Cover Material

There are currently topsoil and subsoil stockpiles located in the ~~northwestern~~ northeastern and southwestern portions of the site. These stockpiles have been surrounded by a full containment berm. ~~Olympus Aerial Surveys and~~ EarthFax Engineering Group, LLC estimated the volume in each stockpile. ~~as well as the volume of soil in the containment berms.~~

~~Topsoil Stockpiles volume = 8,549 CY~~

Topsoil Stockpile #1 volume =5,612CY (Existing) + 4,088CY (Phase II Expansion) = 9,700CY

Topsoil Stockpile #2 volume = 2,937 CY (Existing)

Topsoil Stockpile #3 volume = 4,426 CY (Phase II Expansion Addition)

Contemporaneous Reclamation Topsoil volume = 3,086 CY (From Phase II Expansion)

Total Available Topsoil volume = 9,700 CY+2,937 CY+4,426 CY+3,086 CY = 20,149 CY

~~Subsoil Stockpile Volume = 11,964 CY~~

Subsoil Stockpile #1 volume = 9,211 CY (Existing) + 2,920 CY (Phase II Expansion) = 12,131 CY

Contemporaneous Reclamation Subsoil volume = 23,933 CY (From Phase II Expansion)

Total Available Subsoil volume = 12,131 CY+23,933 CY = 36,064 CY

~~Berm volume = 2,947 CY~~

Total cover material ~~currently available~~ anticipated to be placed in the new stockpiles or contemporaneously reclaimed = ~~20,513~~ 56,213 CY.

~~During reclamation the berms and embankments that create the perimeter ditches and sediment pond will be pulled back to blend the undisturbed areas into the reclaimed refuse pile. This process will generate approximately 2,947 CY of additional cover material.~~

~~Total available cover material = 23,460 CY~~

To reduce the volume of imported cover material the bottom foot of cover material will be a blend of coal waste and subsoil. Equal portions of coal waste and subsoil will be used to create this blended cover material. Thus, the volume of available cover material may be increased by ~~11,465~~ 14,675 CY (~~619,107~~ 792,473 ft^2 x 0.5 ft. / 27 ft^3/CY) to a total of ~~34,925~~ 70,888 CY.

The mixing of coal waste and subsoil, to produce the first foot of cover for the refuse pile, will occur only if the coal waste has been demonstrated through sampling and analysis to not be acid or toxic forming. Otherwise the entire 4 feet of cover material will be composed of subsoil and topsoil.

Volume of cover material needing to be imported= ~~91,720~~117,403 – ~~34,925~~ 70,888 = ~~56,795~~ 46,515 CY

Summary of Volumes

Volume of material needed to obtain 4 feet of cover= ~~91,720~~ 117,403 CY
Total cover material available at the site= ~~23,460~~ 56,213 CY
Vol. of coal waste blended with sub-soil to produce the first foot of cover= ~~11,465~~ 14,675 CY
Vol. of subsoil blended with coal waste to produce the first foot of cover= ~~11,465~~ 14,675 CY
Volume of subsoil and topsoil needed to cover the pile= ~~80,255~~ 102,728 CY
Volume of cover material to be imported from borrow site= ~~56,795~~ 46,515 CY

Soil/Waste Rock Mixing Procedure

Depending on conditions there are many ways that the imported soil and coal waste can be effectively mixed. Examples of methods that may be used are:

1. Mixing with a tractor mounted tiller or similar equipment. On flatter areas of the pile a 6-inch layer of soil will be spread on the surface and then tilled with the coal waste to a depth of 12-inches. This tilled material may be left in place and the additional 3-feet of soil placed on top or the mixed material may be pushed onto the slopes as the initial 12'inches of soil cover;

2. Mixing with an excavator or front end loader. Equal amounts of soil and coal waste will be dumped on the surface of the pile and mixed together using an excavator or front end loader. A dozer will then push the mixture onto the surface of the pile in a 12-inch layer;

3. Loading equal amounts of coal waste and soil into a dump truck. Trucks hauling soil to the site can be loaded with an equal amount of coal waste. Mixing will occur as the material is being loaded as well as when the load is dumped.

   Additional mixing will occur when the mixture is pushed out over the pile by a dozer; and

4. Mixing with a dozer. A 6-inch layer of soil can be spread on the surface of the pile and then a dozer will push the soil and 6-inches of coal waste into a pile. The rolling action of the material in front of the dozer blade will mix the soil and coal waste. Additional mixing will occur as the material is pushed back out in a 12-inch layer;

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 3

RA Section 352, page 3-13

RA Appendix 3-2, Raptor Survey "Confidential"

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

350 PERFORMANCE STANDARDS

351 General Requirements

CFC 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 with refuse storage operations. Contemporaneous reclamation will commence on the northeastern portion of the refuse pile and proceed to the south until final reclamation is achieved. See section 242.100 for more details. ~~Two general areas will be contemporaneously reclaimed. These are the soil stockpile and outslope of the refuse pile, once it reaches final configuration.~~ The soil storage area will receive interim seeding following the completion of soil stockpiling. The pile ~~outslope~~ will be covered with soil and seeded with the final vegetation seed mix.

A portion of the refuse pile will receive contemporaneous reclamation, the purpose will be to provide justification for the reduction of cover necessary to comply with regulation R645-301-553.252.

353 Revegetation: General Requirements

A vegetative cover will be established on all reclaimed areas to allow for the designated postmining land use of wildlife habitat and livestock grazing. Refer to Section 411 and the approved M&RP 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

Raptor Survey
for the
Dugout Canyon Mine
2015

in
Carbon County
Utah

(Confidential Files)

Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
P.O. Box 337
Springville, Utah 84663
(801) 489-6937

by

Patrick D. Collins, Ph.D.

for

CANYON FUEL COMPANY, LLC
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

January 2016

Table of Contents

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METHODS 1

RESULTS & SUMMARY 3

FIELD DATA SHEETS 4

GENERAL LOCATION MAPS 17

RAPTOR DATA FORM . . . . Appendix

Introduction

Like the previous raptor monitoring reports for the Dugout Canyon Mine, this document begins with a short history. For several years the Dugout Canyon Mine participated in annual raptor surveys conducted in cooperation with Utah coal operators and the State of Utah, Division of Wildlife Resources (DWR). These surveys were conducted in helicopters using GPS units that logged the flight paths and provided coordinates for the observed nest locations. Bird species, nest condition, clutch size and other nesting activities were noted at for each nest.

Beginning in 2009, DWR opted to discontinue participation in the raptor surveys with the mine operators. Consequently, many operators have also discontinued some of these surveys, or have conducted them independently at a frequency dictated by their respective Mining & Reclamation Plans (MRPs) in order to comply with the regulations of the State of Utah, Division of Oil, Gas & Mining (DOGM). This document reports the findings of Dugout Canyon Mine's 2015 raptor survey.

Methods

Because the cooperative surveys and shared costs of the helicopter were discontinued, Dugout Canyon Mine decided to continue monitoring the known nests of their permit area by conducting ground surveys as needed. It has been recommended that monitoring golden eagle nests for impact from surface disturbance be conducted for 3 to 4 periods if necessary to determine nest status. Recommended monitoring dates are between March 20 and May 31 of the year. Monitoring times are usually conducted from sunrise through 11:00 a.m. and from 3:00 p.m. through sunset. Any combination of these monitoring periods is acceptable as long as at least one morning and one evening session are conducted. The ground surveys for the Dugout Canyon Mine follows this protocol unless other circumstances warranted a modification to it. For example, in 2011 above average snowpack and late spring conditions made access to the observation stations nearly impossible earlier, so the surveys were conducted a week or so later than in previous years. Another year, an eagle was seen at the nest in the middle of the day, so it was unnecessary to continue monitoring the nest during the protocol time periods. Finally, when it was obvious that nests(s) were not active or tended in a given year, the observation time was somewhat shortened.

Even though the locations of raptor nests are considered to be confidential information, the exact locations have been provided in this document. Consequently, *this document and nest locations provided herein, should be placed in DOGM's "**Confidential Files**"* to protect the species and limit access to them by the general public.

Data were recorded in the field and submitted with this report. The data forms provide the following information: methods, survey dates, survey times, observers, location of nests, location of observation points, optics used, distance of visual line of site, weather conditions, nest description, activity, status of nest, additional comments and opinions of the biologists. DOGM's Raptor Survey Form was also in included in the appendix of this report.

Results & Summary

Results from raptor surveys and monitoring in 2015 have been included on the following data sheets. Nest locations, survey methods and/or observation stations are described on the data sheets. Survey areas and nest locations are also shown in a general way on the attached Google Earth aerial imagery.

To summarize, no hawks or eagles were observed at the known nest locations in the 2015 survey. Some raven nests and a previously observed hawk nest have been inactive or not seen for the past few years, so surveys were not conducted in these areas in 2012-15 (nest numbers 1454, 1670 and 424; see data sheets).

FIELD DATA SHEET

SPECIES: Golden Eagle (Aquila chrysaetos)

SURVEY DATE; TIME: 27 May 2015; 10:00 am to noon (see Additional Notes below)

SITE/NEST NUMBER: 776

OBSERVER(S): P.D. Collins

LOCATION OF NEST: Pine Canyon, UT 7.5 Minute Quadrangle Map

GPS Name: CFD09.Eagle776
UTM NAD 83
0539453 E.
4392813 N.

LOCATION OF OBSERVATION OF NEST (as well as comments which would be applicable e.g. observability of nest, view of nest from above/same level/or below, estimated distance to nest):

- Observation site was 0.14 air miles from nest.
- Observation location was below the nest vertically, but far enough away horizontally to provide a good view of the nest and sky for nesting and flight activities.
- Nest exposure: WSW
- Nest in rock cliffs within a Douglas fir community; mostly shaded by rock ledges.
- See also to photographs below and attached Map A.

OPTICS USED FOR OBSERVATIONS (binocular/scope power):

- Binoculars: Swarovski EL, 10X42, 6.3°.
- Spotting Scope: Swarovski EL, 20-60X zoom.

DISTANCE AND VISUAL LINE OF SIGHT FROM NEST TO PROPOSED DISTURBANCE:

- Nest was approximately 700 m NE of the middle of the Dugout Mine's surface facilities.
- Nest is not a direct line of sight for much of the surface facilities.

WEATHER CONDITIONS DURING OBSERVATIONS:

- Mostly sunny and calm; temperatures were in the low 50s F. Very wet conditions due to a previous week of rain.

NEST DESCRIPTION (including condition, location, elevation, as well as applicable comments):

- Condition: nest appeared to be in approximately the same condition as it was in 2012, 2013 & 2014 [in 2012 it was difficult to say for certain, but it looked like there may have been some greenery on the nest (unlike 2011)].
- There was some "white-wash" at the nest but it looked more like it may have been from earlier years(as noted in the 2013 & 2014 surveys), but it was obvious that the nest was inactive in 2015.
- In 2010 and more so in 2011, the nest was flat-topped, but also sloping downward. The nest was not sloping downward in 2012 like those years and it was still flat-topped.
- 8,050 ft elevation.

ACTIVITY/STATUS (ACTIVE/TENDED/INACTIVE/DILAPIDATED), as well as applicable comments:

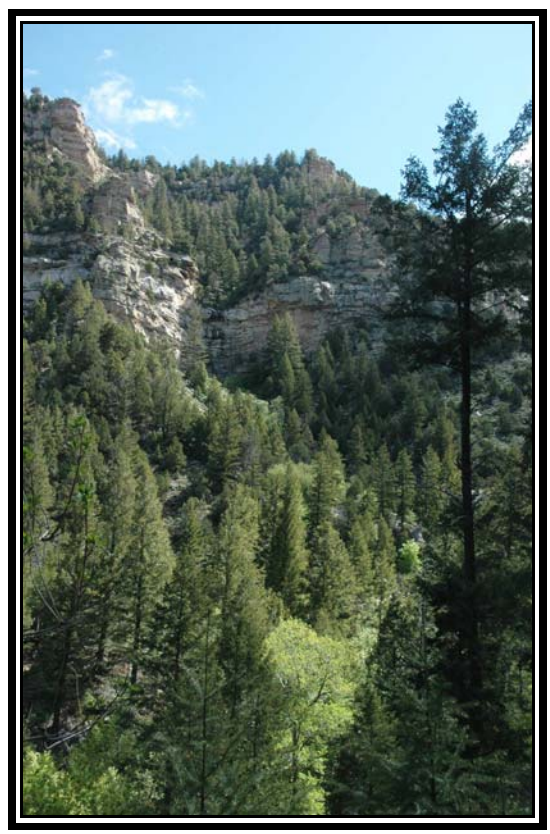
- Unlike 2009, but similar to 2010 - 2014, the nest appeared to be inactive this year and borderline of being "dilapidated". A inquiry could be done with DWR & DOGM for their opinions on whether or not to continue monitoring this nest, but according to previous monitoring information, the nest was inactive for a 7 year time period then became active again (see comments below).

ADDITIONAL COMMENTS:

- *The biologist first went to site to observe nest appearance and condition later in the morning than the normal survey protocol. If nest would have appeared tended or in better condition that the previous few years, a return visit to the site for the entire protocol time periods would have been done. However, and as noted above, the nest has been deteriorating over the past few years. That said, no eagles or signs were observed in the area during the survey period.*
- *From previous DWR data, it appears that this nest was last active in 1999, then again in 2006 (and not the years in-between). Nest was last active in 2009.*
- *See also Appendix A (Raptor Survey Form)*
- *Time was also spent at the site looking for other nearby raptor nests; none were discovered.*

OPINION AND JUSTIFICATIONS OF BIOLOGIST ON SITE AS TO IMPACT OF THE PROPOSED ACTIVITY ON NESTING SUCCESS:

- *The Dugout Canyon Mine's surface facilities are located near-by.*



MT NEBO SCIENTIFIC, INC.
research & consulting

FIELD DATA SHEET

SPECIES: All Raptor Species

SURVEY DATE; TIME: 29 May 2015; 10:00 am to 3:30 pm
1 June 2015; 9:00 am to 1:00 pm

SITE/NEST NUMBER: Waste Rock Site & Expansion Area

OBSERVER(S): P.D. Collins, K. Collins

LOCATION OF STUDY : Sunnyside Junction, Utah 7.5 Minute Quadrangle Map

- See attached aerial imagery

LOCATION OF OBSERVATION OF NEST (as well as comments which would be applicable e.g. observability of nest, view of nest from above/same level/or below, estimated distance to nest):

- To begin the field survey, a 0.50 mile study area was plotted around the outer-most disturbed areas of the current waste rock site for the Dugout Canyon Mine.
- **On May 29, 2015**, the study area was surveyed from horseback by riding the 0.50 mile perimeter and taking several trips to the interior to check isolated tree stands and habitat. A GPS unit was used to facilitate and track this survey.
- The ground surveys were conducted with the goal to observe any raptor activities and nests.
- The next survey period was delayed somewhat due to weather conditions. On **June 1, 2015**, a ground survey was conducted that was more concentrated directly adjacent to disturbed areas around the current waste rock site. For ths survey, observation stations were chosen with respect to their visibility qualities of the study area.
- Refer to attached Maps B & C to see the study area

OPTICS USED FOR OBSERVATIONS (binocular/scope power):

- Binoculars: Swarovski EL, 10X42, 6.3°.
- Spotting Scope: Swarovski EL, 20-60X zoom.

330 East 400 South, Ste. 6, P.O. Box 337, Springville, Utah 84663
(801) 489-6937, (fax) 489-6779

DISTANCE AND VISUAL LINE OF SIGHT FROM NEST TO PROPOSED DISTURBANCE:

- Refer to notes above.

WEATHER CONDITIONS DURING OBSERVATIONS:

- **May 29, 2015**: Mostly sunny and calm: temperatures were in the low 70s F
- **June 1, 2015**: Mostly clear, breezy ne temperatures were in the low 80s F.

NEST DESCRIPTION (including condition, location, elevation, as well as applicable comments):

- No nests were discovered.

ACTIVITY/STATUS (ACTIVE/TENDED/INACTIVE/DILAPIDATED), as well as applicable comments:

- No nests were located.

ADDITIONAL COMMENTS:

- See also Appendix A (Raptor Survey Form)
- Photographs of the study area are shown below.

OPINION AND JUSTIFICATIONS OF BIOLOGIST ON SITE AS TO IMPACT OF THE PROPOSED ACTIVITY ON NESTING SUCCESS:

- The Dugout Canyon Mine has proposed to expand the existing waste rock site, so construction of the site and subsequent site activities.






MT NEBO SCIENTIFIC, INC.
research & consulting

FIELD DATA SHEET

SPECIES: Red-tailed hawk (Buteo jamaicensis)

SURVEY DATE: No nest surveys were conducted from 2012-15 (see notes below)

SITE/NEST NUMBER: 1454

OBSERVER(S): P.D. Collins

LOCATION OF NEST: (UTM NAD 83): Mount Bartles Utah 7.5 Minute Quad Map

GPS Name: CFD09.Hawk1454
Zone 12
0543983 E.
4393764 N.

LOCATION OF OBSERVATION OF NEST (as well as comments which would be applicable e.g. observability of nest, view of nest from above/same level/or below, estimated distance to nest):

- The GPS coordinates suggested the nest should be in aspen trees directly below a sandstone ledge.
- The Division of Wildlife Resources have this nest in their database, but because the nest was not seen from 2009-11, Dugout Mine representatives determined it unnecessary to survey it in 2012-15.
- Refer to attached Map A.

OPTICS USED FOR OBSERVATIONS (binocular/scope power):

- N/A (see comments above).

DISTANCE AND VISUAL LINE OF SIGHT FROM NEST TO PROPOSED DISTURBANCE:

- N/A (see comments above).

WEATHER CONDITIONS DURING OBSERVATIONS:

- N/A (see comments above).

NEST DESCRIPTION (including condition, location, elevation, as well as applicable comments):

- N/A (see comments above).

ACTIVITY/STATUS (ACTIVE/TENDED/INACTIVE/DILAPIDATED), as well as applicable comments:

- N/A (see comments above).

ADDITIONAL COMMENTS:

- See also Appendix A (Raptor Survey Form)

OPINION AND JUSTIFICATIONS OF BIOLOGIST ON SITE AS TO IMPACT OF THE PROPOSED ACTIVITY ON NESTING SUCCESS:

- N/A (see comments above).

Hawk Nest #1454 Area (2011)

Hawk Nest #1454 Tree Location (2011)

FIELD DATA SHEET

SPECIES: Common Raven (Corvus corax)

SURVEY DATE: No nest surveys were conducted from 2012-15 (see notes below)

SITE/NEST NUMBER: 1670 and 424

OBSERVER(S): P.D. Collins

LOCATION STUDY SITE: (UTM NAD 83): Mount Bartles Utah 7.5 Minute Quad Map

GPS Name: CFD09.Raven1670	GPS Name: CFD09.Raven424
Zone 12	Zone 12
0543312 E.	0543432 E.
4393928 N.	4393994 N.

LOCATION OF OBSERVATION OF NESTS (as well as comments which would be applicable e.g. observability of nest, view of nest from above/same level/or below, estimated distance to nest):

- The Division of Wildlife Resources (DWR) have this nest in their database, but because the nest was not seen from 2009-11, Dugout Mine representatives determined it was unnecessary to survey it in 2012-15.
- Refer to attached Map A.

OPTICS USED FOR OBSERVATIONS (binoculars/scope power):

- N/A (see comments above).

DISTANCE AND VISUAL LINE OF SIGHT FROM NESTS TO PROPOSED DISTURBANCE:

- N/A (see comments above).

WEATHER CONDITIONS DURING OBSERVATIONS:

- N/A (see comments above).

NEST DESCRIPTION (including condition, location, elevation, as well as applicable comments):

- N/A (see comments above).

ACTIVITY/STATUS (ACTIVE/TENDED/INACTIVE/DILAPIDATED), as well as applicable comments:

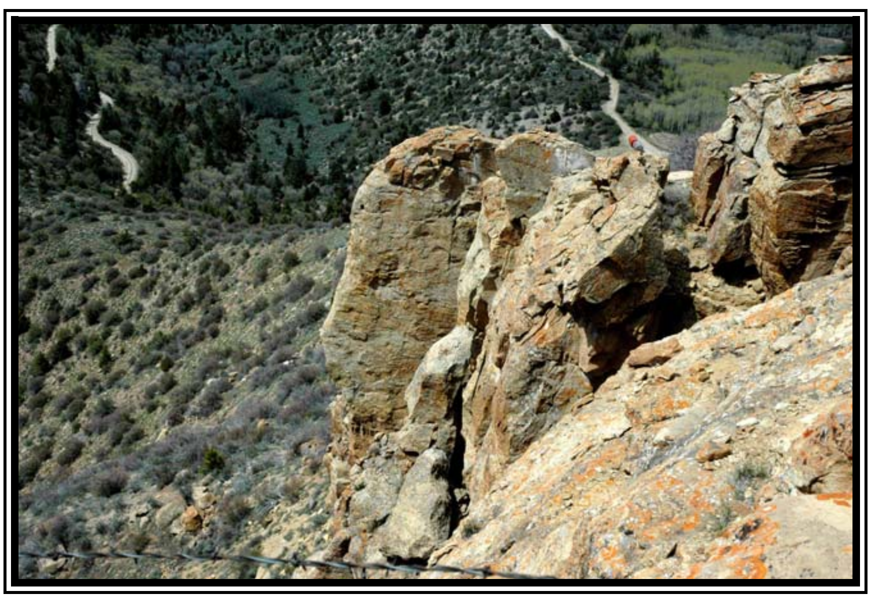
- N/A (see comments above).

ADDITIONAL COMMENTS:

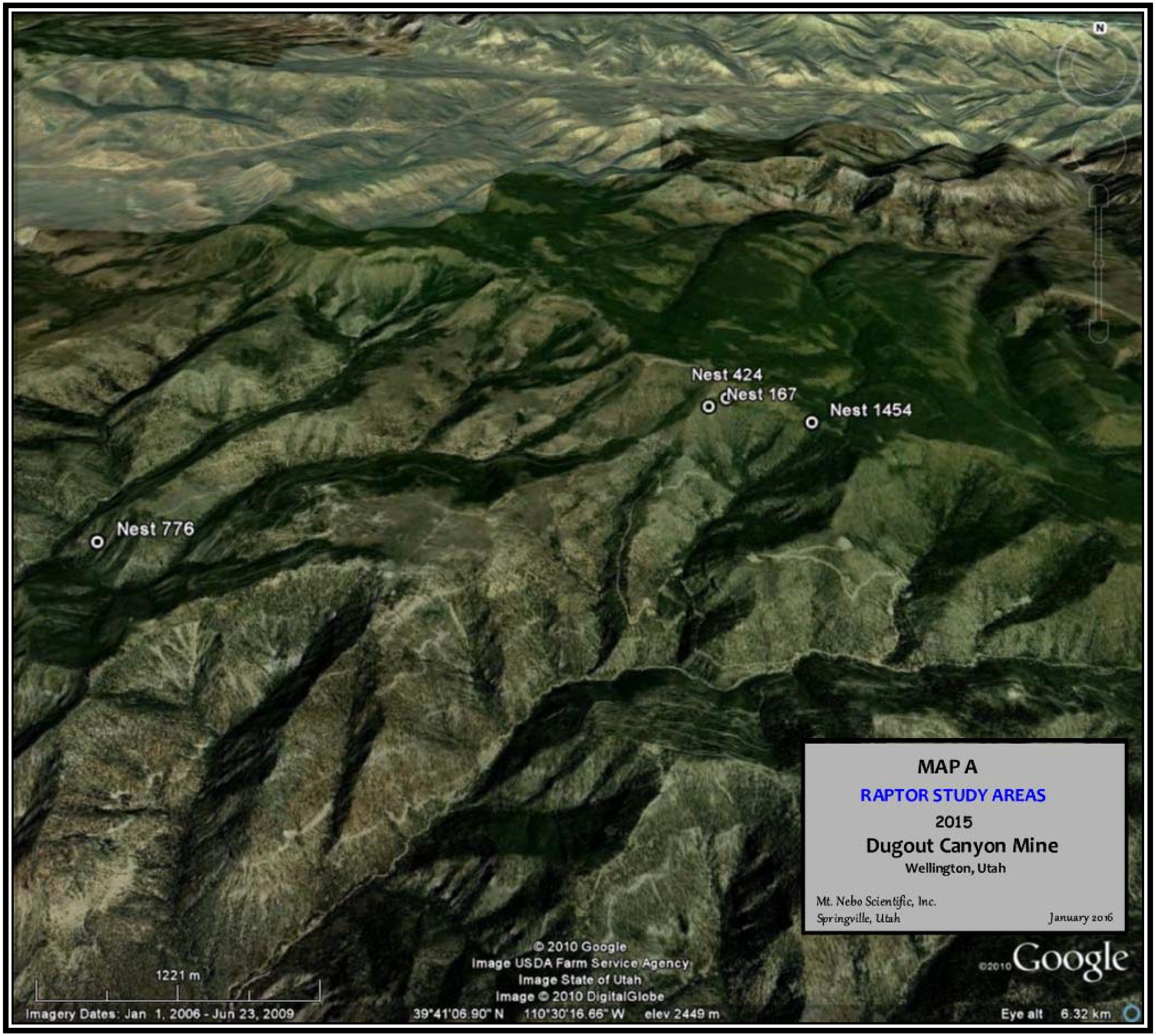
- These nests were previously noted by DWR as raven nests.
- See also Appendix A (Raptor Survey Form)

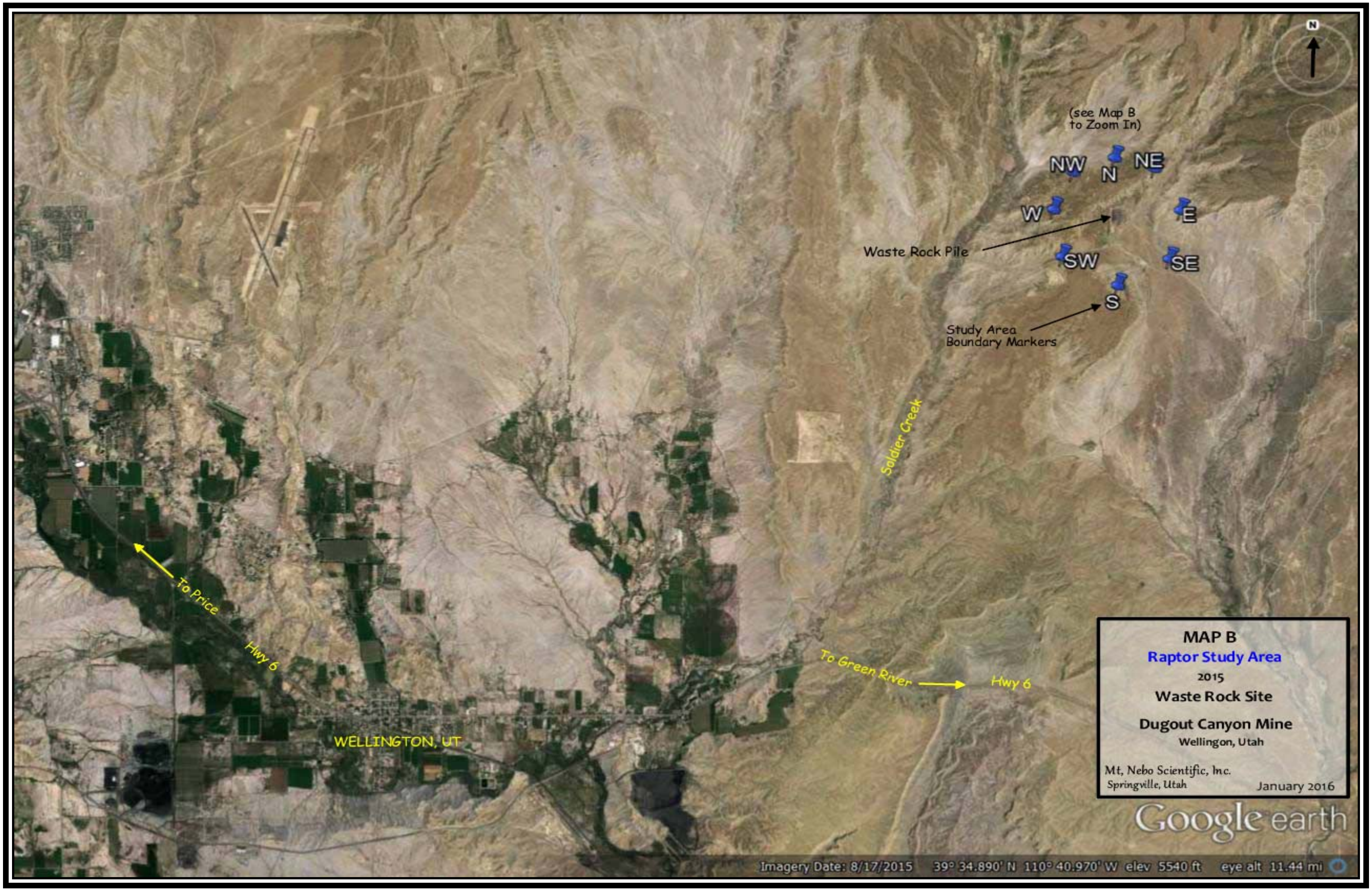
OPINION AND JUSTIFICATIONS OF BIOLOGIST ON SITE AS TO IMPACT OF THE PROPOSED ACTIVITY ON NESTING SUCCESS:

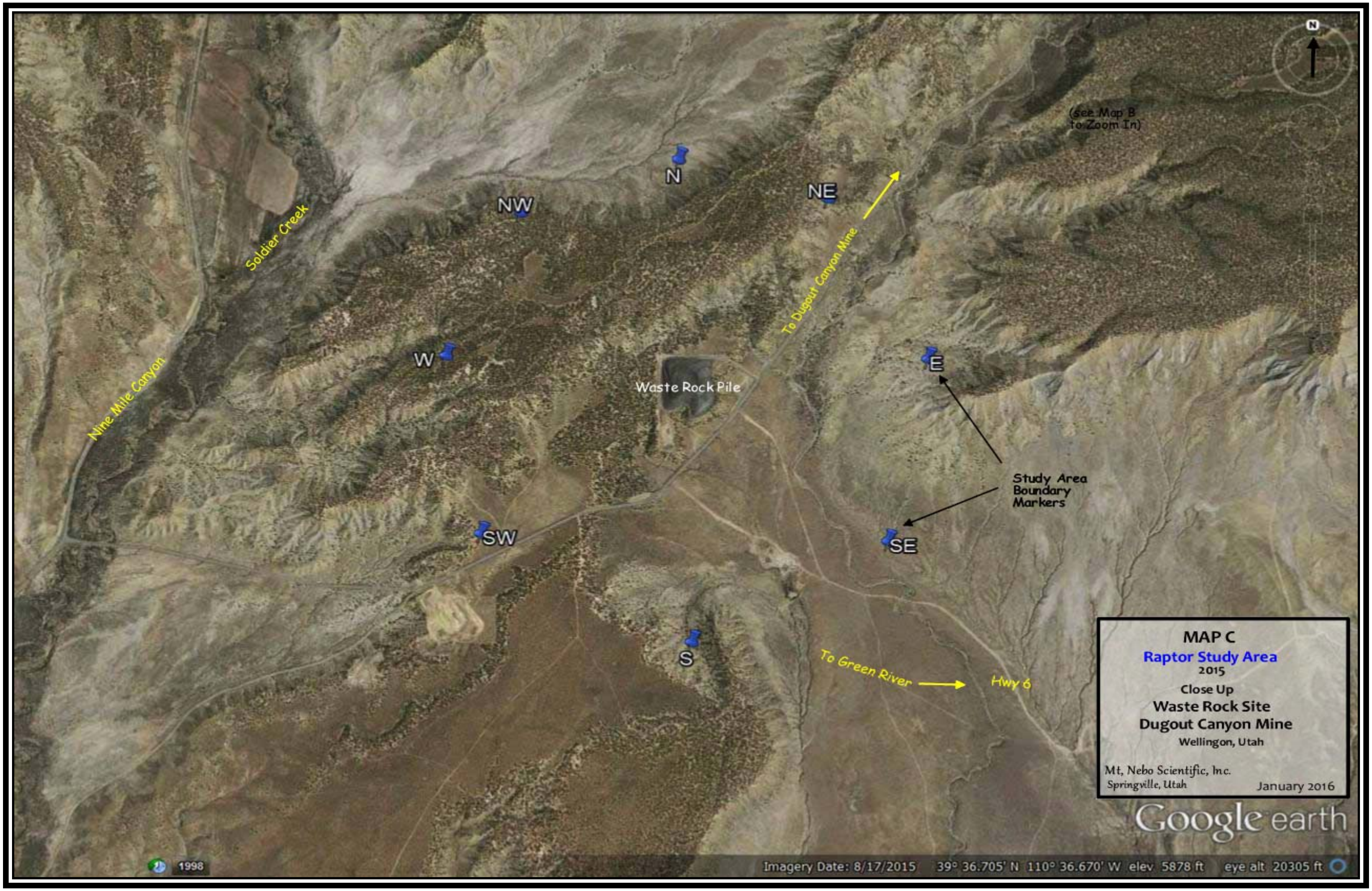
Raven Nest #424 Area (2011)



Raven Nest #1670 Area (2011)


Nest 424
Nest 167
Nest 1454
Nest 776
MAP A
RAPTOR STUDY AREAS
2015
Dugout Canyon Mine
Wellington, Utah
Mt. Nebo Scientific, Inc.
Springville, Utah
January 2016
© 2010 Google
Image USDA Farm Service Agency
Image State of Utah
Image © 2010 DigitalGlobe
1221 m
Imagery Dates: Jan 1, 2006 - Jun 23, 2009
39°41'06.90" N 110°30'16.66" W elev 2449 m
Eye alt 6.32 km
©2010 Google


(see Map B
to Zoom In)
NW
N
NE
W
E
Waste Rock Pile
SW
SE
S
Study Area
Boundary Markers
Soldier Creek
To Price
Hwy 6
To Green River
Hwy 6
WELLINGTON, UT
MAP B
Raptor Study Area
2015
Waste Rock Site
Dugout Canyon Mine
Wellingon, Utah
Mt, Nebo Scientific, Inc.
Springville, Utah
January 2016
Google earth
Imagery Date: 8/17/2015 39° 34.890' N 110° 40.970' W elev 5540 ft eye alt 11.44 mi


(see Map B to Zoom In)
N
NW
NE
Soldier Creek
To Dugout Canyon Mine
W
E
Waste Rock Pile
Nine Mile Canyon
Study Area Boundary Markers
SW
SE
S
To Green River
Hwy 6
MAP C
Raptor Study Area
2015
Close Up
Waste Rock Site
Dugout Canyon Mine
Wellingon, Utah
Mt, Nebo Scientific, Inc.
Springville, Utah
January 2016
Google earth
1998
Imagery Date: 8/17/2015 39° 36.705' N 110° 36.670' W elev 5878 ft eye alt 20305 ft

Appendix A

(Raptor Survey Form)

RAPTOR SURVEY FORM

Division of Oil Gas and Mining
Coal Regulatory Program

UTAH DNR OIL, GAS & MINING

Instructions:

Complete the following form including as much information as possible. This form is to be used for hand entry if direct electronic data entry is not possible. All data collected with this form must be submitted to the Division in an electronic format suitable for uploading into ArcGIS. Only nest status information should be collected aerially. All other data can be collected in a subsequent ground visit. Additional reporting requirements are located in the Raptor Survey Procedures provided by the Division of Oil, Gas and Mining.

1. Qualified Biologist: Patrick D. Collins
2. Mine: Dugout Canyon Mine
3. Survey Date: May 27, 2015 - June 1, 2015

4. Survey Type: (Check One)
- [ ] Aerial
- [X] Ground (for tree or cliff nesting species)
- [ ] Ground (for ground nesting species)
- [ ] Calling

Nest Number or "NEW"	Species	Nest Status *(see Legend)	Nest Condition *(see Legend)	Number of Eggs in the nest:	Number of Young in nest	Age of young in nest (days)	Substrate *(see Legend	Productivity (# fledged)	Elevation/ Exposure of nest (optional)	Comments
#776	Golden Eagle	Inactive soon dilapidated (see data sheets)	Fair	Unable to see.	None	N/A	CLF	N/A	WSW 8,080 ft	See also Field Data Sheets in report (pp. 4-6).
"NEW" Waste Rock Site	General ground survey all species[(1)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	[(1)] See Field Data Sheets in report (pp. 7-10).
#1454	Red-tailed Hawk[(2)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	[(2)] See Field Data Sheets in report (pp. 11-13).
#1670 #424	Common Raven[(3)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	[(3)] See Field Data Sheets in report (pp. 14-16).

LEGEND TO PREVIOUS PAGE

NEST STATUS *

Active	Active nest; a nest in which a breeding attempt was made as indicated by: 1) Eggs in nest, or 2) Young in nest, or 3) Fledged young near nest, or 4) Incubating/brooding adult
ActiveFail	An active nest that did not fledge young, indicated by: 1) Egg shells in or around nest with no young when, young should be in the nest, or 2) Young present but known not to have fledged, or 3) Eggs in nest but obviously abandoned (past the time when eggs should have normally hatched).
Not Found:	Did not locate; surveyor searched but was unable to locate the nest
Tended:	Tended or Occupied; a nest with one or more of the following: 1) Fresh lining material; 2) Adult presence at or near the nest; and 3) Recent and well-used perch site near the nest.
TendedAL:	Occupied Alternate; a tended nest within the boundaries of a territory housing an active nest.
Inactive:	Inactive; a nest with no apparent recent use or adult presence at the time of observation, but in good condition.
Dilapidated:	an inactive nest in a state of ruin due to weather, natural aging and/or neglect.
Destroyed:	Inactive Destroyed; a nest showing no sign of raptor activity that is destroyed to the point that it is no longer usable without major reconstruction. These nests have disappeared, but there is often still lingering evidence of an historic presence.
Predated:	Predated; the nest was active, but there is evidence that it was predated (remains of adults or young, feathers or egg shells scattered)

NEST CONDITION*

Gone:	There may or may not be evidence of where the nest was, but it is no longer there.
Remnants:	Scant material remaining and not usable unless fully rebuilt.
Poor:	Nest is dilapidated, in need of major repair to be used.
Fair:	Nest is not dilapidated, but needs significant repair in order to be used.
Good:	Nest is in need of only minor attention in order for it to be used.
Excellent:	Nest is able to be used with little or no attention or maintenance.
Unknown:	The nest is obviously present (i.e., a tree cavity, rock cavity), but because of its location, a determination can not be made.

SUBSTRATE*

CAV:	Cavity
BLT:	Broadleaf tree
CLF:	Cliff/ Rock outcrop
CON:	Conifer
GHS:	Ground/Hillside
MMS:	Manmade Structure
UTL:	Utility
SNG:	Snag or dead tree
UNK:	Unknown

EXPOSURE OF NEST*

N:	North
S:	South
W:	West
E:	East
NW:	Northwest
NE:	Northeast
SW:	Southwest
SE:	Southeast

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 4

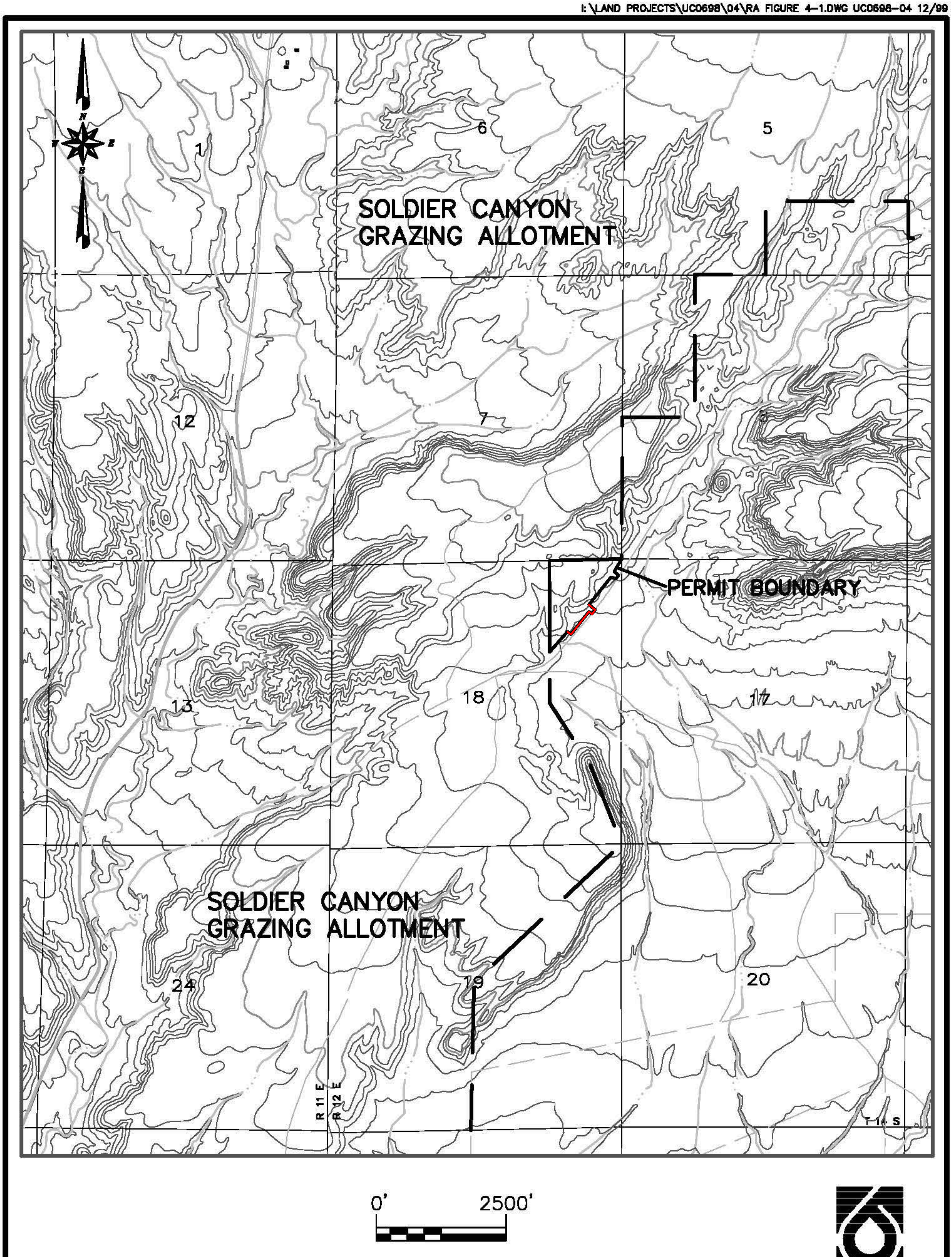
RA Figure 4-1

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only



RA FIGURE 4–1. LAND USE – GRAZING ALLOTMENT

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 5

RA Chapter 5

Plates: RA Plate 5-1, 5-1A, 5-1B, 5-2, 5-2A & 5-3

Attachments: RA Attachment 5-1, 5-2, 5-3 & 5-5

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

CHAPTER 5

ENGINEERING

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CHAPTER 5

ENGINEERING

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 refuse pile. The activities associated with the construction and reclamation of the refuse pile will be designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plans.

511 General Requirements

This permit application includes descriptions of the proposed refuse pile area construction, maintenance, and reclamation operations together with the appropriate maps, plans, and cross sections. Potential environmental impacts 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, geologist 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

The configuration of the refuse pile and cross sections through the pile are provided on RA Plates 5-1, ~~and~~ 5-1A and 5-1B of this submittal. An as-built map of the refuse pile topography (Olympus Aerial Survey, May 2003) is included in RA Attachment 5-5.

512.200 Plans and Engineering Designs

All plans and engineering designs presented in this submittal were prepared by or under the direction of and certified by a qualified registered professional engineer.

Excess Spoil. No excess spoil will be generated from the refuse pile area.

Durable Rock Fills. No durable rock fills will exist in the refuse pile area.

Coal Mine Waste. If coal mine waste is generated by the Dugout Canyon Mine, it will be placed in the refuse pile site.

Impoundments. A sedimentation pond impoundment was built in the refuse pile area and an additional sedimentation pond impoundment will be constructed as the pile expands (see Section 732).

Primary Roads. The access road to the refuse pile and the temporary road to construct the refuse pile are classified as primary roads.

Chapter 1 **Variance From Approximate Original Contour.** CFC does not request a variance from the approximate original contour requirements of the regulations for this site. The proposed configuration of the site will comply with the post-mining land use and blend into the surrounding area.

513 Compliance with MSHA Regulations and MSHA Approvals

513.100 Coal Processing Waste Dams and Embankments

No coal processing waste dams or embankments will exist within the permit area.

513.200 Impoundments and Sedimentation Ponds

No impoundments or sedimentation ponds in the permit area meet the size criteria of 30 CFR 77.216(a).

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

If underground development waste is generated by the Dugout Canyon Mine, it will be stored at the refuse pile site. Coal processing waste will be stored at the refuse pile site. No excess spoil will be generated or stored within this area.

513.400 Refuse Piles

Coal mine waste or underground development waste generated by the Dugout Canyon Mine, will be stored at the refuse pile site. The design of the pile will meet the requirements of MSHA, 30 CFR 77.124 and 30 CFR 77.215 in accordance with Section 536.900.

513.500 Underground Openings to the Surface

No underground openings will be present in this area.

513.600 Discharges to Underground Mines

No discharges to underground mines will occur in this area.

513.700 Surface Coal Mining and Reclamation Activities

No surface coal mining and reclamation activities will occur in this area.

513.800 Coal Mine Waste Fires

If any coal mine waste fires occur within the permit area, these will be reported immediately to MSHA and the Division. Immediate remedial action will be taken as deemed necessary by CFC to protect public health and safety as well as the environment. Following initial remedial efforts, a long-term plan will be formulated in discussion with MSHA and the Division to extinguish any existing fires and prevent future fires.

CFC will utilize a program of prevention and suppression to minimize the potential for coal mine waste fires. An ongoing educational program will emphasize the need for attention to fire prevention. Suppression will occur by separating smoldering material and compacting the adjacent material (to minimize oxygen content in the adjacent material). The burning material will then be extinguished using appropriate methods (see Section 528.300 of the approved M&RP and Section 536.200 of this amendment). No burning mine waste will be removed from the refuse pile area without a removal plan approved by the Division.

514 Inspections

514.100 Excess Spoil

Excess spoil will not be stored in this area.

514.200 Refuse Piles

Quarterly inspections will be made of the refuse pile area (see RA Plate 5-1). These inspections will be performed by a professional engineer or a specialist experienced in the construction of similar earth and waste structures. CFC will provide copies of the certified reports to the Division in the annual report. The report will discuss any appearances of instability, structural weakness, or other hazardous conditions. A copy of this report will be maintained at the mine site.

An MSHA permit was obtained before any refuse was placed in the pile area. All activities performed at this site will be in accordance with the applicable MSHA permit.

514.300 Impoundments

Regular inspections were made during construction of the sedimentation ponds as well as upon completion of construction. These inspections were made by or under the direction of a registered professional engineer experienced in the construction of similar earth and water structures.

Quarterly inspections of the sedimentation ponds will continue until removal of the structure or release of the performance bond. An annual certified report of inspection will be prepared by a qualified registered professional engineer and submitted to the Division in the annual report. The report will discuss any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, and existing or required monitoring procedures and instrumentation, and any other aspects of the structure affecting stability. A copy of this report will be maintained at the mine site.

No impoundments are anticipated within the permit area that are subject to 30 CFR 77.216.

515 Reporting and Emergency Procedures

515.100 Slides

If a slide occurs within the refuse pile area that may have a potential adverse effect on the public, property, health, safety, or the environment, CFC will notify the Division following discovery of the slide and will comply with any remedial measures required by the Division.

515.200 Impoundment Hazards

If any examination or inspection of an impoundment discloses that a potential hazard is associated with that impoundment that may have an adverse effect on the public, property, health, safety, or the environment, the person who examined the impoundment will promptly inform the Division of the finding and of the emergency procedures formulated for public protection and remedial action. If adequate procedures cannot be formulated or implemented, the Division will be notified.

515.300 Temporary Cessation of Operations

Prior to a temporary cessation of operations within the permit area that will last for a period of 30 days or more or as soon as it is known that a temporary cessation will extend beyond 30 days, CFC will submit to the Division a notice of intention to cease or abandon operations. This notice will include the following:

A statement of the number of surface acres affected by mining operations in the permit area prior to cessation of operations,

A discussion of the extent and kind of reclamation activities which will have been accomplished prior to cessation of operations, and

An identification of the backfilling, regrading, revegetation, environmental monitoring, and water treatment activities that will continue during the temporary cessation.

During the temporary cessation, CFC will secure surface facilities in areas in which there are no current operations but where future operations are to be resumed under an approved permit.

5-520 OPERATION PLAN

521 General

521.100 Cross Sections and Maps

Existing Surface and Subsurface Facilities and Features. No buildings are located in and within 1000 feet of the refuse pile area. No surface or subsurface features are within, passing through or passing over the refuse pile area. An existing county road bypasses the area. The county road lies on land either owned by the State of Utah, the United States of America, or Canyon Fuel

Company, LLC (see Plate 1-3 of the approved M&RP).

Landowner, Right-of-Entry, and Public Interest. CFC is the current land owner of the property where the refuse pile is built. It is located adjacent to the county road to Dugout Canyon. Public access will be limited to the site by construction of a suitable fence and gate. The contiguous surface owners are the United States of America and Canyon Fuel Company, LLC (See RA Figure ~~RA~~ 1-1B of this submittal). The contiguous subsurface owner is the United States of America (See RA Figure ~~RA~~ 1-1B of this submittal).

Mining Sequence and Planned . This does not apply to this site (see Section 525).

Land Surface Configuration. Surface contours of undisturbed areas within the storage area are provided on RA Plate 5-1 of this submittal. The initial segment of the refuse pile was constructed in a gravel pit. The first four (4) feet of refuse material was used to fill a pit and bring it to grade. The remainder of the refuse material will be placed above grade and reach a total pile ~~height of~~ elevation of 5996 feet. This elevation is approximately sixty (60) feet above the base of the original refuse pile but, will be nearly one hundred and thirty (130) feet above the base of the southeastern Phase II expansion ~~sixty (60) feet above portions of the immediate surrounding area~~ as provided on RA Plate 5-1 of this submittal. As shown on RA Plate 1-1, the hills surrounding the site range in elevation from 5887 to 6283 feet, therefore the maximum reclaimed elevation of the refuse pile ~~of 5980 to 6000~~ at 5960 feet will blend with the surrounding area.

Surface Facilities. The surface facilities associated with the refuse pile site include: the refuse pile, temporary material/snow storage areas, soil stockpiles, access roads, sedimentation ponds, and drainage control structures. Facilities are shown or mentioned on RA Plate 5-1. Detailed information on sedimentation ponds and drainage facilities is presented in Chapter 7 of this submittal. Cross sections of the refuse storage pile(s) are provided on RA Plate 5-1A and 5-1B.

Transportation Facilities. A permanent road is not anticipated to be constructed, used, or maintained by CFC in the storage area. During construction of the pile, temporary access roads will be constructed and maintained. The temporary roads will be reclaimed and seeded with the permanent reclamation seed mix (Section 341.200 of this amendment). Refer to RA Attachment 5-6 for drawings of the paved access road.

521.200 Signs and Markers

Mine and Permit Identification Signs. A mine and permit identification sign will be displayed at the refuse pile 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 permit area. 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 as obtained from the Division.

Perimeter Markers. The perimeter of all areas affected by surface operations were clearly marked before beginning mining activities. The markers will be a design that can be easily seen and 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 are not required for this area.

Topsoil Markers. Markers will be placed on all soil 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 after the release of all bonds for the permit area.

522 Coal Recovery

No coal recovery will be performed at this site.

523 Mining Methods

No mining will be performed at this site.

524 Blasting and Explosives

No explosives are to be used at this site.

525 Subsidence

No subsidence will occur in this area, because no underground coal mining will occur beneath the refuse pile site. Therefore, there will be no effects on the site from coal mining related subsidence.

526 Mine Facilities

526.100 Mine Structures and Facilities

No buildings exist or are proposed at the refuse pile site; therefore, no existing buildings will be used in connection with or to facilitate this proposed coal mining and reclamation operation.

526.200 Utility Installation and Support Facilities

No utilities are to be installed at this site.

527 Transportation Facilities

527.100 Road Classification

No permanent roads are to be built in association with the construction of the refuse pile. A temporary road will be used to access the site. The access road to the refuse pile and the temporary road to construct the refuse pile are classified as primary roads. Refer to Section 521.100 of this amendment for additional detail. Two additional temporary roads will be constructed to access the sedimentation ponds. Refer to RA Plate 5-1.

The existing road to access the site from the Dugout Canyon Road will be paved to provide all weather access to the site. The road will have a guard rail constructed to comply with engineering, UDOT and MSHA requirements. Refer to RA Attachment 5-6 for drawings of the road.

527.200 Description of Transportation Facilities

The access road to the refuse pile site follows the alignment of an existing road shown on RA Plate 7-1. The access road is approximately 840 feet long and will have paved surface approximately 20 feet wide. The access road will have a maximum grade of 16% and an average grade of 10%. The road will gently slope towards UD-1~~c~~ which drains to culvert UC-1(See cross-section RA Figure 5-2). The road does not cross any natural drainage. Culvert, UC-1, was installed at the intersection of the access road and the county road, to allow free flow of the runoff in the county road borrow ditch. Specific design information for the culvert is provided in RA Attachment 7-24.

The temporary access road is shown on RA Plate 5-1. The road is approximately 20 feet wide and is constructed on compacted subsoil. The road will have an uniform grade of 2% within the (See cross-section RA Figure 5-2). The runoff from the road will flow into drainage ditches and then into the sediment pond.

During operations, the access road and temporary access road will be maintained using a road grader and any other equipment which may be necessary to ensure compliance. Drainage ditches will be maintained to ensure proper functioning.

Accidental spillage of coal mine waste during haulage from the mine site to the refuse pile will be minimized by not overloading the haulage trucks. Accidental spills, if they occur, will be cleaned up and transported to the refuse site, in a timely manner.

If a catastrophic events causes damage to access roads, the rapid repair of the road/roads will begin as soon as practical following the catastrophic damage.

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

Coal mine waste and/or underground development waste materials generated at the Dugout Mine, will be transported to the refuse site and disposed of in a controlled manner in accordance with Section 536. Construction of the refuse pile will meet MSHA and DOGM requirements in accordance with the approved plan.

Non-coal and hazardous wastes will not be disposed of in the refuse pile. They will be handled in accordance with the approved M&RP.

529 Management of Mine Openings

No mine openings will be built in the area.

530 OPERATIONAL DESIGN CRITERIA AND PLANS

531 General

This section contains the general plans for the construction of the sediment control measures and general construction and maintenance of the refuse pile area. This site will be used by CFC to handle coal mine waste or underground development waste that may be generated by the Dugout Mine. Also, a portion of the site will be used as a temporary storage yard for mine materials and a place for disposal of excess snow from the Dugout Mine site.

During operations, the runoff from the site area will be treated through the use of sediment controls such as diversion ditches and berms, a sediment ponds, and silt fences and/or straw bales. These structures will be constructed, to handle the site runoff, before the initial refuse is placed.

532 Sediment Control

Sediment-control measures for the site area are described in detail in Sections 732 and 742 of this submittal. Runoff-control structures at the refuse pile area have been designed to convey runoff in a non-erosive manner. Sediment yields in the permit area are minimized by, disturbing the smallest practicable area during the construction or modification of surface facilities and contemporaneously reclaiming areas suitable for such reclamation.

533 Impoundments

533.100 Slope Stability

~~The only~~ Two impoundments with ~~an~~ embankments ~~that~~ will be constructed, used, or maintained by CFC ~~will be~~ for the sedimentation ponds at the refuse pile site. ~~This~~ These ponds are ~~is an~~ incised ponds with ~~an~~ embankments consisting of native materials. A slope-stability analysis was performed on ~~this~~ the pond embankment materials and is provided in RA Attachment 5-1. According to this analysis, the minimum safety factor for the Sedimentation Pond 1 embankment is 1.9 under static moist conditions. Furthermore, the analysis presented in RA Attachment 5-1 indicates that a minimum safety factor of 2.2 will exist for the Sedimentation Pond 1 embankment under conditions of rapid drawdown. The minimum safety factor for Sedimentation Pond 2 is 1.80 under static conditions and 1.61 under rapid drawdown. All analyses were performed assuming that the pond was full to its maximum design depth. These safety factors exceed the minimum requirements of R645-301-533.100.

533.200 Foundation Considerations

Soils investigations have been conducted at the site of the refuse pile area. Results of these investigations are presented in RA Chapter 2 and RA Attachment 5-1 of this submittal. During these investigations, foundation conditions in the area of the proposed sedimentation pond were evaluated. Based on these investigations, no conditions were encountered which suggested that the materials in which the pond would be constructed would be unstable. The slope-stability analyses presented in RA Attachment 5-1 indicate that the pond embankments will also be stable under operating conditions. Detailed cross sections of the sedimentation pond are presented on RA Plate 7-~~2~~3 of this submittal.

533.300 Slope Protection

The inslopes of the sedimentation ponds and portions of the outslope disturbed by the spillway construction were revegetated following construction to minimize surface erosion and protect the embankments against sudden drawdown. The interim seed mix was used for this revegetation effort (see Section 341.200 of this submittal).

Rapid drawdown in the sedimentation ponds would be restricted to pumping the vertical distance between the spillway and the pond bottom, a distance of ~~11~~ 9 feet for Sedimentation Pond 1 and 6 feet for Sedimentation Pond 2 (see RA Plate 7-~~2~~3). Drawdown of this magnitude and rate is not considered significant and, therefore, not a stability or erosion concern. The analysis presented in

RA Attachment 5-1 indicates that the slope of the embankment will be stable under conditions of rapid drawdown (minimum safety factor of 2.2 for Sedimentation Pond 1 and 1.61 for Sedimentation Pond 2). During pumping of the sedimentation pond, flow rates (and drawdown) will be controlled. Hence, it is unlikely that this drawdown will cause surface erosion of the embankment face.

533.400 Embankment Faces

Embankment inslopes and portions of the outslopes were revegetated following construction of the sedimentation ponds, as outlined in Section 533.300. Riprap will also be placed on the upstream face of the embankments near the emergency spillway structures.

533.500 Highwalls

No highwalls will be located below the discharge lines of the sedimentation pond.

533.600 MSHA Criteria

The sedimentation ponds do~~es~~ not meet the size criteria of 30 CFR 216(a).

533.700 Pond Operation and Maintenance Plans

The sedimentation ponds ~~has~~ have been designed as a total containment pond to contain the 100-year, 24-hour storm event, plus an adequate freeboard. Details of the design and the requirements for operation and maintenance of the pond are presented in Chapter 7 of this submittal.

534 Roads

534.100 Location, Design, Construction, Reconstruction, Use, Maintenance, and Reclamation

No permanent roads will be constructed in the storage area. The refuse will be transported to the refuse pile area using the existing county road. A temporary access road between the refuse pile area and county road will be constructed to allow equipment access to the pile. The temporary road will be reclaimed. The temporary road will be maintained in accordance with the approved M&RP. Refer to Section 527.200 for additional description of the transportation facilities.

Control of Damage to Public or Private Property. Roads will be designed in accordance with applicable county and State standards. By designing according to these standards, damage to public or private property will be been minimized.

Road Surfacing. The county road surface, which accesses the mine site, consists of asphalt. The temporary access road surface material will be surfaced with asphalt. No acid- or toxic-forming materials will be used in the road surfaces. The characteristics of the substances used for road surfaces will be nonacid-and nontoxic-forming. The roads are not established on constructed lands and road slopes are less than 2:1.

534.200 Environmental Protection and Safety

The design and construction of the temporary road will be in accordance with Section 534.200 of the approved M&RP.

534.300 Primary Roads

The access road to the refuse pile will be constructed in accordance with the requirements of Section 534.300 of the M&RP.

535 Spoil

No spoil will be generated in the refuse pile permit area.

536 Coal Mine Waste

Coal mine and underground development waste resulting from mining activities at the Dugout Canyon Mine will be disposed of at the refuse pile.

536.100 Design

The designs and their associated evaluations were based on the results of detailed foundation and laboratory analyses of soils at the site of the refuse pile. These results are presented in RA Attachment 5-2 of this submittal.

As illustrated on RA Plate 5-1, the proposed maximum constructed elevation of the refuse pile is 5,996 feet. To assure stability of this design, an analysis was completed on a theoretical refuse pile extended to an elevation of 6,085 feet with 2H:1V outslopes (see RA Attachment 5-2). This is approximately 90 feet higher than the proposed refuse pile. The analysis results show that in the area of the original pile (base elevation 5,935 feet), the safety factors are 1.86 and 1.91. This is for a refuse pile overlying granular soils and overlying weathered Mancos Shale respectively. For the Phase II southern expansion (base elevation 5,870 feet), the safety factor is 1.8 for both the granular soil and Mancos Shale foundation conditions. Given these acceptable safety factors for the theoretically extended refuse pile, the smaller proposed refuse pile will have safety factors equal to, or better than, those calculated.

~~Based on the materials encountered in the refuse pile site area, the refuse pile can be constructed to an approximate height of 60 feet with 2H:1V outslopes on the native alluvial soils and have a static safety factor of 1.59 for failure surfaces starting in the refuse and terminating in the underlying soils. If the weathered Mancos Shale, which is present over the majority of the site, is used in the evaluation, the static safety factor rises to 2.38 for the 60-foot height pile configuration. For failure surfaces originating and terminating in the refuse materials, the pile has a static safety factor of 2.27. Therefore, the proposed pile configuration meets the minimum regulatory requirements. Because the effects of bedrock were not included in the analyses, the results are considered to be conservative. RA Plate 5-1 presents the proposed configuration of the refuse pile.~~

RA Plate 5-2 shows the reclamation topography and treatment for the refuse pile. Reclamation cross sections are shown on RA Plate ~~5-2A~~ 5-1A and 5-1B. The reclaimed refuse pile will have concave slopes with 2:1 slopes near the top of the pile and 3:1 slopes or less at the toe of the reclaimed slope. The top of the reclaimed pile will be regraded to have an irregular plateau surface that drains towards all pile outslopes instead of draining only towards one side of the pile. The top of the reclaimed refuse pile will have slopes of 6:1 or less. Where possible the reclaimed slopes will be varied to blend into the shape of undisturbed areas. Outslopes of the reclaimed pile will be varied as much as possible to prevent long straight surfaces with uniform slopes.

Storage capacity of the pile is estimated to be approximately ~~1,018,792~~ 1,949,887 tons of refuse.

Calculations are presented in RA Attachment 5-3.

536.200 Waste Emplacement

~~Construction. Prior to the start of refuse pile construction, the appropriate sediment control facilities (sediment pond, undisturbed diversion ditch/berm, and disturbed area diversions) described in Chapter 7 were in place. Since initial waste rock storage will occur in an area 4 feet below natural grade, it is anticipated that ditches DD-1 and DD-2 will be constructed to their full extent only after waste reaches a level equal to the currently existing ground surface. An interim berm will be constructed to direct surface runoff away from the storage area below grade and toward ditch DD-3 and the sediment pond. RA Plate 5-1 presents the layout of the refuse pile areas.~~

Construction. Prior to the start of refuse pile construction and/or expansion, the appropriate sediment control facilities (sediment ponds, undisturbed diversion ditch/berm, and disturbed area diversions) described in Chapter 7 will be in place. However, many of the runoff control features are designed to best accommodate runoff as the refuse pile nears its maximum storage capacity. Therefore, the placement and construction of some runoff control features will need to efficiently evolve with the gradual expansion of the refuse pile. RA Plate 5-1 presents the layout of the refuse pile areas once the pile has reached its maximum storage capacity.

Vegetative cover will be removed from the refuse site area, prior to placement of any coal mine or underground development waste. Soil materials shall be removed, stockpiled, and properly protected for future use in reclaiming the site. As the site has previously been disturbed there is limited ~~no~~ topsoil present. CFC commits to reasonable mechanized efforts to collect the maximum amount of soil materials still present on the site. It is anticipated that all suitable soil materials down to the Mancos Shale will be stripped. The soil materials salvaged from the strip area will be stored in the soil stockpile. The details of the soil salvage operations and estimates of the volume of soil to be stripped are presented in Chapter 2.

Once the soils have been stripped from the area, the refuse material will be placed. Based on prior experience, the refuse materials anticipated to be generated by the mine will generally consist of shale with some sandstone, bone coal, and in limited quantities, sandstone from paleochannels.

Sediment pond wastes from either the mine site or refuse area sediment pond will be stored in the refuse pile.

Coal processing waste to will be stored at the refuse site, should economics justify the washing of coal. Waste stored at the refuse site will be hauled to a wash facility for processing and the waste material not shipped to customers will be returned to the Dugout refuse site for disposal. The waste material returned to the Dugout refuse site will primarily be from Canyon Fuel Mines. However, coal from other sources may occasionally be processed through the Castle Valley Preparation Plant. Refuse from this processing may also be returned to the Dugout refuse site. Waste materials will be sampled as described below under the subheading "Testing".

Operation. Refuse materials will be hauled to the site using either belly dump trailers or end dump trucks. At the refuse site, the trucks will deposit the refuse on a fill bench, where it will be spread and compacted by truck and equipment traffic. Successive lift will be allowed to drain (when necessary) before it is capped with the next lift in the construction sequence.

The gradation of the refuse material will most likely be coarse and poorly graded with a small percentage of fine materials. Therefore, it is necessary to rework and level the lifts to assist in achieving the desired densities and prevent the formation of large voids. Additional compaction of each lift can be accomplished by routing the loaded haul trucks over the lift surface in such a manner as to cover the surface uniformly.

Waste rock loads containing non-cemented, soft shale, clay, or fine-grained materials shall be mixed with coarser graded loads in a controlled manner to limit concentrations of fine materials within the fill. This will be especially true for sediment pond wastes from either the mine site or refuse area sediment ponds.

All lifts will be emplaced in a controlled manner to ensure the mass stability of the refuse pile and prevent mass movement during and after construction. Additionally, the lifts shall be graded to promote drainage off the pile surface. No intentional impoundments will be created by the placement of the refuse materials.

As the limits of the site area are reached laterally, the outer slope shall conform to the slope indicated in RA Plate 5-1.

Maintenance. Coal mine and underground development waste may have high moisture content. Controlled placement and compaction of the refuse materials will minimize the potential for spontaneous combustion or ignition of these materials. In the unlikely event that any burning waste is found during the regular inspections of the refuse pile area, it will be separated and extinguished either by burying the burning materials or by using water sprays. Once extinguished, the material will be placed, compacted, and buried on the active refuse pile bench.

Testing. Due to the anticipated coarse, open graded nature of the refuse materials, most quality control work for the fill will have to be on a visual basis. Conventional in-place density tests will not give reliable results under these circumstances.

Based on analyses of the materials that have been encountered in the Dugout Canyon Mine and other CFC mines to date, no acid-forming problems are anticipated. When the site is receiving materials, a representative sample will be collected of the material at a rate of one sample per 2,000 cubic yards of material through the fourth quarter of 2005 and one sample per 5,000 cubic yards of material, thereafter. These samples will be analyzed for the parameters listed in Table 6 of the Division's topsoil and overburden guidelines (Leatherwood and Duce, 1988). Analyses reports of the sampled waste rock will be submitted with the annual report.

Should a problem be identified, a mitigation plan will be prepared and submitted to the Division for approval. All identified potential acid or toxic-forming materials will be buried after the material handling plan is approved by the Division.

Copies of the toxicity/acid-base results from the samples collected at the Dugout Canyon Mine are presented in RA Attachment 5-4 and Appendix 5-7 of the approved M&RP.

537 Regraded Slopes

537.100 Division Approval

No mining or reclamation activities will be conducted in the refuse pile permit area that require approval of the Division for alternative specifications or for steep cut slope.

537.200 Regrading of Settled and Revegetated Fills

Upon completion of the filling of the refuse pile, the site will be reclaimed. The refuse fill will be constructed in a prudent manner to ensure that the pile will be stable. Geotechnical analysis of the proposed configuration is presented in RA Attachment 5-2.

Based on the proposed construction plans, the pile will be constructed to achieve the final configuration. Following completion of the construction, the pile surface will be prepared for soil distribution and revegetation according to plans presented in Chapter 2 and 3 of this submittal.

540 RECLAMATION PLAN

541 General

541.100 Commitment

Upon the permanent cessation of coal mining and reclamation operations at the Dugout Canyon Mine, CFC will close, backfill, or otherwise permanently reclaim all affected areas in accordance with the R645 regulations and this reclamation plan.

541.200 Surface Coal Mining and Reclamation Activities

No surface coal mining and reclamation activities will be conducted in the permit area.

541.300 Underground Coal Mining and Reclamation Activities

No underground activities are planned for this site.

541.400 Environmental Protection Performance Standards

Performance Standards

The plan presented herein 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 RA Figure 5-1. The first phase consists of regrading the site, placing soil, surface roughening, and seeding (vegetating) the site. This phase will take approximately six (6) months to complete based on the number and anticipated types of construction equipment to be used, the number of operators and laborers necessary to complete the work, and the number of weather days (when work cannot take place) anticipated to occur. Work will be completed sooner if bad weather is not encountered. The second phase will be an approximate 10 month period where the success of the surface reclamation will be evaluated in relation to the surface roughening and the initial seeding success. If the surface roughening and/or initial reseeding (vegetation) does not appear successful, additional seeding or reworking of portions of the reclaimed surface may be necessary.

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

Based on the proposed construction plans, the pile will be constructed so that the pile will be at final configuration when the disposal of waste is completed. Therefore, it is anticipated that little regrading will need to be conducted. The construction plans for the refuse pile area were designed to meet the objectives of maximizing refuse storage quantities and maintaining a geotechnically stable base. The primary features of this plan are:

Constructing a 2H to 1V outslope for the refuse pile;

Placement of soil;

Revegetation and mulching of the soiled site; and

Breaching and filling of the sedimentation ponds with embankment materials.

Following completion of the construction, the pile surface will be prepared for soil distribution from the soils in the stage storage area. The quantity of soil cover required for the refuse pile facility is discussed in Section 242 of this amendment.

Grading activities during operations will develop a pile with a final surface configuration approximating that defined by RA Plates 5-1. Once this final surface is achieved, the top two feet of the surface not be compacted or the surface will be ripped to prepare it for soil spreading. Details regarding soil placement and revegetation following regrading are provided in Chapters 2 and 3, respectively.

Sedimentation Pond Removal and Interim Sediment Control. The sedimentation ponds will be retained for as long as practical during reclamation. Because the ponds are ~~is~~ constructed as ~~an~~ incised structures, the pond reclamation will consist primarily of breaching the ponds and pushing the embankments into the pond to create a gentle slope. The emergency spillway outlet channel for Sedimentation Pond 1 will be extended upstream to create RD-4. The emergency spillway for Sedimentation Pond 2 will be removed. ~~removed and the rock from the spillways will be used in the construction of reclaimed channel RD-1c~~. ~~During reclamation the berm materials of the diversion ditches around the refuse pile will be pushed into the ditch and a free draining slope will be constructed to allow runoff from the pile site to enter the natural drainages. Once the sediment pond and ditch areas are adequately graded, the soil materials will be redistributed and revegetated in accordance with Chapters 2 and 3.~~

542.300 Final Surface Configuration Maps and Cross Sections

Final surface configuration maps and cross sections for the Dugout Canyon refuse pile site are provided on RA Plates 5-2, 5-1A and 5-1B ~~and 5-2A~~. The topography illustrated on RA Plate 5-2 shows the proposed pile configuration and the proposed final configuration of the ground surface. RA Plate ~~5-2A~~ 5-1A and 5-1B presents final configuration cross-sections of the refuse pile site.

542.400 Removal of Temporary Structures

No surface structures are planned to be associated with the refuse pile operation.

542.500 Removal of Sedimentation Pond

Refer to Section 542.200 of this amendment.

542.600 Roads

All temporary access roads constructed during refuse pile construction activities will be reclaimed when no longer needed for access to the site. Any surfacing material will be removed, the area will be regraded, ripped, and the final reclamation seed mix will be applied as specified in Chapter 3.

542.700 Final Abandonment of Mine Openings and Disposal Areas

No mine openings or disposal areas will exist in this area.

542.800 Estimated Cost of Reclamation

Refer to the existing M&RP. It is anticipated that the cost of reclamation of the refuse pile is adequately covered within the existing Dugout Canyon Mine reclamation bond.

550 RECLAMATION DESIGN CRITERIA AND PLANS

551 Casing and Sealing of Underground Openings

No underground openings will exist in the area.

552 Permanent Features

552.100 Small Depressions

No small depressions will be created as part of the refuse pile construction and reclamation. Additionally, the original topographic divide that existed on the site pre-disturbance will be enhanced as part of the refuse pile construction plan.

552.200 Permanent Impoundments

No permanent impoundments will be left following reclamation.

553 Backfilling and Grading

553.100 Disturbed Area Backfilling and Grading

Approximate Original Contour. As indicated earlier, the site of the refuse pile is a previously disturbed site. The proposed configuration of the site will comply with the post-mining land use and blend into the surrounding area.

Based on the proposed plan, a portion of the existing ground surface will be raised by the construction of the refuse pile. Prior to placing refuse, the soils present on the site will be stripped and temporarily stored on site. At final reclamation, the stored soil will be redistributed and revegetated as described in Chapters 2 and 3 of this submittal.

The reclaimed slopes of the refuse pile will have a similar shape to the slopes in the surrounding area, including concave slopes and slope breaks. The top of the reclaimed pile will be regraded to have an irregular plateau surface that drains towards all pile outslopes instead of draining only towards one side of the pile (refer to RA Plates 5-2 ~~and 5-2A~~).

Erosion and Water Pollution. Sediment-control measures will be implemented during and following reclamation activities.

Prior to seeding, all areas with a slope steepness of 3H:1V or steeper will be roughened using a trackhoe. The final surface will consist of mounds and depressions capable of holding runoff and/or erosion control matting. Additionally, a 10 foot wide terrace will be placed along the southern slope of the pile at approximately 5,925 feet in elevation with a 10-foot variation to allow for tie into adjacent drainage ditches. Refer to Sections 355 and 341 regarding erosion-control and revegetation.

During these activities temporary sediment controls will consist of installation of silt fences, berms, and/or straw bales, surface roughening, and re-establishment of the vegetative cover for the limited areas. As vegetation becomes established on the reclaimed surfaces, erosion potentials will be further minimized. By minimizing erosion, water pollution will also be precluded.

Post-Mining Land Use. The disturbed area will be reclaimed in a manner that supports the approved post-mining land use.

553.200 Spoil and Waste

Spoil. No spoil will be generated within the permit area.

Coal Processing Waste. No coal processing waste will be generated within the permit area. However, should coal from the CFC mines be processed at a washing facility, there is potential for the processing waste to be returned to the refuse pile site for disposal.

553.250 Refuse Piles

The refuse pile site is a previously disturbed area. The site is to be located in a played out gravel pit. Therefore, little soil materials remain available on the site. The refuse pile surface will be prepared and the soil will be distributed and revegetated in accordance with the plans proposed in Chapters 2 and 3.

553.300 Exposed Coal Seams, Acid- and Toxic-Forming Materials, and Combustible Materials

No coal seams are present in the area.

553.400 Cut-and-Fill Terraces

A 10-foot wide terrace will be placed on the southern slope as described in Section 242.100 and 553.100.

553.500 Highwalls From Previously Mined Areas

No highwalls exist or will be built at the refuse pile site.

553.600 Previously Mined Areas

The area has not been previously mined.

553.700 Backfilling and Grading - Thin Overburden

Backfilling and grading will occur during reclamation, as described in Sections 534.100 and 542.600.

553.800 Backfilling and Grading - Thick Overburden

Backfilling and grading will occur during reclamation, as described in Sections 534.100 and 542.600.

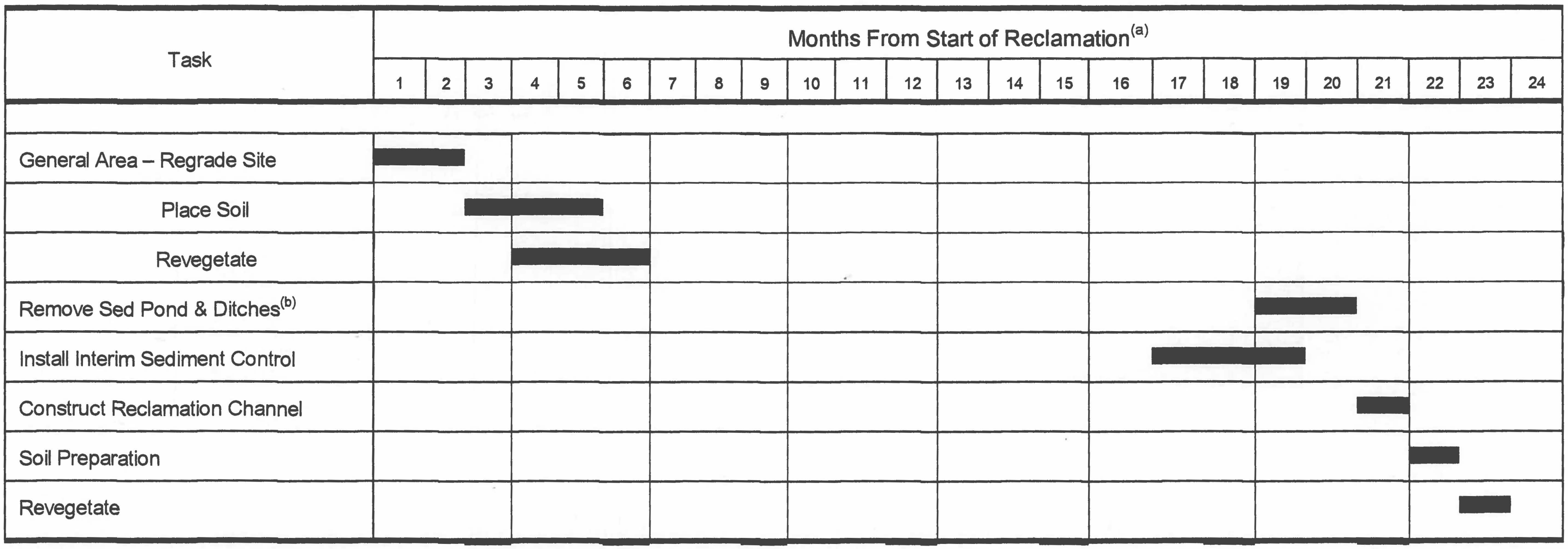
553.900 Regrading of Settled and Revegetated Fills

No settled or revegetated fills currently or will exist at the storage site.

560 PERFORMANCE STANDARDS

Coal mining and reclamation operations at the Dugout Canyon Mine will be conducted in accordance with the approved permit and the requirements of R645-301-510 through R645-301-553.

RA FIGURE 5-1
Reclamation Schedule



(a) Schedule assumes that weather conditions are conducive to reclamation activities

(b) Schedule will be based on success of the revegetation. If necessary, the timing can be extended.

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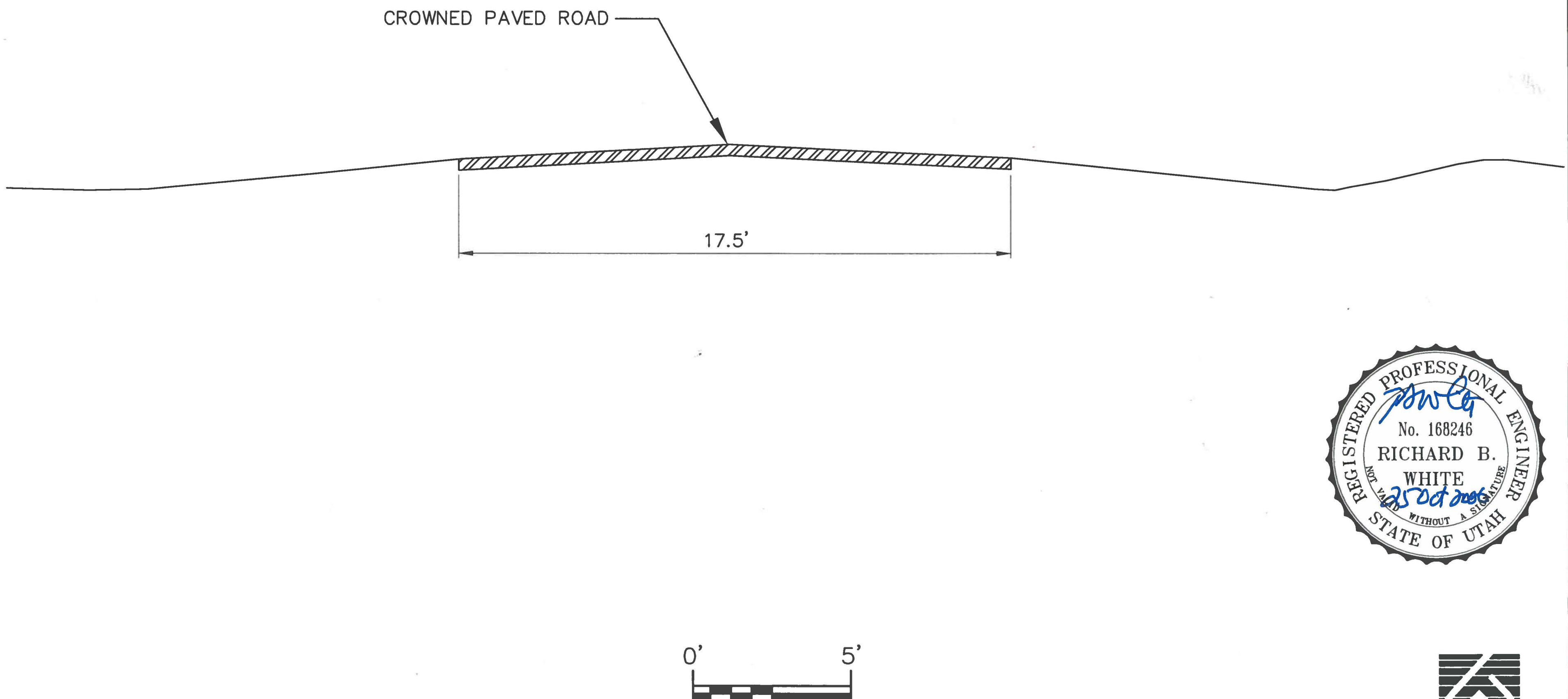
5-27



REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
25 Oct 2006
NOT VALID WITHOUT A SIGNATURE
STATE OF UTAH

RA FIGURE 5-2. TYPICAL ACCESS ROAD CROSS-SECTION

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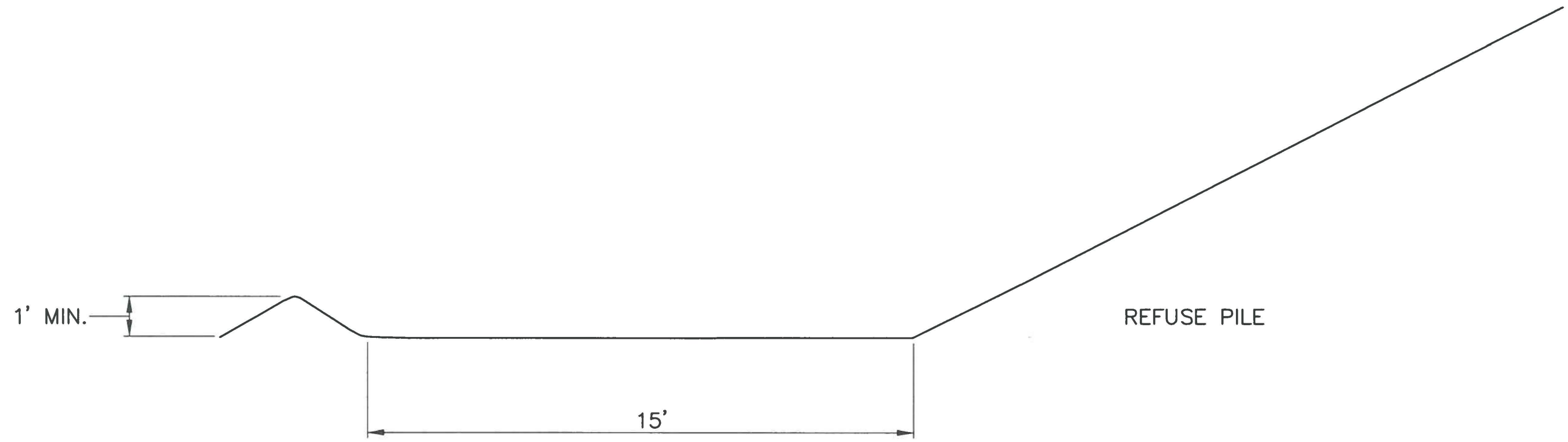

REGISTERED PROFESSIONAL ENGINEER
No. 168246
RICHARD B. WHITE
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STATE OF UTAH

RA FIGURE 5-3. TYPICAL TEMPORARY ACCESS ROAD CROSS-SECTION

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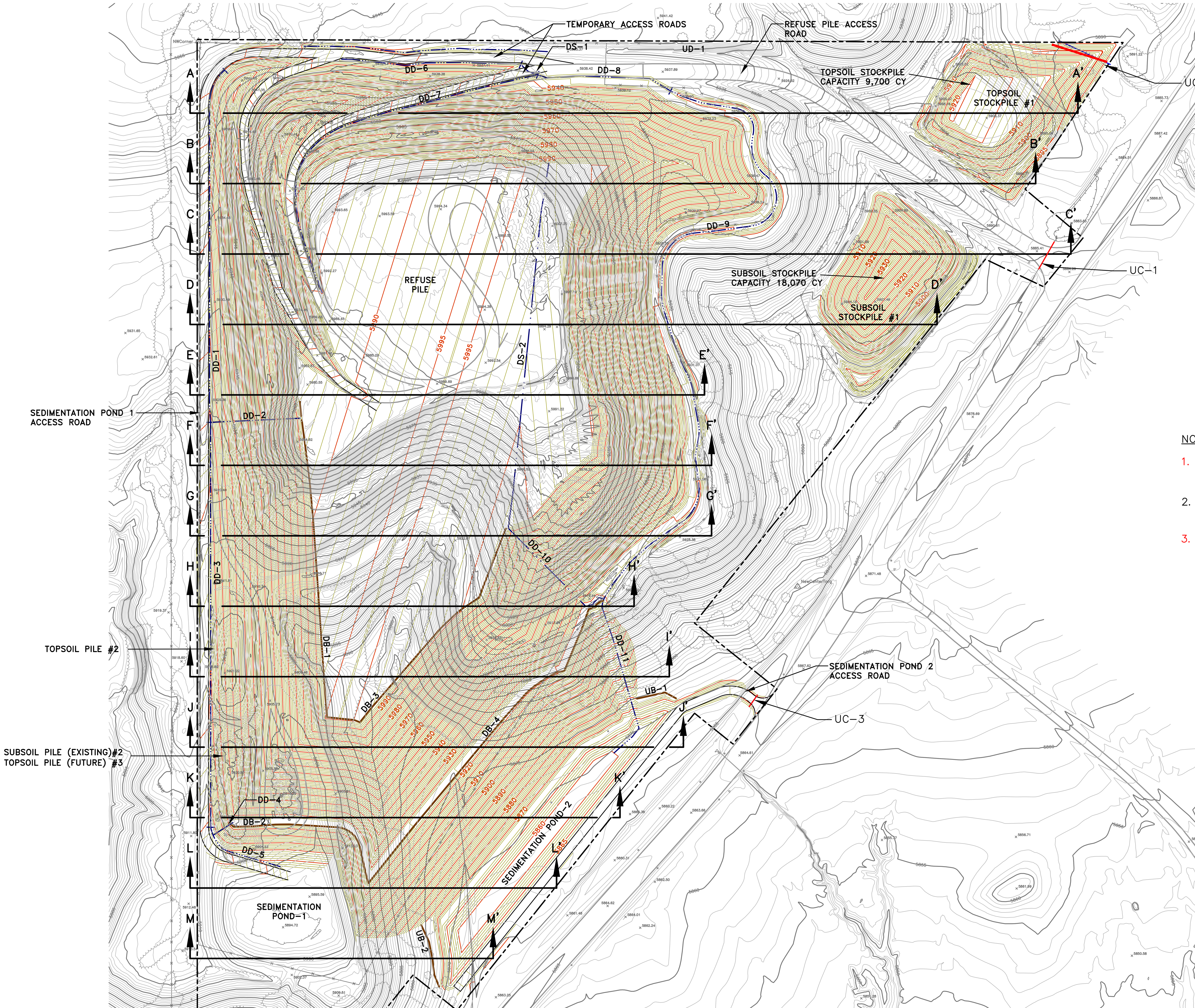
DUGOUT REFUSE PILE

DESIGN



REFUSE STOCKPILE	EXISTING(CY)	PHASE II(CY)	TOTAL(CY)
REFUSE PILE VOLUME	728,055	585,000	1,313,055

TOPSOIL STOCKPILE	EXISTING(CY)	PHASE II(CY)	TOTAL(CY)
TOPSOIL WITHIN TOPSOIL STOCKPILE #1	5,612	4,088	9,700
TOPSOIL WITHIN TOPSOIL STOCKPILE #2	2,937		2,937
TOPSOIL WITHIN TOPSOIL STOCKPILE #3		4,426	4,426
TOPSOIL CONTEMPORANEOUSLY RECLAIMED		3,086	3,086
TOTAL TOPSOIL VOLUME	8,549	11,600	20,149

SUBSOIL STOCKPILE	EXISTING(CY)	PHASE II(CY)	TOTAL(CY)
SUBSOIL WITHIN SUBSOIL STOCKPILE #1	9,211	2,920	12,131
SUBSOIL CONTEMPORANEOUSLY RECLAIMED		23,933	23,933
TOTAL SUBSOIL VOLUME	9,211	26,853	36,064

NOTES:

1. THE EXISTING SURFACE IS FROM AREO-GRAHICS DECEMBER 17, 2015 FOR THE PRE-OPERATIONAL SURVEY SURFACE SEE RA PLATE 5-3
2. PORTIONS OF THE SITE MAY BE USED FOR STORAGE OF SNOW AND EQUIPMENT.
3. TOPSOIL AND SUBSOIL STOCKPILES WILL BE USED FOR CONTEMPORANEOUS RECLAMATION PRIOR TO REFUSE PLACEMENT IN ASSOCIATED AREAS.

LEGEND

- PERMIT AREA BOUNDARY
- 8140 EXISTING GROUND MAJOR CONTOUR (5 FOOT)
- EXISTING GROUND MINOR CONTOUR (1 FOOT)
- 8120 OPERATIONAL GROUND MAJOR CONTOUR (5 FOOT)
- OPERATIONAL GROUND MINOR CONTOUR (1 FOOT)
- PROPOSED BERM, AS SPECIFIED
- PROPOSED CULVERT
- PROPOSED DITCH
- EXISTING DIRT ROAD
- EXISTING STREAM
- X X PROPOSED FENCE/GATE
- A A' CROSS-SECTION (SEE RA PLATES 5-1A AND 5-1B)

0 80 160
FEET

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

SEAL:

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

DUGOUT REFUSE PILE DESIGN
OPERATIONAL PLAN
PHASE II

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84542 435-637-6360	DATE: 2/2017	CK.BY: TAJ	REVISION: 0
CAD FILE: RA PLATE 5-1.DWG	SCALE: AS SHOWN	DR.BY: SWF	
DWG. NO.:	RA PLATE 5-1		

SEE RA PLATE 5–1 FOR CROSS SECTION LOCATIONS

SEAL:

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

DUGOUT REFUSE PILE DESIGN
OPERATIONAL AND RECLAIMED CROSS–SECTIONS

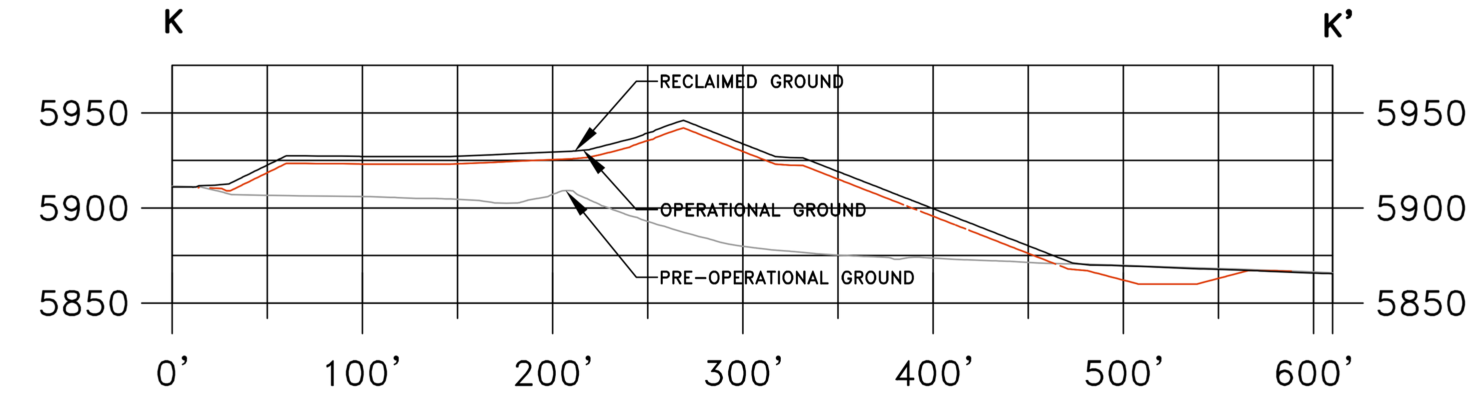
Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84114 435–637–6360
CAD FILE: EF–G:\UC462/03/PLATE 5–1A

DATE: 1/2017	CK.BY:RBW	REVISION: 0
SCALE: AS SHOWN	DR.BY:SWF	
DWG. NO.:	RA PLATE 5–1A	

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

0 80 160
FEET



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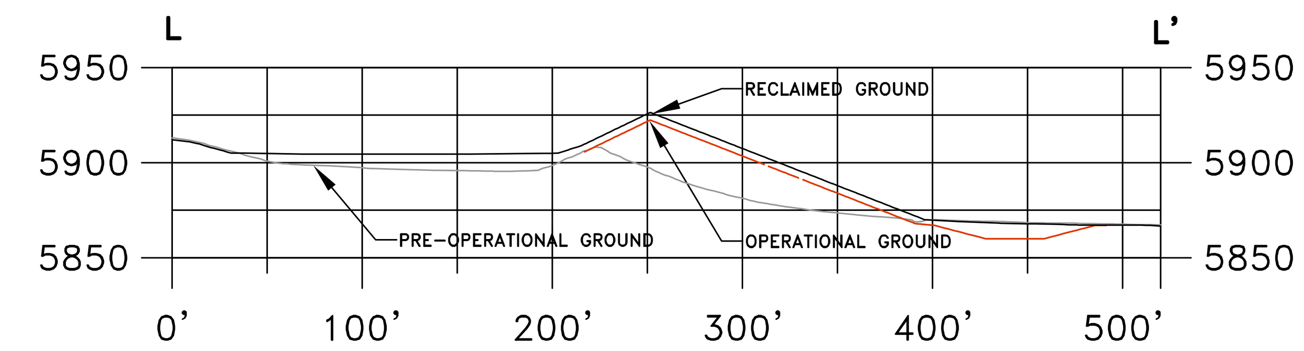

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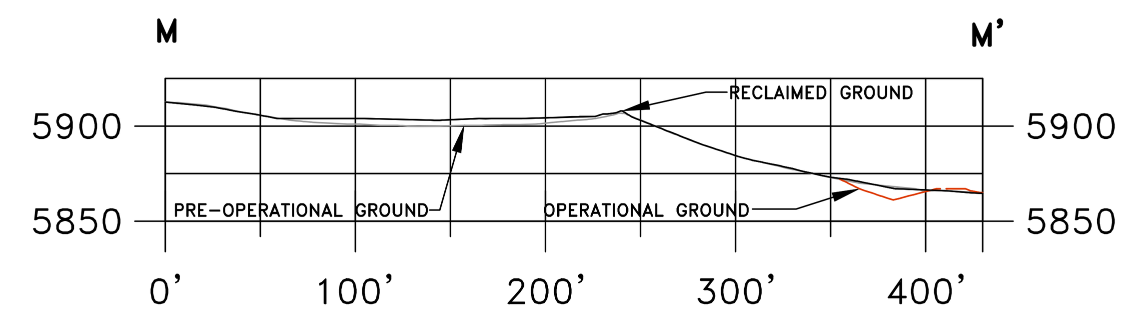


SECTION M–M'

SEE RA PLATE 5–1 FOR CROSS SECTION LOCATIONS

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

0 80 160
FEET

SEAL:
REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

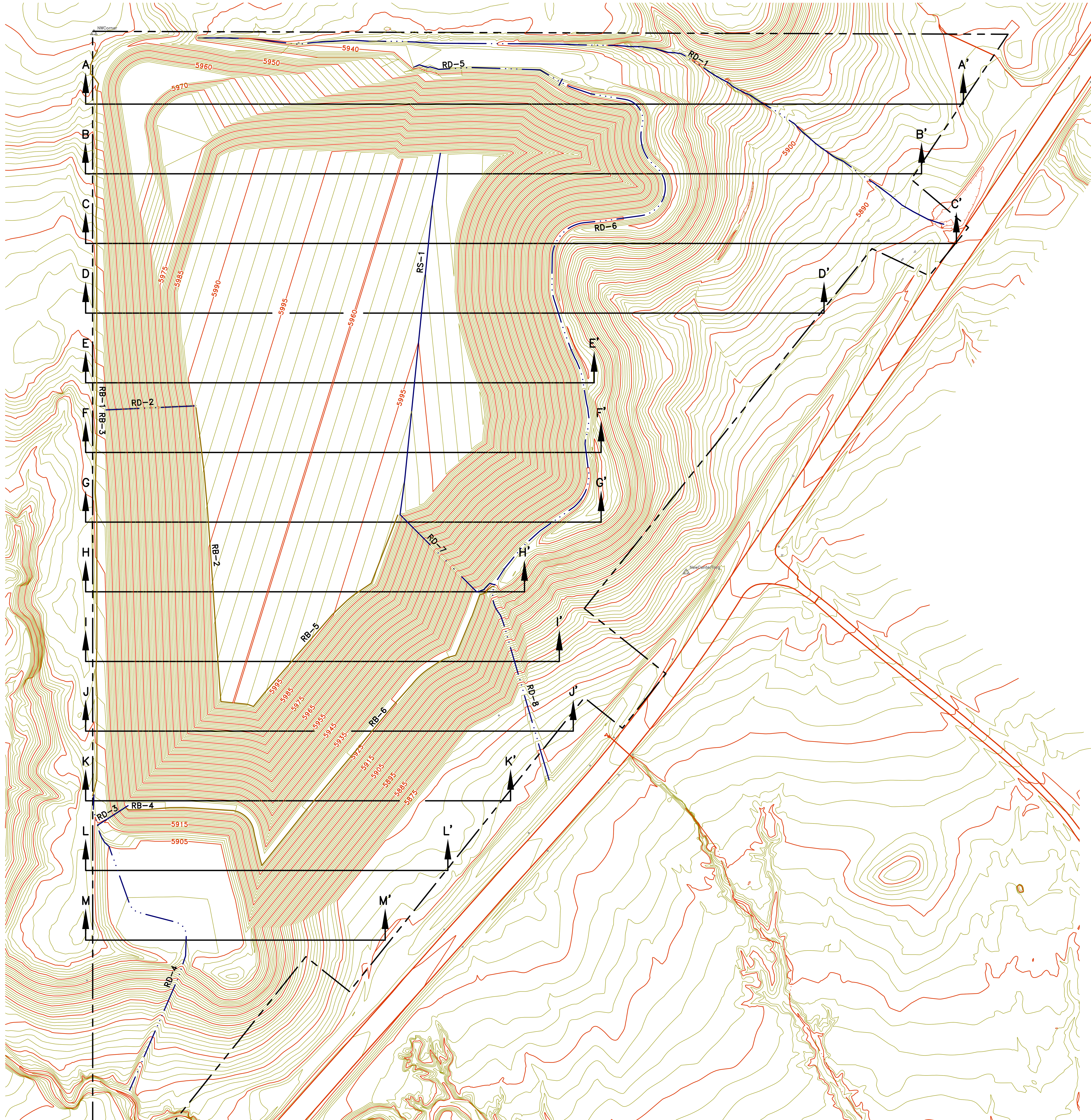
DUGOUT REFUSE PILE DESIGN
OPERATIONAL AND RECLAIMED CROSS–SECTIONS

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84114 435–637–6360
CAD FILE: EF–G:\UC462/03/PLATE 5–1B

DATE: 1/2017	CK.BY: RBW	REVISION:
SCALE: AS SHOWN	DR.BY: SWF	0

DWG. NO.: RA PLATE 5-1B



RECLAMATION	FILL (CY)
0.4' TOPSOIL COVER VOLUME	11,740
3.1' SUBSOIL COVER VOLUME	90,988
COAL BLEND	14,675
TOTAL RECLAMATION VOLUME	117,403

LEGEND

PERMIT AREA BOUNDARY

8140 RECLAIMED GROUND MAJOR CONTOUR (5 FOOT)

RECLAIMED GROUND MINOR CONTOUR (1 FOOT)

RECLAMATION DITCH

RECLAMATION BERM (TO BE REMOVED WITH SP-1)

EXISTING DIRT ROAD

EXISTING STREAM

A A' CROSS-SECTION (SEE RA PLATES 5-1A AND 5-1B)

EarthFax Engineering, Inc.
Engineers/Scientists

0 80 160
FEET

SEAL:

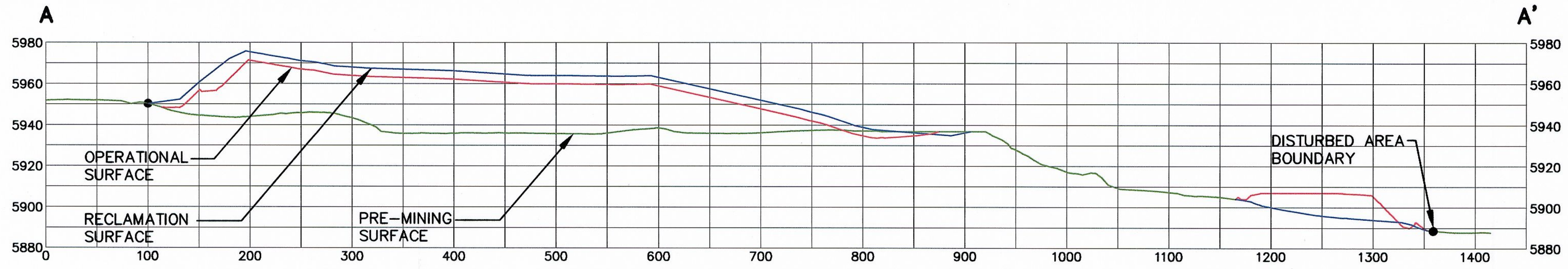
REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

DUGOUT REFUSE PILE DESIGN
RECLAMATION PLAN
PHASE II

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84542 435-637-6360	DATE: 1/2017	CK.BY: TAJ	REVISION: 0
CAD FILE: RA PLATE 5-2.DWG	SCALE: AS SHOWN	DR.BY: SWF	
DWG. NO.:		RA PLATE 5-2	



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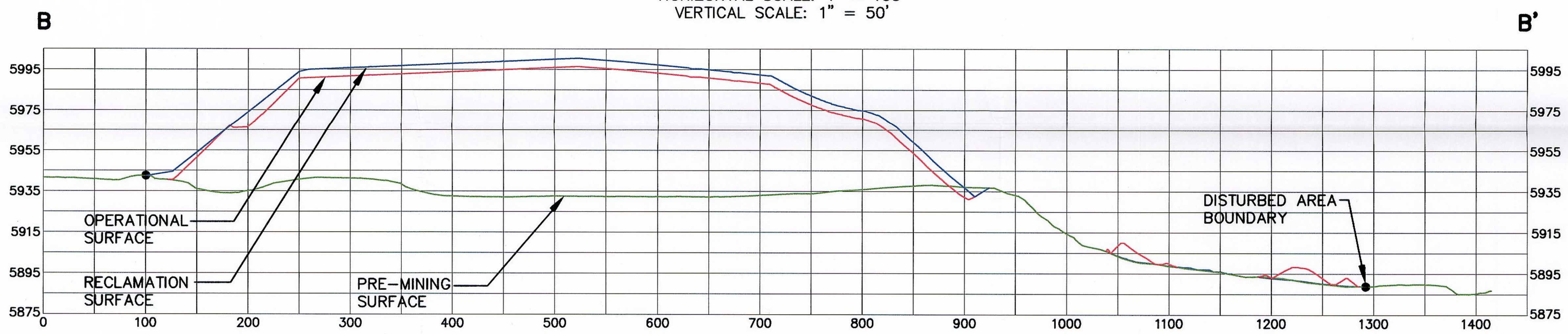
VERTICAL SCALE: 1" = 50'



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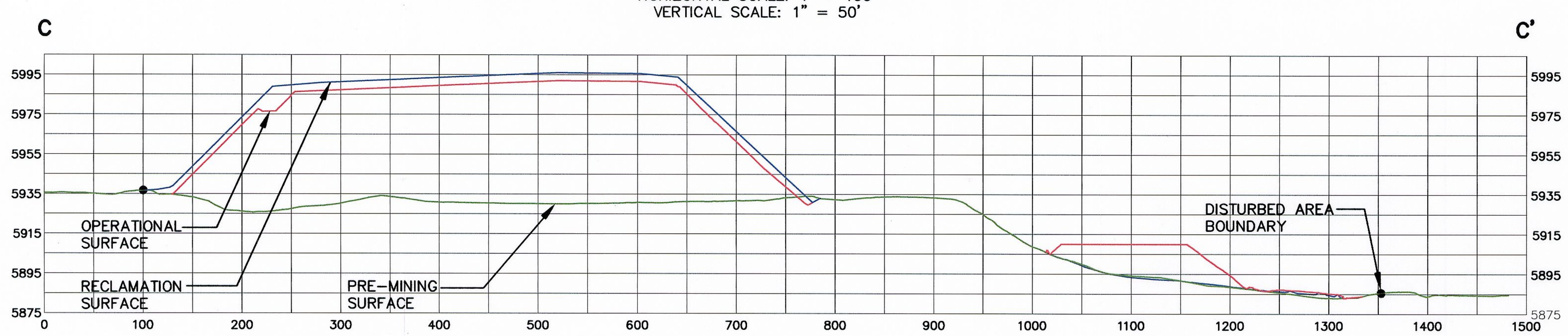
VERTICAL SCALE: 1" = 50'



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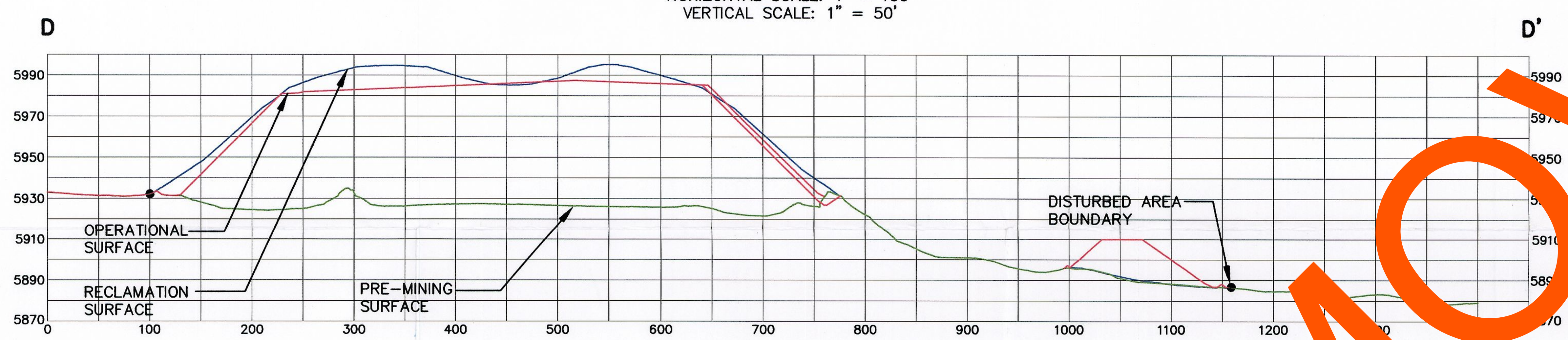
VERTICAL SCALE: 1" = 50'



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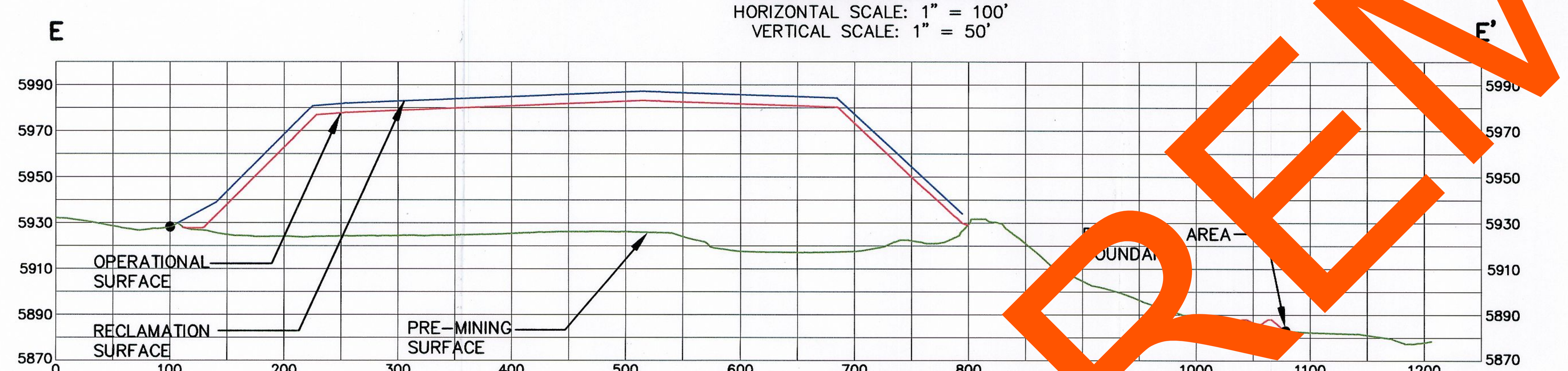

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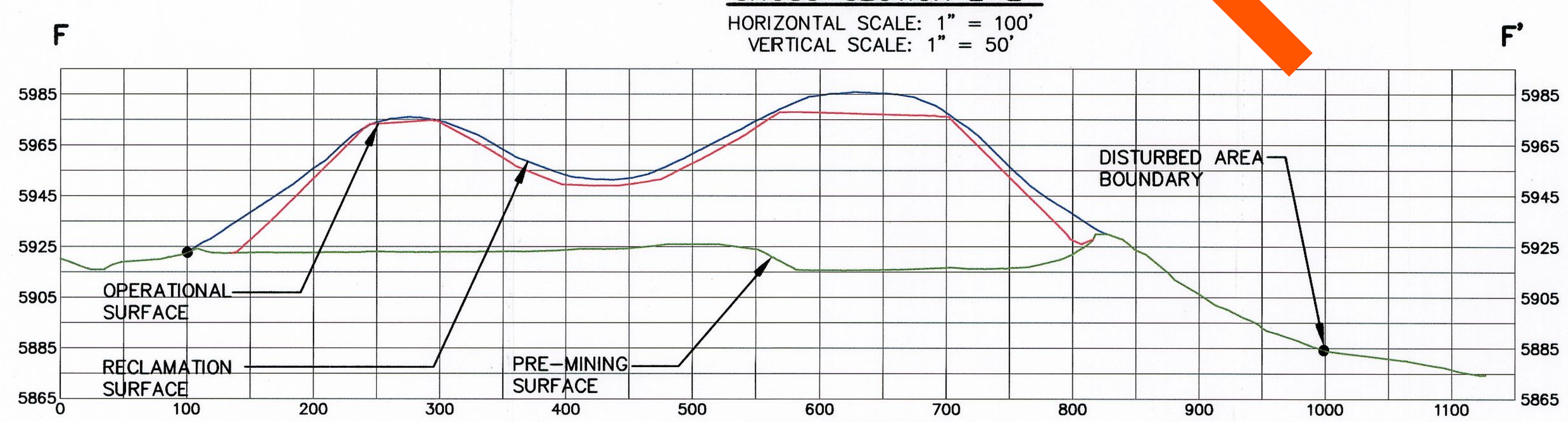

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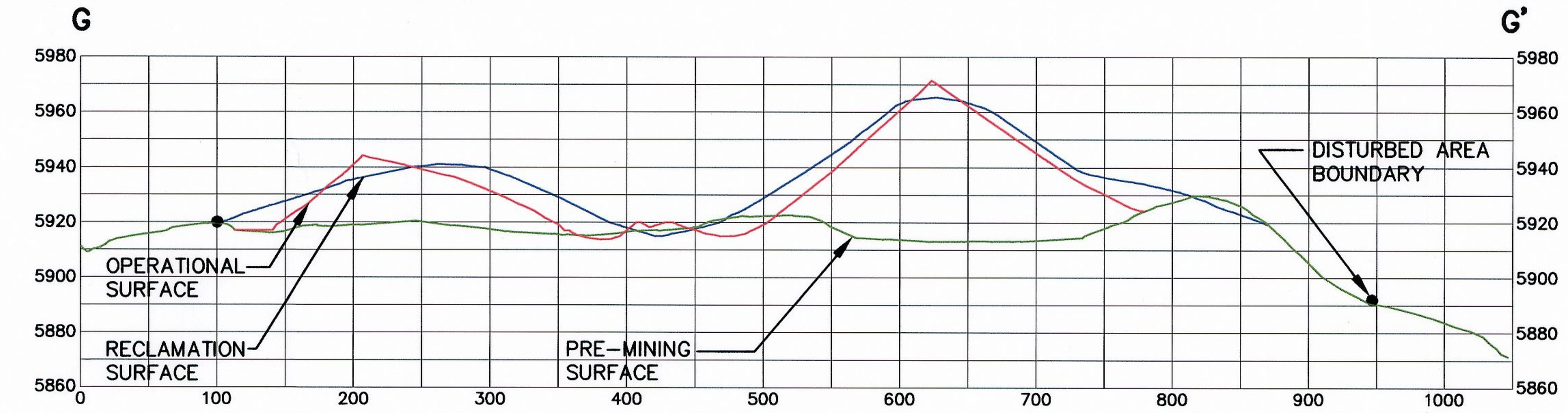

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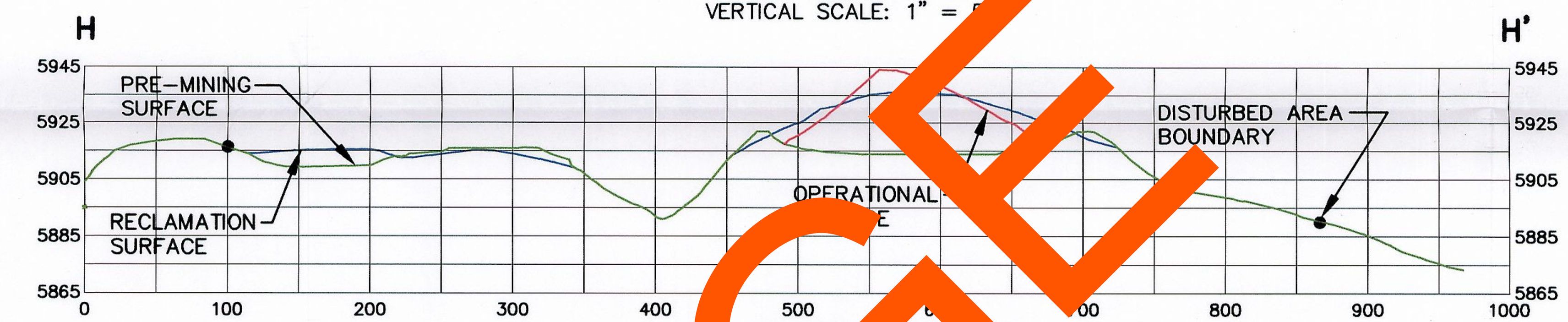

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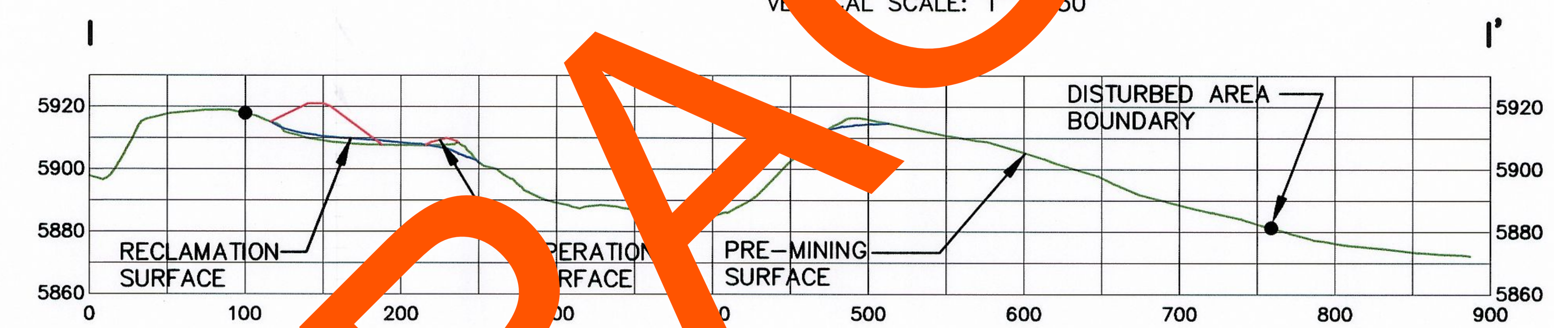
VERTICAL SCALE: 1" = 50'



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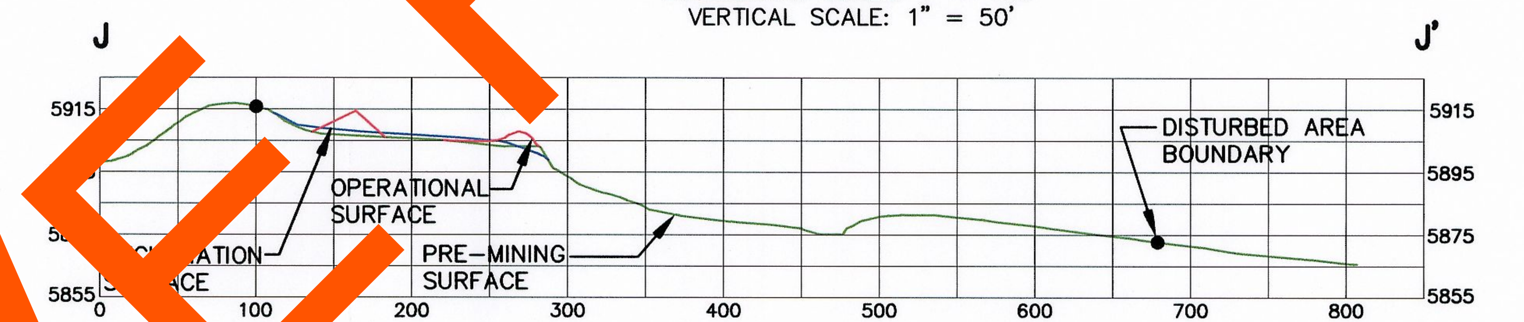
VERTICAL SCALE: 1" = 50'



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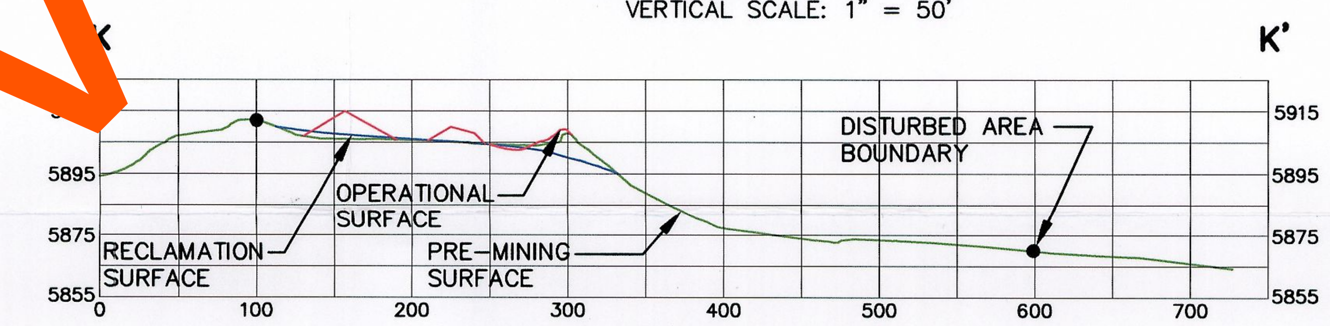

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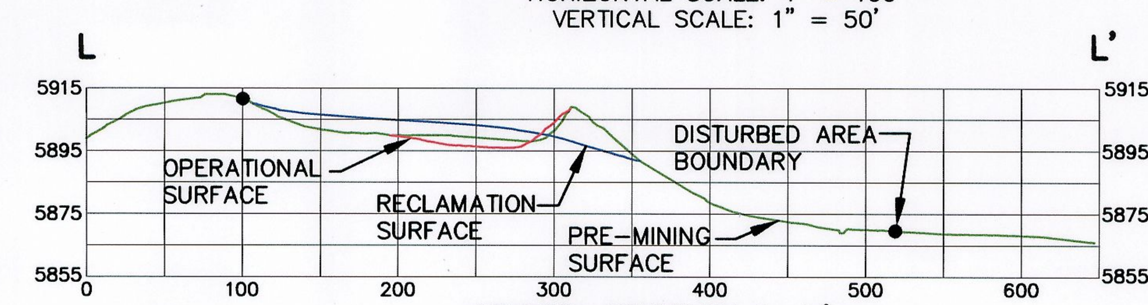

CROSS-SECTION L-L'
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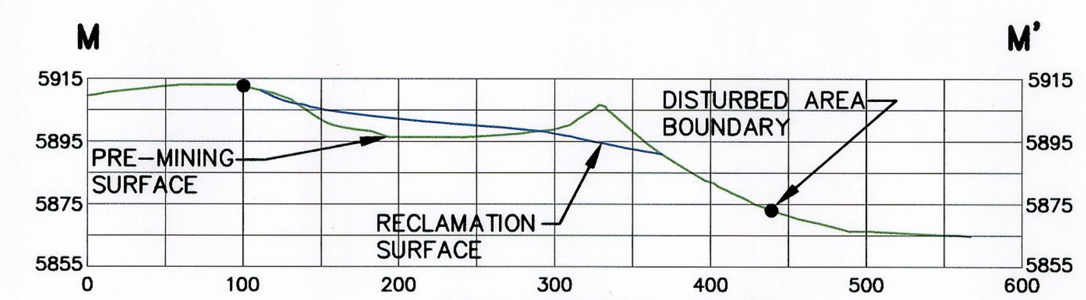

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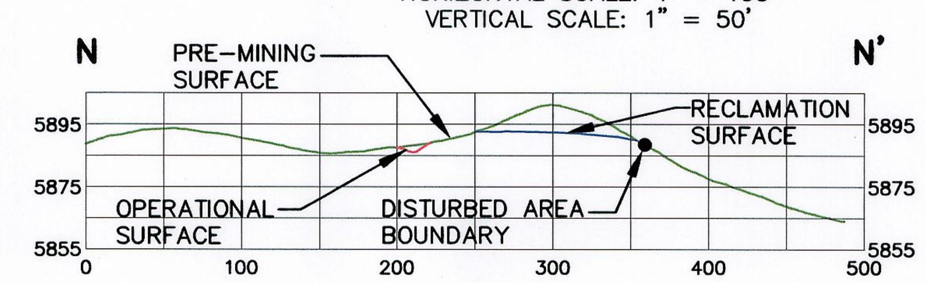

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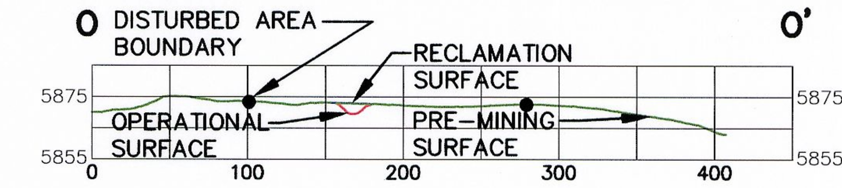
VERTICAL SCALE: 1" = 50'



CROSS-SECTION O-O'
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 50'

LEGEND

PRE-MINING SURFACE
OPERATIONAL SURFACE
RECLAMATION SURFACE

NOTE: THE RECLAMATION SURFACE REPRESENTS THE REGRADED COAL WASTE WITH 4' OF SOIL COVER.

REVISION	
DATE	BY
3/2015	TAJ

Canyon Fuel Company, LLC
Soldier Canyon & Dugout Canyon Mines

STORAGE AREA
RECLAMATION CROSS SECTIONS

Dugout Canyon Mine

DRAWN BY: SWF/TAJ	DATE: JAN 2006	SCALE: AS SHOWN
APPROVED BY: RBW	FILE NAME: G:\UC1462\1\DWG\PLATE-RA5-2A PHASE 1.DWG	DRAWING OR MAP NUMBER: RA PLATE 5-2A

LEGEND

DISTURBED AREA BOUNDARY AND PERMIT AREA BOUNDARY

5940 / 5950 PRE-PERMITTED CONTOURS

NOTES:

1. THIS TOPOGRAPHY REPRESENTS CONDITIONS OF THE SITE PRIOR TO 1998 BUT AFTER THE SITE WAS USED AS A GRAVEL PIT.

0' 100'

PROJECT AREA LOCATED ENTIRELY WITHIN SEC. 18, T. 14 S., R. 12 E., SLBM

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

REVISION	
DATE	BY
10/28/16	TAJ

Canyon Fuel Company, LLC
Soldier Canyon & Dugout Canyon Mines

STORAGE AREA
PRE–MINING CONDITIONS

Dugout Canyon Mine

DRAWN BY: SWF	DATE: NOV 2016	SCALE: 1"=100'	
APPROVED BY: TAJ	FILE NAME: RAPlate 5-3.DWG	DRAWING OR MAP NUMBER	RA PLATE 5–3

RA ATTACHMENT 5-1

SEDIMENT POND SLOPE STABILITY EVALUATION

Dugout Canyon Mine
Refuse Pile Sedimentation Pond 2
Slope Stability Analysis

Canyon Fuel Company
Dugout Mine
Wellington, Utah

February 2017

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A.
JIMENEZ
2/16/2017
STATE OF UTAH

EarthFax EarthFax Engineering Group, LLC

Engineers / Scientists
www.earthfax.com

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TABLE 1 Soil Properties used for *Slide* Analyses
TABLE 2 Results of *Slide* Analyses

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Attachment A EarthFax 2001 Slope Stability Investigations
Attachment B *Slide* Geometry and Output

DUGOUT CANYON MINE
REFUSE PILE SEDIMENTATION POND 2
SLOPE STABILITY ANALYSES

CHAPTER 1

INTRODUCTION

Canyon Fuel Company is planning the expansion of an existing Refuse Pile (the Site). The Site is located on Dugout Canyon Road 8 miles northwest of Wellington, Utah. The proposed expansion will generally extend the Refuse Pile towards the south. As part of this expansion a second sedimentation pond (Sedimentation Pond 2) will be constructed at the Site. In support of the Sedimentation Pond 2 design, a slope stability analysis was performed for this pond to confirm that the pond will be stable. The purpose of this report is to summarize the methods and findings of the slope stability analyses performed for the proposed Dugout Mine Refuse Sedimentation Pond 2. This report was prepared for Canyon Fuel Company by EarthFax Engineering Group, LLC (EarthFax).

CHAPTER 2
BACKGROUND INFORMATION

The Site was originally used by the mine as a borrow source for granular fill. This borrow pit generally extended downward until weathered Mancos Shale or Mancos Shale bedrock was encountered. Following the area's abandonment as a borrow pit, the Site was then used to stockpile refuse from the mine, backfilling the borrow pit and raising the Site above the original grade to its present configuration.

Prior to using the area to stockpile refuse material, a slope stability investigation was performed by EarthFax (see Attachment A). This investigation included the installation of ten shallow test pits to log soils and collect samples for geotechnical laboratory analyses. Soil samples were analyzed for grain size distribution, shear strength, and Atterberg limits.

The EarthFax field investigation generally encountered surficial materials consisting of granular gravelly sand alluvium, sandy silt and silty sand with gravel ("granular soils"), or weathered Mancos shale. The granular soils and weathered Mancos Shale varied in thickness from 2 to 9+ feet and were overlying Mancos Shale bedrock. Additional detail on this investigation including test pit locations, detailed soil logs, and laboratory testing results can be found in the investigation's letter report included in Attachment A.

CHAPTER 3
EVALUATION METHODS

The stability of Sedimentation Pond 2 was evaluated using the slope stability software *Slide 5.0* ("*Slide*") developed by RocScience. This program uses an iterative procedure to evaluate the factor of safety against rotational shear failure for tens of thousands of potential failure surfaces that may develop within a given slope. Each trial failure surface is discretized into small slices and the driving and resisting forces/moments are calculated for each according to Bishop's Simplified Method of Slices. These forces are then summed over the entire failure surface to obtain a factor of safety defined as the sum of the resisting forces divided by the sum of the driving forces. Therefore, a factor of safety less than 1.0 indicates an imminent potential for slope failure.

The analyses discussed herein relied on soils data collected during the 2001 EarthFax field investigation, as this investigation encompassed the same general area as Sedimentation Pond 2. The stability of the existing Sedimentation Pond 1 embankment was not analyzed within this report as slope stability analyses have been previously performed for this embankment (see Attachment A). The previous analyses indicated the configuration of Sedimentation Pond 1was sufficiently stable under steady-state seepage conditions. It is our understanding that the Sedimentation Pond 2's geometry will be maintained or improved as part of the proposed Refuse Pile expansion.

Details on the slope-stability scenarios analyzed and soil properties used for these analyses are included in the following sections.

3.1 Sedimentation Pond 2 Embankment

Sedimentation Pond 2 embankment will be an incised pond with a maximum fill height along the embankment of 2 feet. According to soil study test pit analysis on-site soils appear to be suitable. However, if during construction the soils change from those located in the test pit, embankment materials maybe imported. Therefore, to be conservative, the embankment was modeled as being entirely constructed with imported fill materials which are less suitable than on-site soils and a maximum outer slope height of 10 feet. The model used the following geometry:

- **Inner slope.** Maximum 7 feet tall at a 3H:1V slope
- **Crest.** Minimum 12 feet wide
- **Outer Slope**. Maximum 10 feet tall at a 2H:1V slope

The stability of Sedimentation Pond 2 embankment's outer slope was analyzed under the steady-state seepage condition. This condition assumes Sedimentation Pond 2 is completely full of water with a phreatic surface fully developed within the embankment. The location of the phreatic surface was determined using *Slide*'s finite-element seepage sub-program and assumed hydraulic conductivities.

The stability of Sedimentation Pond 2 embankment's inner slope was analyzed under a "rapid drawdown" condition. Under this condition, the pond is quickly drained such that the buttressing effect of the pond water is lost but pore pressures remain trapped within the embankment that had developed during the steady-state seepage condition, thus weakening the slope. This is the most critical condition for the inner slopes of Sedimentation Pond 2 embankment.

Stability analyses for Sedimentation Pond 2 embankments assumed that all native soils (either granular or weathered Mancos Shale) below the phreatic surface were fully saturated and weakened. For this analysis, strengths for all saturated soils beneath Sedimentation Pond 2 were taken as 2/3 of the laboratory strengths reported in the 2001 EarthFax report in Attachment A. This is considered a conservative assumption since in reality Sedimentation Pond 2 will only be filled intermittently and with a finite quantity of water incapable of saturating all underlying soils.

As was done for the Refuse-Pile stability analyses, the analyses of Sedimentation Pond 2 embankment were performed with the embankment overlying both granular soils and weathered Mancos Shale since both are possible in the vicinity of Sedimentation Pond 2. The analyses also conservatively ignored any potential presence of Mancos Shale bedrock.

3.2 Soil Properties Used for Slide Analyses

The soil properties used as input for *Slide* analyses are summarized in Table 1. As discussed above, these data are taken from the 2001 EarthFax report (see Attachment A). In the interest of conservatism, the weakest soils from the laboratory testing program were used in the slope stability analyses.

CHAPTER 4
RESULTS

The calculated minimum factors of safety for the various scenarios described above are summarized in Table 2. The minimum factor of safety for Sedimentation Pond 2 embankment under steady-state seepage is 1.46.

The minimum acceptable factor of safety promulgated by the Utah Division of Oil, Gas, and Mining ("DOGM") for Sedimentation Pond 2 embankment is 1.3 under steady-state seepage conditions (R645-301-533.110). This factor of safety applies to NRCS (1985) Class A embankments and those not meeting the criteria of MSHA 30 CFR Sec. 77.216(a). The proposed embankment classifies as a Class A embankment given its rural location, low ponded depth of 7 feet and low retention volume, less than 3 acre-feet. The calculated factor of safety of 1.46 is therefore considered acceptable and the embankment is expected to remain stable under the geometry and loading conditions presented herein.

CHAPTER 5

ENGINEERING PRACTICES

The results of this investigation apply to the slope geometries and soil conditions discussed above. If actual conditions differ from those assumed in this report, Sedimentation Pond 2 embankment slope stability should be re-evaluated as necessary.

The following are recommended specific to the design and construction of Sedimentation Pond 2 embankment:

- The embankment should be placed on a well-prepared and compacted subgrade free from any organic soils, vegetation, debris, frozen soils, soft soils, or other deleterious materials (R645-533.220).
- The embankments should be well keyed into, or otherwise secured to, the underlying subgrade and adjacent slopes where not incised.
- Embankment soils should be compacted with an appropriate compactor to at least 95% of the Standard Proctor maximum dry density (ASTM D698) at ±2% of the soil's optimum moisture content. Compacted lifts should not exceed 8 inches.
- It is recommended that topsoil be placed on the outer slope of constructed embankments and vegetation established in order to reduce the potential for erosion (R645-301-533.400). However, no trees, brush, or shrubs should be allowed to grow on the embankment. This can cause failure due to "piping" along root paths.
- Embankments should be regularly inspected as promulgated by DOGM for signs of damage, erosion, and piping and repairs made as necessary.

CHAPTER 6

REFERENCES

Anderson, L.R., I.S. Dunn, and F.W. Kiefer. 1980. Fundamentals of Geotechnical Analysis. John Wiley & Sons, Inc. New York, New York.

EarthFax Engineering, Inc. 2001b. Results of slope stability analyses for the proposed sedimentation pond for the Dugout Canyon Mine. Letter report submitted to Mr. Chris Hansen of Canyon Fuel Company. May 21, 2001.

NRCS (Natural Resource Conservation Service). 1985. Earth Dams and Reservoirs. Technical Release No. 60.

TABLES

TABLE 1
Soil Properties used for *Slide* Analyses

Soil Type	Unit Weight	Moist		Saturated		Permeability
		Cohesion	Friction Angle	Cohesion	Friction Angle	
	(lb/ft^3)	(lb/ft^2)	(deg)	(lb/ft^2)	(deg)	(cm/sec)
Refuse	122	490	35	325	23	10^{-1}
Native Granular Soils	122	0	43	0	28	10^{-4}
Native Weathered Mancos Shale	122	1,360	33	900	22	10^{-4}
Embankment Soils	122	N/A Assumed to be Saturated		200	25	10^{-7}

TABLE 2
Results of *Slide* Analyses

Condition/ Location	Minimum Factor of Safety Overlying Granular Soils	Factor of Safety Overlying Weathered Mancos Shale	Minimum Acceptable Factor of Safety
Sedimentation Pond 2 Embankment Outslope with Steady-State Seepage	1.46	3.44	1.3
Sedimentation Pond 2 Embankment Inslope with Rapid Drawdown	1.61	3.22	1.3

ATTACHMENT A

EarthFax 2001 Sedimentation Pond 1 Slope Stability Investigation

EarthFax
Engineering Inc.
Engineers/Scientists
7324 So. Union Park Ave.
Suite 100
Midvale, Utah 84047
Telephone 801-561-1555
Fax 801-561-1861

May 21, 2001

Mr. Chris Hansen
Canyon Fuel Company, LLC
Dugout Canyon Mine
HC35 Box 380
Helper, Utah 84526

Subject: Results of slope stability analyses for the proposed sedimentation pond for the Dugout Canyon Mine

Dear Chris:

The purpose of this letter is to present the results of slope stability analyses for the proposed sedimentation pond for the Dugout Canyon Mine near Wellington, Utah. The proposed sedimentation pond is located about 4.5 miles southwest of the mine.

BACKGROUND INFORMATION

The site was originally investigated by RB&G Engineering, Inc. (1998; Provo, Utah) as a potential borrow source for granular fill used at the Dugout Canyon Mine. The results of that investigation indicated that the native soils consisted of interbedded layers of gravel and clay overlying Mancos Shale. Following removal and stockpiling of the topsoil, the underlying granular soils were excavated, crushed, screened, and transported to the Dugout Canyon Mine. The excavation typically continued downward until weathered Mancos Shale was encountered. As a result, the remaining soil at the site consisted primarily of thin layers of granular alluvium overlying weathered Mancos Shale and Mancos Shale bedrock.

The topography of the site following removal of the surficial granular soils and stockpiling of the topsoil is shown in Figure 1 (attached). As shown on Figure 1, the site has an irregular shape with most of the surface area present at the north end. Dugout Canyon Mine proposes to construct a waste-rock pile along the east-half of the north end of the site. Mine construction materials will be temporarily stockpiled at the west-half of the north end of the site. This area will also be used to pile snow removed from the working areas around the mine. A sedimentation pond to contain surface water runoff will be constructed at the south end of the site in a depression that was formed during removal of the surficial granular soils.

Based on preliminary design information, the inslope of the sedimentation pond embankment will be about 14 feet high and will slope 2 horizontal to 1 vertical (2H:1V). The embankment crest will be a minimum of 10 feet wide. The native slope will be used as the embankment outslope. In general, the top 26 feet of this native outslope slopes at about 21 degrees (2.6H:1V) (see Section A-A' in Figure 1). The lower portions of the native outslope flattens to about 11 degrees. The ponded water in the sedimentation pond will be a maximum of 11 feet deep, thereby leaving a freeboard of about 3 feet.

SOILS INFORMATION

As part of this investigation, EarthFax installed ten shallow test pits using a rubber tire backhoe. The locations of the test pits are presented in Figure 1 (attached). Test Pits DCW-1 through DCW-9 were excavated within the area from which granular alluvium was removed (see the previous section). Test Pits DCW-4 and DCW-5 were located within the footprint of the proposed sedimentation pond. Test Pit DCW-10 was installed to investigate the native outslope soils near the proposed sedimentation pond.

The test pits were logged by a geotechnical engineer from EarthFax and by a soil scientist from EIS, Inc. (Salt Lake City, Utah). EarthFax's test pit logs are attached. Nuclear density/moisture tests were conducted on the surface soils at most of the test pits to provide remolding criteria for samples submitted for direct shear tests. Select samples were submitted to Applied Geotechnical Engineering Consultants, Inc. (Sandy, Utah) for geotechnical laboratory analyses.

According to the test pit logs, a thin layer (2 to 2.2 feet thick) of weathered Mancos Shale over Mancos Shale bedrock was encountered at Test Pits DCW-3 and DCW-9. Remnants (2.7 to 9 feet thick) of gravelly sand alluvium were encountered at Test Pits DCW-1, DCW-2, DCW-4, and DCW-5. Mancos Shale bedrock was encountered below the alluvial soil at Test Pits DCW-1 and DCW-4. Test Pit DCW-6 contained layers of silty sand and sandy silt to a depth of 6 feet overlying gravelly sand to a depth of 7.5 feet. Test Pit DCW-7 encountered some coal, gravel, and soil to a depth of 0.7 feet, silty sand alluvium to a depth of 6 feet, and gravelly sand alluvium to a depth of about 7 feet. Stockpiled topsoil was encountered to a depth of 5 feet at Test Pit DCW-8, under which a gravelly sand alluvium extended to the bottom of the test pit at a depth of 6.5 feet.

Beyond the disturbed area at Test Pit DCW-10, the subsurface soils consisted of a silty sand topsoil to a depth of 1.1 feet over a gravelly sand layer to the bottom of the test pit at a depth of 8.5 feet.

Results of the laboratory analyses are attached and are summarized in Table 1. Direct shear tests were conducted on samples that were remolded to the same dry density and moisture contents that were recorded in the field from the nuclear density/moisture tests. According to the data in Table 1, the soil property parameters are as follows:

- **Weathered Mancos Shale (Test Pits DCW-3 and DCW-9):** The material contained 0 to 49% gravel, 15 to 16% sand, 25 to 61% silt, and 10 to 24% clay. According to the Atterberg Limits data, the liquid limit was 26 to 33, the plastic limit was 17 to 18, and the plastic index was 9 to 15. The angle of internal friction ranged between 33 and 37 degrees, and the cohesion intercept values ranged between 1320 and 1360 pounds per square foot ("psf"). The direct shear tests were conducted under consolidated, undrained, unsaturated (moist) conditions.

- **Gravelly Sand Alluvium (Test Pit DCW-1):** The material contained 52% gravel, 30% sand, and 18% silt. The angle of internal friction was 43 degrees and the soil was noncohesive from direct shear tests conducted under consolidated, undrained, unsaturated (moist) conditions.

- **Sandy Silt (Test Pit DCW-6):** The material contained 59% silt and 41% sand. The angle of internal friction was 45 degrees and the soil was noncohesive from direct shear tests conducted under consolidated, undrained, unsaturated (moist) conditions.

- **Native Soil Beyond the Disturbed Area (Test Pit DCW-10):** The material contained 34% gravel, 34% sand, and 32% silt. The angle of internal friction was 43 degrees and the cohesion intercept value was 210 psf from direct shear tests conducted under consolidated, undrained, unsaturated (moist) conditions.

ASSUMPTIONS

The following assumptions were made for the slope stability analyses:

1. As a worst-case condition, the native soil is vertically continuous and the failure surfaces do not intersect the Mancos Shale bedrock. This assumption was included because the Mancos Shale bedrock surface is variable throughout the site.

2. The native soils sampled and tested at Test Pit DCW-10 near the proposed sedimentation pond are representative of the moist embankment soils. Therefore, the soil property parameters in Table 1 (cohesive strength = 210 psf; angle of internal friction = 43 degrees) were used for the slope stability analyses.

3. The saturated strength of the native soil is two-thirds of the moist strength presented in the previous item in accordance with recommendations by Dunn et al. (1980).

4. The soils drain rapidly, and excess pore pressures do not develop in response to strains and stress changes.

5. The phreatic surface extends linearly from the full pond level to a level about 10 feet below the native soil surface for analyses conducted under saturated steady-state seepage conditions.

6. The pseudostatic seismic analysis assumes that the site will experience a peak horizontal acceleration of 0.18g (g is the acceleration of gravity), which has a 90% probability of not being exceeded in 50 years at the site (Algermissen et al., 1982).

RESULTS

Slope stability analyses were performed using the computer program GEOSLOPE (Version 5.0). GEOSLOPE utilizes the limit equilibrium procedure of slices (Simplified Bishop's method) to determine the safety factor of potential failure surfaces for circular shapes.

Using the assumptions presented above, results of the slope stability analyses are attached and are summarized in Table 2 (attached). The results of the stability analyses include the data files and the output files. Table 2 includes a description of the analysis slope, the number of trial failure surfaces, and the critical safety factor against sliding. From Table 2, the results are as follows:

- **Outslope with Full Pond and No Phreatic Surface:** This condition assumes that the water level in the pond is 3 feet below the embankment crest, but the embankment is not saturated. The critical safety factor was 3.5.

- **Outslope with Full Pond and Phreatic Surface (Steady-State Seepage):** This condition assumes that the water level in the pond is 3 feet below the embankment crest, and that a phreatic surface develops that extends linearly to a level about 10 feet below the native soil surface, thereby creating a steady-state seepage condition wherein the deeper native soils become saturated. The critical safety factor was 1.9, which satisfies the minimum regulatory requirement of 1.3 promulgated by the Utah Division of Oil, Gas, and Mining (R645-301-533.100).

- **Steady-State Seepage with Seismic Loading:** This condition includes the steady-state seepage condition described in the previous item with a peak horizontal acceleration of 0.18g applied to the embankment for a pseudostatic seismic analysis. The critical safety factor was 1.23.

- **Inslope with Rapid Drawdown:** This condition assumes that the water level in the pond was 3 feet below the embankment crest, that a phreatic surface developed that extended linearly to a level about 10 feet below the native soil surface, and that the pond then drained rapidly. The critical safety factor was 2.2.

We have appreciated the opportunity to provide this information. If you have any questions, please call.

Sincerely,

Rhett Brooks

Rhett Brooks, P.E.
EarthFax Engineering, Inc.

cc: Tom Suchoski, EarthFax

REGISTERED PROFESSIONAL ENGINEER
92-187704-2202
RHETT K.
BROOKS
STATE OF UTAH

Rhett Brooks

May 21, 2001

REFERENCES

Algermissen, S., D. Perking, P. Thenhaus, S. Hanson, and B. Bender, 1982. Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States. U.S. Geological Survey Open-File Report 82-1033.

Dunn, I.S., L.R. Anderson, and F.W. Kiefer. Fundamentals of Geotechnical Analysis. John Wiley & Sons, New York, New York.

Utah Division of Oil, Gas, and Mining. 1996. Utah Coal Mining Regulations. Salt Lake City, Utah.

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

Test Pit and Depth (Ft.)	Gradation (%)				Atterberg Limits			Direct Shear Test Values	
	Gravel	Sand	Silt	Clay	Liquid Limit	Plastic Index	Plastic Limit	Cohesive Strength (psf)	Angle of Internal Friction (degrees)
DCW-1 0-3.2[a]	52	30	18		--	--	--	0	43
DCW-3 0-2.2[b]	49	16	25	10	33	15	18	1320	37
DCW-6 2.5-6[c]	0	41	59		--	--	--	0	45
DCW-9 0-1.2[d]	0	15	61	24	26	9	17	1360	33
DCW-10 1.1-8.5[e]	34	34	32		--	--	--	210	43

[a] Alluvium. Sample for direct shear test remolded to a dry density of 115 pcf at a moisture content of 6%, which were the results of a nuclear density/moisture test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

[b] Weathered Mancos Shale. Direct shear test samples remolded to a dry density of 113 pcf at a moisture content of 6%, which were the results of a nuclear tests conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

[c] Silty sand. Sample for direct shear test remolded to a dry density of 112 pcf at a moisture content of 9%, which were the results of a nuclear density/moisture test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

[d] Weathered Mancos Shale. Direct shear test samples remolded to a dry density of 98 pcf at a moisture content of 6%, which were the results of a nuclear test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

[e] Silty Sand. Direct shear test samples remolded to a dry density of 100 pcf at a moisture content of 8%, which were the results of a nuclear test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 500, 1500, and 2500 psf.

TABLE 2

RESULTS OF SLOPE STABILITY ANALYSES

Condition	Number of Trial Failure Surfaces	Safety Factor
Outslope with Full Pond and No Phreatic Surface	3600	3.5
Outslope with Full Pond and Phreatic Surface (Steady-State Seepage)	3600	1.9
Steady-State Seepage with Seismic Loading	3600	1.23
Inslope with Rapid Drawdown	2700	2.2

G:\UC698\11\DWG\FIG-1TP.DWG 10-28-99

LEGEND

DCW-1
● TEST PIT LOCATION

0' 200'

FIGURE 1. TEST PIT LOCATIONS

EarthFax

TEST PIT DCW-1
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 3.2	Sandy Gravel w/ Silt and Cobbles. Alluvium. About 42% gravel, 30% sand, 10% cobbles, and 18% silt. Sand is typically fine to coarse grained. Cobbles are up to 7 inches in diameter, subround. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 115.5 pounds per cubic foot, wet density = 122.1 pounds per cubic foot. Brown 10YR 4/3. GM.
3.2 - 4.6	Mancos Shale Bedrock. Fractured. Gray. Hard to dig.

TEST PIT DCW-2
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 7.7	Gravelly Sand w/ Silt, Cobbles, and Boulders. Alluvium. About 45% sand, 25% gravel, 15% cobbles/boulders, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 8-inch nuclear density/moisture test: moisture content = 7.8%, dry density = 115.0 pounds per cubic foot, wet density = 124.0 pounds per cubic foot. Brown 10YR 4/3. Boulders at bottom impeded digging deeper. SM.

TEST PIT DCW-3
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 2.2	Weathered Mancos Shale. 49% gravel (fractured Mancos Shale), 16% sand, 25% silt, and 10% clay. Loose in top 3 inches, firmer and less weathered with depth. From a 12-inch nuclear density/moisture test: moisture content = 5.6%, dry density = 112.6 pounds per cubic foot, wet density = 118.8 pounds per cubic foot.
2.2 - 3.2	Mancos Shale Bedrock. Fractured and slightly weathered. Gray. Hard to dig.

TEST PIT DCW-4
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 2.7	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Cobbles are up to 7 inches in diameter, subround. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 115.5 pounds per cubic foot, wet density = 122.1 pounds per cubic foot. Brown 10YR 4/3. SM.
2.7 - 3.2	Mancos Shale Bedrock. Fractured. Gray. Hard to dig.

TEST PIT DCW-5
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 9	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Cobbles are up to 7 inches in diameter, subround. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 115.5 pounds per cubic foot, wet density = 122.1 pounds per cubic foot. Brown 10YR 4/3. SM.

TEST PIT DCW-6
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 1.5	Silty Sand. About 60% sand and 40% silt. Sand is very fine to fine grained. Nonplastic. Numerous large roots from pine trees. From a 12-inch nuclear density/moisture test: moisture content = 8.8%, dry density = 102.9 pounds per cubic foot, wet density = 111.9 pounds per cubic foot. Yellowish brown 10YR 5/4. SM.
1.5 - 2.5	Sandy Silt. About 65% silt and 35% silt. Sand is very fine grained. Low plasticity, somewhat cohesive. Dry and hard. Very friable. ML.
2.5 - 6	Sandy Silt. About 59% silt and 41% sand. Sand is very fine grained. Nonplastic. Probably a blow sand layer. Light yellowish brown 2.5Y 6/3. ML.
6 - 7.5	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles/boulders, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

TEST PIT DCW-7
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 0.7	Mix of Rubbish. Mix of coal, sandstone, and dark brown soil (silt through cobbles). SM.
0.7 - 6	Silty Sand w/ Gravel. Alluvium. About 70% sand, 10% gravel/cobbles, 20% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.
6 - 7	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

TEST PIT DCW-8
Topsoil Stockpile
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 5	Topsoil Stockpile. Topsoil that had been stripped from the site and piled in this area. Primarily silty sand with gravel and organic matter.
5 - 6.5	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

TEST PIT DCW-9
(Excavated and logged on September 16, 1999)

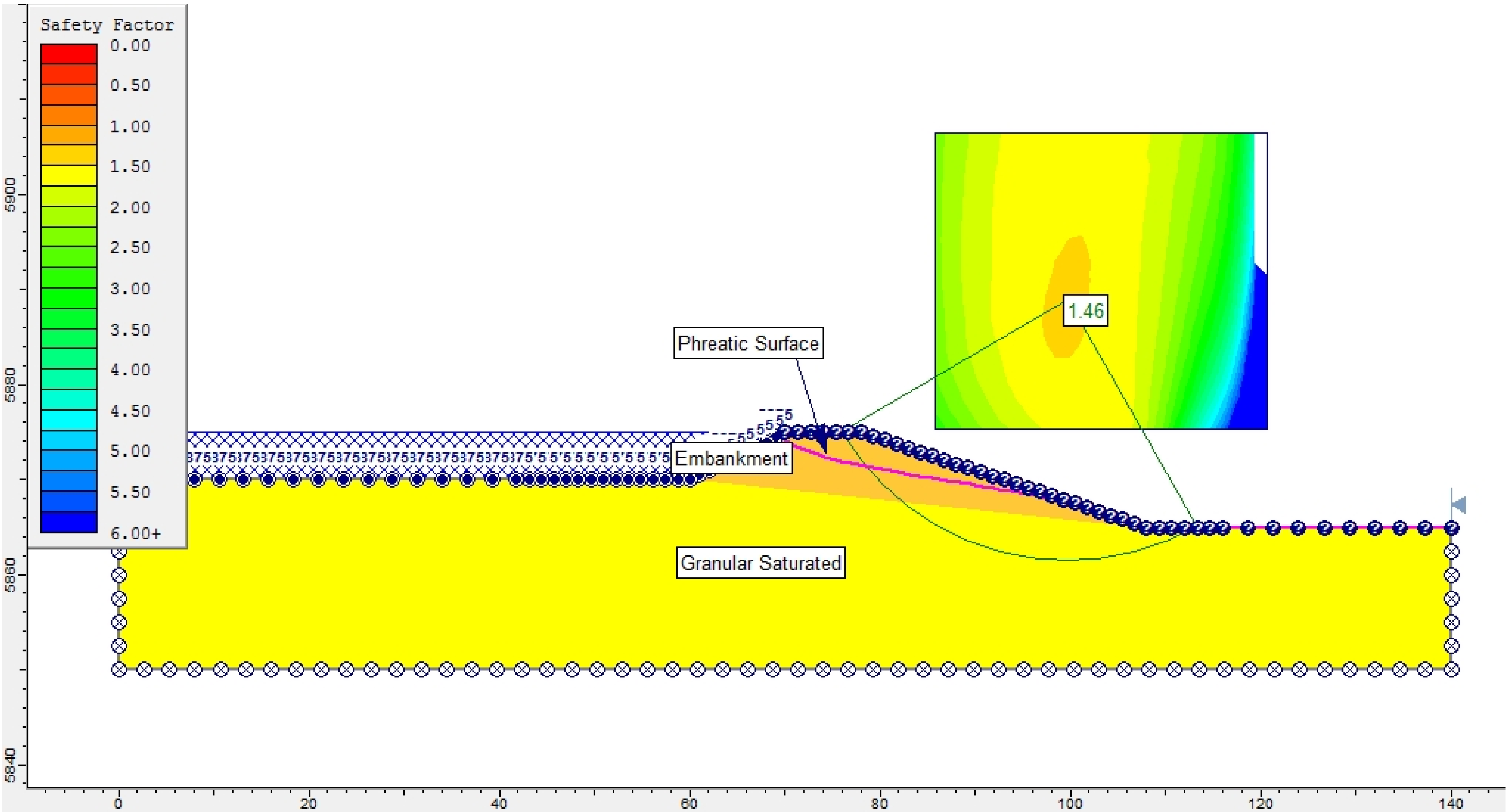
Depth (ft.)	Description
0 - 2	Weathered Mancos Shale. 61% silt, 24% clay, and 15% sand. Loose in top 14 inches, firmer and less weathered with depth. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 98.3 pounds per cubic foot, wet density = 103.8 pounds per cubic foot. CL.
2 - 2.5	Mancos Shale Bedrock. Fractured and slightly weathered. Gray. Hard to dig.

TEST PIT DCW-10
Near Proposed Sedimentation Pond Embankment
(Excavated and logged on September 16, 1999)

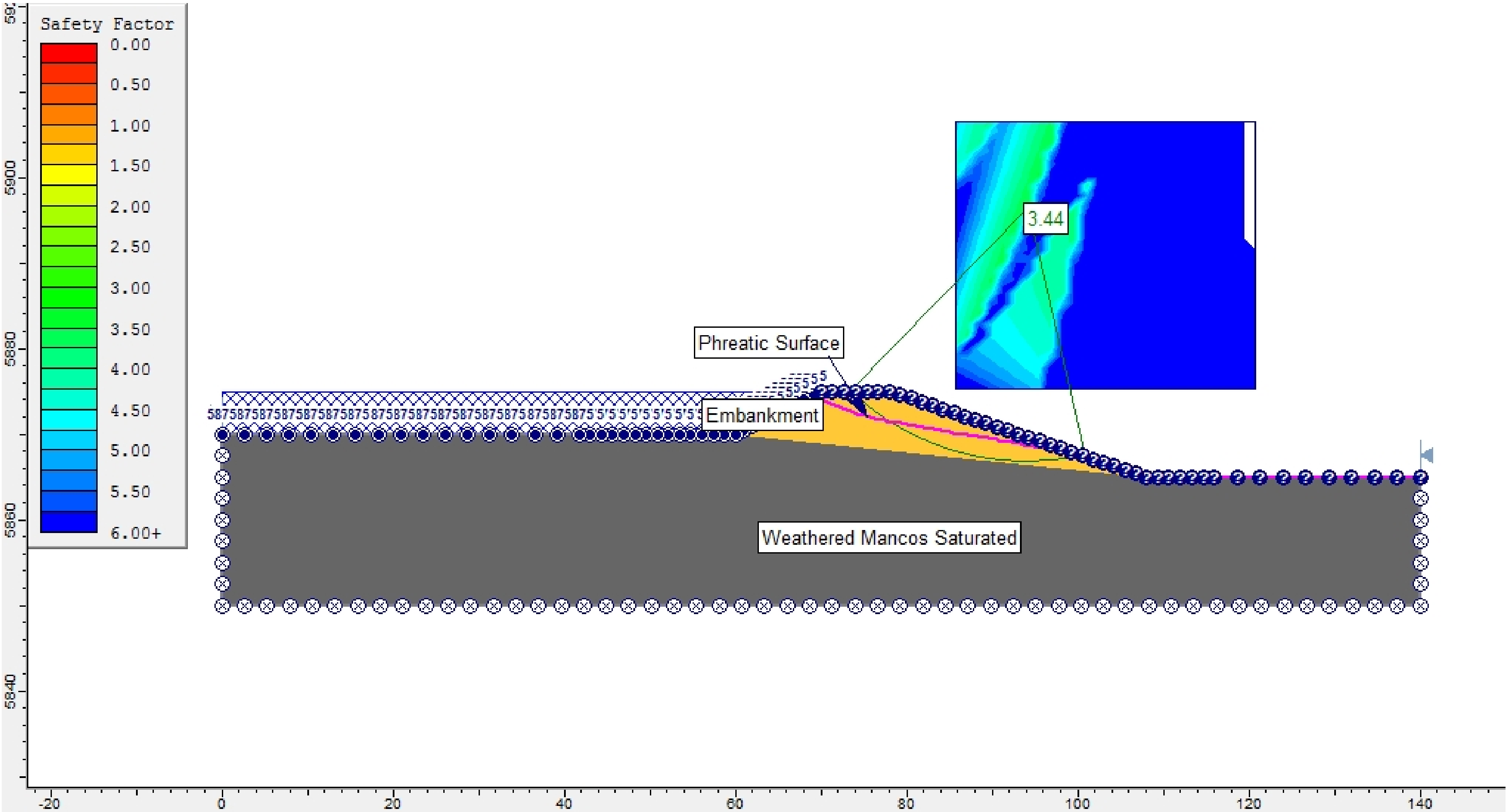
Depth (ft.)	Description
0 - 1.1	Silty Sand Topsoil. About 75% sand and 25% silt. Sand is very fine to fine grained. Nonplastic. Numerous fine roots. From a 12-inch nuclear density/moisture test: moisture content = 8.2%, dry density = 95.9 pounds per cubic foot, wet density = 103.7 pounds per cubic foot. Brown 10YR 4/3. SM.
1.1 - 8.5	Gravelly Sand w/ Silt. Alluvium. About 34% sand, 34% gravel/cobbles, and 32% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

ATTACHMENT B

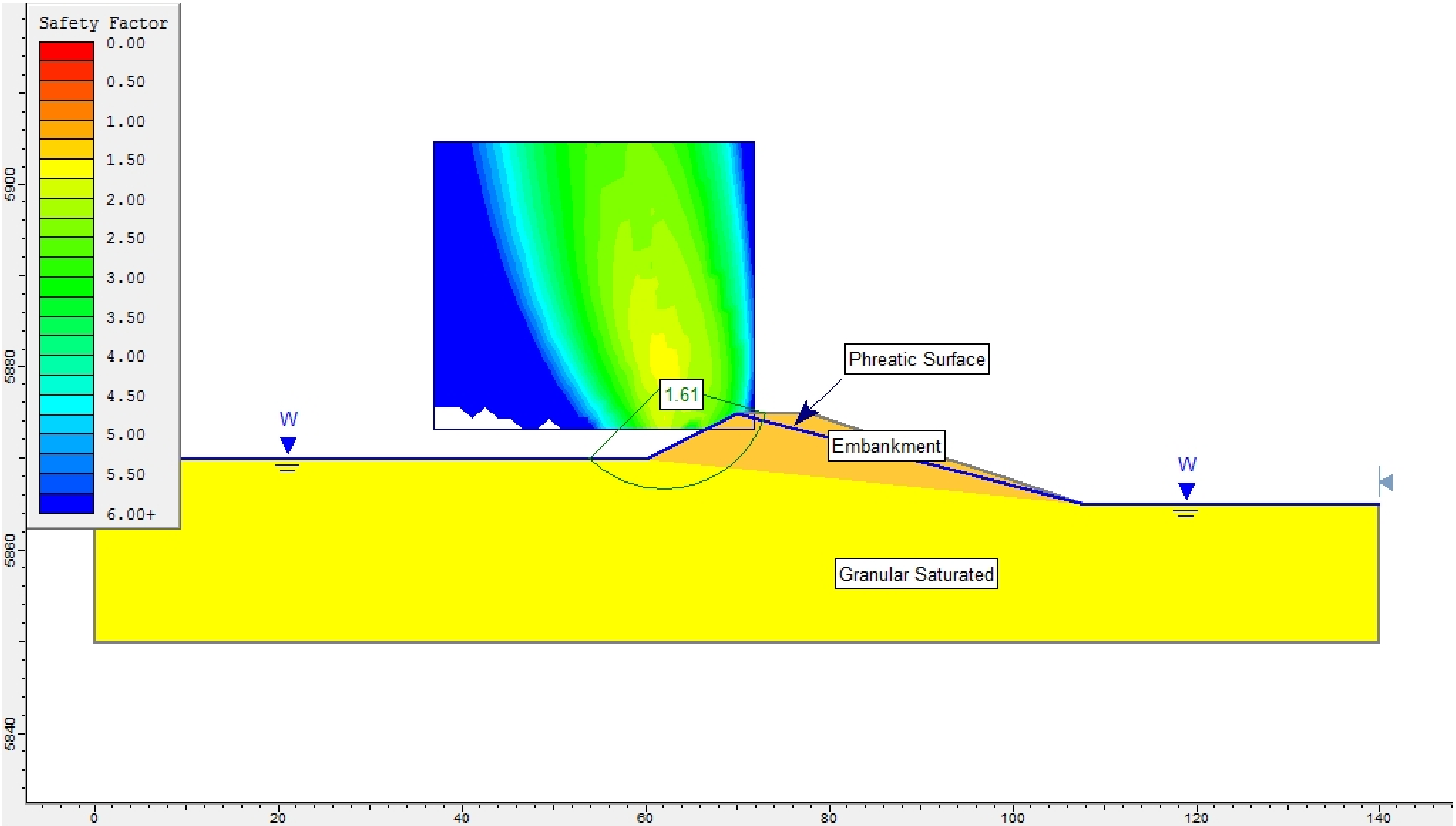
Slide Geometry and Output



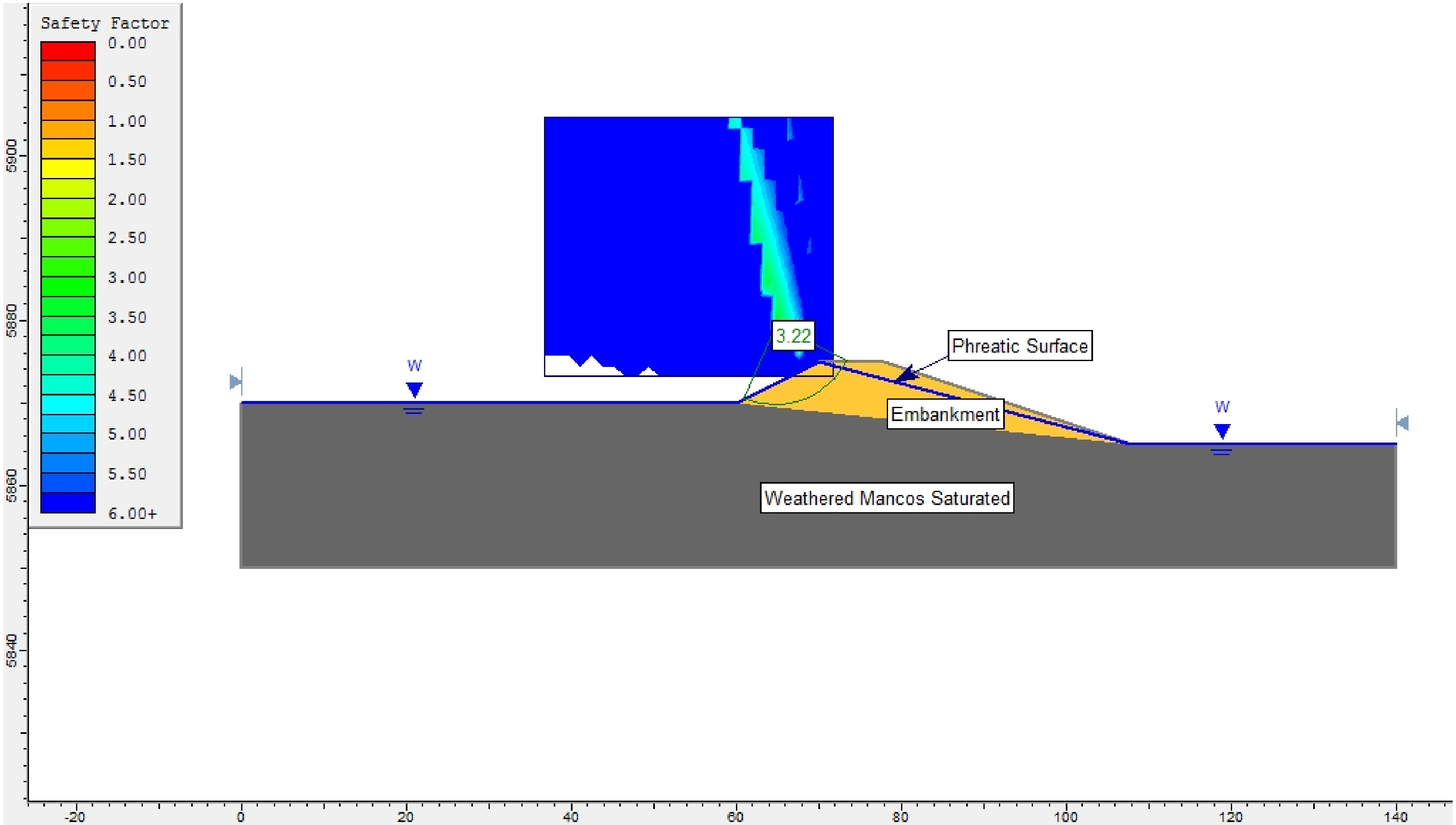
Sedimentation Pond 2 Embankment– Outslope with Steady-State Seepage (overlying granular soil)



Sedimentation Pond 2 Embankment– Outslope with Steady-State Seepage (overlying weathered Mancos Shale)



Sedimentation Pond 2 Embankment– Inslope with Rapid Drawdown (overlying granular soil)



Sedimentation Pond 2 Embankment– Inslope with Rapid Drawdown (overlying weathered Mancos Shale)

RA ATTACHMENT 5-2

REFUSE PILE SLOPE STABILITY EVALUATION

Dugout Canyon Mine
Refuse Pile Expansion
Slope Stability Analysis

Canyon Fuel Company
Dugout Mine
Wellington, Utah

February 2017

PROFESSIONAL ENGINEER
No. 9501032
TIMOTHY A.
JIMENEZ
2/16/2017
STATE OF UTAH

EarthFax EarthFax Engineering Group, LLC

Engineers / Scientists
www.earthfax.com

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TABLE 1 Soil Properties used for *Slide* Analyses
TABLE 2 Results of *Slide* Analyses

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Attachment A EarthFax 2001 Slope Stability Investigations
Attachment B *Slide* Geometry and Output

DUGOUT CANYON MINE
REFUSE PILE EXPANSION
SLOPE STABILITY ANALYSES

CHAPTER 1

INTRODUCTION

Canyon Fuel Company is planning the expansion of an existing Refuse Pile (the Site). The Site is located on Dugout Canyon Road 8 miles northwest of Wellington, Utah. The proposed expansion will generally extend the Refuse Pile towards the south. In support of the Site design, a slope stability analysis was performed for the Site to confirm that the Site expansion will be stable. The potential to expand the pile vertically was also evaluated. The purpose of this report is to summarize the methods and findings of the slope stability analyses performed for the proposed Dugout Mine Refuse Pile expansion. This report was prepared for Canyon Fuel Company by EarthFax Engineering Group, LLC (EarthFax).

CHAPTER 2
BACKGROUND INFORMATION

The Site was originally used by the mine as a borrow source for granular fill. This borrow pit generally extended downward until weathered Mancos Shale or Mancos Shale bedrock was encountered. Following the area's abandonment as a borrow pit, the Site was then used to stockpile refuse from the mine, backfilling the borrow pit and raising the Site above the original grade to its present configuration.

Prior to using the area to stockpile refuse material, a slope stability investigation was performed by EarthFax (see Attachment A). This investigation included the installation of ten shallow test pits to log soils and collect samples for geotechnical laboratory analyses. Soil samples were analyzed for grain size distribution, shear strength, and Atterberg limits.

The EarthFax field investigation generally encountered surficial materials consisting of granular gravelly sand alluvium, sandy silt and silty sand with gravel ("granular soils"), or weathered Mancos shale. The granular soils and weathered Mancos Shale varied in thickness from 2 to 9+ feet and were overlying Mancos Shale bedrock. Additional detail on this investigation including test pit locations, detailed soil logs, and laboratory testing results can be found in the investigation's letter report included in Attachment A.

CHAPTER 3
EVALUATION METHODS

The stability of the expanded Refuse Pile was evaluated using the slope stability software *Slide 5.0* ("*Slide*") developed by RocScience. This program uses an iterative procedure to evaluate the factor of safety against rotational shear failure for tens of thousands of potential failure surfaces that may develop within a given slope. Each trial failure surface is discretized into small slices and the driving and resisting forces/moments are calculated for each according to Bishop's Simplified Method of Slices. These forces are then summed over the entire failure surface to obtain a factor of safety defined as the sum of the resisting forces divided by the sum of the driving forces. Therefore, a factor of safety less than 1.0 indicates an imminent potential for slope failure.

The analyses discussed herein relied on soils data collected during the 2001 EarthFax field investigation, as this investigation encompassed the same general area as the proposed Refuse Pile expansion.

Details on each of the slope-stability scenarios analyzed and soil properties used for these analyses are included in the following sections.

3.1 Refuse Pile

The Refuse Pile is permitted for a maximum elevation of 5,995 feet with maximum side slopes of 2 horizontal to 1 vertical ("2H:1V"). However, this analysis presented herein is based on a maximum constructible elevation of 6,085 feet. It is assumed that if the Refuse Pile is stable at an elevation of 6,085 feet, than the Refuse Pile will be stable at 5,995 feet. Depending on the location within the Refuse Pile, the contact with underlying native soils varies between elevation 5,870 and 5,935 feet, resulting in maximum constructible Refuse-Pile fill heights ranging from 150 to 215 feet. As a result of this variability, analyses were performed for both fill heights in order to encompass the range of native-soil contact elevations.

Because the underlying native soils also vary throughout the Site between granular soils and weathered Mancos Shale, analyses were performed for the Refuse Pile overlying each. The underlying native granular soils and weathered Mancos Shale were modeled with a 2H:1V slope as this is the steepest slope observed in these soils along the edges of the Refuse Pile expansion (see Figure 1). Analyses also conservatively ignored the presence of any Mancos Shale bedrock that may be present within the site. Mancos Shale bedrock, if present, would increase the stability of the slope over that predicted for the other conditions that were evaluated.

3.2 Soil Properties Used for Slide Analyses

The soil properties used as input for *Slide* analyses are summarized in Table 1. As discussed above, these data are taken from the 2001 EarthFax report (see Attachment A). In the interest of conservatism, the weakest soils from the laboratory testing program were used in the slope stability analyses.

CHAPTER 4
RESULTS

The calculated minimum factors of safety for the various scenarios described above are summarized in Table 2. As shown in this table, the minimum factor of safety for the Refuse Pile is expected to be 1.80.

The minimum acceptable factor of safety promulgated by the Utah Division of Oil, Gas, and Mining ("DOGM") for coal mine waste stockpiles is 1.5 (R645-301-536.110). The minimum calculated factor of safety of 1.80 is, under the assumptions made above, considered acceptable and slopes are expected to remain stable under the geometry and loading conditions presented herein.

CHAPTER 5
ENGINEERING PRACTICES

The results of this investigation apply to the slope geometries and soil conditions discussed above. If actual conditions differ from those assumed in this report, the Refuse Pile slope stability should be re-evaluated as necessary.

The following are current engineering practices specific to the design and construction of the Refuse Pile:

- Material shall be placed in a controlled manner.
- Although the lift thickness should not exceed 2 feet ± 10%, it may be advantageous to reduce this to facilitate drainage and improve condition. This should be evaluated early in the operation.
- New lifts should be placed only over refuse has been properly compacted to provide a stable base for a new lift.
- The dump surface should always be graded to facilitate drainage away from recently placed fill toward surface drainage courses. It may be advantageous to cut shallow ditches at each lift elevation to improve surface drainage.
- In the unlikely event that severe waste rock handling, placement and compaction problems are encountered, consideration should be given to temporarily flattening the dump face slope angles or utilizing artificial refuse stabilization measure. Other measures may be considered on a case-by-case basis.

CHAPTER 6

REFERENCES

Anderson, L.R., I.S. Dunn, and F.W. Kiefer. 1980. Fundamentals of Geotechnical Analysis. John Wiley & Sons, Inc. New York, New York.

EarthFax Engineering, Inc. 2001a. Results of a foundation investigation and slope stability analysis for a proposed waste-rock pile for the Dugout Canyon Mine. Letter report submitted to Mr. Chris Hansen of Canyon Fuel Company. May 15, 2001.

NRCS (Natural Resource Conservation Service). 1985. Earth Dams and Reservoirs. Technical Release No. 60.

TABLES

TABLE 1
Soil Properties used for *Slide* Analyses

Soil Type	Unit Weight	Moist		Saturated		Permeability
		Cohesion	Friction Angle	Cohesion	Friction Angle	
	(lb/ft^3)	(lb/ft^2)	(deg)	(lb/ft^2)	(deg)	(cm/sec)
Refuse	122	490	35	325	23	10^{-1}
Native Granular Soils	122	0	43	0	28	10^{-4}
Native Weathered Mancos Shale	122	1,360	33	900	22	10^{-4}
Embankment Soils	122	N/A Assumed to be Saturated		200	25	10^{-7}

TABLE 2
Results of *Slide* Analyses

Condition/ Location	Minimum Factor of Safety Overlying Granular Soils	Factor of Safety Overlying Weathered Mancos Shale	Minimum Acceptable Factor of Safety
Refuse Pile w/ Native Contact @ 5870 Fill Height = 215 feet	1.80	1.80	1.5
Refuse Pile w/ Native Contact @ 5935 Fill Height = 150 feet	1.86	1.91	1.5

ATTACHMENT A

EarthFax 2001 Refuse Pile Slope Stability Investigation

EarthFax

EarthFax
Engineering Inc.
Engineers/Scientists
7324 So. Union Park Ave.
Suite 100
Midvale, Utah 84047
Telephone 801-561-1555
Fax 801-561-1861

May 15, 2001

Mr. Chris Hansen
Canyon Fuel Company, LLC
Dugout Canyon Mine
HC35 Box 380
Helper, Utah 84526

Subject: Results of a foundation investigation and slope stability analysis for a proposed waste-rock pile for the Dugout Canyon Mine

Dear Chris:

The purpose of this letter is to present the results of a foundation investigation and slope stability analysis for a proposed waste-rock pile for the Dugout Canyon Mine near Wellington, Utah. The proposed waste-rock pile is located about 4.5 miles southwest of the mine. The project was conducted in general accordance with the proposal from EarthFax dated September 8, 1999.

BACKGROUND INFORMATION

The site was originally investigated by RB&G Engineering, Inc. (1998; Provo, Utah) as a potential borrow source for granular fill used at the Dugout Canyon Mine. The results of that investigation indicated that the native soils consisted of interbedded layers of gravel and clay overlying Mancos Shale. Following removal and stockpiling of the topsoil, the underlying granular soils were excavated, crushed, screened, and transported to the Dugout Canyon Mine. The excavation typically continued downward until weathered Mancos Shale was encountered. As a result, the remaining soil at the site consisted primarily of thin layers of granular alluvium overlying weathered Mancos Shale and Mancos Shale bedrock.

The topography of the site following removal of the surficial granular soils and stockpiling of the topsoil is shown in Figure 1 (attached). As shown on Figure 1, the site has an irregular shape with most of the surface area present at the north end. Dugout Canyon Mine proposes to construct a waste-rock pile along the east-half of the north end of the site. Mine construction materials (i.e., timbers) will be temporarily stockpiled at the west-half of the north end of the site. This area will also be used to pile snow removed from the working areas around the mine. A sedimentation pond to contain surface water runoff will be constructed at the south end of the site in a depression that was formed during removal of the surficial granular soils.

Based on preliminary design information, the north edge of the waste-rock pile will only be about 2 feet high. The waste-rock pile will be placed with a longitudinal peak along the north-south axis that slopes southward at about 2 percent. From the peak, the waste-rock pile surface will also slope toward the east and west at about 2 percent. Because the 2% waste-rock slope is less than the slope of the existing ground surface, the thickness of the waste-rock pile will gradually increase progressing toward the south to a maximum thickness of about 10 feet at the south end. The waste-rock pile outslope will be constructed at about 3 horizontal to 1 vertical. The outside toe of the east and south ends of the waste-rock pile will be maintained about 10 feet inward of the top of the existing native slope. This 10-foot area will be sloped from the waste-rock pile at about 10 horizontal to 1 vertical to a ditch/berm to contain surface-water runoff, which will be directed toward the proposed sedimentation pond at the south end of the site.

SOILS INFORMATION

As part of this investigation, EarthFax installed ten shallow test pits using a rubber tire backhoe. The locations of the test pits are presented in Figure 1 (attached). Test Pits DCW-1 through DCW-9 were excavated within the area from which granular alluvium was removed (see the previous section). Two of these test pits (DCW-1 and DCW-2) were excavated within the footprint of the proposed waste rock pile. Native soil properties were evaluated beyond the disturbed area by excavating one test pit (DCW-10) south of the proposed waste-rock pile. The test pits were logged by a geotechnical engineer from EarthFax and by a soil scientist from EIS, Inc. (Salt Lake City, Utah). EarthFax's test pit logs are attached. Nuclear density/moisture tests were conducted on the surface soils at most of the test pits to provide remolding criteria for samples submitted for direct shear tests. Select samples were submitted to Applied Geotechnical Engineering Consultants, Inc. (Sandy, Utah) for geotechnical laboratory analyses.

According to the test pit logs, a thin layer (2 to 2.2 feet thick) of weathered Mancos Shale over Mancos Shale bedrock was encountered at Test Pits DCW-3 and DCW-9. Remnants (2.7 to 9 feet thick) of gravelly sand alluvium were encountered at Test Pits DCW-1, DCW-2, DCW-4, and DCW-5. Mancos Shale bedrock was encountered below the alluvial soil at Test Pits DCW-1 and DCW-4. Test Pit DCW-6 contained layers of silty sand and sandy silt to a depth of 6 feet overlying gravelly sand to a depth of 7.5 feet. Test Pit DCW-7 encountered some coal, gravel, and soil to a depth of 0.7 feet, silty sand alluvium to a depth of 6 feet, and gravelly sand alluvium to a depth of about 7 feet. Stockpiled topsoil was encountered to a depth of 5 feet at Test Pit DCW-8, under which a gravelly sand alluvium extended to the bottom of the test pit at a depth of 6.5 feet.

Beyond the disturbed area at Test Pit DCW-10, the soils consisted of a silty sand topsoil to a depth of 1.1 feet over a gravelly sand layer to the bottom of the test pit at a depth of 8.5 feet.

Results of the laboratory analyses are attached and are summarized in Table 1. Direct shear tests were conducted on samples that were remolded to the same dry density and moisture contents that were recorded in the field from the nuclear density/moisture tests. According to the data in Table 1, the soil property parameters are as follows:

- **Weathered Mancos Shale (Test Pits DCW-3 and DCW-9):** The material contained 0 to 49% gravel, 15 to 16% sand, 25 to 61% silt, and 10 to 24% clay. According to the Atterberg Limits data, the liquid limit was 26 to 33, the plastic limit was 17 to 18, and the plastic index was 9 to 15. The angle of internal friction ranged between 33 and 37 degrees, and the cohesion intercept values ranged between 1320 and 1360 pounds per square foot ("psf"). The direct shear tests were conducted under consolidated, undrained, unsaturated (moist) conditions.

- **Gravelly Sand Alluvium (Test Pit DCW-1):** The material contained 52% gravel, 30% sand, and 18% silt. The angle of internal friction was 43 degrees and the soil was noncohesive from direct shear tests conducted under consolidated, undrained, unsaturated (moist) conditions.

- **Sandy Silt (Test Pit DCW-6):** The material contained 59% silt and 41% sand. The angle of internal friction was 45 degrees and the soil was noncohesive from direct shear tests conducted under consolidated, undrained, unsaturated (moist) conditions.

- **Native Soil Beyond the Disturbed Area (Test Pit DCW-10):** The material contained 34% gravel, 34% sand, and 32% silt. The angle of internal friction was 43 degrees and the cohesion intercept value was 210 psf from direct shear tests conducted under consolidated, undrained, unsaturated (moist) conditions.

WASTE-ROCK

The waste-rock to be placed at the site will originate as roof-fall and other rock materials removed from the Dugout Canyon Mine. Similar waste-rock had been tested for a slope stability analysis of a temporary waste-rock pile at the Dugout Canyon Mine. The results of this analysis were presented in a letter dated July 27, 1998 from EarthFax to Canyon Fuel Company. As part of that investigation, gradation, Atterberg Limits, Standard Proctor compaction, and direct shear tests were conducted on the waste-rock. Results of these analyses are attached (data sheets dated July 15, 1998). According to these analyses, the waste-rock is coarse-grained with about 95% retained on the No. 200 sieve (i.e., sand fraction or larger), and about 82% retained on the No. 4 sieve (i.e., gravel fraction). The material is poorly-graded with a Unified Soil Classification of GP-GM. The sample had an angle of internal friction of 35 degrees and a cohesion strength of 490 pounds per square foot. These strength parameters will be used for the slope stability analysis of the proposed waste-rock pile.

ASSUMPTIONS

The following assumptions were made for the slope stability analyses:

1. The outslope of the waste-rock pile will be placed at a slope of 3 horizontal to 1 vertical (about 18 degrees) to a maximum height of 10 feet. The outslope toe of the waste-rock pile will be maintained about 10 feet inward of the top of the existing native slope. The surface of the waste-rock pile will be placed with a slope of about 2 percent.

2. As a worst-case condition, the native soil has a maximum slope of 30 degrees for a height of 40 feet. The topography of the existing native slope east and south of the proposed waste-rock pile in Figure 1 indicates that the native slope typically ranges between 20 and 30 degrees (near Section A-A' in Figure 1) with a maximum height of less than 40 feet.

3. As a worst-case condition, the native soil is vertically continuous and the failure surfaces do not intersect the Mancos Shale bedrock. This assumption was included because the Mancos Shale bedrock surface is variable throughout the site.

4. The soil property parameters used for the analyses are representative of the native soils throughout the site. In the interest of conservatism, the weakest soils from the direct shear tests were used for the analyses, which were as follows (see Table 1):

	Granular Soil	Weathered Mancos Shale
Angle of Internal Friction (degrees)	43	33
Cohesive Strength (psf)	0	1360

5. The soils do not become saturated, and there is no phreatic surface. The soils drain rapidly, and excess pore pressures do not develop in response to strains and stress changes.

6. The results of direct shear tests on the waste-rock presented in the letter dated July 27, 1998 from EarthFax to Canyon Fuel Company are representative of the proposed waste-rock pile. Therefore, the angle of internal friction of the waste-rock is 35 degrees and the cohesive strength is 490 pounds per square foot.

RESULTS

Slope stability analyses were performed using the computer program GEOSLOPE (Version 5.0). GEOSLOPE utilizes the limit equilibrium procedure of slices (Simplified Bishop's method) to determine the safety factor of potential failure surfaces for circular shapes.

Using the assumptions presented above, results of the slope stability analyses are attached and are summarized in Table 2 (attached). The results of the stability analyses include the data files and the output files. Table 2 includes a description of the analysis slope, the number of trial failure surfaces, and the safety factor against sliding. From Table 2, the critical safety factor was 1.62 for failure surfaces originating at the toe of the native slope (alluvial soil) and terminating in the waste-rock pile. When soil strength parameters for weathered Mancos Shale were used for the native soils, the safety factor increased to 3.73. The critical safety factor was 7.48 for failure surfaces originating and terminating in the waste-rock pile. These values satisfy the minimum regulatory requirement of 1.5 promulgated by the Utah Division of Oil, Gas, and Mining (R645-301-536.110). Because the effects of bedrock were not included in the analyses, the results are considered to be conservative.

We have appreciated the opportunity to provide this information. If you have any questions, please call.

Sincerely,

Rhett Brooks

Rhett Brooks, P.E.
EarthFax Engineering, Inc.

cc: Tom Suchoski, EarthFax

REGISTERED PROFESSIONAL ENGINEER
92-187704-2202
RHETT K.
BROOKS
STATE OF UTAH

Rhett Brooks
May 15, 2001

REFERENCES

RB&G Engineering, Inc. 1998. Canyon Fuel Company, Dugout Canyon Surface Coal Handling Facilities near Wellington, Utah. Project report dated June 1998 prepared for Canyon Fuel Company. Provo, Utah.

Utah Division of Oil, Gas, and Mining. 1996. Utah Coal Mining Regulations. Salt Lake City, Utah.

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

Test Pit and Depth (Ft.)	Gradation (%)				Atterberg Limits			Direct Shear Test Values	
	Gravel	Sand	Silt	Clay	Liquid Limit	Plastic Index	Plastic Limit	Cohesive Strength (psf)	Angle of Internal Friction (degrees)
DCW-1 0-3.2[a]	52	30	18		--	--	--	0	43
DCW-3 0-2.2[b]	49	16	25	10	33	15	18	1320	37
DCW-6 2.5-6[c]	0	41	59		--	--	--	0	45
DCW-9 0-1.2[d]	0	15	61	24	26	9	17	1360	33
DCW-10 1.1-8.5[e]	34	34	32		--	--	--	210	43

(a) Alluvium. Sample for direct shear test remolded to a dry density of 115 pcf at a moisture content of 6%, which were the results of a nuclear density/moisture test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

(b) Weathered Mancos Shale. Direct shear test samples remolded to a dry density of 113 pcf at a moisture content of 6%, which were the results of a nuclear tests conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

(c) Silty sand. Sample for direct shear test remolded to a dry density of 112 pcf at a moisture content of 9%, which were the results of a nuclear density/moisture test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

(d) Weathered Mancos Shale. Direct shear test samples remolded to a dry density of 98 pcf at a moisture content of 6%, which were the results of a nuclear test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 1200, 3600, and 6000 psf.

(e) Silty Sand. Direct shear test samples remolded to a dry density of 100 pcf at a moisture content of 8%, which were the results of a nuclear test conducted on the ground surface near the test pit. Direct shear test conducted under consolidated-undrained (CU) unsaturated conditions with vertical effective pressures of 500, 1500, and 2500 psf.

TABLE 2

RESULTS OF SLOPE STABILITY ANALYSES

Slope	Number of Trial Failure Surfaces	Safety Factor
Native Soil (Alluvium) and Waste-Rock Pile	930	1.62
Native Soil (Mancos Shale) and Waste-Rock Pile	930	3.73
Waste-Rock Pile	660	7.48

G:\UC698\11\DWG\FIG-1TP.DWG 10-28-99

LEGEND

DCW-1

● TEST PIT LOCATION

0' 200'

EarthFax

FIGURE 1. TEST PIT LOCATIONS

TEST PIT DCW-1
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 3.2	Sandy Gravel w/ Silt and Cobbles. Alluvium. About 42% gravel, 30% sand, 10% cobbles, and 18% silt. Sand is typically fine to coarse grained. Cobbles are up to 7 inches in diameter, subround. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 115.5 pounds per cubic foot, wet density = 122.1 pounds per cubic foot. Brown 10YR 4/3. GM.
3.2 - 4.6	Mancos Shale Bedrock. Fractured. Gray. Hard to dig.

TEST PIT DCW-2
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 7.7	Gravelly Sand w/ Silt, Cobbles, and Boulders. Alluvium. About 45% sand, 25% gravel, 15% cobbles/boulders, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 8-inch nuclear density/moisture test: moisture content = 7.8%, dry density = 115.0 pounds per cubic foot, wet density = 124.0 pounds per cubic foot. Brown 10YR 4/3. Boulders at bottom impeded digging deeper. SM.

TEST PIT DCW-3
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 2.2	Weathered Mancos Shale. 49% gravel (fractured Mancos Shale), 16% sand, 25% silt, and 10% clay. Loose in top 3 inches, firmer and less weathered with depth. From a 12-inch nuclear density/moisture test: moisture content = 5.6%, dry density = 112.6 pounds per cubic foot, wet density = 118.8 pounds per cubic foot.
2.2 - 3.2	Mancos Shale Bedrock. Fractured and slightly weathered. Gray. Hard to dig.

TEST PIT DCW-4
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 2.7	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Cobbles are up to 7 inches in diameter, subround. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 115.5 pounds per cubic foot, wet density = 122.1 pounds per cubic foot. Brown 10YR 4/3. SM.
2.7 - 3.2	Mancos Shale Bedrock. Fractured. Gray. Hard to dig.

TEST PIT DCW-5
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 9	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Cobbles are up to 7 inches in diameter, subround. Gravel is subround to subangular. Moist. No cementation or cohesion. Good foundation material or fill material. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 115.5 pounds per cubic foot, wet density = 122.1 pounds per cubic foot. Brown 10YR 4/3. SM.

TEST PIT DCW-6
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 1.5	Silty Sand. About 60% sand and 40% silt. Sand is very fine to fine grained. Nonplastic. Numerous large roots from pine trees. From a 12-inch nuclear density/moisture test: moisture content = 8.8%, dry density = 102.9 pounds per cubic foot, wet density = 111.9 pounds per cubic foot. Yellowish brown 10YR 5/4. SM.
1.5 - 2.5	Sandy Silt. About 65% silt and 35% silt. Sand is very fine grained. Low plasticity, somewhat cohesive. Dry and hard. Very friable. ML.
2.5 - 6	Sandy Silt. About 59% silt and 41% sand. Sand is very fine grained. Nonplastic. Probably a blow sand layer. Light yellowish brown 2.5Y 6/3. ML.
6 - 7.5	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles/boulders, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

TEST PIT DCW-7
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 0.7	Mix of Rubbish. Mix of coal, sandstone, and dark brown soil (silt through cobbles). SM.
0.7 - 6	Silty Sand w/ Gravel. Alluvium. About 70% sand, 10% gravel/cobbles, 20% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.
6 - 7	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

TEST PIT DCW-8
Topsoil Stockpile
(Excavated and logged on September 16, 1999)

Depth (ft.)	Description
0 - 5	Topsoil Stockpile. Topsoil that had been stripped from the site and piled in this area. Primarily silty sand with gravel and organic matter.
5 - 6.5	Gravelly Sand w/ Silt. Alluvium. About 55% sand, 20% gravel, 10% cobbles, and 15% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

TEST PIT DCW-9
(Excavated and logged on September 16, 1999)

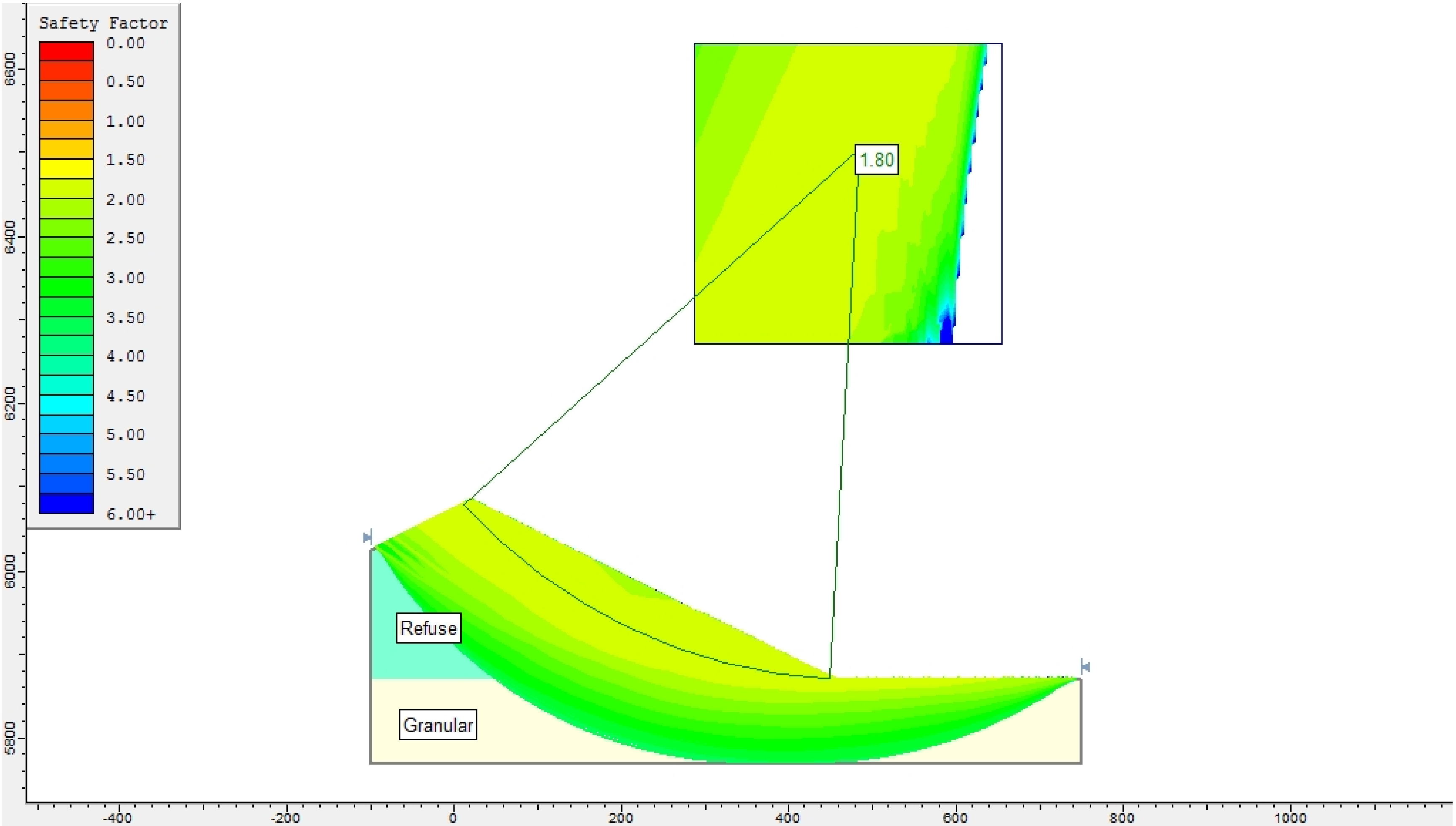
Depth (ft.)	Description
0 - 2	Weathered Mancos Shale. 61% silt, 24% clay, and 15% sand. Loose in top 14 inches, firmer and less weathered with depth. From a 12-inch nuclear density/moisture test: moisture content = 5.7%, dry density = 98.3 pounds per cubic foot, wet density = 103.8 pounds per cubic foot. CL.
2 - 2.5	Mancos Shale Bedrock. Fractured and slightly weathered. Gray. Hard to dig.

TEST PIT DCW-10
Near Proposed Sedimentation Pond Embankment
(Excavated and logged on September 16, 1999)

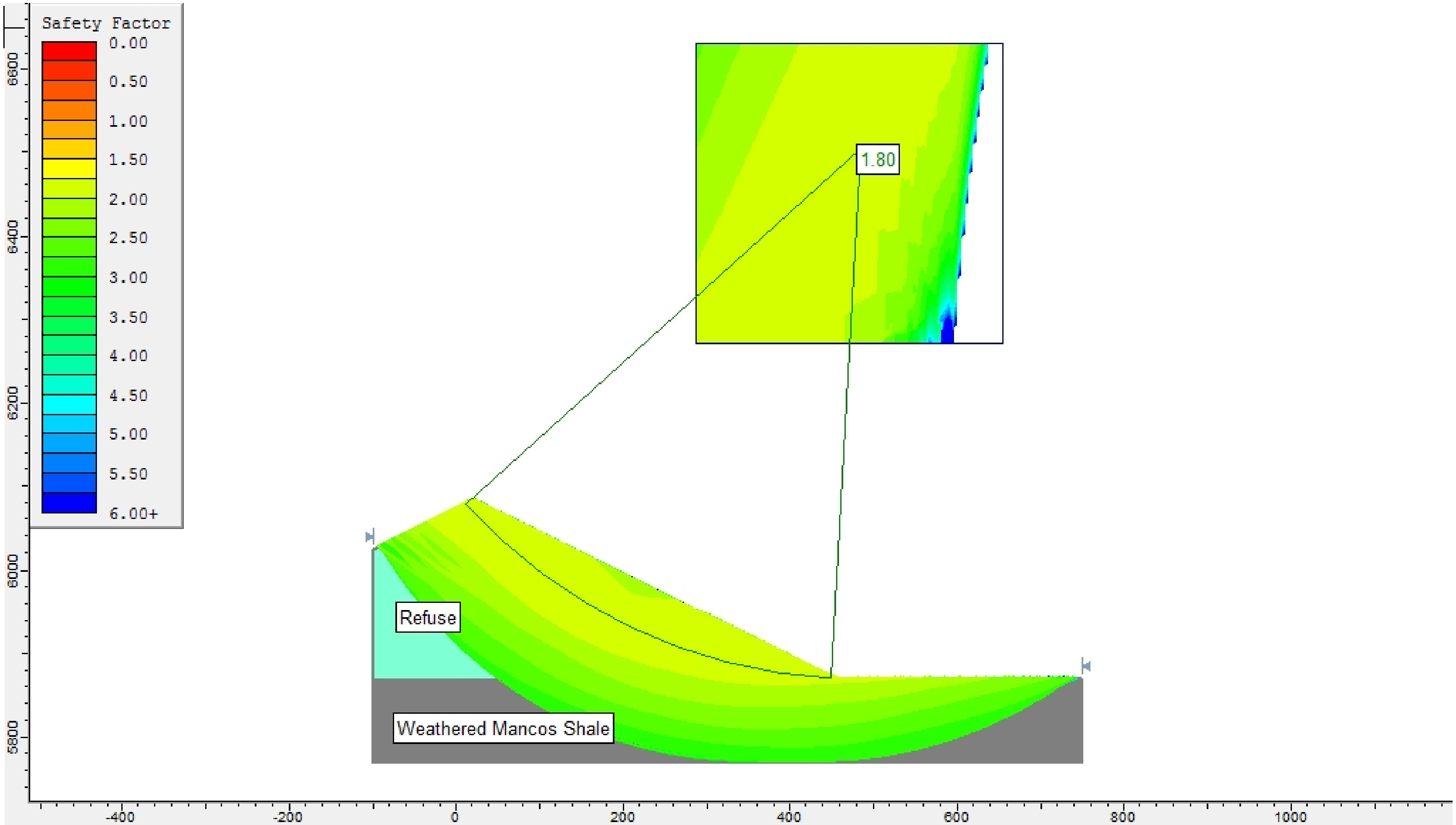
Depth (ft.)	Description
0 - 1.1	Silty Sand Topsoil. About 75% sand and 25% silt. Sand is very fine to fine grained. Nonplastic. Numerous fine roots. From a 12-inch nuclear density/moisture test: moisture content = 8.2%, dry density = 95.9 pounds per cubic foot, wet density = 103.7 pounds per cubic foot. Brown 10YR 4/3. SM.
1.1 - 8.5	Gravelly Sand w/ Silt. Alluvium. About 34% sand, 34% gravel/cobbles, and 32% silt. Sand is typically fine to coarse grained. Gravel is subround to subangular. Moist. No cementation or cohesion. Brown 10YR 4/3. SM.

ATTACHMENT B

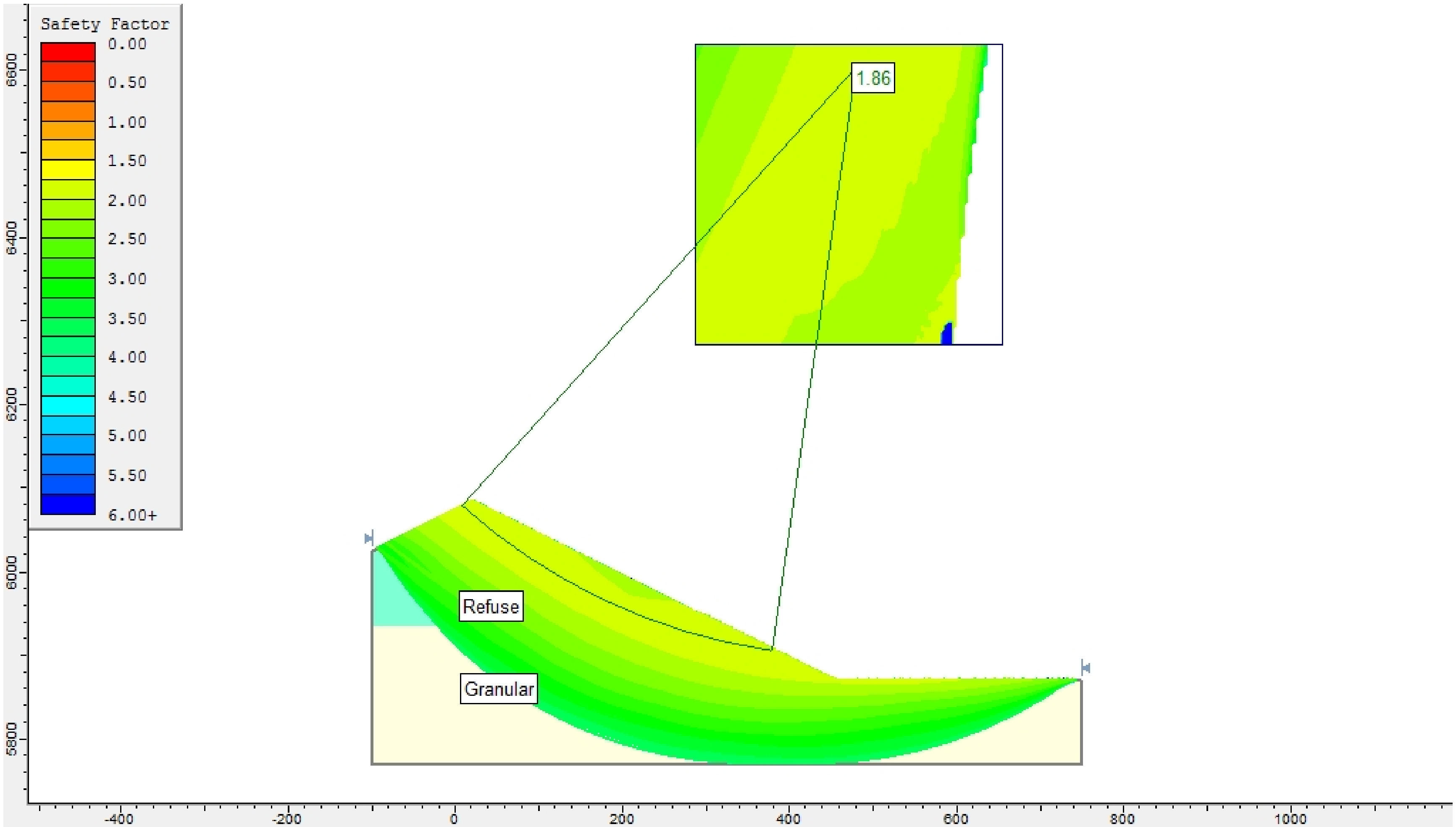
Slide Geometry and Output



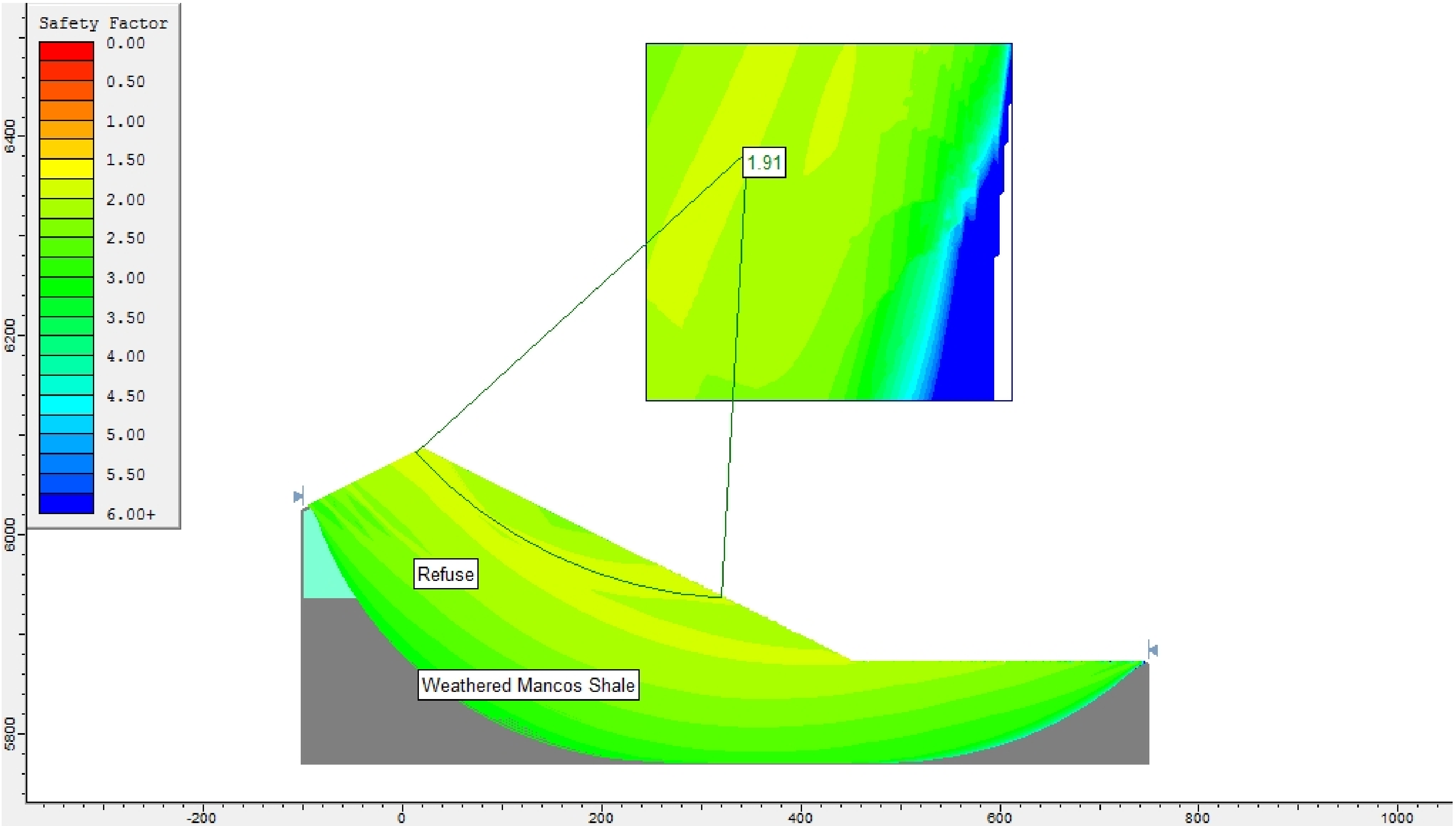
Refuse Pile Stability – Native Contact at Elevation 5870, Fill Height = 215 feet (overlying granular soil)



Refuse Pile Stability – Native Contact at Elevation 5870, Fill Height = 215 feet (overlying weathered Mancos Shale)



Refuse Pile Stability – Native Contact at Elevation 5935, Fill Height = 150 feet (overlying granular soil)



Refuse Pile Stability – Native Contact at Elevation 5935, Fill Height = 150 feet (overlying weathered Mancos Shale)

RA ATTACHMENT 5-3

REFUSE PILE VOLUME CALCULATIONS

Determination of Refuse Tonnage for Final Pile Configuration

The existing topography shown on the maps is representative of the site when the last aerial survey was conducted on August 12, 2004. At that time Olympus Aerial Surveys had estimated that 46,217 CY of coal refuse had already been placed at the site.

At the final pile configuration an additional 639,838 CY of coal waste will have been added to the refuse pile.

Disturbed acres = 26.8 acres

Total coal refuse in the pile = 46,217 CY + 639,838 CY = 686,055 CY

Unit weight of coal refuse = 110 lbs/ft^3

Tonnage = (686,055 CY * 27 ft^3/CY * 110 lbs/ft^3) / 2000 lbs/ft^3 = 1,018,792 tons

2015 Phase I Pile Expansion

Disturbed acres = 26.8

Unit weight of coal refuse = 110 lbs/ft^3

Additional tonnage capacity = (42,000 CY * 27 ft^3/CY * 110 lbs/ft^3) / 2000 lbs/ft^3 = 62,370 tons

Total combined tonnage capacity = (686,055+42,000 CY * 27 ft^3/CY * 110 lbs/ft^3) / 2000 lbs/ft^3 = 1,081,162 tons

2017 Phase II Pile Expansion

Additional disturbed acres = 1.4 acres

Total disturbed acres = 26.8 + 1.4 = 28.2 acres

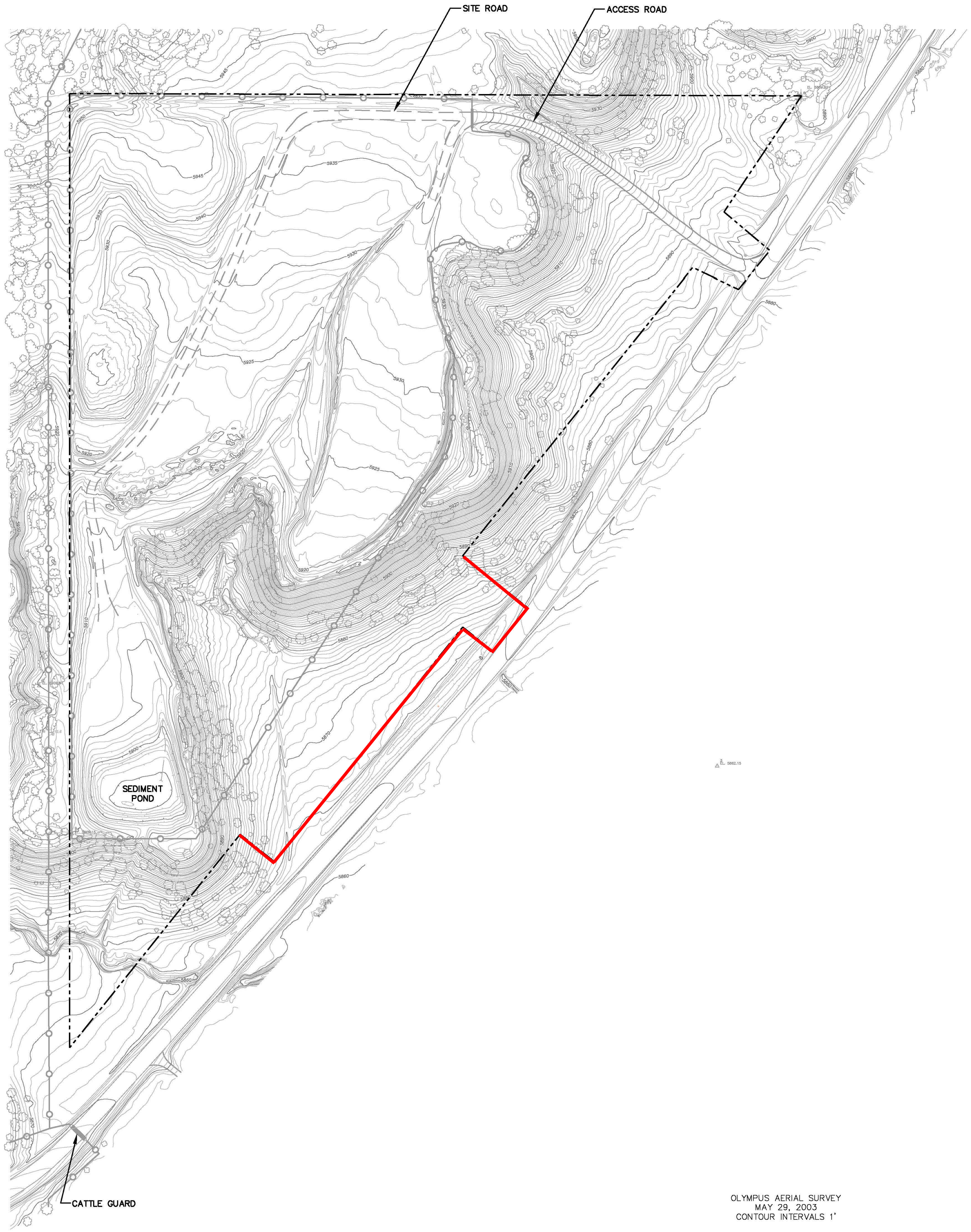
Unit weight of coal refuse = 110 lbs. /ft^3

Additional tonnage capacity = (585,000 CY * 27 ft^3/CY * 110 lbs. /ft^3) / 2000 lbs. /ft^3 = 868,725 tons

Total combined tonnage capacity = (686,055+42,000+585,000 CY * 27 ft^3/CY * 110 lbs. /ft^3) / 2000 lbs. /ft^3 = 1,949,887 tons

RA ATTACHMENT 5-5

AS-BUILT TOPOGRAPHY MAP



OLYMPUS AERIAL SURVEY
MAY 29, 2003
CONTOUR INTERVALS 1'

LEGEND

— · — · —	DISTURBED AREA BOUNDARY AND PERMIT AREA BOUNDARY
—o——o—	FENCE
— — · — — ·	DITCH
— — — —	SITE ROAD
———	ACCESS ROAD

NOTE:
FACILITY FENCE ADDED POST AERIAL SURVEY.

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

0' 100'

PROJECT AREA LOCATED ENTIRELY WITHIN SEC. 18, T. 14 S., R. 12 E., SLBM

REVISION	
DATE	BY
11/1/2016	BK

Canyon Fuel Company, LLC
Dugout Canyon Mine

AS BUILT TOPOGRAPHY
MAY 2003

Dugout Canyon Mine

DRAWN BY: RR	DATE: SEPT. 24, 2003 (WasteRock.ctb)	SCALE: 1"=100'
APPROVED BY: VSM	FILE NAME: X:\DOGM\0 Approved\Dugout\Drawings\As Builts\FACILITIES BASE.dwg	DRAWING OR MAP NUMBER FACILITIES BASE

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 6

RA Figure 6-1

Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

FROM: USGS, 1972
Anderson, 1978

LEGEND

Qal QUATERNARY ALLUVIUM
Qg QUATERNARY PEDIMENT GRAVELS
Km CRETACEOUS MANCOS SHALE

0' 2500'

EarthFax

RA FIGURE 6-1. AREA GEOLOGY

Waste Rock Site Phase II Expansion

Dugout M&RP, Refuse Amendment, Chapter 7

RA Chapter 7

RA Figure 7-1

Tables RA Table 7-3 & 7-4

Plates: RA Plate 7-1a, 7-2a, 7-3a, 7-4a & 7-5a

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Dugout Canyon Mine Permit Number C/007/039

Canyon Fuel Company

Redline Strikeout

Title page for reference only

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HYDROLOGY

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RA Plate 7-3a Operational Sediment Pond Details, Phase II
RA Plate 7-4a Operational Watersheds, Phase II
RA Plate 7-5a Reclamation Watersheds, Phase II

CHAPTER 7

HYDROLOGY

710 INTRODUCTION

711 General Requirements

This chapter presents a description of:

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

A qualified, registered professional engineer has certified all maps, plans, and cross sections presented in this chapter.

713 Inspection

Refer to the approved M&RP

720 ENVIRONMENTAL DESCRIPTION

721 General Requirements

This section presents a description of the pre-mining hydrologic resources within the permit and adjacent areas that may be affected or impacted by the proposed coal mining and reclamation operation.

Reference RA Attachment 2-3 for soil information, pictures and drawings and RA Attachment 7-3, Addendum A for hydrologic information pertaining to the soil borrow area to be used for reclamation of the refuse pile.

722 Cross Sections and Maps

722.100 Location and Extent of Subsurface Water

No seeps or springs are present in the immediate area of the refuse pile site. Three monitoring wells were installed in the site area (see RA Plate 7-1a). The completion details of these wells are discussed in Chapter 6, RA Attachment 6-1 of this submittal.

722.200 Location of Surface Water Bodies

Dugout Creek is located to the east of the refuse pile between an 1/8 and 1/4 of a mile. Due to the distance to the creek, no impact to this stream is anticipated.

722.300 Locations of Monitoring Stations

Two surface water monitoring stations have been located for the refuse pile area (see RA Plate 7-1a). These stations are discussed in Section 731 of this submittal.

722.400 Location and Depth of Water Wells

No water-supply wells exist in the refuse pile area.

722.500 Surface Topography

Surface topographic features in the permit and adjacent areas are shown on the base map used for RA Plate 7-1a.

723 Sampling and Analysis

Refer to the approved M&RP.

724 Baseline Information

Baseline information for Dugout Creek is presented in the approved M&RP. Baseline data for the sampling of the groundwater and surface water stations are presented in RA Attachment 7-1.

724.100 Groundwater Information

Mancos Shale. The refuse pile area is located on the Mancos Shale. The relatively impermeable marine shale is not considered to be a regional or local aquifer. Groundwater samples collected from four monitoring wells (MW-1M, MW-2M, MW-3M and MW-1C) located approximately 2 miles south of Soldier Canyon Mine (see Plate 7-1a, RA Attachment 7-6) have a mean TDS concentration of approximately 10,000 mg/l and are of the sodium-sulfate-chloride type (Appendix 7-3 of the approved M&RP). Chemical compositions are consistent with the dissolution of halite and gypsum as well as cation exchange. While it is anticipated that the water quality within the Mancos Shale in the Soldier Canyon Mine area is similar to the waste rock site, samples will be obtained from DH-1 beginning in the first quarter of 2003. Water samples from this drill hole will be analyzed for the parameters listed in Table 7-4 of the existing M&P.

Recharge and Discharge Relations. Recharge to the Mancos Shale within the refuse pile area would be minimal since the formation is relatively impermeable, the refuse pile area is limited to only a few acres, and the refuse pile area is not located within a known recharge area.

Depth to Groundwater. Water level measurements from the three monitoring wells located on or immediately adjacent to the refuse pile site indicate that water is found at a depth ranging from 35 to 90 feet below ground surface. The water is originating either from the Mancos Shale or from the Alluvium/ Mancos Shale contact. It took approximately one month for the water levels in the wells to stabilize, indicating a very low permeability for the formation. The direction of groundwater flow is to south toward Dugout Creek (see RA Figure 7-1).

724.200 Surface Water Information

The refuse pile area exists entirely within the Dugout Creek watershed. Based on field observations, Dugout Creek is considered to be intermittent in this area. Several smaller tributaries to the creek in the area are ephemeral. No gauging stations are located within the immediate area of the refuse pile. The disturbance associated with the construction of the refuse pile is not anticipated to significantly increase or decrease runoff to Dugout Creek (Appendix 7-9, Addendum A).

Two baseline surface water monitoring stations have been located in the ephemeral drainage to the southwest of the refuse pile. Data from these stations is presented in RA Attachment 7-1. No flow has been identified in the drainage through during the period of monitoring (August 2002).

724.300 Geologic Information

Geologic information related to the refuse pile area and adjacent areas is presented in Chapter 6 of this submittal and the approved M&RP.

724.400 Climatological Information

Climatological data are summarized in Appendix 4-1 of the approved M&RP and in RA Attachment 7-5.

724.500 Supplemental Information

All information pertinent to a determination of the probable hydrologic consequences of the constructing, maintaining, and reclaiming of the proposed refuse pile are presented in both this submittal and the approved M&RP.

724.600 Survey of Renewable Resource Lands

The existence and recharge of groundwater systems in the refuse pile and adjacent areas is discussed in Section 724.100 of this submittal and the approved M&RP.

724.700 Alluvial Valley Floor Requirements

Information regarding the presence or absence of alluvial valley floors in the permit and adjacent areas is presented in Chapter 9 of the approved M&RP and this submittal.

725 Baseline Cumulative Impact Area Information

The hydrologic and geologic information required for the Division to develop a Cumulative Hydrologic Impact Assessment is presented in the approved M&RP and this submittal under Chapters 6 and 7. Required information not available in these chapters is available from the Utah Divisions of Water Rights and Water Resources and from the U.S. Geological Survey and the U.S. Bureau of Land Management.

726 Modeling

No numerical groundwater or surface water modeling was conducted in support of this submittal.

727 Alternative Water Source Information

No surface mining will be conducted in this area and adjacent areas. Therefore, this section does not apply.

728 Probable Hydrologic Consequences

This section addresses the probable hydrologic consequences of construction and reclamation operations in the refuse pile area. Mitigating measures are discussed generally in this section and in detail in Section 730 of the approved M&RP.

728.100 Potential Impacts to Surface and Groundwater

Potential impacts of storing refuse and materials in this area on the quality and quantity of surface and groundwater flow may include:

Contamination from acid- or toxic- forming materials;
Increased sediment yield from disturbed areas;

Increased total dissolved solids concentrations;

Impacts to groundwater or surface water availability;

Hydrocarbon contamination from the use of hydrocarbons in the refuse pile area; and

Contamination of surface and groundwater from road salting activities.

These potential impacts are addressed in the following sections and in the approved M&RP.

728.200 Baseline Hydrologic and Geologic Information

Baseline geologic information is presented in Chapter 6 of the approved M&RP and this submittal. Baseline hydrologic information is presented in Sections 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 refuse pile and adjacent areas are addressed in the following subsections of this submittal and the approved M&RP.

Acid- or Toxic- Forming Materials. No acid- or toxic-forming materials have been identified in the soils or strata of the Dugout Canyon Mine (Chapter 6 of the approved M&RP). Canyon Fuel commits to sampling any refuse materials generated by the mine in accordance with the approved M&RP to aid in identifying any acid- or toxic-forming materials. Thus, no significant potential exists for the contamination of surface and groundwater in the refuse pile and adjacent areas by acid- or toxic-forming materials. In the event that acid- or toxic-forming materials are identified, this material will be buried with a minimum of 4 feet of non-acid, non-toxic, non-combustible materials.

Sediment Yield. The potential impact of construction, maintenance, and reclamation of the refuse pile on sediment yield is an increase in sediment in the surface waters downstream from disturbed areas. Sediment-control measures (such as diversions, sediment ponds, straw bales, etc.) will be installed to minimize this impact. These facilities will be regularly inspected (see Section 514 of the M&RP) and maintained to ensure that they remain in proper operating condition.

Various sediment-control measures will be implemented during reclamation as the vegetation becomes established. As discussed in Section 542.200 of this submittal, these measures will include maintenance of sediment ponds, berms, and diversions in appropriate locations to minimize potential contributions of sediment to Dugout Creek and off-site areas. These measures will reduce the amount of erosion from the reclaimed areas, thereby precluding adverse impacts to the environment.

Once vegetation is adequately established, the berms will be pushed into the diversion ditches and revegetated in accordance with Chapter 2 and 3 of this submittal. Additionally, the sediment ponds embankment will be breached and the outlet works of the sediment pond will be removed, thereby ensuring a positive drainage from the site area.

Acidity, Total Suspended Solids, and Total Dissolved Solids. Probable impacts of mining and reclamation operations on the acidity and total suspended solids concentrations of surface and groundwater in the permit and adjacent areas were addressed previously in this section.

Groundwater and Surface Water Availability. Construction, maintenance, and reclamation of the refuse pile will not affect groundwater and surface water availability. As discussed previously, the refuse pile is of limited areal extent, is located on the Mancos Shale, and does not significantly affect surface runoff.

Potential Hydrocarbon Contamination. Diesel fuel, oils, greases, and other hydrocarbon products will not be stored at the site. Fuels, greases and other oils may leak from equipment during construction operations. These spills will be handled as specified in the approved M&RP.

Road Salting. No salting of roads will occur within the refuse pile area. Hence, this impact is not a significant concern.

729 Cumulative Hydrologic Impact Assessment (CHIA)

A Cumulative Hydrologic Impact Assessment to include the permit and adjacent areas is to be prepared by the Division.

730 OPERATION PLAN

731 General Requirements

731.100 Hydrologic-Balance Protection

Groundwater Protection. The effect on groundwater in this area is expected to be minimal as discussed in Section 724.200. Groundwater will not be encountered or used during construction, maintenance, and reclamation of the refuse pile. The three wells that have been drilled in this area are used to aid in monitoring the potential impacts of the refuse pile.

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 streamflow outside the permit area, and otherwise prevents water pollution. Additionally, CFC will maintain adequate runoff- and sediment-control facilities to protect local surface waters.

During initial construction and prior to installation of all runoff- and sediment-control facilities, silt fences were installed along the down gradient edge of the refuse pile area. These silt fences were installed in accordance with the approved M&RP. If required for control of local erosion, straw-bale dikes may also be installed at the site during initial construction. The silt fences and straw-bale dikes will be periodically inspected, and accumulated sediment will be removed as needed to maintain functionality. Once the diversion ditches are installed, the silt fences and straw-bale dikes will be removed.

The initial placement of waste rock ~~will~~ did take place in an area lower than the existing surrounding grade. ~~The operator will construct the a~~Appropriate ditches adjacent to and upstream of the growing pile were constructed when the placement of waste rock reached ~~once the surface of the pile meets and exceeds~~ the level of the surrounding existing ground surface. Prior to construction of the ditches, a temporary interim berm ~~will be~~ was constructed upstream of the below-grade storage area to divert water to the sediment pond. ~~(RA Plate 7-1)~~

Once the runoff- and sediment-control facilities outlined in Section 732 have been installed, these structures will prevent additional contributions of suspended solids to streamflow outside the permit area. A description of sediment control following reclamation is presented in Sections 540 and 760 of this submittal and the approved M&RP.

Reference RA Attachment 7-3, Addendum A for hydrologic information pertaining to the soil borrow area.

731.200 Water Monitoring

Groundwater Monitoring. Groundwater monitoring associated with the refuse pile will include quarterly water level measurements. In accordance with Table 7-4, Groundwater Monitoring Program of the approved M&RP, Wells DH-1, DH-2 and DH-3 will be monitored using Protocols A, 1. Water quality samples will be obtained quarterly from DH-1 beginning in the first quarter of 2003 and ending the 4th quarter of 2004. Thereafter, a water quality sample from DH-1 will be taken annually, until bond release. The samples from DH-1 will be analyzed for the parameters listed in Table 7-4, "Groundwater Monitoring Program". At least one borehole volume of water will be removed from the well prior to obtaining the water sample for analysis. Water level data collected through the first quarter of 2002 are presented in RA Attachment 7-1.

Should the subsoil stockpile be moved to the area of Well DH-2, the casing will be elevated above the stockpile to allow for continued monitoring (RA Plate 7-1a).

Surface Water Monitoring. Two surface water monitoring sites are located in the refuse pile area (see RA Plate 7-1a). These stations are located on the ephemeral drainage to the west and southwest of the pile. One point is located upstream of the pile, while the second point is located downstream of the site at the county road crossing. These stations are monitored to evaluate surface-water conditions upstream and downstream from the pile. The stations will be monitored in accordance with the schedule and protocols established in the approved M&RP. In accordance with Table 7-5, Surface Water Monitoring Program of the approved M&RP, Surface Water Monitoring Sites SS-1 and SS-2 are monitored using Protocol 1. Data collected through the third quarter of 2002 are presented in RA Attachment 7-1.

731.300 Acid- and Toxic-Forming Materials

Acid- or toxic forming materials are not expected to be produced from the mine. CFC commits to monitor all materials produced and analyze them for acid- or toxic-forming materials. If any materials are identified, they will be placed in the refuse pile and covered with a minimum of 4 feet of non-acid, non-toxic, non-combustible materials. Copies of the toxicity/acid-base results from the samples collected at the Dugout Canyon Mine are presented in RA Attachment 5-4 and Appendix 5-7 of the approved M&RP.

731.400 Transfer of Wells

The three ground water monitoring wells, which exist at the site, will be abandoned following the reclamation of the site when no longer required for ground water monitoring. Therefore, no well transfers are required.

731.500 Discharges

No mines are located in the refuse pile area, thus no discharges to mines is possible.

731.600 Stream Buffer Zones

The refuse pile for the Dugout Canyon Mine will not be constructed within 100 feet of a perennial stream.

Stream Channel Diversions. No stream channel diversions are planned for this site.

Buffer Zone Designation. No buffer zone designation is necessary at this site.

731.700 Cross Sections and Maps

RA Plate 7-1a shows the location of each monitoring station and the watershed boundaries for the area watersheds. RA Plate 7-1a shows the proposed location of the diversion ditches and culverts and sediment ponds associated with the refuse pile area. RA Plate 7-2 and RA Plate 7-3a presents the design details of the sediment ponds with appropriate cross sections of the ponds and embankments.

731.800 Water Rights and Replacement

No surface or groundwater sources are located within the refuse pile area.

732 Sediment Control Measures

The sediment control measures within the refuse pile area have been designed to prevent additional contributions of sediment to stream flow or to runoff outside the permit area. In addition, they have been designed to meet applicable effluent limitations, and minimize erosion to the extent possible.

The structures to be used for the runoff-control plan for the permit area include disturbed and undisturbed area diversion channels, ~~a~~ sedimentation ponds, berms, silt fences, and road diversions and culverts.

Reference RA Attachment 7-3, Addendum A for hydrologic information pertaining to the soil borrow area.

732.100 Siltation Structures

The siltation structures within the permit area ~~is~~ are ~~a~~ sediment ponds as described in Section 732.200. In addition to the sediment ponds, a berm encircles the topsoil/subsoil stockpiles, providing treatment and total containment of the runoff from the stockpiles (RA Attachment 7-2 and 7-7). Typical cross sections of the ditches, berm and containment area are located in RA Plate 7-2a and RA Attachment 7-4.

732.200 Sedimentation Ponds

There ~~is a single~~ are two sedimentation ponds operating at the refuse pile site. The sedimentation pond topography and cross sections are presented on RA Plate 7-2 and RA Plate 7-3a ~~of this submittal~~. Details regarding sedimentation pond design are presented in Section 742.100 and RA Attachments 7-2 and 7-7. The sedimentation ponds are ~~is~~ defined as a Class A pond in accordance with TR-60 (U.S. Soil Conservation Service, 1976). A clean-out marker will be installed in the sediment ponds.

The sedimentation ponds are ~~is~~ within the disturbed area boundary and are ~~is~~ subject to final reclamation. The areas are ~~is~~ included in the calculation of the disturbed area subject to bonding and in the calculation of final reclamation costs.

Compliance Requirements. The sedimentation ponds will be maintained until removal in accordance with the reclamation plan (see Section 540 of this submittal). When the pond is removed, the land will be revegetated in accordance with the reclamation plan defined in Section 540.

MSHA Requirements. MSHA requirements defined in 30 CFR 77.216 are not applicable since the sedimentation ponds will not impound water or sediment to an elevation of 20 feet or more above the upstream toe of the structure. The ponds will have a storage volume of less than 20 acre-feet.

732.300 Diversions

The objective of the runoff control plan is to isolate, to the maximum degree possible, runoff from disturbed areas from that of undisturbed areas. This is accomplished by routing runoff from the undisturbed slope above the refuse pile facilities via diversion berm/ditch UD-1 ~~2~~ around the upstream side of the pile (see RA Plate 7-1a). Disturbed area runoff will be collected by ~~five~~ diversion ditches and conveyed to the sediment ponds. A brief list of each proposed diversion structure is as follows:

Diversion Ditches:

Undisturbed drainage ditch~~es~~ UD-1~~a,b and c~~ located on the north side of the pile, will collect runoff from the undisturbed watershed above of the pile. The runoff will be discharge into UC-1.

Disturbed drainage ditch DD-1 is located along the northwest ~~east~~ side of the pile and will connect to DD-3.

Disturbed Berm 1 (DB-1) connects to DD-2 along the west side of the pile.

DD-2 is connected to DD-3 along the southwest side of the pile.

DD-3 is connected to DD-5 along the south side of the pile.

DB-2 connects to DD-4 along the south side of the pile.

DD-4 connects to DD-5.

DD-5 connects to Sedimentation Pond 1 at the south side of the pile.

DD-6 along the north side of the pile connects to DS-1.

DS-1 located north of the pile connects to DD-8 northeast of the pile.

DD-7 collects runoff from the upper haul, along the northwest side of the pile, and connect to DD-8.

~~Disturbed drainage ditches DD-2a and b are located on the northwest side of the pile.~~

~~Disturbed drainage ditches DD-3a and b will connect ditches DD-1 and DD-2 to the sediment pond~~.

DD-8 connects to DD-9, located along the east side of the pile.

DS-2 collects runoff from the east half of the top of the pile and connects to DD-10 along the southeast side of the pile.

DD-10 connects to DD-11.

DD-9 connects to DD-11, located along the southeast side of the pile.

DD-11 directs runoff to Sedimentation Pond 2.

Diversions Swales:

Disturbed swale DS-1 will convey runoff from DD-1 to DD-6 over the Upper Haul Road.

DS-2 conveys runoff from the east half of the top of the pile to DD-10.

Diversion Culverts:

Culvert UC-1 will convey runoff from the county road borrow ditch under the pile access road. This runoff will ultimately discharge to the natural drainage under the county road.

Culvert UC-2 will be constructed only if the “topsoil stockpile” is relocated adjacent to the Dugout Canyon Road. UC-2 will convey water from the undisturbed drainage above the disturbed area, under the stockpile to the undisturbed drainage below the site (RA Table 7-4 and RA Attachment 7-4 7). Detailed diversion design is presented in Section 742.

Culvert UC-3 will convey runoff from the undisturbed area east of the refuse pile and from UC-1 under the access road for Sedimentation Pond 2.

732.400 Road Drainage

No permanent roads are to be built within the refuse pile area. Road drainage facilities will include diversion ditches and culverts. The road drainage diversion ditches and culverts for the refuse pile area are included in the list of diversions presented in Section 732.300 above. Additional road drainage design information is presented in Section 742.

All road drainage diversions will be maintained and repaired as needed. The culvert to be installed in the county road borrow ditch within the disturbed area is discussed in Section 742.300.

733 Impoundments

733.100 General Plans

There ~~is a single~~ are two sedimentation ponds operating at the refuse pile facility as described in Section 732.200. The sedimentation ponds are ~~is~~ located in the southern portion of the disturbed area. The sedimentation pond topography and cross sections are presented on RA Plate 7-2 and

RA Plate 7-3a ~~of this submittal~~. Detailed design information is presented in RA Attachments 7-2 and 7-7.

Certification. All maps and cross sections of the sedimentation ponds have been prepared by or under the direction of, and certified by a qualified, registered, professional engineer.

Maps and Cross Sections. The topography and cross sections for the sedimentation ponds are provided on RA Plate 7-2 and Ra plate 7-3a ~~of this submittal~~.

Narrative. A description of the sedimentation ponds is presented in Sections 732.200 and 742 of this submittal.

Subsidence Survey Results. No underground coal mining will occur beneath the proposed sedimentation ponds. Therefore, there will be no effects on the ponds or pond embankments from subsidence.

Hydrologic Impact. The hydrologic and geologic information required to assess the hydrologic impacts of the proposed sedimentation ponds are presented in Section 724 and Chapter 6 of this submittal and approved M&RP, respectively.

Design Plans and Construction Schedule. There are no additional structures proposed for the refuse pile area at this time. Any structures proposed in the future will not be constructed until the Division has approved the detailed design plan for the structure.

733.200 Permanent and Temporary Impoundments

Requirements. The sedimentation ponds have ~~has~~ been designed using current, prudent engineering practices. Specific foundation design and construction criteria are presented in Chapter 5 of this submittal. Specific hydrologic design criteria for the pond are presented in Section 743. The pond will be inspected regularly based on the schedule contained in Section 514.300.

Permanent Impoundments. There are no permanent impoundment structures proposed for use in mining and reclamation operations within the permit and adjacent areas.

Temporary Impoundments. The Division's authorization is being sought for the construction of the sedimentation ponds as a temporary impoundment at the refuse pile area as part of coal mining and reclamation operations.

Hazard Notifications. The sedimentation ponds will be examined for structural weakness and erosion in accordance with the schedule presented in Section 514.300. A report of these findings will be submitted to the Division as outlined in Section 514.300.

734 Discharge Structures

Discharge structures within the refuse pile area will consist of the emergency spillway on the sedimentation ponds. All discharge structures will be constructed and maintained to comply with R645-301-744.

Reference RA Attachment 7-3, Addendum A for hydrologic information pertaining to the soil borrow area.

735 Disposal of Excess Spoil

There will be no excess spoil generated in the refuse pile area.

736 Coal Mine Waste

Coal mine waste generated by the Dugout Mine, will be stored and disposed of as described in Chapter 5 of this submittal.

737 Noncoal Mine Waste

Noncoal mine waste will be stored and disposed of as described in Chapter 5 of the approved M&RP.

738 Temporary Casing and Sealing of Wells

Each groundwater monitoring well identified on RA Plate 7-1a will be operated and maintained as described in Section 748.

740 DESIGN CRITERIA AND PLANS

741 General Requirements

This submittal includes site-specific plans that incorporate minimum design criteria for the control of drainage from disturbed and undisturbed areas.

742 Sediment Control Measures

742.100 General Requirements

Design. Sediment-control measures have been designed to provide the following:

Prevent additional contributions of sediment to stream flow or to runoff outside the permit area;

Meet the effluent limitations defined in Section 751 of this amendment; and

Minimize erosion to the extent possible.

Measures and Methods. The sediment control measures at the mine will include practices carried out within and adjacent to the disturbed area. Sediment control methods will include:

Retention of sediment within the disturbed area;

Diversion of upstream runoff away from the disturbed area; and

Provision of silt fences, riprap, contemporaneous revegetation, vegetative sediment filters, ~~a~~ sediment ponds, and other measures that reduce overland flow velocities, reduce runoff volumes or trap sediment.

742.200 Siltation Structures

General Requirements. Additional contributions of suspended solids and sediment to stream flow or runoff outside the permit area will be prevented to the extent possible using ~~a~~ sedimentation ponds. These ponds will be constructed before refuse pile construction operations begin. A qualified registered professional engineer will certify pond construction.

Sedimentation Ponds. ~~A single~~ Two sedimentation ponds have ~~has~~ been designed for the refuse pile facilities. These sedimentation ponds are ~~is~~ located in the southern portion of the disturbed area. ~~This~~ These ponds will function as ~~a single~~ total containment ponds with no planned discharge.

The location of the sedimentation ponds is shown on RA Plate 7-1a. These ponds will not be located within a perennial stream channel.

Design, Construction, and Maintenance

Originally, ~~T~~the entire area draining to the sedimentation pond has been defined as a single watershed (DWS-1). The sedimentation pond (Sediment Pond 1) has been designed to control sediment from areas which have been disturbed. The disturbed area contributing runoff to the sedimentation pond contains 15.60 acres. Refer to RA Plate 7-1 for a delineation of watershed boundaries and RA Attachment 7-2 for additional pond detail.

The sedimentation pond was designed to fully contain the sediment generated within the disturbed area. The sedimentation pond has been designed with a sediment storage capacity of 0.67 feet. The elevation of the maximum sediment level is 5897.55 feet. The 60% sediment clean-out volume of 0.40 acre-feet is an elevation of 5896.5 feet.

Under the Phase II expansion of the refuse pile, a second sediment pond has been included. As the Phase II refuse pile expands and matures, the western portion of the pile will ultimately drain into Sedimentation Pond 1 and the eastern portion will drain into Sedimentation Pond 2. ~~The~~ These sedimentation ponds have ~~has~~ been designed to control sediment from areas which have been disturbed. Ultimately ~~T~~the disturbed area~~s~~ contributing runoff to ~~the~~ Sedimentation ~~p~~Pond 1 will contain~~s~~ 6.08 ~~15.60~~ acres and the disturbed area contributing runoff to Sedimentation Pond 2 will contain 13.6 acres. Refer to RA Plate 7-4a ~~7-1~~ for a delineation of watershed boundaries and RA Plate 7-3a and RA Attachment 7-~~2~~7 for additional pond details.

The sedimentation ponds were ~~was~~ designed to fully contain the sediment generated within the disturbed area. As the Phase II expansion continues, more and more runoff will be directed away from Sediment Pond 1, towards Sediment Pond 2. Ultimately, ~~T~~the design parameters for Sedimentation Pond 1 can be reevaluated. ~~has been~~ The originally designed ~~with a~~ sediment storage capacity of 0.67 acre-feet can be increased to 1.81 acre-feet, and ~~T~~the elevation of the maximum sediment level ~~is~~ can be increased from 5,897.55 feet to 5,901.0 feet. The 60% sediment clean-out volume of 0.40 acre-feet ~~is~~ at an elevation of 5,896.5 feet will also increase to 1.81 acre-feet at an elevation of 5,901.0 feet. Sedimentation Pond 2 has been designed with a sediment storage capacity of 0.68 acre-feet. The elevation of the maximum sediment level is 5,862.52 feet. The 60% sediment clean-out volume of 0.41 acre-feet is an elevation of 5,861.70 feet.

Sediment Removal. Sediment removal from the sedimentation ponds will occur when the sediment level reaches the 60% clean-out level. The sediment will be disposed in the refuse pile as discussed in Section 526.100 and 732.200 of this M&RP.

Design Event. As these are ~~this is a~~ total containment structures, the sedimentation ponds have ~~has~~ been designed to fully contain runoff resulting from the 100-year, 24-hour precipitation event ~~(2.8 inches)~~, instead of the 10-year, 24-hour event ~~(1.65 inches)~~. This will provide a significant additional storage volume.

Detention Time. As these ~~this~~ structures are ~~is~~ planned to be ~~a~~ total containment ponds, no decant structures will be part of the pond design. If collected water is to be removed from the structures, it would be pumped. Any such pumping activities will comply with the sites approved UPDES permit. ~~Division approval will be obtained and an adequate detention time will be provided in the water collected in the pond to allow the effluent to meet UPDES and 40 CFR Part 434 limitations.~~

Runoff Volume. The curve numbers used to determine the runoff volumes were based on professional judgment and soil and vegetation information presented in Chapters 2 and 3 of this submittal. The curve number for the pond area was assumed to be 98 ~~90~~.

The storm runoff volume to the Phase II Sedimentation Pond 1 resulting from the 100-year, 24-hour storm event was calculated to be 0.62 ~~2.22~~ acre-feet. The combined volume of the runoff from the 100-year, 24-hour storm event and the maximum sediment storage is 2.43 ~~2.89~~ ac-ft. The storm runoff volume to Sedimentation Pond 2 resulting from the 100-year, 24-hour storm event was calculated to be 1.31 acre-feet. The combined volume of the runoff from the 100-year 24-hour storm event and the maximum sediment storage is 1.99 acre-feet. Calculations for pond sizing are contained in RA Attachment 7-~~2~~7.

As the ponds are ~~is a~~ total containment structures, no principal spillways or dewatering structures are ~~is~~ included in the design. RA Attachments 7-2 and 7-7 present~~s~~ the stage-capacity table for the ponds.

An open-channel emergency spillway has been designed for each of the ponds to allow discharge from the ponds in the event that a series of greater than design events occur within a short period. Details regarding ~~this~~ these emergency spillways are discussed in RA Attachments 7-2 and 7-7.

The original emergency spillway of Sedimentation Pond 1 was ~~has been~~ designed with a median riprap diameter of 6 inches within the crest section and 12 and 9 inches in the outslope sections of the spillway. This riprap was underlain with a geofabric liner. The expected velocity at the spillway outlet to the ephemeral channel will be 4.47 feet per second, which velocity is not considered erosive. Calculations regarding the emergency spillway are presented in RA Attachment 7-2.

The emergency spillway for Sedimentation Pond 2 has been designed with a median riprap diameter of 4 inches. This riprap will be underlain with a geofabric liner. The expected velocity at the spillway outlet to the ephemeral channel will be 4.14 feet per second, which velocity is not considered erosive. Calculations regarding the emergency spillway are presented in RA Attachment 7-7.

Dewatering Device. No dewatering devices are ~~is~~ planned for the ponds. Runoff water collected will seep through the pond bottoms, evaporate from the ponded water surface, and be used for dust suppression on the site area.

Short Circuiting. Short circuiting will not occur as the ponds will be ~~a~~ total containment structures.

Excessive Settlement. The sedimentation pond~~s~~ are ~~is~~ to be incised in native material. Therefore, it is not expected that embankment settlement will be a significant concern. Stability analyses presented in Chapter 5 indicate that the pond embankments will be stable under both normal and rapid drawdown conditions.

Embankment Material. During construction of ~~the~~ Sedimentation Pond 1 and Sedimentation Pond 2, the inslopes of the ponds ~~was~~ were or will be shaped to provide a 2H:1V and 3H:1V slope, respectively. Material to be used on the inslope was or will be inspected to ensure the material is free of sod, large roots, and frozen soil.

Compaction. The sedimentation ponds were or will be ~~was~~ incised in native materials. Any materials that are disturbed during the inslope reshaping will be compacted to a minimum dry density of 90% as determined by ASTM D1557.

MSHA Sedimentation Ponds. MSHA requirements defined in 30 CFR 77.216 are not applicable at this site since the proposed sedimentation ponds will not impound water or sediment to an elevation of 20 feet or more above the upstream toe of the structures. The ponds will also store a volume less than 20 acre-feet.

Other Treatment Facilities. There are no other treatment facilities within the mine permit area.

Exemptions. No exemptions are being proposed at this time.

742.300 Diversions

General Requirements. The diversions within the refuse pile area will consist of drainage ditches, berms, swales and culverts. All diversions within the site area have been designed to minimize adverse impacts to the hydrologic balance, to prevent material damage outside the permit area, and to assure the safety of the public.

All diversions and diversion structures have been designed and will be constructed, maintained and used to:

Be stable;

Provide protection against flooding and resultant damage to life and property;

Prevent, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area; and

Comply with all applicable local, state, and federal laws and regulations.

All diversions within the refuse pile area will be removed when no longer needed. The diversions will be reclaimed in accordance with the reclamation plan defined in Chapter 5.

Peak discharge rates from the undisturbed and disturbed area drainages within the site area were calculated for use in designing diversion ditches and culverts. The storm runoff calculations for the temporary diversion structures were based on the 10~~100~~-year, 6-hour precipitation event ~~of 2.05 inches~~. The storm runoff calculations for the permanent diversion structures were based on the 100-year, 6-hour precipitation event.

Curve numbers were based on professional judgment and information presented in Chapters 2 and 3 of this submittal. The curve numbers for the various watersheds are summarized in RA Attachment 7-2 ~~7-4~~.

The drainage areas within and above the facilities area are presented on RA Plate 7-1a. A summary of the characteristics of watersheds contributing to the diversions is presented in RA Attachments 7-4 and 7-7.

The size and location of each proposed diversion ditch, berm, swale and culvert will be verified in the field prior to initiating refuse pile construction. All proposed diversions are presented on RA Plate 7-1 and RA Plate 7-1a. The minimum capacity and freeboard of each diversion ditch, berm, swale and culvert was determined based on the minimum ditch slope. The maximum velocity and need for a channel lining or outlet protection was calculated based on the maximum ditch, berm, swale or culvert slope. Slopes were measured from a survey provided by Canyon Fuel Company in AutoCAD format. ~~contour map with a scale of 1" = 100'.~~ All diversion and culvert calculations are presented in RA Attachments 7-4 and 7-7 and summarized in RA Tables 7-3 and 7-4.

~~Diversion Berms. Diversion ditch DD-1 planned for this site will be an asymetrical ditch which will have a 10H:1V slope from the pile to the ditch bottom and a 2H:1V slope out of the ditch. The purpose of this ditch shape is to provide vehicle access to the pile outslope once the final configuration is reached, as well as a means of conveying the runoff from the pile. However, to meet MSHA requirements for safety concerns adjacent to slopes, a berm will need to be placed immediately adjacent to the ditch along the outslope. Since none of the berms have been designed specifically to convey runoff, no calculations concerning the hydraulic characteristics of these berms are provided.~~

~~A temporary interim berm will be constructed to divert water away from the below grade waste rock storage area. This will remain in place until the waste rock fill reaches the level of the surrounding ground and the construction of Ditches DD-1 and DD-2 is completed.~~

742.400 Road Drainage

No permanent roads are to be built in the refuse pile area. Runoff from the temporarily constructed road within the disturbed area will be treated by collection in the diversion ditches, berms, swales and sediment ponds. The drainage ditches associated with the county road will be maintained during operations by placing a culvert under the refuse pile access road. Once the refuse pile is completed and reclaimed so that the road is no longer required for access, the drainage ditch along the county road will be restored by removing the culvert and reclaiming the road in accordance with Chapter 5 of this submittal. None of these roads are located in the channel of an intermittent or perennial stream. Control structures have been located to minimize downstream sedimentation and flooding. Diversion ditches and culverts for all roads are described in Section 732.300.

743 Impoundments

All pertinent information regarding the sedimentation ponds is presented in Sections 732.200 and 742.200.

744 Discharge Structures

The discharge structures within the permit area are ~~is~~ the emergency spillways on the sedimentation ponds. The spillways on the sedimentation ponds have ~~has~~ been designed to ~~pass the 100-year, 6-hour storm event assuming that the pond was full. Therefore, the spillway will adequately~~ pass the peak discharge from the 25-year, 6-hour precipitation event. Detailed information concerning the sedimentation ponds is presented in Section 742.200.

745 Disposal of Excess Spoil

There will be no excess spoil generated within the refuse pile area.

746 Coal Mine Waste

746.100 General Requirements

All coal mine waste will be placed in a controlled manner to minimize adverse effects of leachate and surface water runoff on surface and groundwater quality and quantity. This waste will be placed in the refuse pile facility as described in Chapter 5 of this submittal.

746.200 Refuse Piles

A detailed description of the refuse pile is presented in Chapter 5 of this submittal.

746.300 Impounding Structures

No impounding structures within the refuse pile area will be constructed of coal mine waste or used to impound coal mine waste.

746.400 Return of Coal Processing Waste to Abandoned Underground Workings

No coal processing waste will be generated in the permit area.

747 Disposal of Noncoal Mine Waste

Disposal of noncoal mine waste is discussed in Chapter 5 of the approved M&RP.

748 Casing and Sealing of Wells

Each monitoring well has been cased, sealed, or otherwise managed, as approved by the Division, to prevent acid or other toxic drainage from entering ground or surface water, to minimize disturbance to the hydrologic balance, and to ensure the safety of people, livestock, fish and wildlife, and machinery in the site and adjacent area. The drill logs and completion diagrams for the wells are contained in RA Attachment 6-1.

750 PERFORMANCE STANDARDS

All operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area, and support approved post-mining land uses.

751 Water Quality Standards and Effluent Limitations

Discharges of water from disturbed areas will be in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining contained in 40 CFR Part 434.

752 Sediment Control Measures

All sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 732, 742, and 760 of this submittal and the approved M&RP.

752.100 Siltation Structures and Diversions

Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 732, 742, and 763 of this submittal and the approved M&RP.

752.200 Road Drainage

Runoff from temporary roads will be treated through siltation structures which will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 732, 742, and 763 of this submittal and the approved M&RP.

753 Impoundments and Discharge Structures

Impoundments and discharge structures will be located, maintained, constructed and reclaimed as described in Sections 733, 734, 743, 745, and 760 of this M&RP.

754 Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste

Disposal areas for coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed as described in Sections 736, 737, 746, 747, 760 and Chapter 5 of this submittal and the approved M&RP.

755 Casing and Sealing of Wells

All wells will be managed as described in Sections 551, 748 and 765 of this submittal.

760 RECLAMATION

761 General Requirements

A detailed reclamation plan for the mine is presented in Section 540. In general, CFC will ensure that all temporary structures are removed and reclaimed. ~~Other than for~~ For restoration of natural drainage patterns, ~~no~~ some permanent diversions are included in the reclamation plan as illustrated in RA Plate 7-5a. Reference RA Attachment 2-3 for soil information, pictures and drawings and RA Attachment 7-3, Addendum A for hydrologic information pertaining to the soil borrow area.

762 Roads

No roads will be retained after reclamation of the site.

762.100 Restoring the Natural Drainage Patterns

Natural drainages will be restored during reclamation of the refuse pile area by removing the sediment ponds and temporary diversions and establishing some permanent runoff control features ~~ditches~~. As presented in Chapter 5, the existing topography will be altered by the construction of the refuse pile. This alteration will not significantly alter the natural drainage pattern of the area. This is because the site is located on a topographic divide between two small ephemeral drainages. RA Plate 5-2 and RA Plate 7-5a ~~7-3~~ presents the reclaimed drainages.

Several ~~Two~~ channels will be installed as part of the final reclamation (see RA Plates 5-2 and 7-5a ~~7-3~~). Due to the proximity of the adjacent refuse, the channels will be designed to safely convey the peak flow resulting from the 100-year, 6-hour precipitation event. Table 7-3 summarizes the reclaimed channel configurations.

Erosive velocity has been determined to be 5 feet per second based on alluvial silts and fine gravels expected in the area (Chow, V.T., 1959. Open Channel Flow. McGraw-Hill Book Company, New York, New York. Page 680). ~~For channels RD-1 and RD-2, riprap will only be installed in the steeper channel sections.~~ A typical ~~riprap~~ cross section is provided in RA Plate 7-2a ~~Attachment 7-4~~.

The cross-sections for the reclamation channels were designed using the minimum channel slope, while riprap sizing was designed using the maximum channel slope. Reclamation slopes were estimated from the topographic contours provided in RA Plate 5-2 and 7-5a ~~7-3~~. ~~Thickness of the riprap layer will be a minimum of 12". Sand filter blankets will be installed beneath the riprap at a thickness equal to one-half the thickness of the riprap or 6 inches; whichever is greater.~~

~~Since the site materials will be reworked during reclamation of the facility, pre-construction samples of channel bed materials would not likely be representative of reclamation conditions. Hence, no information is presented in this submittal regarding filter blanket sizing. Following regrading of the materials at the location of the reclamation channel, and prior to installation of the riprap, samples of the bed material will be collected and analyzed to determine soil gradations. The filter blanket will then be sized in accordance with standard practices at the time (e.g., Barfield et al., 1981) to determine the thickness and gradation of filter blanket materials.~~

762.200 Reshaping Cut and Fill Slopes

Through the use of contemporaneous reclamation, the fill slopes of the pile will be reclaimed as they are constructed. Section 540 describes the regrading process. All slopes will be shaped to be compatible with the post-mining land use and to complement the drainage pattern of the surrounding terrain.

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

The land on which the siltation structures were located will be regraded and revegetated in accordance with the reclamation plan presented in Section 540 of this amendment.

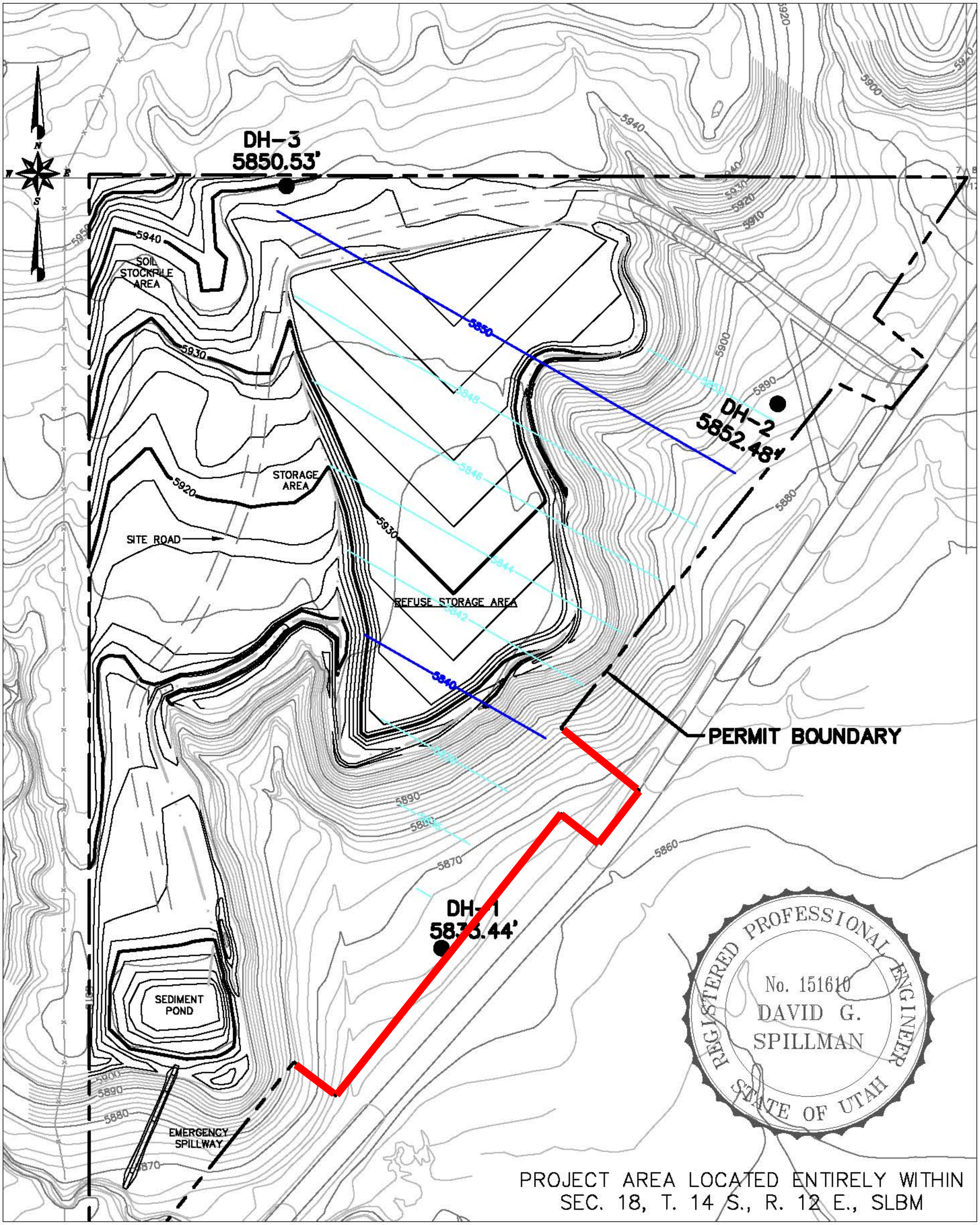
764 Structure Removal

A timetable for the reclamation of the site is presented in RA Figure 5-1.

765 Permanent Casing and Sealing of Wells

When no longer required to monitor ground water levels in the area of the refuse pile or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division. Permanent closure measures will be designed to prevent access.

RA Figure7-1.dwg



POTENTIOMETRIC SURFACE BASED ON
WATER ELEVATIONS MEASURED MARCH 25, 2002
ADDITIONAL WATER LEVEL DATA
CONTAINED IN RA ATTACHMENT 7–1.

0' 200'

RA FIGURE 7–1. POTENTIOMETRIC SURFACE

RA TABLE 7-3

DIVERSION DESIGN SUMMARY

I.D. No.	Min. Bottom Width (ft)	Min. Channel Depth (ft)	Left Side Slope (xH:1V)	Right Side Slope (xH:1V)	Max. Flow Depth (ft)	Min. Slope (%)	Max. Slope (%)	Peak Flow (cfs)~~[a]~~	Req. Riprap D_{50} (ft)	Minimum Freeboard (ft)
OPERATIONAL DIVERSIONS (Following the Phase I Expansion) Peak Flow Calculated from the 100-Yr, 6-Hr Storm Event										
DD-1	4.0	1.5	2.0	2.0	0.96	0.6	12.9	12.82	0.5*	0.54
DD-2a	15.0	1.0	2.0	2.0	0.22	1.9	10.0	8.02	None	0.78
DD-2b	4.0	1.0	2.0	2.0	0.41	5.0	13.5	8.02	0.5	0.59
DD-3a	15.0	1.0	2.0	2.0	0.37	1.3	3.5	16.03	None	0.63
DD-3b	2.0	1.5	2.0	2.0	1.03	1.3	9.0	16.03	0.5	0.47
UD-1a	1.0	1.0	2.0	2.0	0.27	2.0	15.0	0.71	None	0.73
UD-1b	2.0	1.5	2.0	2.0	0.87	0.3	2.8	4.74	None	0.63
UD-1c	2.0	1.0	2.0	2.0	0.5	4.4	23.3	4.74	0.5	0.5
~~RECLAMATION CHANNELS~~										
~~RD-1a~~	~~1.0~~	~~1.0~~	~~2.0~~	~~2.0~~	~~0.35~~	~~2.0~~	~~15.0~~	~~5.41~~	~~None~~	~~0.65~~
~~RD-1b~~	~~3.0~~	~~1.5~~	~~2.0~~	~~2.0~~	~~0.83~~	~~0.3~~	~~4.6~~	~~5.41~~	~~None~~	~~0.67~~
~~RD-1c~~	~~2.0~~	~~1.0~~	~~2.0~~	~~2.0~~	~~0.59~~	~~4.4~~	~~23.3~~	~~6.36~~	~~0.5~~	~~0.41~~
~~RD-2~~	~~1.0~~	~~1.0~~	~~2.0~~	~~2.0~~	~~0.20~~	~~1.0~~	~~14.3~~	~~0.46~~	~~None~~	~~0.80~~
~~RD-3~~	~~2.0~~	~~1.0~~	~~2.0~~	~~2.0~~	~~0.10~~	~~8.0~~	~~30.5~~	~~0.73~~	~~None~~	~~0.90~~
~~RD-4~~	~~1.0~~	~~1.0~~	~~2.0~~	~~2.0~~	~~0.15~~	~~2.8~~	~~6.1~~	~~0.37~~	~~None~~	~~0.85~~
~~RD-5~~	~~3.0~~	~~1.0~~	~~2.0~~	~~2.0~~	~~0.56~~	~~1.7~~	~~2.4~~	~~6.87~~	~~None~~	~~0.44~~
~~Swale 1~~	~~3.0~~	~~1.0~~	~~4.0~~	~~4.0~~	~~0.44~~	~~NA~~	~~NA~~	~~6.36~~	~~None~~	~~0.56~~
OPERATIONAL DIVERSIONS (TEMPORARY) -PHASE II EXPANSION 10-Yr, 6-Hr Storm Event, Watershed CN = 86										
DD-1	0.0	1.0	1.5	1.5	0.48	3.0	8.0	0.86	None	0.5
DD-3	0.0	1.5	1.5	1.5	0.75	1.7	5.0	2.17	None	0.75
DD-5	2.0	1.0	2.0	2.0	0.34	2.0	10.0	2.14	None	0.66
DD-6	0.0	1.0	1.5	1.5	0.55	2.0	5.0	1.02	None	0.45
DD-7	0.0	1.0	1.5	1.5	0.59	5.0	10.0	1.97	None	0.41

I.D. No.	Min. Bottom Width (ft)	Min. Channel Depth (ft)	Left Side Slope (xH:1V)	Right Side Slope (xH:1V)	Max. Flow Depth (ft)	Min. Slope (%)	Max. Slope (%)	Peak Flow (cfs)~~[a]~~	Req. Riprap D_{50} (ft)	Minimum Freeboard (ft)
DS-1	10.0	0.5	20.0	20.0	0.08	2.0	5.0	0.86	None	0.42
OPERATIONAL DIVERSIONS (PERMANENT) -PHASE II EXPANSION 100-Yr, 6-Hr Storm Event, Watershed CN = 86										
DB-1	0.0	1.0	20	1.5	0.39	1.0	5.0	2.29	None	0.61
DB-2	0.0	1.0	20	1.5	0.34	0.5	5.0	1.15	None	0.66
DB-3	0.0	1.0	20	1.5	0.32	1.0	5.0	1.39	None	0.68
DB-4	0.0	1.0	20	1.5	0.48	0.5	5.0	2.86	None	0.52
DD-2	2.0	1.0	2.0	2.0	0.15	33.0	50.0	1.78	0.33	0.85
DD-4	0.0	1.0	2.0	2.0	0.29	33.0	50.0	0.93	0.33	0.71
DD-8	0.0	2.0	2.0	2.0	1.34	0.5	4.5	7.61	None	0.66
DD-9	4.0	1.5	2.0	2.0	0.75	1.0	3.0	12.04	None	0.75
DD-10	4.0	1.0	2.0	2.0	0.43	1.0	50.0	3.92	0.33	0.57
DD-11	8.0	1.0	2.0	2.0	0.35	10.0	35.0	17.08	0.5	0.65
DS-2	0.0	1.0	20.0	20.0	0.49	0.5	2.0	5.54	Road Material	0.51
UB-1	0.0	0.5	3.0	2.0	0.13	2.5	15.0	0.07	None	0.87
UB-2	0.0	0.5	3.0	2.0	0.13	2.5	15.0	0.08	None	0.87
UD-1	0.0	1.5	2.0	2.0	0.89	0.8	17.0	2.55	Existing Grasses	0.61
RECLAMATION CHANNELS (PERMANENT) -PHASE II EXPANSION 100-Yr, 6-Hr Storm Event, Watershed CN = 71										
RB-1	0.0	1.0	1.5	10	0.33	3.0	8.0	1.37	None	0.67
RB-2	0.0	1.0	1.5	20	0.21	1.0	5.0	0.42	None	0.79
RB-3	0.0	1.0	1.5	10	0.41	1.0	5.0	1.44	None	0.59
RB-4	0.0	1.0	1.5	20	0.20	0.5	5.0	0.29	None	0.80
RB-5	0.0	2.0	1.5	20	0.18	1.0	5.0	0.31	None	0.82
RB-6	0.0	1.5	1.5	20	0.29	0.5	5.0	0.71	None	0.71
RD-1	0.0	1.5	2.0	2.0	1.01	0.8	17.0	3.54	Existing Grasses	0.49
RD-2	2.0	1.0	2.0	2.0	0.04	33.0	50.0	0.24	None[a]	0.96

I.D. No.	Min. Bottom Width (ft)	Min. Channel Depth (ft)	Left Side Slope (xH:1V)	Right Side Slope (xH:1V)	Max. Flow Depth (ft)	Min. Slope (%)	Max. Slope (%)	Peak Flow (cfs)~~(a)~~	Req. Riprap D_{50} (ft)	Minimum Freeboard (ft)
RD-3	0.0	1.0	2.0	2.0	0.15	33.0	50.0	0.17	None[(a)]	0.85
RD-4	6.0	1.0	2.0	2.0	0.09	10.0	35.0	1.46	None[(a)]	0.91
RD-5	0.0	1.0	2.0	2.0	0.43	0.5	4.5	0.36	None	0.57
RD-6	4.0	1.0	2.0	2.0	0.26	1.0	3.0	1.89	None	0.74
RD-7	4.0	1.0	2.0	2.0	0.58	1.0	5.0	0.58	None[(a)]	0.86
RD-8	8.0	1.0	2.0	2.0	0.09	10.0	35.0	1.60	None[(a)]	0.91
RS-1	0.0	0.5	20	20	0.28	0.5	2.0	1.23	None	0..22

(a) ~~Peak discharge resulting from the 100-year, 6-hour precipitation event.~~ Due to the lower curve numbers (CN) of the reclaimed watersheds, riprap is not required within these reclamation channels. However, these channels were developed during the facilities operational phase when riprap was required. Therefore, this existing riprap may be retained within these reclamation channels.

* 6" only on slopes exceeding 4%.

RA TABLE 7-4
CULVERT DESIGN SUMMARY

Diversion Culvert	Minimum Diameter (in)	Culvert Material	Inlet Type	Culvert Slope (%)	Peak Flow (cfs) [(a)]	Outlet Velocity (fps)	Outlet Riprap D_{50} (in)
UC-1	24	CMP	Projecting	4.5	2.46~~4.74~~	2.46~~6.31~~	None~~6~~
UC-2*	24	CMP	Projecting	1.25~~1.5~~	6.44~~6.78~~	4.17~~4.66~~	None
UC-3	24	CMP	Projecting	2.5	2.81	4.27	None

(a) Peak discharge resulting from the 100-year, 6-hour precipitation event.

* Culvert UC-2 will be constructed only if the Topsoil Stockpile, ~~is~~ ~~re~~located adjacent to the Dugout Canyon Road, is extended into the drainage of watershed UW-2.

LEGEND

	DISTURBED AREA BOUNDARY AND PERMIT AREA BOUNDARY
5900 / 5895	OPERATIONAL CONTOURS
5900 / 5895	EXISTING GROUND CONTOURS
UD-2	UNDISTURBED DITCH
DD-4	DISTURBED DITCH
	UNDISTURBED WATERSHED BOUNDARY
	DISTURBED WATERSHED BOUNDARY
DH-1	GROUNDWATER MONITORING LOCATION (WELLS)
SS-1	SURFACE WATER MONITORING LOCATION
UC-1	UNDISTURBED CULVERT

REVISION	
DATE	BY

Canyon Fuel Company, LLC
Dugout Canyon Mine

DRAINAGES, SEDIMENT CONTROL STRUCTURES AND SAMPLING LOCATIONS Phase II

Dugout Canyon Mine

DRN BY: SWF/TJS/TAJ	DATE: JANUARY 2017	SCALE: 1"=100'
APPROVED BY: TAJ	FILE NAME: RA Plate 7-1a.DWG	DRAWING OR MAP NUMBER RA PLATE 7-1a

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

AS SHOWN

SEAL:
REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

OPERATIONAL AND RECLAMATION STORM WATER CONVEYANCE DETAILS
PHASE II

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84542 435-637-6360	DATE: 1/2017	CK.BY:TAJ	REVISION:
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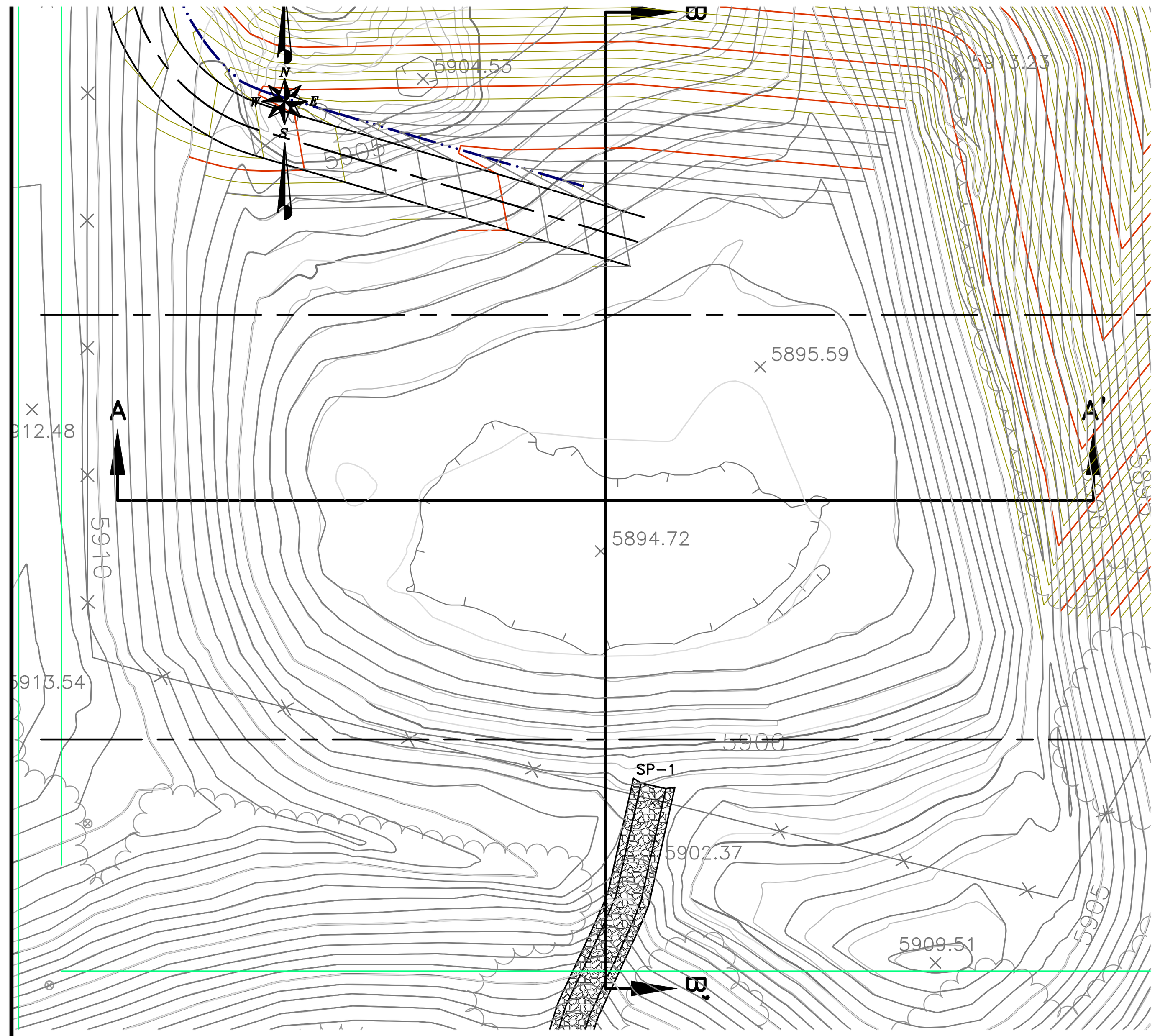
DWG. NO.:		RA PLATE 7-2a	



PLAN
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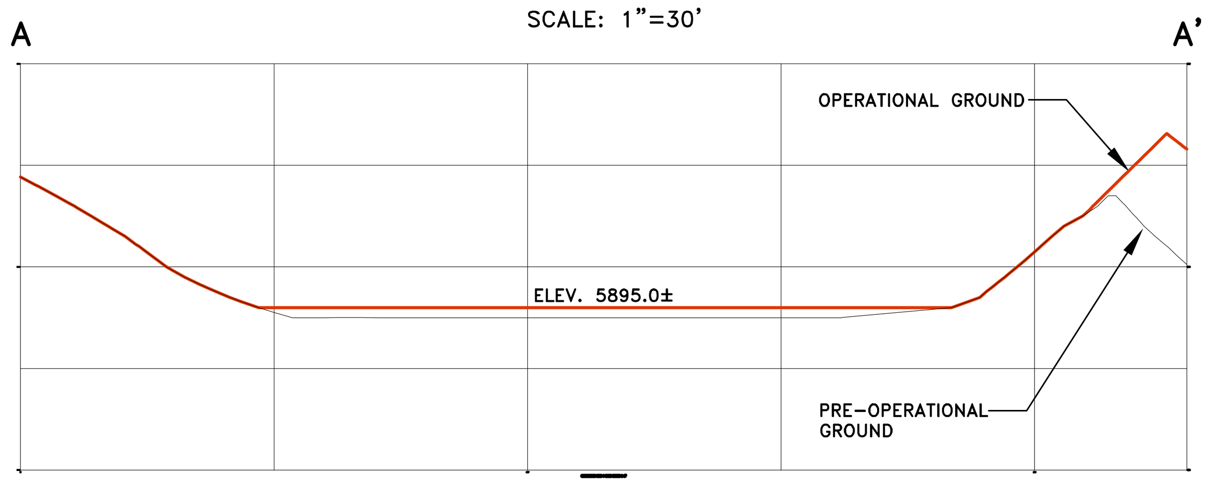

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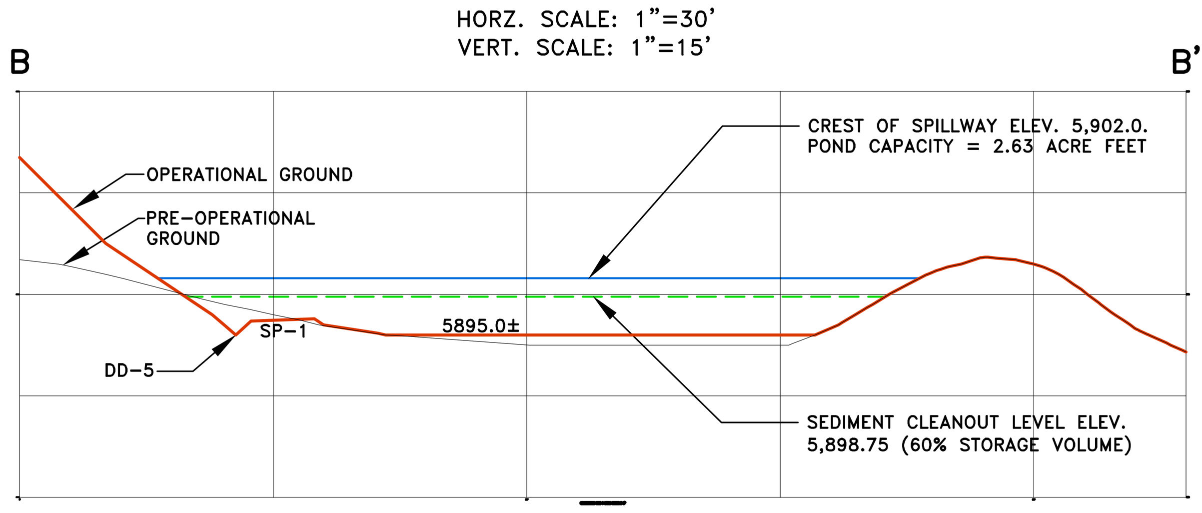
VERT. SCALE: 1"=15'



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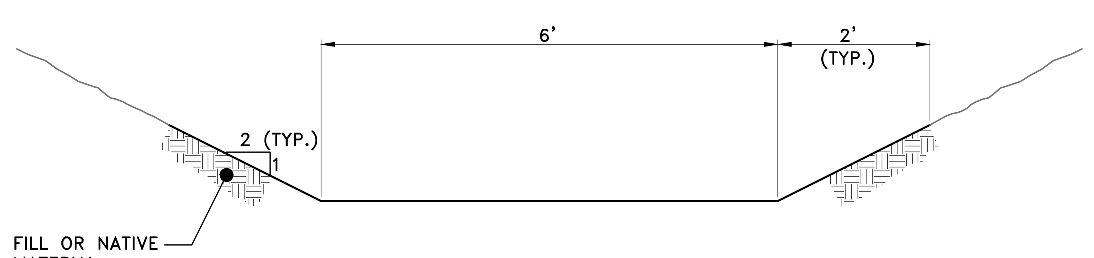
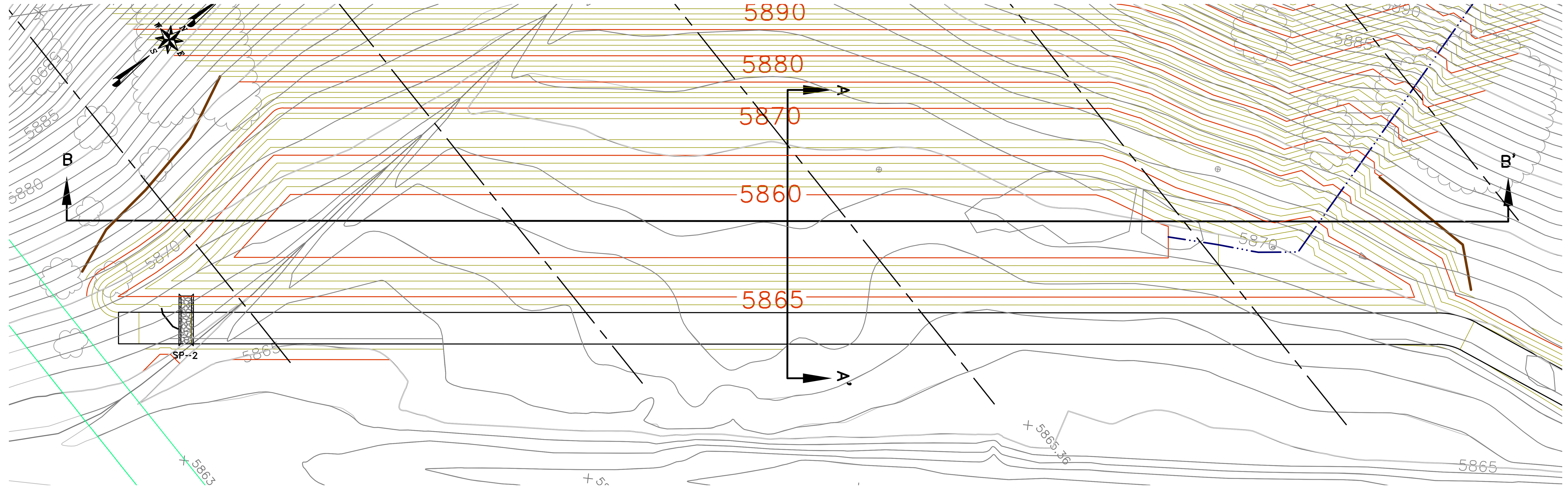


SP-1 SPILLWAY/RD-4
SCALE: 1"=2.0'

SEDIMENTAION POND-1 PLAN AND SECTIONS



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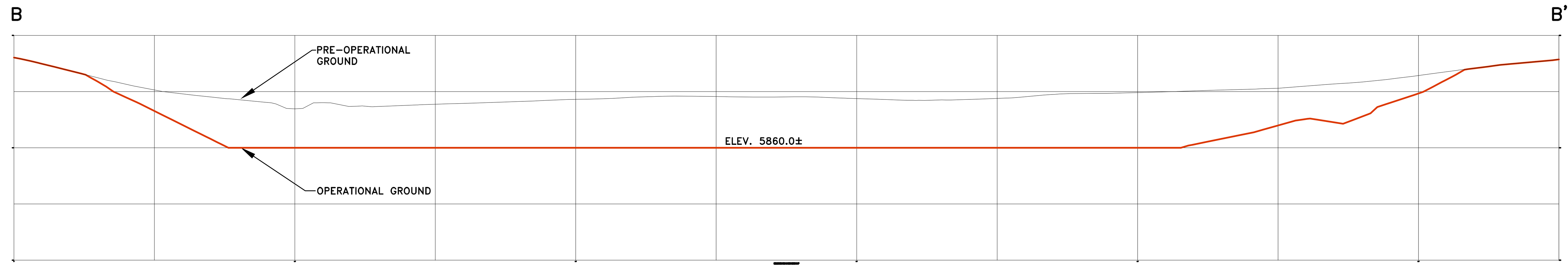
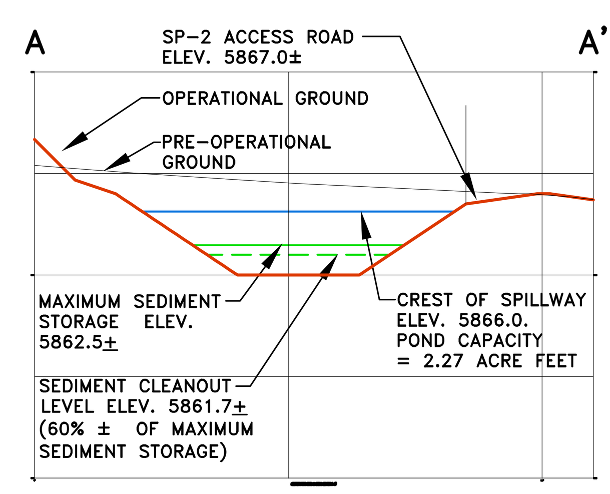
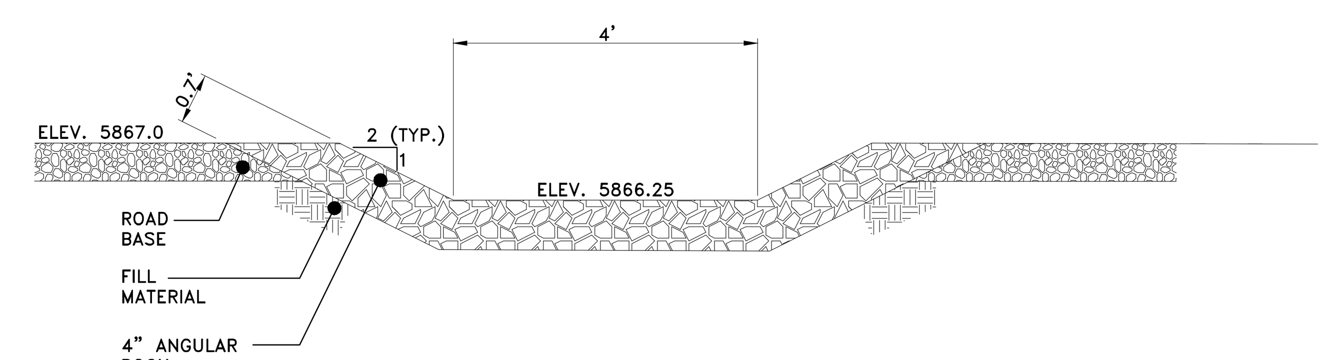


HORZ. SCALE: 1"=30'
VERT. SCALE: 1"=15'



HORZ. SCALE: 1"=30'
VERT. SCALE: 1"=15'



SP-2 SPILLWAY
SCALE: 1"=2.0'

SEDIMENTAION POND-2 PLAN AND SECTIONS

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

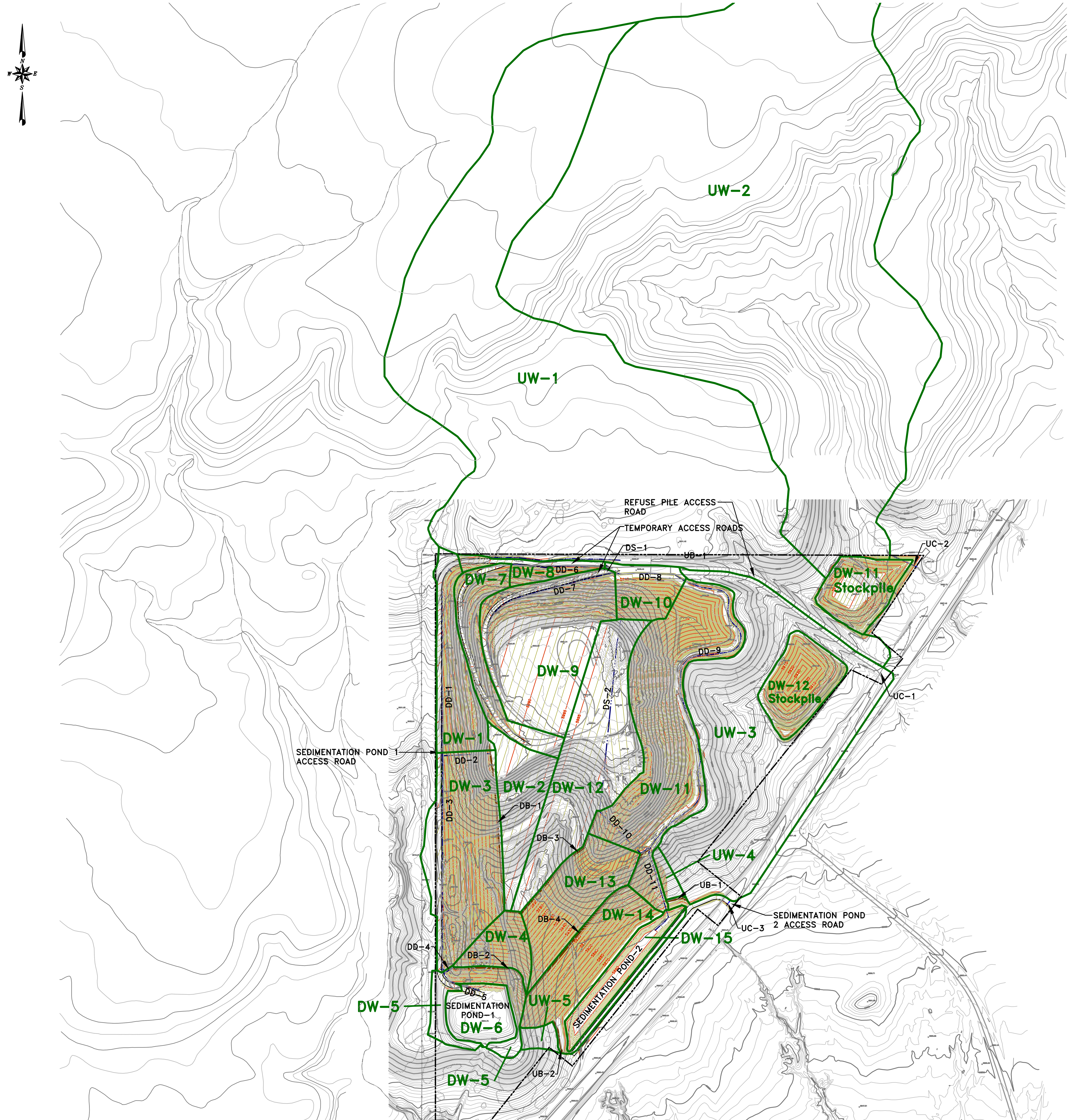
SEAL:
REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

OPERATIONAL SEDIMENTATION POND DETAILS
PHASE II

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84542 435-637-6360	DATE: 1/2017	CK.BY: TAJ	REVISION:
CAD FILE: RA PLATE 7-3a.DWG	SCALE: AS SHOWN	DR.BY: SWF	0
DWG. NO.:	RA PLATE 7-3a		



LEGEND

WATERSHED BOUNDARY

MAXIMUM CONTRIBUTING WATERSHED BOUNDARY

PERMIT AREA BOUNDARY

8140 EXISTING GROUND MAJOR CONTOUR (5 FOOT)

EXISTING GROUND MINOR CONTOUR (1 FOOT)

8120 OPERATIONAL GROUND MAJOR CONTOUR (5 FOOT)

OPERATIONAL GROUND MINOR CONTOUR (1 FOOT)

OPERATIONAL CULVERT

OPERATIONAL BERM AS SPECIFIED

PROPOSED DITCH

EXISTING DIRT ROAD

EXISTING STREAM

X X PROPOSED FENCE/GATE

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SEAL:

REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
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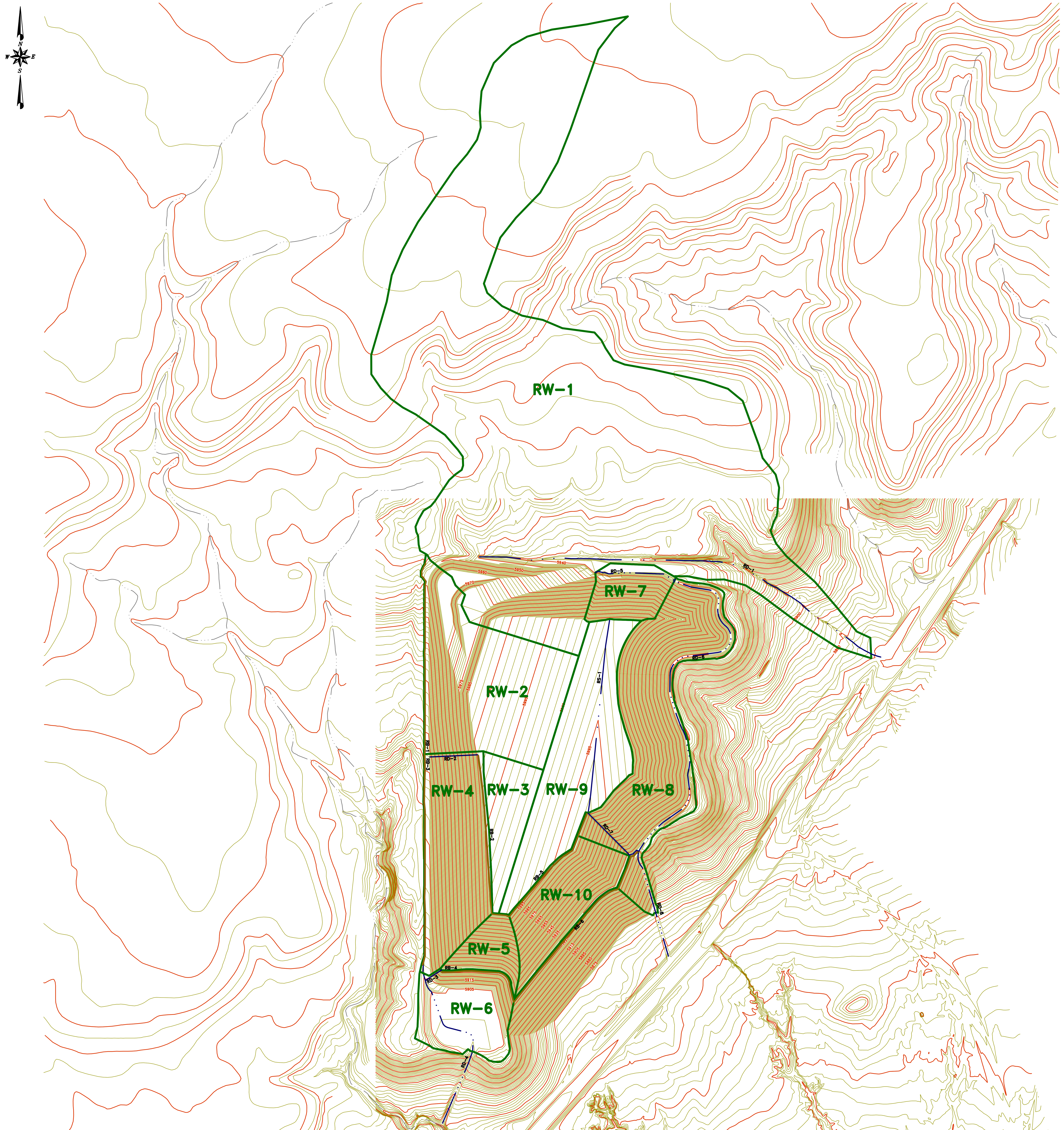
DATE	No.	REVISIONS

OPERATIONAL WATERSHEDS
PHASE II

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84542 435-637-6360	DATE: 1/2017	CK.BY: TAJ	REVISION: 0
CAD FILE: RA PLATE 7-4a.DWG	SCALE: AS SHOWN	DR.BY: SWF	
DWG. NO.:	RA PLATE 7-4a		



LEGEND

- WATERSHED BOUNDARY
- PERMIT AREA BOUNDARY
- 8140 RECLAIMED GROUND MAJOR CONTOUR (5 FOOT)
- RECLAIMED GROUND MINOR CONTOUR (1 FOOT)
- EXISTING DIRT ROAD
- EXISTING STREAM
- PROPOSED FENCE/GATE

EarthFax Engineering, Inc.
Engineers/Scientists
EarthFax

0 150 300
FEET

SEAL:
REGISTERED PROFESSIONAL ENGINEER
No. 151610
DAVID G. SPILLMAN
STATE OF UTAH

DATE	No.	REVISIONS

RECLAMATION WATERSHEDS
PHASE II

Canyon Fuel Company, LLC
Dugout Canyon Mine

P.O. BOX 1029 WELLINGTON, UTAH 84542 435-637-6360	DATE: 1/2017	CK.BY: TAJ	REVISION: 0
CAD FILE: RA PLATE 7-5a.DWG	SCALE: AS SHOWN	DR.BY: SWF	
DWG. NO.: RA PLATE 7-5a			

RA ATTACHMENT 7-7

REFUSE PILE PHASE II
HYDROLOGY DESIGN REPORT

Dugout Canyon Mine
Refuse Pile Phase II
Hydrology Design Report

Canyon Fuel Company
Dugout Mine
Wellington, Utah

January 2017

EarthFax Engineering Group, LLC

Engineers / Scientists
www.earthfax.com

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DUGOUT CANYON MINE
REFUSE PILE PHASE II
RUNOFF AND SEDIMENT CONTROL DESIGN REPORT

CHAPTER 1
INTRODUCTION

Canyon Fuel Company (Canyon Fuel) is planning the expansion of an existing refuse pile to service the Dugout Canyon Mine and other Canyon Fuel facilities. The refuse pile is located on Dugout Canyon Road 8 miles northwest of Wellington, Utah. To prevent adverse hydrologic impacts to the surrounding area, the mine will add to the existing runoff and sediment control system with additional berms, ditches, a swale, and a sedimentation pond.

The purpose of this document is to present design information for the runoff and sediment controls. A storm water conveyance system will be installed around the perimeter of the refuse pile to contain sediment and runoff discharges from the disturbed areas and direct runoff into sedimentation ponds and sediment basins. Additionally, a berm and ditch system will be installed to divert upstream runoff and sediment around the site. The runoff and sediment controls have been designed to conform to the applicable criteria outlined in the Utah Administrative Code Titles R645-300 and 301. However, Dugout Mine has requested that the sedimentation ponds be designed to safely retain runoff resulting from the 100-year, 24-hour storm event and not the 10-year, 24-hour storm event as specified in R645-301-742.221.33. This document has been prepared for Canyon Fuel by EarthFax Engineering Group, LLC, and contains the following information:

- Location and background information;
- Hydrologic analyses to determine runoff and sediment discharge for both the regulator design storm event and the requested design storm event;
- Sediment control design criteria;
- Berms, ditches, swale, sedimentation pond, and sediment construction drawings.

Engineering calculations are included as an attachment to this document.

CHAPTER 2
LOCATION AND BACKGROUND INFORMATION

The general layout of the proposed operational refuse pile is shown on RA Plate 5-1. The total developed watershed includes the boundary of the refuse pile, approximately 21.5 acres. An existing ditch along the west and north side of the refuse pile will divert all undisturbed upstream runoff around the refuse pile. An existing sedimentation pond (SP-1) has been evaluated to insure it will safely retain runoff resulting from the 100-year, 24-hour storm event for the proposed refuse pile layout. The access road for SP-1 will be moved and re-graded to allow for expansion of the refuse pile. Additionally, Drainage Ditch-1 (DD-1), DD-3, and DD-5 will be constructed adjacent to the SP-1 access road and will safely convey runoff resulting from the 10-year, 6-hour storm event. Due to grading and elevations at the site a proposed operational secondary sedimentation pond (SP-2) will need to be constructed. SP-2 will be constructed to safely retain runoff resulting from the 100-year, 24-hour storm event. Proposed operational ditches along the north and east side (DD-6 through DD-11 and Disturbed Swale-1 (DS-1) and DS-2 will be constructed to safely convey runoff to SP-2. DD-6, DD-7, and DS-1 are designed to be temporary and will be removed during reclamation. However, DD-8 through DD-11 and DS-2 are considered permanent as they will remain after reclamation. Therefore, these ditches have been designed to safely convey runoff resulting from the 100-year, 6-hour storm event.

Two constructed berms, Undisturbed Berm-1 (UB-1) and UB-2, north and west of SP-2 will direct undisturbed runoff around the pond. Some of the area to be developed for the expansion of the refuse pile has not been previously developed. The topsoil will be removed and stockpiled on-site. Some of the material will be used to provide contemporaneous remediation along the northeast side of the refuse pile.

The storm water runoff and sedimentation conveyance system for the sedimentation ponds have been designed to safely convey site runoff as specified in the Utah Administrative

Code Titles R645-301-742 and 751. Thus, the conveyance system has been designed to comply with the following criteria:

- The temporary conveyance system will safely convey the runoff from a 10-year, 6-hour storm event.
- The permanent and reclaimed conveyance system will safely convey the runoff from a 100-year, 6-hour storm event.
- The sedimentation ponds will safely detain the runoff from a 100-year, 24-hour storm event due to a design request from Dugout Canyon Mine.
- The sedimentation ponds will be evaluated for compliance to 10-year, 24-hour event.
- All of the side slopes of the refuse pile along the berm have been designed to prevent degradation and erosion of the refuse pile.
- Sedimentation ponds, berms, ditches, and swale will be installed according to engineering specifications.

The storm water runoff and sedimentation conveyance system for the sediment basins for the soil stockpiles have been designed to safely convey site runoff as specified in the Utah Administrative Code Titles R645-301-742 and 751. Thus, the conveyance system has been designed to comply with the following criteria:

- The conveyance system and sediment basins will safely convey and detain the runoff from a 10-year, 24-hour storm event.
- All of the side slopes of the refuse pile along the berm have been designed to prevent degradation and erosion of the stockpiles.
- Sediment basins, berms, and ditches will be installed according to engineering specifications.
- Emergency spillways will be designed to safely convey runoff from the 25-year, 6-hour storm event off site.

CHAPTER 3
OPERATIONAL HYDROLOGY

3.1 Hydrology Introduction

Storm water discharge for the area was calculated using HydroCAD version 10.00. The curve number (CN) value used was assigned for the site soil types and type of development. According to Natural Resources Conservation Service a majority of the native soil types are categorized as Hydrologic Soil Group B soils. Due to the site being a refuse pile no vegetation is assumed to be left in the developed areas. Although some contemporaneous reclamation will occur as the site is developed, the operational hydrological design assumes that no contemporaneous reclamation will occur. Due to this all non-pond disturbed areas are assumed to have a CN value of 86 and pond areas have a CN value of 98. Undeveloped and reclaimed areas have or will have Pinyon and Juniper forested areas with sage brush in poor condition. Therefore, a conservative CN value of 71 was used within these areas. The subsoil and topsoil stockpiles will be revegetated with native grass and brush and be assumed to have poor vegetative cover. Therefore, a conservative CN value of 67 was used in the model.

Design storm magnitudes were taken from the National Oceanic and Atmospheric Administration (NOAA) ATLAS 14, Point Precipitation Frequency Estimates web page (http://hdsc.nws.noaa.gov/hdsc/pfds/sa/ut_pfds.html). Site watershed areas and average slopes were calculated from 1-foot contour interval topographic map provided by Dugout Canyon Mine using AutoCAD 2016 software. All storm runoff calculations are included in Attachment A.

3.2 Drainage Area Characteristics

The drainage area contributing to the refuse pile watershed and soil stockpiles are delineated in RA Plate 7-4a for operational watersheds and RA Plate 7-5a for reclaimed watersheds. The area draining to the sedimentation ponds through the storm water conveyance system will include all of the refuse pile. In addition the unpaved portions of the haul road, SP-1 access road, and approximately 0.05 acres of undisturbed area that cannot be reasonably diverted will also contribute runoff and sediment to the sedimentation ponds.

3.3 Runoff Volume Calculations

Results of the runoff calculations are provided in Attachment A. HydroCAD was used in conjunction with precipitation data from The National Oceanic and Atmospheric Administration Atlas 14 to calculate runoff for the site. The runoff volumes are presented in the HydroCAD worksheets. Total runoff volume discharge contributing to SP-1 resulting from the 100-year, 24-hour storm event is 26,800 cubic feet. Total discharge from the 10-year, 24-hour event is 15,000 cubic feet. Total runoff volume discharge contributing to SP-2 resulting from the 100-year, 24-hour storm event is 56,900 cubic feet. Total discharge from the 10-year, 24-hour event is 31,100 cubic feet.

Topsoil and Subsoil Stockpiles sediment basins (SB-1 and SB-2, respectively) runoff volumes resulting from the 10-year, 24-hour storm event are 220 cubic feet and 270 cubic feet, respectively.

Reclaimed drainage is divided into three areas, north, east, and west. Reclaimed runoff volumes from the 100-year, 6-hour event for the north, east, and west drainages are 14,900 cubic feet, 5,900 cubic feet, and 6,000 cubic feet, respectively.

3.4 Sediment Volume Calculations

The average annual anticipated sediment yield from the refuse pile was calculated using an assumed value of 0.05 acre-feet per acre per year from section 742.200 of the Refuse Pile Amendment for the Dugout Canyon Mine NOI Permit.

The average annual sediment yield in acre-feet per acre for each watershed was multiplied by that watershed's area to find the annual volume of sediment participated from the area. Finally, the volumes for each watershed were summed to determine the total annual yield of the area draining into SP-1 and SP-2. The maximum calculated annual sediment yield for the area draining to SP-1 and SP-2 is 13,200 cubic feet and 29,600 cubic feet, respectively. The maximum calculated annual sediment yield for the area drainage into the SB-1 and SB-2 was 1,600 cubic feet and 2,000 cubic feet, respectively

CHAPTER 4
SEDIMENT CONTROL DESIGN

4.1 Sedimentation Pond and Sediment Basin Capacities

SP-1 is an existing sedimentation pond that will have the access road and the contributing ditch moved west to allow for more material to be placed on the refuse pile. Additionally, portions of the north side of the pond will be filled in to allow for construction of an access road and ditch. SP-1 has been evaluated and will safely detain runoff from a 100-year, 24-hour storm event from contributing watersheds, 26,800 cubic feet, and six years of predicted sediment yield, 79,200 cubic feet, for a total of 106,000 cubic feet. Sediment will be removed when 60% of the sediment capacity is reached, which is approximately 47,500 cubic feet, or approximately 5,898.75 feet elevation is reached. The stage-capacity curve for SP-1 is shown in Table 1.

SP-2 has been designed to safely detain runoff from a 100-year, 24-hour storm event from contributing watersheds, 56,900 cubic feet, and one year of predicted sediment yield, 29,600 cubic feet, for a total of 86,500 cubic feet. Sediment will be removed when the 60% sediment capacity of 17,800 cubic feet or approximately 5,861.7 feet elevation is reached. The stage-capacity curve for SP-2 is shown in Table 2.

SB-1 and SB-2 have been designed to detain runoff from the 10-year, 24-hour event, 220 cubic feet and 270 cubic feet, respectively and one year sediment yield of 1,600 cubic feet and 2,000 cubic feet, respectively. SB-1 and SB-2 will therefore have a maximum capacity of 1,820 cubic feet and 2,270 cubic feet respectively. SB-1 and SB-2 will be cleaned out when they reach 60% sediment capacity of 960 cubic feet or an elevation of 5,892.2 feet and 1,200 cubic feet or and elevation of, 5,886.2 feet, respectively. The stage-capacity curves for SB-1 and SB-2 are shown in Table 3 and 4, respectively.

4.2 Runoff Conveyance System Details

Peak flows for the berms, ditches, and swale were calculated using HydroCAD version 10.00 and FlowMaster version 6.0. The results of these calculations are presented in Attachment A. For design details, see RA Plates 7-2a and 7-3a. The temporary operational conveyance system was designed to safely convey the runoff volume resulting from a 10-year, 6-hour event. The permanent and reclamation conveyance systems were designed to safely convey the 100-year, 6-hour storm event. Velocities above 5.00 fps require rock lining according to the attached U.S. Department of Transportation Table in Attachment A. Conveyance system velocities, depths, and freeboard for both storm events, see Table 6 and Table 7.

CHAPTER 5
RECLAMATION HYDROLOGY

Reclamation of the refuse pile will be performed according to specifications and standards outlined in the Dugout Canyon Mine NOI Permit. As topsoil and subsoil are removed from the expansion to the south the topsoil and subsoil will be placed along the northeast side of the refuse pile. For reclamation layout, see RA Plate 5-2.

UD-1 will become RD-1 during reclamation. Additionally, DD-8, DD-9, and DD-11 will become RD-5, RD-6, and RD-8, respectively, during reclamation. RD-8 will continue to convey runoff into SP-2 during the first stages of reclamation. After reclamation is complete, SP-2 will be backfilled and RD-8 will be extended to the existing roadside ditch along Dugout Canyon Road.

During reclamation a DD-6, DD-7 and DS-1 will be backfilled with subsoil and topsoil for revegetation. Reclaimed Berm-1 (RB-1) will be placed along the west side of the SP-1 access road to convey runoff into SP-1. After reclamation is complete and SP-1 is backfilled the emergency spillway for SP-1 will be extended upstream to the northwest end of the SP-1 backfill. This ditch will become RD-4 and will convey runoff safely off-site into an existing ephemeral drainage. Reclamation conveyance system velocities, depths, and freeboard are illustrated in Table 7. Also, refer to RA Plate 5-1 and RA Plate 5-2 for additional details.

CHAPTER 6
REFERENCES

Heastad Methods, Inc. 1998. FlowMaster I Computer Program, Version 6.0 Waterbury, Connecticut.

HydroCAD Software Solutions LLC. 2013. HydroCAD Version 10.00 Chocorua, New Hampshire.

National Oceanic and Atmospheric Administration, 2013. *Point Precipitation Frequency Estimates from NOAA ATLAS 14.* http://hdsc.nws.noaa.gov/hdsc /index.html

Natural Resources Conservation Service, Web Soil Survey, Carbon Area, Utah, Parts of Carbon and Emery Counties Ver. 4, 2013, http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

U.S. Department of Transportation. 1978. Use of Riprap for Bank Protection. Hydrology Engineering Circular No. 11. Federal Highway Administration. Washington, D.C.

TABLE 1

Sedimentation Pond-1 Stage-Capacities

Elevation	Surface Area (sq ft)	Incremental (cf)	Cumulative Volume (cf)
5,894.50	0		
5,895.00	4,583	1,146	1,146
5,896.00	10,205	7,394	8,540
5,897.00	13,585	11,895	20,435
5,898.00	15,653	14,619	35,054
5,899.00	17,740	16,697	51,750
5,900.00	19,849	18,795	70,545
5,901.00	21,972	20,911	91,455
5,902.00	24,114	23,043	114,498
5,903.00	26,256	25,185	139,683
Total			**139,683**

Surface area at given elevations based on AutoCAD topography of site.

TABLE 2

Sedimentation Pond-2 Stage-Capacities

Elevation	Surface Area (sq ft)	Incremental (cf)	Cumulative Volume (cf)
5,859.90	0		
5,860.00	8,136	407	407
5,861.00	10,629	9,383	9,789
5,862.00	13,541	12,085	21,874
5,863.00	16,307	14,924	36,798
5,864.00	19,203	17,755	54,553
5,865.00	22,221	20,712	75,265
5,865.50	23,774	11,499	86,764
5,866.00	25,327	12,275	99,039
5,867.00	26,413	25,870	124,909
Total			**124,909**

Surface area at given elevations based on AutoCAD topography of site.

TABLE 3

Sediment Basin-1 Stage-Capacities

Elevation	Surface Area (sq ft)	Incremental (cf)	Cumulative Volume (cf)
5,890.9	0		
5,891.0	380	20	20
5,892.0	990	680	700
5,892.8	1,650	1,060	1,760
5,893.0	1,810	1,400	2,100
5,894.0	2,980	1,350	4,500
Total			**4,500**

Surface area at given elevations based on AutoCAD topography of site.

TABLE 4

Sediment Basin-2 Stage-Capacities

Elevation	Surface Area (sq ft)	Incremental (cf)	Cumulative Volume (cf)
5,883.9	0		
5,884.0	250	10	10
5,885.0	450	350	360
5,886.0	750	600	960
5,887.0	1,520	1,140	2,100
5,887.1	1,640	160	2,260
5,888.0	2,690	1,940	4,200
Total			**4,200**

Surface area at given elevations based on AutoCAD topography of site.

TABLE 5

Overflow Structure Details

Emergency Spillway	Maximum Depth (ft)	Maximum Velocity (fps)	Rock Size (Dia. in)
SPO-1	0.13	4.14	Not Required
SPO-2	0.28	6.85	4
SBO-1	0.03	1.20	Not Required
SBO-2	0.03	1.20	Not Required

Depths and velocities based on FlowMaster and assumed elevations from AutoCAD topography of site.
Rock sizing based on U.S. Department of Transportation Table.

TABLE 6

Operational Conveyance and Diversion Structure Details

Diversion Structure	Design Storm Event	Maximum Depth (ft)	Freeboard (ft)	Maximum Velocity (fps)	Rock Size (Dia. in)
DB-1	100-yr, 6-hr	0.39	0.61	2.58	Not Required
DB-2	100-yr, 6-hr	0.34	0.66	2.17	Not Required
DB-3	100-yr, 6-hr	0.32	0.68	2.28	Not Required
DB-4	100-yr, 6-hr	0.48	0.52	2.73	Not Required
DD-1	10-yr, 6-hr	0.48	0.52	3.62	Not Required
DD-2	100-yr, 6-hr	0.15	0.85	6.13	4
DD-3	10-yr, 6-hr	0.75	0.75	3.83	Not Required
DD-4	100-yr, 6-hr	0.29	0.71	6.41	4
DD-5	10-yr, 6-hr	0.34	0.66	4.28	Not Required
DD-6	10-yr, 6-hr	0.55	0.45	3.17	Not Required
DD-7	10-yr, 6-hr	0.59	0.66	4.85	Not Required
DD-8	100-yr, 6-hr	1.34	0.66	4.86	Not Required
DD-9	100-yr, 6-hr	0.75	0.75	4.24	Not Required
DD-10	100-yr, 6-hr	0.43	057	6.66	4
DD-11	100-yr, 6-hr	0.35	0.65	8.22	6
DS-1	10-yr, 6-hr	0.08	0.42	1.22	Not Required
DS-2	100-yr, 6-hr	0.49	0.51	1.97	Not Required
UB-1	100-yr, 6-hr	0.13	0.87	2.02	Not Required
UB-2	100-yr, 6-hr	0.13	0.87	2.09	Not Required
UC-1	100-yr, 6-hr	0.42	1.58	5.05	Not Required
UC-2	100-yr, 6-hr	0.99	1.01	4.17	Not Required
UC-3	100-yr, 6-hr	0.53	1.47	4.27	Not Required
UD-1	100-yr, 6-hr	0.89	0.61	5.04	Existing Grasses

Velocities and Depths based on FlowMaster and assumed elevations from AutoCAD topography of site.
Rock sizing based on U.S. Department of Transportation Table.
(a)Velocities are non-erosive. However, 4-inch rock will likely remain after reclamation.

TABLE 7

Reclamation Conveyance and Diversion Structure Details

Diversion Structure	Design Storm Event	Maximum Depth (ft)	Freeboard (ft)	Maximum Velocity (fps)	Rock Size (Dia. in)
RB-1	100-yr, 6-hr	0.33	0.67	3.14	Not Required
RB-2	100-yr, 6-hr	0.21	0.79	1.69	Not Required
RB-3	100-yr, 6-hr	0.41	0.59	2.67	Not Required
RB-4	100-yr, 6-hr	0.20	0.80	1.54	Not Required
RB-5	100-yr, 6-hr	0.18	0.82	1.56	Not Required
RB-6	100-yr, 6-hr	0.29	0.71	1.92	Not Required
RD-1	100-yr, 6-hr	1.01	0.49	5.47	Existing Grasses
RD-2	100-yr, 6-hr	0.04	0.96	2.94	Not Required
RD-3	100-yr, 6-hr	0.15	0.85	4.19	Not Required
RD-4	100-yr, 6-hr	0.09	0.91	3.86	Not Required(a)
RD-5	100-yr, 6-hr	0.43	0.57	2.26	Not Required
RD-6	100-yr, 6-hr	0.26	0.74	2.27	Not Required
RD-7	100-yr, 6-hr	0.14	0.86	3.22	Not Required
RD-8	100-yr, 6-hr	0.09	0.91	3.59	Not Required
RS-1	100-yr, 6-hr	0.28	0.22	1.35	Not Required

Velocities and Depths based on FlowMaster and assumed elevations from AutoCAD topography of site.
Rock sizing based on U.S. Department of Transportation Table.
(a)Velocities are non-erosive. However, 4-inch rock will likely remain after reclamation.

ATTACHMENT A

HYDROLOGY CALCULATIONS

NOAA Atlas 14, Volume 1, Version 5
Location name: Utah, US*
Coordinates: 39.6141, -110.6110
Elevation: 5926ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.124 (0.107–0.149)	0.159 (0.138–0.191)	0.218 (0.187–0.261)	0.271 (0.232–0.324)	0.354 (0.294–0.423)	0.428 (0.347–0.513)	0.514 (0.408–0.618)	0.614 (0.471–0.745)	0.773 (0.565–0.953)	0.917 (0.645–1.15)
10-min	0.189 (0.163–0.226)	0.242 (0.210–0.290)	0.333 (0.285–0.397)	0.413 (0.352–0.493)	0.539 (0.447–0.643)	0.651 (0.528–0.780)	0.783 (0.620–0.940)	0.935 (0.716–1.13)	1.18 (0.860–1.45)	1.39 (0.981–1.75)
15-min	0.235 (0.202–0.280)	0.300 (0.260–0.360)	0.412 (0.353–0.492)	0.512 (0.437–0.611)	0.668 (0.554–0.798)	0.807 (0.654–0.967)	0.970 (0.769–1.17)	1.16 (0.888–1.41)	1.46 (1.07–1.80)	1.73 (1.22–2.17)
30-min	0.316 (0.272–0.377)	0.404 (0.350–0.484)	0.555 (0.475–0.662)	0.689 (0.588–0.823)	0.899 (0.746–1.07)	1.09 (0.881–1.30)	1.31 (1.04–1.57)	1.56 (1.20–1.89)	1.97 (1.44–2.42)	2.33 (1.64–2.92)
60-min	0.391 (0.336–0.466)	0.500 (0.434–0.599)	0.687 (0.588–0.819)	0.852 (0.728–1.02)	1.11 (0.923–1.33)	1.35 (1.09–1.61)	1.62 (1.28–1.94)	1.93 (1.48–2.34)	2.43 (1.78–3.00)	2.88 (2.03–3.61)
2-hr	0.456 (0.397–0.536)	0.575 (0.500–0.674)	0.762 (0.660–0.892)	0.935 (0.801–1.09)	1.21 (1.01–1.42)	1.46 (1.19–1.72)	1.75 (1.39–2.07)	2.08 (1.61–2.49)	2.63 (1.93–3.21)	3.13 (2.21–3.89)
3-hr	0.509 (0.447–0.590)	0.637 (0.559–0.740)	0.821 (0.720–0.953)	0.990 (0.862–1.15)	1.25 (1.07–1.46)	1.48 (1.24–1.73)	1.77 (1.44–2.08)	2.10 (1.67–2.50)	2.65 (2.02–3.22)	3.15 (2.31–3.93)
6-hr	0.631 (0.560–0.717)	0.780 (0.696–0.892)	0.975 (0.864–1.11)	1.14 (1.01–1.30)	1.38 (1.20–1.58)	1.59 (1.36–1.83)	1.85 (1.56–2.15)	2.16 (1.79–2.53)	2.69 (2.16–3.25)	3.18 (2.48–3.97)
12-hr	0.769 (0.695–0.859)	0.949 (0.857–1.06)	1.16 (1.04–1.30)	1.34 (1.20–1.50)	1.59 (1.40–1.78)	1.79 (1.56–2.02)	2.00 (1.72–2.28)	2.27 (1.93–2.61)	2.75 (2.29–3.28)	3.21 (2.61–4.01)
24-hr	0.971 (0.882–1.08)	1.20 (1.09–1.34)	1.46 (1.32–1.63)	1.66 (1.50–1.85)	1.93 (1.74–2.15)	2.14 (1.91–2.39)	2.35 (2.09–2.63)	2.56 (2.26–2.87)	2.83 (2.46–3.31)	3.24 (2.62–4.05)
2-day	1.13 (1.02–1.26)	1.39 (1.26–1.55)	1.68 (1.52–1.88)	1.92 (1.73–2.14)	2.22 (1.99–2.48)	2.46 (2.19–2.75)	2.69 (2.38–3.02)	2.93 (2.56–3.29)	3.23 (2.80–3.66)	3.46 (2.96–4.09)
3-day	1.22 (1.11–1.36)	1.51 (1.37–1.68)	1.83 (1.65–2.03)	2.08 (1.87–2.31)	2.42 (2.16–2.69)	2.67 (2.37–2.98)	2.93 (2.58–3.28)	3.18 (2.78–3.58)	3.52 (3.03–3.98)	3.77 (3.22–4.37)
4-day	1.32 (1.20–1.47)	1.63 (1.48–1.81)	1.97 (1.78–2.19)	2.24 (2.02–2.49)	2.61 (2.33–2.90)	2.88 (2.56–3.21)	3.16 (2.79–3.54)	3.44 (3.00–3.86)	3.81 (3.27–4.30)	4.08 (3.47–4.64)
7-day	1.54 (1.39–1.74)	1.90 (1.71–2.15)	2.31 (2.07–2.59)	2.62 (2.35–2.95)	3.05 (2.72–3.44)	3.37 (2.99–3.81)	3.70 (3.25–4.19)	4.02 (3.50–4.58)	4.44 (3.82–5.10)	4.75 (4.04–5.49)
10-day	1.76 (1.59–1.95)	2.18 (1.97–2.42)	2.64 (2.39–2.93)	3.00 (2.71–3.33)	3.48 (3.12–3.85)	3.84 (3.42–4.26)	4.19 (3.71–4.66)	4.54 (4.00–5.06)	4.98 (4.34–5.60)	5.31 (4.58–6.01)
20-day	2.17 (1.97–2.42)	2.70 (2.45–3.01)	3.30 (2.99–3.68)	3.77 (3.41–4.19)	4.38 (3.94–4.88)	4.85 (4.33–5.40)	5.31 (4.70–5.93)	5.76 (5.06–6.46)	6.35 (5.50–7.17)	6.78 (5.81–7.70)
30-day	2.59 (2.36–2.87)	3.21 (2.92–3.56)	3.88 (3.54–4.29)	4.40 (3.99–4.85)	5.06 (4.57–5.59)	5.55 (4.98–6.13)	6.02 (5.38–6.68)	6.48 (5.74–7.22)	7.05 (6.18–7.92)	7.47 (6.48–8.43)
45-day	3.12 (2.85–3.45)	3.87 (3.53–4.27)	4.68 (4.26–5.16)	5.30 (4.81–5.84)	6.09 (5.51–6.71)	6.66 (6.00–7.35)	7.22 (6.47–7.97)	7.74 (6.90–8.57)	8.39 (7.41–9.33)	8.84 (7.76–9.87)
60-day	3.65 (3.33–4.03)	4.52 (4.13–5.00)	5.49 (5.00–6.05)	6.22 (5.65–6.84)	7.15 (6.46–7.88)	7.82 (7.04–8.64)	8.48 (7.58–9.38)	9.10 (8.08–10.1)	9.86 (8.67–11.0)	10.4 (9.07–11.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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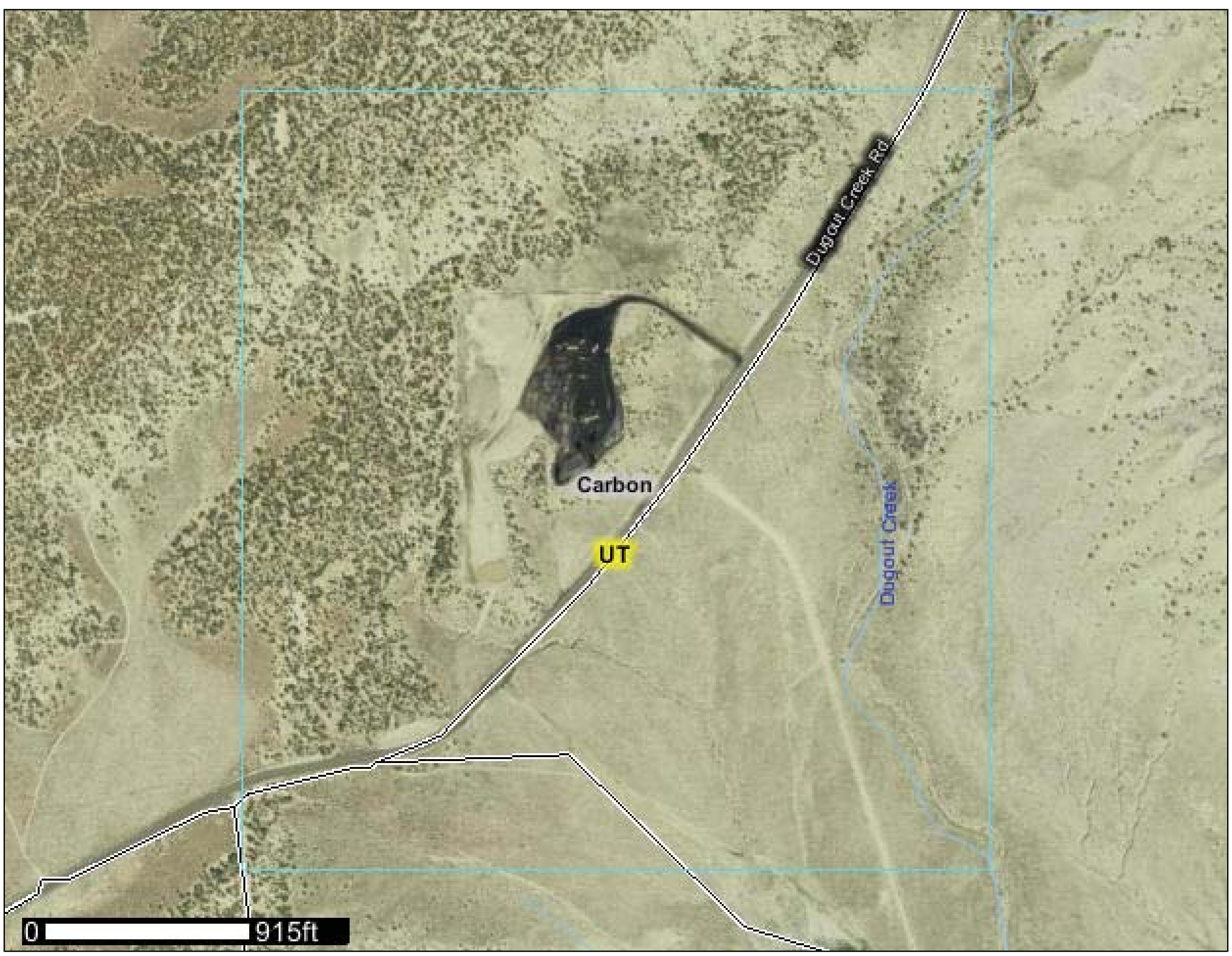
United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Carbon Area, Utah, Parts of Carbon and Emery Counties



February 25, 2013

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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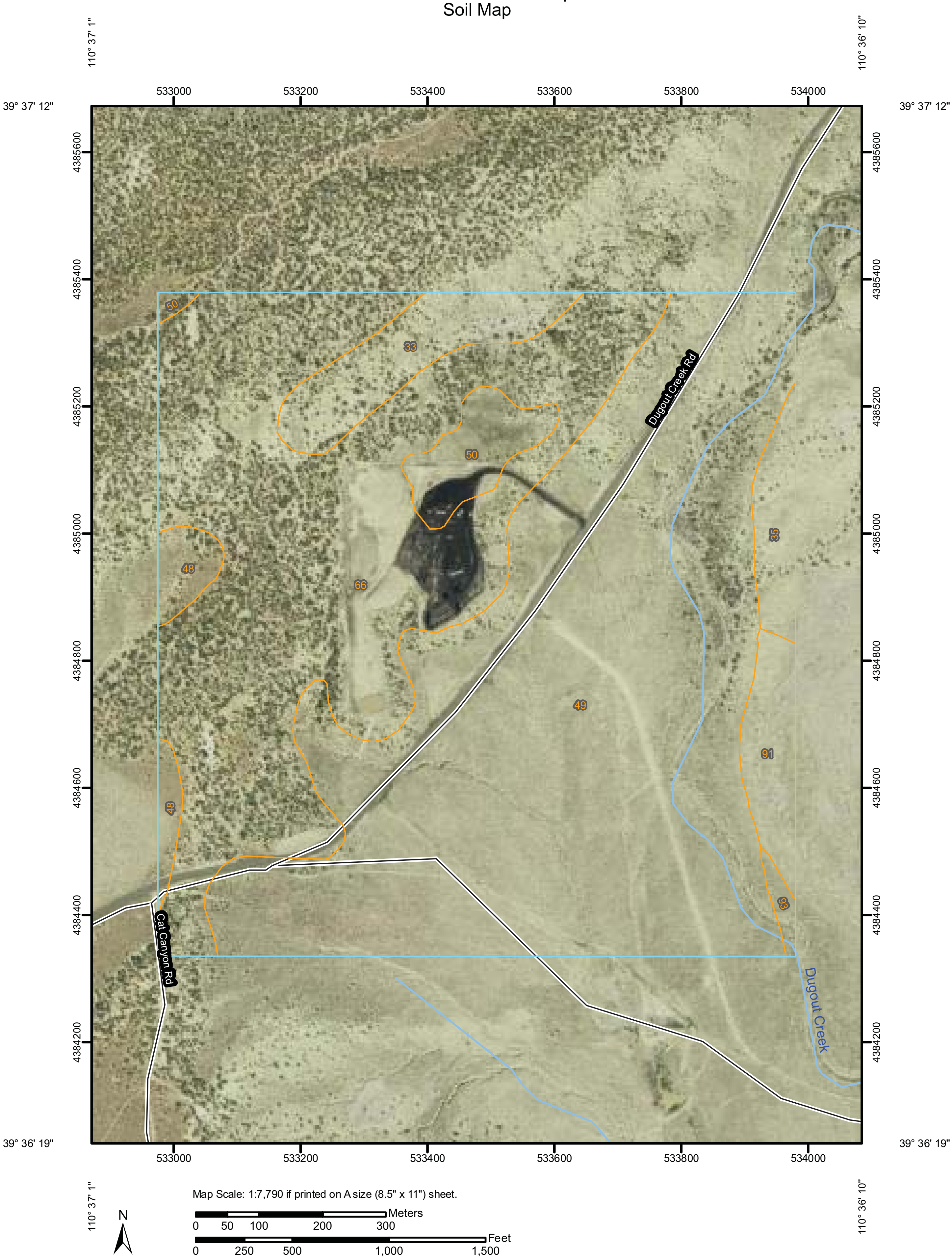
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:7,790 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Carbon Area, Utah, Parts of Carbon and Emery Counties
Survey Area Data: Version 5, Sep 3, 2009

Date(s) aerial images were photographed: 8/29/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Erosion

This folder contains a collection of tabular reports that present soil erosion factors and groupings. The reports (tables) include all selected map units and components for each map unit. Soil erosion factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

RUSLE2 Related Attributes

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factors Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the surface horizon.

Report—RUSLE2 Related Attributes

RUSLE2 Related Attributes– Carbon Area, Utah, Parts of Carbon and Emery Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
33—Gerst-Badland-Rubbleland complex, 15 to 50 percent slopes								
Gerst	40	—	D	.28	2	41.6	37.4	21.0
Badland	25	—	D	—	—	—	—	0.0
Rubbleland	20	—	A	—	5	—	—	0.0
Rock outcrop	12	—	—	—	—	—	—	—
Strych	3	—	—	—	—	—	—	—
35—Gerst-Badland-Stormitt complex								
Gerst	55	—	D	.37	2	41.6	37.4	21.0
Badland	20	—	D	—	—	—	—	0.0
Stormitt	15	—	B	.17	2	58.7	17.8	23.5
Gerst	8	—	—	—	—	—	—	—
Rock outcrop	2	—	—	—	—	—	—	—
48—Haverdad loam, 1 to 8 percent slopes								
Haverdad	85	—	B	.28	5	42.4	38.1	19.5
Glenburg	5	—	—	—	—	—	—	—
Ravola	5	—	—	—	—	—	—	—
Billings	3	—	—	—	—	—	—	—
Haverdad, alkali, 0 to 3 percent slopes	2	—	—	—	—	—	—	—
49—Haverdad loam, alkali, 0 to 3 percent slopes								
Haverdad	90	—	B	.28	5	43.0	38.5	18.5
Glenberg	5	—	—	—	—	—	—	—
Haverdad	5	—	—	—	—	—	—	—
50—Haverdad loam, moist, 1 to 5 percent slopes								
Haverdad	90	—	B	.28	5	42.4	38.1	19.5
Glanberg	5	—	—	—	—	—	—	—
Haverdad, colder	5	—	—	—	—	—	—	—
66—Mivida gravelly fine sandy loam, 3 to 8 percent slopes								
Mivida	85	—	B	.24	2	69.2	16.3	14.5
Gerst	5	—	—	—	—	—	—	—
Haverdad	5	—	—	—	—	—	—	—
Strych	5	—	—	—	—	—	—	—

RUSLE2 Related Attributes– Carbon Area, Utah, Parts of Carbon and Emery Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
91—Ravola loam, 1 to 6 percent slopes, eroded								
Ravola	80	279	B	.28	5	37.4	42.6	20.0
Billings	5	—	—	—	—	—	—	—
Kilpack	5	—	—	—	—	—	—	—
Persayo	5	—	—	—	—	—	—	—
Ravola, 1 to 3 percent slopes	5	—	—	—	—	—	—	—
93—Ravola-Slickspots complex								
Ravola	70	351	B	.28	5	37.4	42.6	20.0
Slickspots	20	—	D	—	—	—	—	—
Billings	10	—	—	—	—	—	—	—

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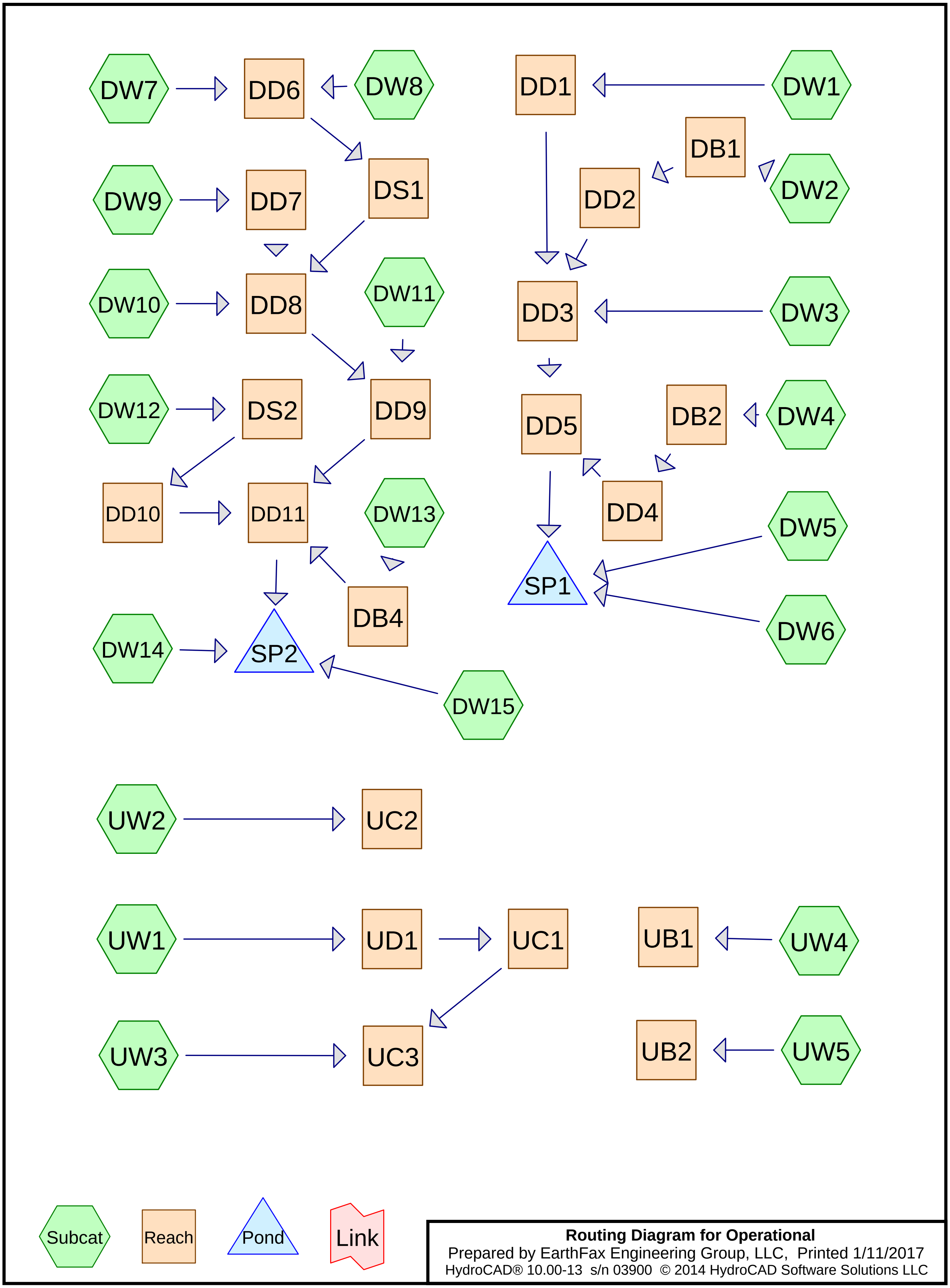


Routing Diagram for Operational
Prepared by EarthFax Engineering Group, LLC, Printed 1/11/2017
HydroCAD® 10.00-13 s/n 03900 © 2014 HydroCAD Software Solutions LLC

Summary for Subcatchment DW1:

Runoff = 0.86 cfs @ 2.91 hrs, Volume= 0.024 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
1.081	86	Newly graded area, HSG B
1.081		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	130	0.5000	3.01		**Lag/CN Method,**

Summary for Subcatchment DW10:

Runoff = 0.45 cfs @ 2.91 hrs, Volume= 0.013 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.567	86	Newly graded area, HSG B
0.567		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	130	0.5000	3.01		**Lag/CN Method,**

Summary for Subcatchment DW11:

Runoff = 2.58 cfs @ 2.91 hrs, Volume= 0.073 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
3.247	86	Newly graded area, HSG B
3.247		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	150	0.5000	3.10		**Lag/CN Method,**

Summary for Subcatchment DW12:

Runoff = 2.05 cfs @ 2.94 hrs, Volume= 0.059 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
2.616	86	Newly graded area, HSG B
2.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	150	0.0500	0.98		**Lag/CN Method,**

Summary for Subcatchment DW13:

Runoff = 1.04 cfs @ 2.91 hrs, Volume= 0.030 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
1.313	86	Newly graded area, HSG B
1.313		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	160	0.5000	3.14		**Lag/CN Method,**

Summary for Subcatchment DW14:

Runoff = 1.11 cfs @ 2.91 hrs, Volume= 0.031 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
1.388	86	Newly graded area, HSG B
1.388		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	120	0.5000	2.97		**Lag/CN Method,**

Summary for Subcatchment DW15:

Runoff = 1.47 cfs @ 2.89 hrs, Volume= 0.047 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.606	98	Water Surface, HSG B
0.606		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.3300	2.91		**Lag/CN Method,**

Summary for Subcatchment DW2:

Runoff = 0.84 cfs @ 2.95 hrs, Volume= 0.025 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
1.088	86	Newly graded area, HSG B
1.088		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	180	0.0500	1.02		**Lag/CN Method,**

Summary for Subcatchment DW3:

Runoff = 1.73 cfs @ 2.91 hrs, Volume= 0.049 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
2.175	86	Newly graded area, HSG B
2.175		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	160	0.5000	3.14		**Lag/CN Method,**

Summary for Subcatchment DW4:

Runoff = 0.42 cfs @ 2.91 hrs, Volume= 0.012 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.527	86	Newly graded area, HSG B
0.527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	150	0.5000	3.10		**Lag/CN Method,**

Summary for Subcatchment DW5:

Runoff = 0.48 cfs @ 2.91 hrs, Volume= 0.014 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.600	86	Newly graded area, HSG B
0.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	60	0.1900	1.59		**Lag/CN Method,**

Summary for Subcatchment DW6:

Runoff = 1.47 cfs @ 2.89 hrs, Volume= 0.047 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG B
0.605		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		**Lag/CN Method,**

Summary for Subcatchment DW7:

Runoff = 0.73 cfs @ 2.91 hrs, Volume= 0.021 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.908	86	Newly graded area, HSG B
0.908		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	90	0.5000	2.80		**Lag/CN Method,**

Summary for Subcatchment DW8:

Runoff = 0.29 cfs @ 2.91 hrs, Volume= 0.008 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
0.351	86	Newly graded area, HSG B
0.351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	70	0.5000	2.66		**Lag/CN Method,**

Summary for Subcatchment DW9:

Runoff = 1.97 cfs @ 2.95 hrs, Volume= 0.058 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

Area (ac)	CN	Description
2.573	86	Newly graded area, HSG B
2.573		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	285	0.0880	1.48		**Lag/CN Method,**

Summary for Subcatchment UW1:

Runoff = 0.15 cfs @ 4.37 hrs, Volume= 0.035 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

	Area (ac)	CN	Description
*	17.676	71	Pinyon/juniper range, Poor, HSG B
	17.676		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	1,760	0.0300	0.78		**Lag/CN Method,**

Summary for Subcatchment UW2:

Runoff = 0.23 cfs @ 3.61 hrs, Volume= 0.050 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

	Area (ac)	CN	Description
*	25.400	71	Pinyon/juniper range, Poor, HSG B
	25.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	1,280	0.1000	1.34		**Lag/CN Method,**

Summary for Subcatchment UW3:

Runoff = 0.06 cfs @ 3.44 hrs, Volume= 0.011 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

	Area (ac)	CN	Description
*	5.720	71	Pinyon/juniper range, Poor, HSG B
	5.720		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	440	0.1250	1.21		**Lag/CN Method,**

Summary for Subcatchment UW4:

Runoff = 0.00 cfs @ 3.37 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

	Area (ac)	CN	Description
*	0.131	71	Pinyon/juniper range, Poor, HSG B
	0.131		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.3000	1.51		**Lag/CN Method,**

Summary for Subcatchment UW5:

Runoff = 0.00 cfs @ 3.37 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 10-yr, 6-hr Rainfall=1.14"

	Area (ac)	CN	Description
*	0.141	71	Pinyon/juniper range, Poor, HSG B
	0.141		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	150	0.2000	1.24		**Lag/CN Method,**

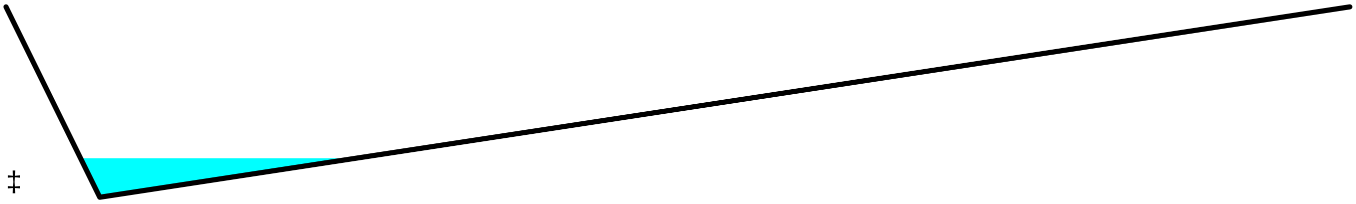
Summary for Reach DB1:

Inflow Area = 1.088 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 0.84 cfs @ 2.95 hrs, Volume= 0.025 af
Outflow = 0.58 cfs @ 3.10 hrs, Volume= 0.025 af, Atten= 31%, Lag= 9.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.32 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 14.5 min

Peak Storage= 199 cf @ 3.00 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 40.71 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 440.0' Slope= 0.0205 '/'
Inlet Invert= 5,996.00', Outlet Invert= 5,987.00'



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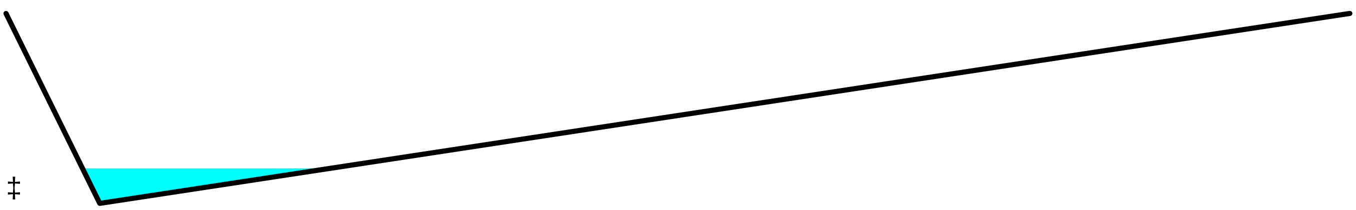
Summary for Reach DB2:

Inflow Area = 0.527 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 0.42 cfs @ 2.91 hrs, Volume= 0.012 af
Outflow = 0.30 cfs @ 3.05 hrs, Volume= 0.012 af, Atten= 29%, Lag= 8.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.85 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 12.1 min

Peak Storage= 91 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 28.46 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 250.0' Slope= 0.0100 '/'
Inlet Invert= 5,923.50', Outlet Invert= 5,921.00'



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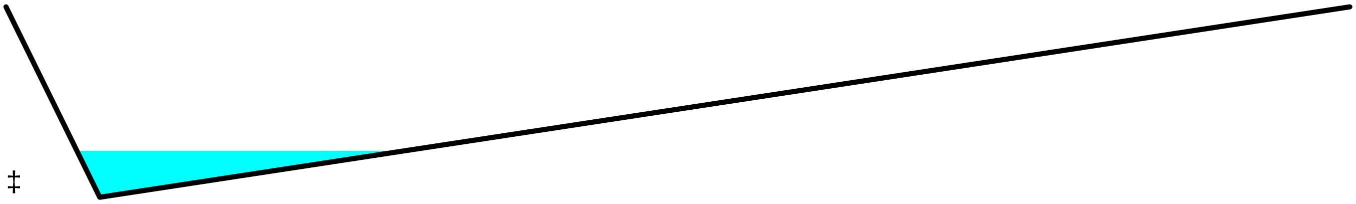
Summary for Reach DB4:

Inflow Area = 1.313 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 1.04 cfs @ 2.91 hrs, Volume= 0.030 af
Outflow = 0.52 cfs @ 3.17 hrs, Volume= 0.030 af, Atten= 50%, Lag= 15.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.84 fps, Min. Travel Time= 10.5 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 32.8 min

Peak Storage= 338 cf @ 2.99 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.13 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 530.0' Slope= 0.0066 '/'
Inlet Invert= 5,923.50', Outlet Invert= 5,920.00'



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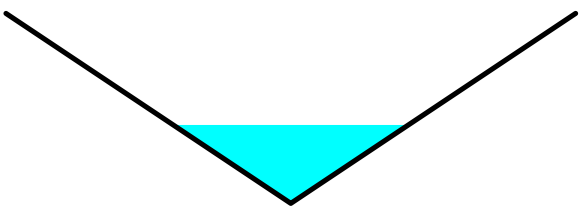
Summary for Reach DD1:

Inflow Area = 1.081 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 0.86 cfs @ 2.91 hrs, Volume= 0.024 af
Outflow = 0.74 cfs @ 3.00 hrs, Volume= 0.024 af, Atten= 14%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.93 fps, Min. Travel Time= 2.8 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 6.8 min

Peak Storage= 128 cf @ 2.95 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 7.94 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 500.0' Slope= 0.0500 '/'
Inlet Invert= 5,949.00', Outlet Invert= 5,924.00'



Summary for Reach DD10:

Inflow Area = 2.616 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 1.17 cfs @ 3.16 hrs, Volume= 0.059 af
Outflow = 1.11 cfs @ 3.19 hrs, Volume= 0.059 af, Atten= 5%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.96 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 2.5 min

Peak Storage= 72 cf @ 3.17 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 195.10 cfs

8.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 185.0' Slope= 0.3703 '/'
Inlet Invert= 5,988.50', Outlet Invert= 5,920.00'

Summary for Reach DD11:

Inflow Area = 11.575 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 4.20 cfs @ 3.20 hrs, Volume= 0.262 af
Outflow = 4.16 cfs @ 3.22 hrs, Volume= 0.262 af, Atten= 1%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.54 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 2.2 min

Peak Storage= 171 cf @ 3.21 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 171.61 cfs

8.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 185.0' Slope= 0.2865 '/'
Inlet Invert= 5,920.00', Outlet Invert= 5,867.00'

Summary for Reach DD2:

Inflow Area = 1.088 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 0.58 cfs @ 3.10 hrs, Volume= 0.025 af
Outflow = 0.57 cfs @ 3.11 hrs, Volume= 0.025 af, Atten= 3%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.07 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.60 fps, Avg. Travel Time= 1.4 min

Peak Storage= 19 cf @ 3.10 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 75.06 cfs

2.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 130.0' Slope= 0.4846 '/'
Inlet Invert= 5,987.00', Outlet Invert= 5,924.00'

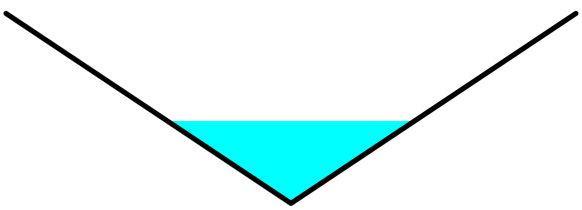
Summary for Reach DD3:

Inflow Area = 4.344 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 2.17 cfs @ 2.94 hrs, Volume= 0.098 af
Outflow = 1.85 cfs @ 3.04 hrs, Volume= 0.098 af, Atten= 15%, Lag= 6.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.94 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 1.06 fps, Avg. Travel Time= 9.1 min

Peak Storage= 369 cf @ 2.98 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 1.50' Flow Area= 3.4 sf, Capacity= 17.38 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 4.50'
Length= 580.0' Slope= 0.0276 '/'
Inlet Invert= 5,924.00', Outlet Invert= 5,908.00'



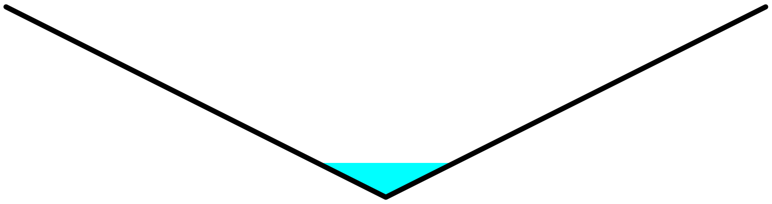
Summary for Reach DD4:

Inflow Area = 0.527 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 0.30 cfs @ 3.05 hrs, Volume= 0.012 af
Outflow = 0.29 cfs @ 3.05 hrs, Volume= 0.012 af, Atten= 1%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.56 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 0.2 min

Peak Storage= 2 cf @ 3.05 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 28.60 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 30.0' Slope= 0.4333 '/'
Inlet Invert= 5,921.00', Outlet Invert= 5,908.00'



Summary for Reach DD5:

Inflow Area = 4.871 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 2.14 cfs @ 3.04 hrs, Volume= 0.110 af
Outflow = 2.12 cfs @ 3.05 hrs, Volume= 0.110 af, Atten= 1%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.07 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.35 fps, Avg. Travel Time= 1.5 min

Peak Storage= 64 cf @ 3.05 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 37.31 cfs

2.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 120.0' Slope= 0.0917 '/'
Inlet Invert= 5,908.00', Outlet Invert= 5,897.00'

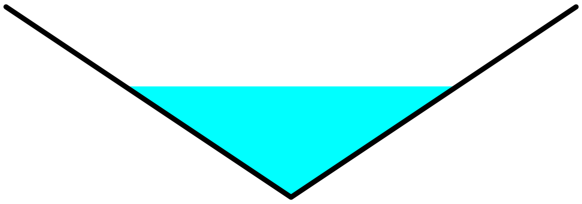
Summary for Reach DD6:

Inflow Area = 1.259 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 1.02 cfs @ 2.91 hrs, Volume= 0.028 af
Outflow = 0.86 cfs @ 2.99 hrs, Volume= 0.028 af, Atten= 16%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.77 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 6.2 min

Peak Storage= 132 cf @ 2.94 hrs
Average Depth at Peak Storage= 0.58'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 3.81 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 260.0' Slope= 0.0115 '/'
Inlet Invert= 5,941.00', Outlet Invert= 5,938.00'



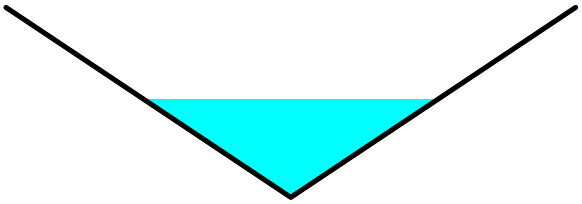
Summary for Reach DD7:

Inflow Area = 2.573 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 1.97 cfs @ 2.95 hrs, Volume= 0.058 af
Outflow = 1.68 cfs @ 3.02 hrs, Volume= 0.058 af, Atten= 15%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.36 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 5.0 min

Peak Storage= 225 cf @ 2.98 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 10.23 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 560.0' Slope= 0.0830 '/'
Inlet Invert= 5,984.00', Outlet Invert= 5,937.50'



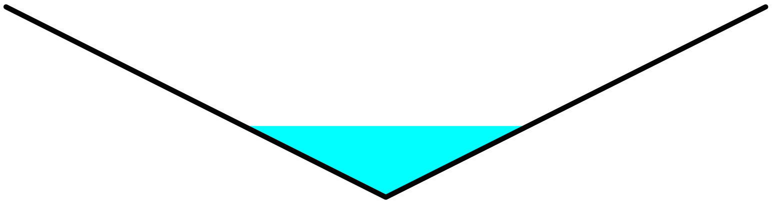
Summary for Reach DD8:

Inflow Area = 4.399 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 2.64 cfs @ 3.00 hrs, Volume= 0.100 af
Outflow = 2.46 cfs @ 3.05 hrs, Volume= 0.100 af, Atten= 7%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.27 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 3.7 min

Peak Storage= 224 cf @ 3.02 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 35.25 cfs

0.00' x 2.00' deep channel, n= 0.035 Rough earth
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 200.0' Slope= 0.0125 '/'
Inlet Invert= 5,937.50', Outlet Invert= 5,935.00'



Summary for Reach DD9:

Inflow Area = 7.646 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 3.63 cfs @ 2.95 hrs, Volume= 0.173 af
Outflow = 2.63 cfs @ 3.23 hrs, Volume= 0.173 af, Atten= 28%, Lag= 16.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 8.6 min
Avg. Velocity = 0.58 fps, Avg. Travel Time= 30.1 min

Peak Storage= 1,366 cf @ 3.08 hrs
Average Depth at Peak Storage= 0.29'
Bank-Full Depth= 1.50' Flow Area= 10.5 sf, Capacity= 52.84 cfs

4.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,040.0' Slope= 0.0144 '/'
Inlet Invert= 5,935.00', Outlet Invert= 5,920.00'

Summary for Reach DS1:

Inflow Area = 1.259 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 0.86 cfs @ 2.99 hrs, Volume= 0.028 af
Outflow = 0.84 cfs @ 2.99 hrs, Volume= 0.028 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.97 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.33 fps, Avg. Travel Time= 1.0 min

Peak Storage= 18 cf @ 2.99 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 28.22 cfs

10.00' x 0.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 20.0 '/' Top Width= 30.00'
Length= 20.0' Slope= 0.0250 '/'
Inlet Invert= 5,938.00', Outlet Invert= 5,937.50'

‡

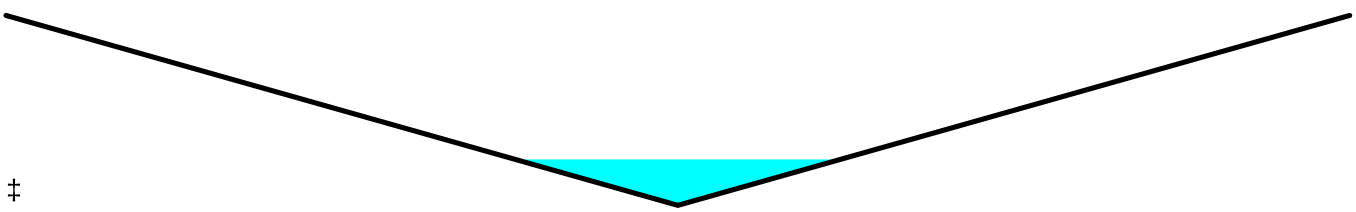
Summary for Reach DS2:

Inflow Area = 2.616 ac, 0.00% Impervious, Inflow Depth = 0.27" for 10-yr, 6-hr event
Inflow = 2.05 cfs @ 2.94 hrs, Volume= 0.059 af
Outflow = 1.17 cfs @ 3.16 hrs, Volume= 0.059 af, Atten= 43%, Lag= 12.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.02 fps, Min. Travel Time= 8.5 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 26.7 min

Peak Storage= 610 cf @ 3.01 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 20.0 sf, Capacity= 52.41 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 20.0 '/' Top Width= 40.00'
Length= 520.0' Slope= 0.0096 '/'
Inlet Invert= 5,993.50', Outlet Invert= 5,988.50'



‡

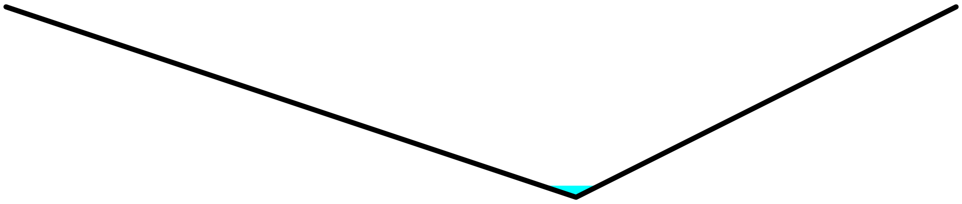
Summary for Reach UB1:

Inflow Area = 0.131 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr, 6-hr event
Inflow = 0.00 cfs @ 3.37 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 3.42 hrs, Volume= 0.000 af, Atten= 1%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.56 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 2.0 min

Peak Storage= 0 cf @ 3.39 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 2.24 cfs

0.00' x 0.50' deep channel, n= 0.035
Side Slope Z-value= 3.0 2.0 '/' Top Width= 2.50'
Length= 60.0' Slope= 0.0500 '/'
Inlet Invert= 5,875.00', Outlet Invert= 5,872.00'



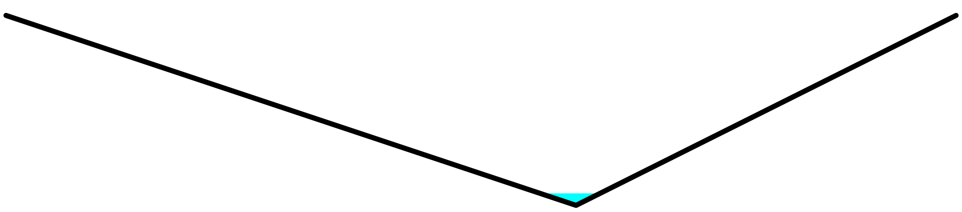
Summary for Reach UB2:

Inflow Area = 0.141 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr, 6-hr event
Inflow = 0.00 cfs @ 3.37 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 3.45 hrs, Volume= 0.000 af, Atten= 1%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.55 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 2.8 min

Peak Storage= 0 cf @ 3.40 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 2.17 cfs

0.00' x 0.50' deep channel, n= 0.035
Side Slope Z-value= 3.0 2.0 '/' Top Width= 2.50'
Length= 85.0' Slope= 0.0471 '/'
Inlet Invert= 5,876.00', Outlet Invert= 5,872.00'



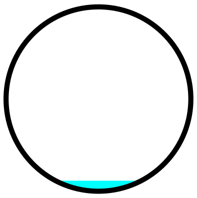
Summary for Reach UC1:

Inflow Area = 17.676 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr, 6-hr event
Inflow = 0.15 cfs @ 4.79 hrs, Volume= 0.035 af
Outflow = 0.15 cfs @ 4.80 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.21 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 0.7 min

Peak Storage= 4 cf @ 4.79 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 24.95 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 60.0' Slope= 0.0450 '/'
Inlet Invert= 5,883.00', Outlet Invert= 5,880.30'



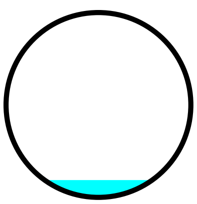
Summary for Reach UC2:

Inflow Area = 25.400 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr, 6-hr event
Inflow = 0.23 cfs @ 3.61 hrs, Volume= 0.050 af
Outflow = 0.23 cfs @ 3.64 hrs, Volume= 0.050 af, Atten= 0%, Lag= 1.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.60 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 1.0 min

Peak Storage= 12 cf @ 3.62 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.15 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 80.0' Slope= 0.0125 '/'
Inlet Invert= 5,890.00', Outlet Invert= 5,889.00'



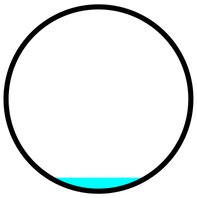
Summary for Reach UC3:

Inflow Area = 23.396 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr, 6-hr event
Inflow = 0.20 cfs @ 4.71 hrs, Volume= 0.046 af
Outflow = 0.20 cfs @ 4.72 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.94 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.15 fps, Avg. Travel Time= 0.3 min

Peak Storage= 2 cf @ 4.71 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 18.60 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 20.0' Slope= 0.0250 '/'
Inlet Invert= 5,863.00', Outlet Invert= 5,862.50'



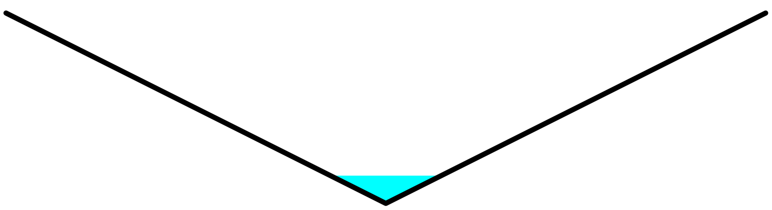
Summary for Reach UD1:

Inflow Area = 17.676 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr, 6-hr event
Inflow = 0.15 cfs @ 4.37 hrs, Volume= 0.035 af
Outflow = 0.15 cfs @ 4.79 hrs, Volume= 0.035 af, Atten= 1%, Lag= 25.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.60 fps, Min. Travel Time= 12.0 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 22.0 min

Peak Storage= 110 cf @ 4.59 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 26.01 cfs

0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 1,150.0' Slope= 0.0522 '/'
Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'



Summary for Pond SP1:

Inflow Area = 6.076 ac, 9.96% Impervious, Inflow Depth = 0.34" for 10-yr, 6-hr event
Inflow = 2.38 cfs @ 3.04 hrs, Volume= 0.171 af
Outflow = 1.43 cfs @ 3.22 hrs, Volume= 0.171 af, Atten= 40%, Lag= 10.7 min
Primary = 1.43 cfs @ 3.22 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,902.08' @ 3.22 hrs Surf.Area= 24,281 sf Storage= 1,890 cf

Plug-Flow detention time= 21.9 min calculated for 0.170 af (100% of inflow)
Center-of-Mass det. time= 22.0 min (239.1 - 217.1)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	25,185 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0.0	0	0
5,895.00	4,583	0.0	0	0
5,896.00	10,205	0.0	0	0
5,897.00	13,585	0.0	0	0
5,898.00	15,653	0.0	0	0
5,899.00	17,740	0.0	0	0
5,900.00	19,849	0.0	0	0
5,900.40	20,698	0.0	0	0
5,901.00	21,972	0.0	0	0
5,902.00	24,114	0.0	0	0
5,903.00	26,256	100.0	25,185	25,185

Device	Routing	Invert	Outlet Devices
#1	Primary	5,902.00'	**Special & User-Defined** Head (feet) 0.00 0.12 Disch. (cfs) 0.000 2.200

Primary OutFlow Max=1.43 cfs @ 3.22 hrs HW=5,902.08' (Free Discharge)
↑—**1=Special & User-Defined** (Custom Controls 1.43 cfs)

Summary for Pond SP2:

Inflow Area = 13.569 ac, 4.47% Impervious, Inflow Depth = 0.30" for 10-yr, 6-hr event
Inflow = 4.46 cfs @ 3.22 hrs, Volume= 0.340 af
Outflow = 2.19 cfs @ 3.48 hrs, Volume= 0.340 af, Atten= 51%, Lag= 15.8 min
Primary = 2.19 cfs @ 3.48 hrs, Volume= 0.340 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,866.16' @ 3.48 hrs Surf.Area= 25,500 sf Storage= 4,044 cf

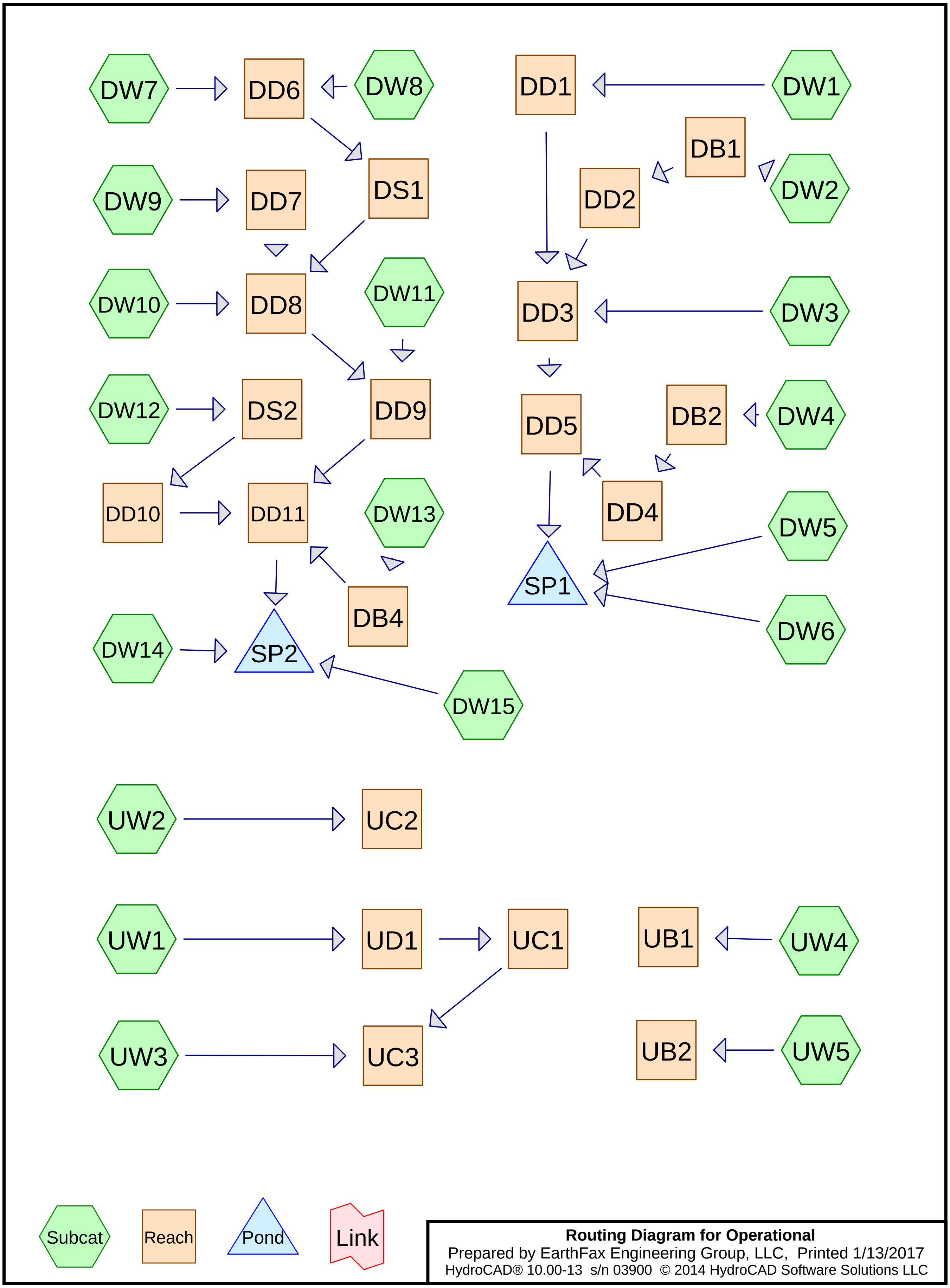
Plug-Flow detention time= 30.7 min calculated for 0.339 af (100% of inflow)
Center-of-Mass det. time= 30.7 min (264.3 - 233.6)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	25,870 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0.0	0	0
5,860.00	8,136	0.0	0	0
5,861.00	10,629	0.0	0	0
5,862.00	13,541	0.0	0	0
5,862.52	14,979	0.0	0	0
5,863.00	16,307	0.0	0	0
5,864.00	19,203	0.0	0	0
5,865.00	22,221	0.0	0	0
5,865.50	23,774	0.0	0	0
5,866.00	25,327	0.0	0	0
5,867.00	26,413	100.0	25,870	25,870

Device	Routing	Invert	Outlet Devices
#1	Primary	5,866.00'	**Special & User-Defined** Head (feet) 0.00 0.26 Disch. (cfs) 0.000 3.580

Primary OutFlow Max=2.19 cfs @ 3.48 hrs HW=5,866.16' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 2.19 cfs)



Routing Diagram for Operational
Prepared by EarthFax Engineering Group, LLC, Printed 1/13/2017
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Summary for Subcatchment DW1:

Runoff = 2.37 cfs @ 2.90 hrs, Volume= 0.066 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
1.081	86	Newly graded area, HSG B
1.081		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	130	0.5000	3.01		**Lag/CN Method,**

Summary for Subcatchment DW10:

Runoff = 1.24 cfs @ 2.90 hrs, Volume= 0.035 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.567	86	Newly graded area, HSG B
0.567		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	130	0.5000	3.01		**Lag/CN Method,**

Summary for Subcatchment DW11:

Runoff = 7.08 cfs @ 2.91 hrs, Volume= 0.199 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
3.247	86	Newly graded area, HSG B
3.247		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	150	0.5000	3.10		**Lag/CN Method,**

Summary for Subcatchment DW12:

Runoff = 5.54 cfs @ 2.94 hrs, Volume= 0.161 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
2.616	86	Newly graded area, HSG B
2.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	150	0.0500	0.98		**Lag/CN Method,**

Summary for Subcatchment DW13:

Runoff = 2.86 cfs @ 2.91 hrs, Volume= 0.081 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
1.313	86	Newly graded area, HSG B
1.313		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	160	0.5000	3.14		**Lag/CN Method,**

Summary for Subcatchment DW14:

Runoff = 3.04 cfs @ 2.90 hrs, Volume= 0.085 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
1.388	86	Newly graded area, HSG B
1.388		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	120	0.5000	2.97		**Lag/CN Method,**

Summary for Subcatchment DW15:

Runoff = 2.48 cfs @ 2.89 hrs, Volume= 0.082 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.606	98	Water Surface, HSG B
0.606		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	20	0.3300	2.91		**Lag/CN Method,**

Summary for Subcatchment DW2:

Runoff = 2.29 cfs @ 2.94 hrs, Volume= 0.067 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
1.088	86	Newly graded area, HSG B
1.088		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	180	0.0500	1.02		**Lag/CN Method,**

Summary for Subcatchment DW3:

Runoff = 4.74 cfs @ 2.91 hrs, Volume= 0.134 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
2.175	86	Newly graded area, HSG B
2.175		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	160	0.5000	3.14		**Lag/CN Method,**

Summary for Subcatchment DW4:

Runoff = 1.15 cfs @ 2.91 hrs, Volume= 0.032 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.527	86	Newly graded area, HSG B
0.527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	150	0.5000	3.10		**Lag/CN Method,**

Summary for Subcatchment DW5:

Runoff = 1.32 cfs @ 2.90 hrs, Volume= 0.037 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.600	86	Newly graded area, HSG B
0.600		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	60	0.1900	1.59		**Lag/CN Method,**

Summary for Subcatchment DW6:

Runoff = 2.48 cfs @ 2.89 hrs, Volume= 0.082 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.605	98	Water Surface, HSG B
0.605		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	10	0.3300	2.53		**Lag/CN Method,**

Summary for Subcatchment DW7:

Runoff = 2.01 cfs @ 2.90 hrs, Volume= 0.056 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.908	86	Newly graded area, HSG B
0.908		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	90	0.5000	2.80		**Lag/CN Method,**

Summary for Subcatchment DW8:

Runoff = 0.78 cfs @ 2.90 hrs, Volume= 0.022 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
0.351	86	Newly graded area, HSG B
0.351		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	70	0.5000	2.66		**Lag/CN Method,**

Summary for Subcatchment DW9:

Runoff = 5.37 cfs @ 2.94 hrs, Volume= 0.158 af, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

Area (ac)	CN	Description
2.573	86	Newly graded area, HSG B
2.573		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	285	0.0880	1.48		**Lag/CN Method,**

Summary for Subcatchment UW1:

Runoff = 2.55 cfs @ 3.48 hrs, Volume= 0.307 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	17.676	71	Pinyon/juniper range, Poor, HSG B
	17.676		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.5	1,760	0.0300	0.78		**Lag/CN Method,**

Summary for Subcatchment UW2:

Runoff = 6.44 cfs @ 3.14 hrs, Volume= 0.441 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	25.400	71	Pinyon/juniper range, Poor, HSG B
	25.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.9	1,280	0.1000	1.34		**Lag/CN Method,**

Summary for Subcatchment UW3:

Runoff = 2.45 cfs @ 3.01 hrs, Volume= 0.099 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	5.720	71	Pinyon/juniper range, Poor, HSG B
	5.720		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	440	0.1250	1.21		**Lag/CN Method,**

Summary for Subcatchment UW4:

Runoff = 0.07 cfs @ 2.95 hrs, Volume= 0.002 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	0.131	71	Pinyon/juniper range, Poor, HSG B
	0.131		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	150	0.3000	1.51		**Lag/CN Method,**

Summary for Subcatchment UW5:

Runoff = 0.08 cfs @ 2.95 hrs, Volume= 0.002 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	0.141	71	Pinyon/juniper range, Poor, HSG B
	0.141		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	150	0.2000	1.24		**Lag/CN Method,**

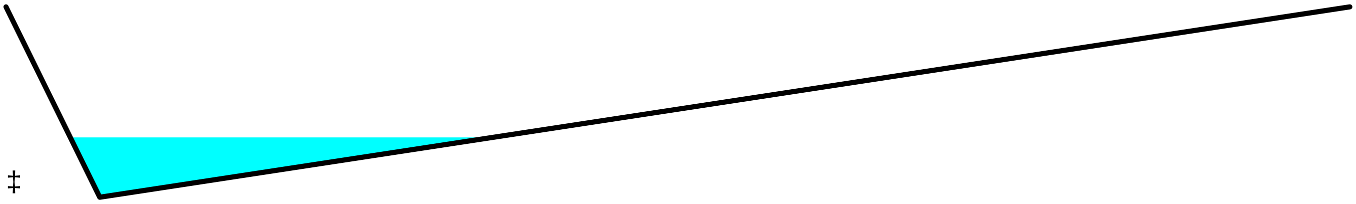
Summary for Reach DB1:

Inflow Area = 1.088 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 2.29 cfs @ 2.94 hrs, Volume= 0.067 af
Outflow = 1.78 cfs @ 3.05 hrs, Volume= 0.067 af, Atten= 22%, Lag= 6.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.74 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.60 fps, Avg. Travel Time= 12.2 min

Peak Storage= 466 cf @ 2.98 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 40.71 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 440.0' Slope= 0.0205 '/'
Inlet Invert= 5,996.00', Outlet Invert= 5,987.00'



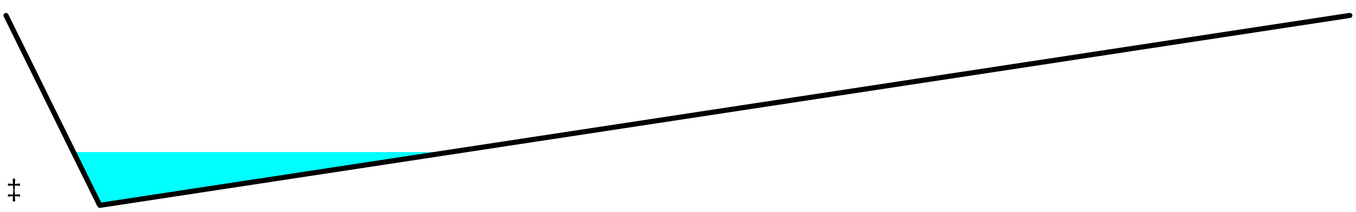
Summary for Reach DB2:

Inflow Area = 0.527 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 1.15 cfs @ 2.91 hrs, Volume= 0.032 af
Outflow = 0.93 cfs @ 3.00 hrs, Volume= 0.032 af, Atten= 19%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.14 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 10.1 min

Peak Storage= 212 cf @ 2.95 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 28.46 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 250.0' Slope= 0.0100 '/'
Inlet Invert= 5,923.50', Outlet Invert= 5,921.00'



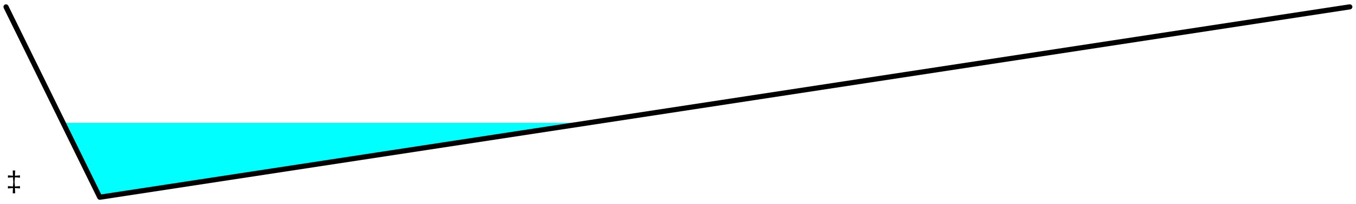
Summary for Reach DB4:

Inflow Area = 1.313 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 2.86 cfs @ 2.91 hrs, Volume= 0.081 af
Outflow = 1.81 cfs @ 3.10 hrs, Volume= 0.081 af, Atten= 37%, Lag= 11.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.14 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.32 fps, Avg. Travel Time= 28.0 min

Peak Storage= 869 cf @ 2.97 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.13 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 530.0' Slope= 0.0066 '/'
Inlet Invert= 5,923.50', Outlet Invert= 5,920.00'



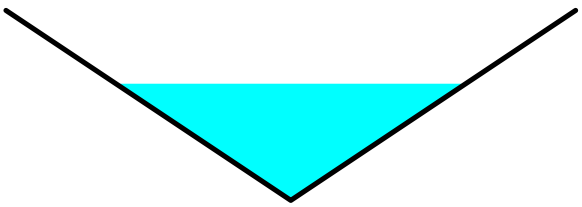
Summary for Reach DD1:

Inflow Area = 1.081 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 2.37 cfs @ 2.90 hrs, Volume= 0.066 af
Outflow = 2.02 cfs @ 2.97 hrs, Volume= 0.066 af, Atten= 15%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.80 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 5.6 min

Peak Storage= 282 cf @ 2.93 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 7.94 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 500.0' Slope= 0.0500 '/'
Inlet Invert= 5,949.00', Outlet Invert= 5,924.00'



Summary for Reach DD10:

Inflow Area = 2.616 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 3.92 cfs @ 3.09 hrs, Volume= 0.161 af
Outflow = 3.84 cfs @ 3.11 hrs, Volume= 0.161 af, Atten= 2%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.06 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 1.8 min

Peak Storage= 120 cf @ 3.10 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 107.76 cfs

4.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 185.0' Slope= 0.3703 '/'
Inlet Invert= 5,988.50', Outlet Invert= 5,920.00'

‡

Summary for Reach DD11:

Inflow Area = 11.575 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 15.43 cfs @ 3.10 hrs, Volume= 0.711 af
Outflow = 15.24 cfs @ 3.11 hrs, Volume= 0.711 af, Atten= 1%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.43 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.74 fps, Avg. Travel Time= 1.8 min

Peak Storage= 385 cf @ 3.11 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 171.61 cfs

8.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 185.0' Slope= 0.2865 '/'
Inlet Invert= 5,920.00', Outlet Invert= 5,867.00'

‡

Summary for Reach DD2:

Inflow Area = 1.088 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 1.78 cfs @ 3.05 hrs, Volume= 0.067 af
Outflow = 1.74 cfs @ 3.06 hrs, Volume= 0.067 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.06 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.03 fps, Avg. Travel Time= 1.1 min

Peak Storage= 38 cf @ 3.06 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 75.06 cfs

2.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 130.0' Slope= 0.4846 '/'
Inlet Invert= 5,987.00', Outlet Invert= 5,924.00'

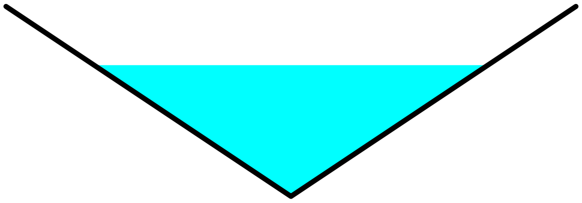
Summary for Reach DD3:

Inflow Area = 4.344 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 6.85 cfs @ 2.93 hrs, Volume= 0.267 af
Outflow = 6.31 cfs @ 3.00 hrs, Volume= 0.267 af, Atten= 8%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.02 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 7.6 min

Peak Storage= 933 cf @ 2.96 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 1.50' Flow Area= 3.4 sf, Capacity= 17.38 cfs

0.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 4.50'
Length= 580.0' Slope= 0.0276 '/'
Inlet Invert= 5,924.00', Outlet Invert= 5,908.00'



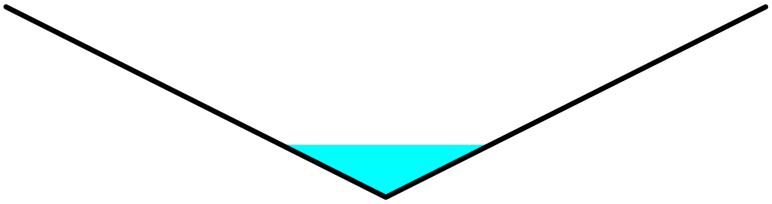
Summary for Reach DD4:

Inflow Area = 0.527 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 0.93 cfs @ 3.00 hrs, Volume= 0.032 af
Outflow = 0.92 cfs @ 3.01 hrs, Volume= 0.032 af, Atten= 1%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.06 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.53 fps, Avg. Travel Time= 0.2 min

Peak Storage= 5 cf @ 3.01 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 28.60 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 30.0' Slope= 0.4333 '/'
Inlet Invert= 5,921.00', Outlet Invert= 5,908.00'



Summary for Reach DD5:

Inflow Area = 4.871 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 7.23 cfs @ 3.00 hrs, Volume= 0.299 af
Outflow = 7.10 cfs @ 3.01 hrs, Volume= 0.299 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.91 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.73 fps, Avg. Travel Time= 1.2 min

Peak Storage= 146 cf @ 3.01 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 37.31 cfs

2.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 120.0' Slope= 0.0917 '/'
Inlet Invert= 5,908.00', Outlet Invert= 5,897.00'

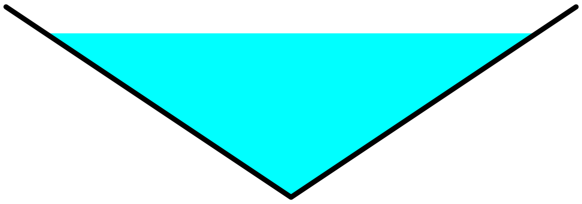
Summary for Reach DD6:

Inflow Area = 1.259 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 2.78 cfs @ 2.90 hrs, Volume= 0.077 af
Outflow = 2.39 cfs @ 2.96 hrs, Volume= 0.077 af, Atten= 14%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.27 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 5.1 min

Peak Storage= 288 cf @ 2.93 hrs
Average Depth at Peak Storage= 0.86'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 3.81 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 260.0' Slope= 0.0115 '/'
Inlet Invert= 5,941.00', Outlet Invert= 5,938.00'



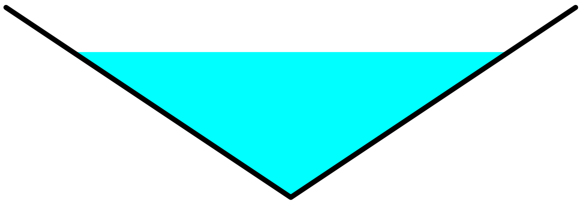
Summary for Reach DD7:

Inflow Area = 2.573 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 5.37 cfs @ 2.94 hrs, Volume= 0.158 af
Outflow = 4.75 cfs @ 2.99 hrs, Volume= 0.158 af, Atten= 12%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.68 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.25 fps, Avg. Travel Time= 4.2 min

Peak Storage= 491 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.76'
Bank-Full Depth= 1.00' Flow Area= 1.5 sf, Capacity= 10.23 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 '/' Top Width= 3.00'
Length= 560.0' Slope= 0.0830 '/'
Inlet Invert= 5,984.00', Outlet Invert= 5,937.50'



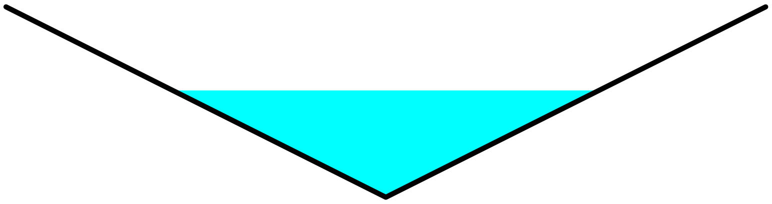
Summary for Reach DD8:

Inflow Area = 4.399 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 7.61 cfs @ 2.97 hrs, Volume= 0.270 af
Outflow = 7.28 cfs @ 3.00 hrs, Volume= 0.270 af, Atten= 4%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.99 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 3.1 min

Peak Storage= 503 cf @ 2.99 hrs
Average Depth at Peak Storage= 1.12'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 35.25 cfs

0.00' x 2.00' deep channel, n= 0.035 Rough earth
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 200.0' Slope= 0.0125 '/'
Inlet Invert= 5,937.50', Outlet Invert= 5,935.00'



Summary for Reach DD9:

Inflow Area = 7.646 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 12.04 cfs @ 2.94 hrs, Volume= 0.470 af
Outflow = 9.80 cfs @ 3.10 hrs, Volume= 0.470 af, Atten= 19%, Lag= 9.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.10 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 24.4 min

Peak Storage= 3,324 cf @ 3.00 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 1.50' Flow Area= 10.5 sf, Capacity= 52.84 cfs

4.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 1,040.0' Slope= 0.0144 '/'
Inlet Invert= 5,935.00', Outlet Invert= 5,920.00'

Summary for Reach DS1:

Inflow Area = 1.259 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 2.39 cfs @ 2.96 hrs, Volume= 0.077 af
Outflow = 2.35 cfs @ 2.96 hrs, Volume= 0.077 af, Atten= 2%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.37 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 0.43 fps, Avg. Travel Time= 0.8 min

Peak Storage= 35 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 28.22 cfs

10.00' x 0.50' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 20.0 '/' Top Width= 30.00'
Length= 20.0' Slope= 0.0250 '/'
Inlet Invert= 5,938.00', Outlet Invert= 5,937.50'

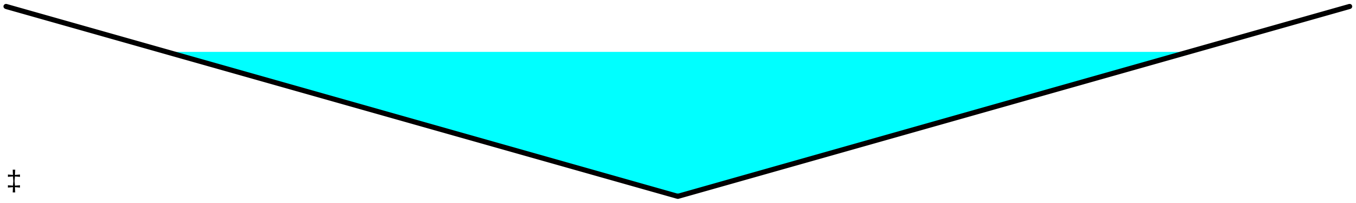
Summary for Reach DS2:

Inflow Area = 2.616 ac, 0.00% Impervious, Inflow Depth = 0.74" for 100-yr, 6-hr event
Inflow = 5.54 cfs @ 2.94 hrs, Volume= 0.161 af
Outflow = 3.92 cfs @ 3.09 hrs, Volume= 0.161 af, Atten= 29%, Lag= 9.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.37 fps, Min. Travel Time= 6.3 min
Avg. Velocity = 0.33 fps, Avg. Travel Time= 26.2 min

Peak Storage= 1,503 cf @ 2.99 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 0.50' Flow Area= 5.0 sf, Capacity= 8.25 cfs

0.00' x 0.50' deep channel, n= 0.035
Side Slope Z-value= 20.0 '/' Top Width= 20.00'
Length= 520.0' Slope= 0.0096 '/'
Inlet Invert= 5,993.50', Outlet Invert= 5,988.50'



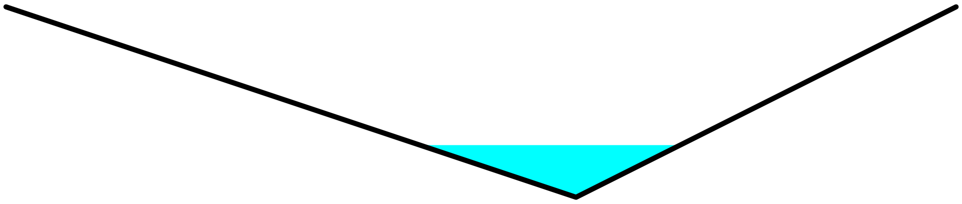
Summary for Reach UB1:

Inflow Area = 0.131 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.07 cfs @ 2.95 hrs, Volume= 0.002 af
Outflow = 0.06 cfs @ 2.97 hrs, Volume= 0.002 af, Atten= 11%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.50 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 1.2 min

Peak Storage= 3 cf @ 2.96 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 2.24 cfs

0.00' x 0.50' deep channel, n= 0.035
Side Slope Z-value= 3.0 2.0 '/' Top Width= 2.50'
Length= 60.0' Slope= 0.0500 '/'
Inlet Invert= 5,875.00', Outlet Invert= 5,872.00'



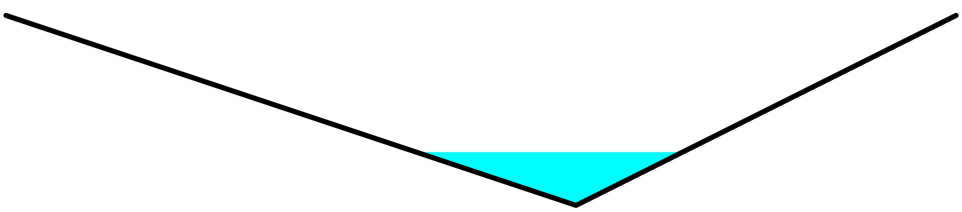
Summary for Reach UB2:

Inflow Area = 0.141 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.08 cfs @ 2.95 hrs, Volume= 0.002 af
Outflow = 0.06 cfs @ 2.99 hrs, Volume= 0.002 af, Atten= 16%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.47 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 1.8 min

Peak Storage= 4 cf @ 2.97 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.50' Flow Area= 0.6 sf, Capacity= 2.17 cfs

0.00' x 0.50' deep channel, n= 0.035
Side Slope Z-value= 3.0 2.0 '/' Top Width= 2.50'
Length= 85.0' Slope= 0.0471 '/'
Inlet Invert= 5,876.00', Outlet Invert= 5,872.00'



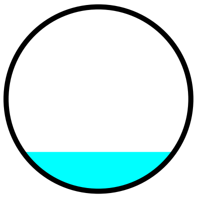
Summary for Reach UC1:

Inflow Area = 17.676 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 2.46 cfs @ 3.66 hrs, Volume= 0.307 af
Outflow = 2.45 cfs @ 3.67 hrs, Volume= 0.307 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.25 fps, Avg. Travel Time= 0.4 min

Peak Storage= 29 cf @ 3.67 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 24.95 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 60.0' Slope= 0.0450 '/'
Inlet Invert= 5,883.00', Outlet Invert= 5,880.30'



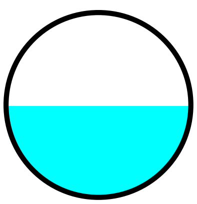
Summary for Reach UC2:

Inflow Area = 25.400 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 6.44 cfs @ 3.14 hrs, Volume= 0.441 af
Outflow = 6.40 cfs @ 3.15 hrs, Volume= 0.441 af, Atten= 1%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.17 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 0.6 min

Peak Storage= 124 cf @ 3.15 hrs
Average Depth at Peak Storage= 0.99'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.15 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 80.0' Slope= 0.0125 '/'
Inlet Invert= 5,890.00', Outlet Invert= 5,889.00'



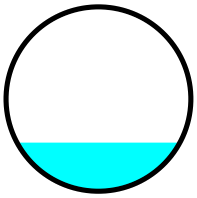
Summary for Reach UC3:

Inflow Area = 23.396 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 2.81 cfs @ 3.66 hrs, Volume= 0.407 af
Outflow = 2.81 cfs @ 3.67 hrs, Volume= 0.407 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.27 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.91 fps, Avg. Travel Time= 0.2 min

Peak Storage= 13 cf @ 3.66 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 18.60 cfs

24.0" Round Pipe
n= 0.025 Corrugated metal
Length= 20.0' Slope= 0.0250 '/'
Inlet Invert= 5,863.00', Outlet Invert= 5,862.50'



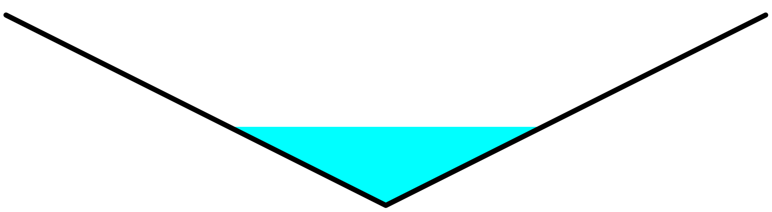
Summary for Reach UD1:

Inflow Area = 17.676 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 2.55 cfs @ 3.48 hrs, Volume= 0.307 af
Outflow = 2.46 cfs @ 3.66 hrs, Volume= 0.307 af, Atten= 4%, Lag= 11.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.20 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 14.3 min

Peak Storage= 881 cf @ 3.56 hrs
Average Depth at Peak Storage= 0.62'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 26.01 cfs

0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 1,150.0' Slope= 0.0522 '/'
Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'



Summary for Pond SP1:

Inflow Area = 6.076 ac, 9.96% Impervious, Inflow Depth = 0.83" for 100-yr, 6-hr event
Inflow = 8.18 cfs @ 2.97 hrs, Volume= 0.418 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,901.24' @ 22.45 hrs Surf.Area= 22,493 sf Storage= 18,209 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	61,029 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0.0	0	0
5,895.00	4,583	0.0	0	0
5,896.00	10,205	0.0	0	0
5,897.00	13,585	0.0	0	0
5,898.00	15,653	0.0	0	0
5,899.00	17,740	0.0	0	0
5,900.00	19,849	0.0	0	0
5,900.40	20,698	0.0	0	0
5,901.00	21,972	100.0	12,801	12,801
5,902.00	24,114	100.0	23,043	35,844
5,903.00	26,256	100.0	25,185	61,029

Device	Routing	Invert	Outlet Devices
#1	Primary	5,902.00'	**Special & User-Defined** Head (feet) 0.00 0.12 Disch. (cfs) 0.000 2.200

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,894.50' (Free Discharge)
└─**1=Special & User-Defined** (Controls 0.00 cfs)

Summary for Pond SP2:

Inflow Area = 13.569 ac, 4.47% Impervious, Inflow Depth = 0.78" for 100-yr, 6-hr event
Inflow = 15.94 cfs @ 3.11 hrs, Volume= 0.878 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,864.64' @ 24.00 hrs Surf.Area= 21,148 sf Storage= 38,264 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	95,620 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0.0	0	0
5,860.00	8,136	0.0	0	0
5,861.00	10,629	0.0	0	0
5,862.00	13,541	0.0	0	0
5,862.52	14,979	0.0	0	0
5,863.00	16,307	100.0	7,509	7,509
5,864.00	19,203	100.0	17,755	25,264
5,865.00	22,221	100.0	20,712	45,976
5,865.50	23,774	100.0	11,499	57,474
5,866.00	25,327	100.0	12,275	69,750
5,867.00	26,413	100.0	25,870	95,620

Device	Routing	Invert	Outlet Devices
#1	Primary	5,866.00'	**Special & User-Defined** Head (feet) 0.00 0.26 Disch. (cfs) 0.000 3.580

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,859.90' (Free Discharge)
└─**1=Special & User-Defined** (Controls 0.00 cfs)

Runoff Conveyance System Details

Label	Discharge (cfs)	Velocity (ft/s)	Depth (ft)	Left Side Slope (V : H)	Bottom Width (ft)	Right Side Slope (V : H)	Slope (ft/ft)	Mannings Coefficient
DB-1 Max Depth (100yr, 6hr)	2.29	1.41	0.39	0.67		0.05	0.010	0.035
DB-1 Max Velocity (100yr, 6hr)	2.29	2.58	0.29	0.67		0.05	0.050	0.035
DB-2 Max Depth (100yr, 6hr)	1.15	0.92	0.34	0.67		0.05	0.005	0.035
DB-2 Max Velocity (100yr, 6hr)	1.15	2.17	0.22	0.67		0.05	0.050	0.035
DB-3 Max Depth (100yr, 6hr)	1.39	1.24	0.32	0.67		0.05	0.010	0.035
DB-3 Max Velocity (100yr, 6hr)	1.39	2.28	0.24	0.67		0.05	0.050	0.035
DB-4 Max Depth (100yr, 6hr)	2.86	1.15	0.48	0.67		0.05	0.005	0.035
DB-4 Max Velocity (100yr, 6hr)	2.86	2.73	0.31	0.67		0.05	0.050	0.035
DD-1 Max Depth (10yr, 6hr)	0.86	2.51	0.48	0.67		0.67	0.030	0.035
DD-1 Max Velocity (10yr, 6hr)	0.86	3.62	0.40	0.67		0.67	0.080	0.035
DD-10 Max Depth (100yr, 6hr)	3.92	1.86	0.43	0.50	4.00	0.50	0.010	0.040
DD-10 Max Velocity (100yr, 6hr)	3.92	6.66	0.14	0.50	4.00	0.50	0.500	0.040
DD-11 Max Depth (100yr, 6hr)	17.08	5.52	0.35	0.50	8.00	0.50	0.100	0.040
DD-11 Max Velocity (100yr, 6hr)	17.08	8.22	0.24	0.50	8.00	0.50	0.350	0.040
DD-2 Max Depth (100yr, 6hr)	1.78	5.35	0.15	0.50	2.00	0.50	0.330	0.040
DD-2 Max Velocity (100yr, 6hr)	1.78	6.13	0.13	0.50	2.00	0.50	0.500	0.040
DD-3 Max Depth (10yr, 6hr)	2.17	2.55	0.75	0.67		0.67	0.017	0.035
DD-3 Max Velocity (10yr, 6hr)	2.17	3.83	0.62	0.67		0.67	0.050	0.035
DD-4 Max Depth (100yr, 6hr)	0.93	5.48	0.29	0.50		0.50	0.330	0.040
DD-4 Max Velocity (100yr, 6hr)	0.93	6.41	0.27	0.50		0.50	0.500	0.040
DD-5 Max Depth (10yr, 6hr)	2.14	2.49	0.34	0.67	2.00	0.67	0.020	0.035
DD-5 Max Velocity (10yr, 6hr)	2.14	4.28	0.22	0.67	2.00	0.67	0.100	0.035
DD-6 Max Depth (10yr, 6hr)	1.02	2.25	0.55	0.67		0.67	0.020	0.035
DD-6 Max Velocity (10yr, 6hr)	1.02	3.17	0.46	0.67		0.67	0.050	0.035
DD-7 Max Depth (10yr, 6hr)	1.97	3.74	0.59	0.67		0.67	0.050	0.035
DD-7 Max Velocity (10yr, 6hr)	1.97	4.85	0.52	0.67		0.67	0.100	0.035
DD-8 Max Depth (100yr, 6hr)	7.61	2.13	1.34	0.50		0.50	0.005	0.035
DD-8 Max Velocity (100yr, 6hr)	7.61	4.86	0.89	0.50		0.50	0.045	0.035
DD-9 Max Depth (100yr, 6hr)	12.04	2.90	0.75	0.50	4.00	0.50	0.010	0.035
DD-9 Max Velocity (100yr, 6hr)	12.04	4.24	0.56	0.50	4.00	0.50	0.030	0.035
DS-1 Max Depth (10yr, 6hr)	0.86	0.91	0.08	0.05	10.00	0.05	0.020	0.040
DS-1 Max Velocity (10yr, 6hr)	0.86	1.22	0.06	0.05	10.00	0.05	0.050	0.040
DS-2 Max Depth (100yr, 6hr)	5.54	1.17	0.49	0.05		0.05	0.005	0.035
DS-2 Max Velocity (100yr, 6hr)	5.54	1.97	0.38	0.05		0.05	0.020	0.035
UB-1 Max Depth (100yr, 6hr)	0.07	1.03	0.13	0.15		0.50	0.025	0.035
UB-1 Max Velocity (100yr, 6hr)	0.07	2.02	0.09	0.15		0.50	0.150	0.035
UB-2 Max Depth (100yr, 6hr)	0.08	1.07	0.13	0.15		0.50	0.025	0.035
UB-2 Max Velocity (100yr, 6hr)	0.08	2.09	0.09	0.15		0.50	0.150	0.035
UD-1 Max Depth (100yr, 6hr)	2.55	1.60	0.89	0.50		0.50	0.008	0.045
UD-1 Max Velocity (100yr, 6hr)	2.55	5.04	0.50	0.50		0.50	0.170	0.045

Summary for Pond SP1:

Inflow Area = 6.076 ac, 9.96% Impervious, Inflow Depth > 0.68" for 10-yr, 24-hr event
Inflow = 4.44 cfs @ 11.96 hrs, Volume= 0.345 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,901.10' @ 24.00 hrs Surf.Area= 22,186 sf Storage= 15,011 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	61,029 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0.0	0	0
5,895.00	4,583	0.0	0	0
5,896.00	10,205	0.0	0	0
5,897.00	13,585	0.0	0	0
5,898.00	15,653	0.0	0	0
5,899.00	17,740	0.0	0	0
5,900.00	19,849	0.0	0	0
5,900.40	20,698	0.0	0	0
5,901.00	21,972	100.0	12,801	12,801
5,902.00	24,114	100.0	23,043	35,844
5,903.00	26,256	100.0	25,185	61,029

Device	Routing	Invert	Outlet Devices
#1	Primary	5,902.00'	**Special & User-Defined** Head (feet) 0.00 0.12 Disch. (cfs) 0.000 2.200

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,894.50' (Free Discharge)
└─**1=Special & User-Defined** (Controls 0.00 cfs)

Summary for Pond SP2:

Inflow Area = 13.569 ac, 4.47% Impervious, Inflow Depth > 0.63" for 10-yr, 24-hr event
Inflow = 8.43 cfs @ 12.14 hrs, Volume= 0.713 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,864.29' @ 24.00 hrs Surf.Area= 20,092 sf Storage= 31,049 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	95,620 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0.0	0	0
5,860.00	8,136	0.0	0	0
5,861.00	10,629	0.0	0	0
5,862.00	13,541	0.0	0	0
5,862.52	14,979	0.0	0	0
5,863.00	16,307	100.0	7,509	7,509
5,864.00	19,203	100.0	17,755	25,264
5,865.00	22,221	100.0	20,712	45,976
5,865.50	23,774	100.0	11,499	57,474
5,866.00	25,327	100.0	12,275	69,750
5,867.00	26,413	100.0	25,870	95,620

Device	Routing	Invert	Outlet Devices
#1	Primary	5,866.00'	**Special & User-Defined** Head (feet) 0.00 0.26 Disch. (cfs) 0.000 3.580

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,859.90' (Free Discharge)
└─**1=Special & User-Defined** (Controls 0.00 cfs)

Summary for Pond SP1:

Inflow Area = 6.076 ac, 9.96% Impervious, Inflow Depth > 1.22" for 100-yr, 24-hr event
Inflow = 9.07 cfs @ 11.96 hrs, Volume= 0.616 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,901.62' @ 24.00 hrs Surf.Area= 23,299 sf Storage= 26,824 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	61,029 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0.0	0	0
5,895.00	4,583	0.0	0	0
5,896.00	10,205	0.0	0	0
5,897.00	13,585	0.0	0	0
5,898.00	15,653	0.0	0	0
5,899.00	17,740	0.0	0	0
5,900.00	19,849	0.0	0	0
5,900.40	20,698	0.0	0	0
5,901.00	21,972	100.0	12,801	12,801
5,902.00	24,114	100.0	23,043	35,844
5,903.00	26,256	100.0	25,185	61,029

Device	Routing	Invert	Outlet Devices
#1	Primary	5,902.00'	**Special & User-Defined** Head (feet) 0.00 0.12 Disch. (cfs) 0.000 2.200

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,894.50' (Free Discharge)
└─**1=Special & User-Defined** (Controls 0.00 cfs)

Summary for Pond SP2:

Inflow Area = 13.569 ac, 4.47% Impervious, Inflow Depth > 1.16" for 100-yr, 24-hr event
Inflow = 17.55 cfs @ 12.10 hrs, Volume= 1.307 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,865.48' @ 24.00 hrs Surf.Area= 23,701 sf Storage= 56,916 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	95,620 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0.0	0	0
5,860.00	8,136	0.0	0	0
5,861.00	10,629	0.0	0	0
5,862.00	13,541	0.0	0	0
5,862.52	14,979	0.0	0	0
5,863.00	16,307	100.0	7,509	7,509
5,864.00	19,203	100.0	17,755	25,264
5,865.00	22,221	100.0	20,712	45,976
5,865.50	23,774	100.0	11,499	57,474
5,866.00	25,327	100.0	12,275	69,750
5,867.00	26,413	100.0	25,870	95,620

Device	Routing	Invert	Outlet Devices
#1	Primary	5,866.00'	**Special & User-Defined** Head (feet) 0.00 0.26 Disch. (cfs) 0.000 3.580

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5,859.90' (Free Discharge)
└─**1=Special & User-Defined** (Controls 0.00 cfs)

Summary for Pond SP1:

Inflow Area = 6.076 ac, 9.96% Impervious, Inflow Depth = 0.49" for 25-yr, 6-hr event
Inflow = 4.01 cfs @ 2.98 hrs, Volume= 0.248 af
Outflow = 2.20 cfs @ 3.20 hrs, Volume= 0.248 af, Atten= 45%, Lag= 13.3 min
Primary = 2.20 cfs @ 3.20 hrs, Volume= 0.248 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,902.12' @ 3.20 hrs Surf.Area= 24,378 sf Storage= 2,992 cf

Plug-Flow detention time= 22.0 min calculated for 0.248 af (100% of inflow)
Center-of-Mass det. time= 22.1 min (236.1 - 214.1)

Volume	Invert	Avail.Storage	Storage Description
#1	5,894.50'	25,185 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,894.50	0	0.0	0	0
5,895.00	4,583	0.0	0	0
5,896.00	10,205	0.0	0	0
5,897.00	13,585	0.0	0	0
5,898.00	15,653	0.0	0	0
5,899.00	17,740	0.0	0	0
5,900.00	19,849	0.0	0	0
5,900.40	20,698	0.0	0	0
5,901.00	21,972	0.0	0	0
5,902.00	24,114	0.0	0	0
5,903.00	26,256	100.0	25,185	25,185

Device	Routing	Invert	Outlet Devices
#1	Primary	5,902.00'	**Special & User-Defined** Head (feet) 0.00 0.12 Disch. (cfs) 0.000 2.200

Primary OutFlow Max=2.20 cfs @ 3.20 hrs HW=5,902.12' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 2.20 cfs)

Summary for Pond SP2:

Inflow Area = 13.569 ac, 4.47% Impervious, Inflow Depth = 0.45" for 25-yr, 6-hr event
Inflow = 7.78 cfs @ 3.17 hrs, Volume= 0.506 af
Outflow = 3.58 cfs @ 3.41 hrs, Volume= 0.506 af, Atten= 54%, Lag= 14.5 min
Primary = 3.58 cfs @ 3.41 hrs, Volume= 0.506 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,866.26' @ 3.41 hrs Surf.Area= 25,609 sf Storage= 6,618 cf

Plug-Flow detention time= 30.7 min calculated for 0.505 af (100% of inflow)
Center-of-Mass det. time= 30.8 min (258.5 - 227.8)

Volume	Invert	Avail.Storage	Storage Description
#1	5,859.90'	25,870 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

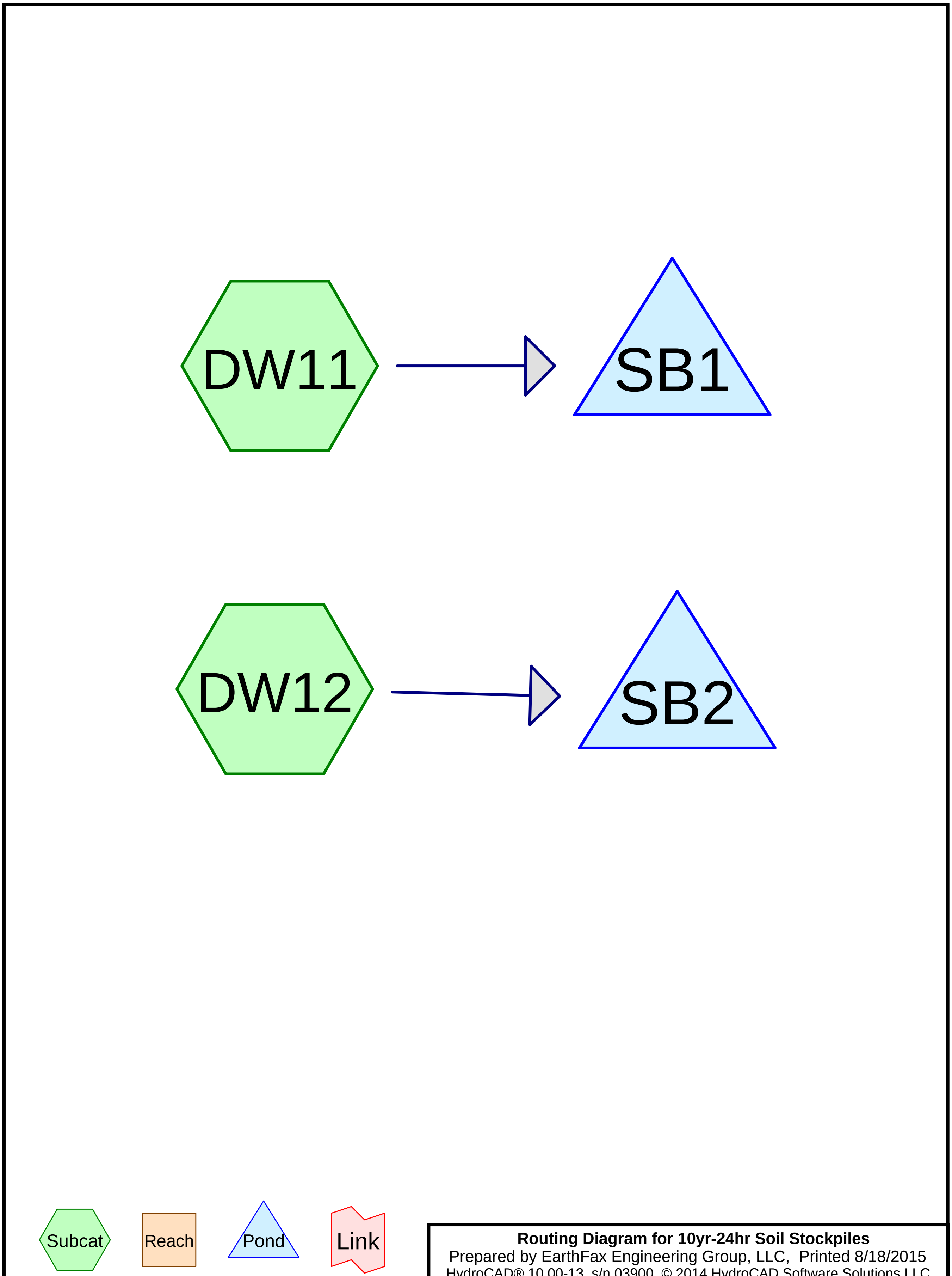
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,859.90	0	0.0	0	0
5,860.00	8,136	0.0	0	0
5,861.00	10,629	0.0	0	0
5,862.00	13,541	0.0	0	0
5,862.52	14,979	0.0	0	0
5,863.00	16,307	0.0	0	0
5,864.00	19,203	0.0	0	0
5,865.00	22,221	0.0	0	0
5,865.50	23,774	0.0	0	0
5,866.00	25,327	0.0	0	0
5,867.00	26,413	100.0	25,870	25,870

Device	Routing	Invert	Outlet Devices
#1	Primary	5,866.00'	**Special & User-Defined** Head (feet) 0.00 0.26 Disch. (cfs) 0.000 3.580

Primary OutFlow Max=3.57 cfs @ 3.41 hrs HW=5,866.26' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 3.57 cfs)

Runoff Conveyance System Details

Label	Discharge (cfs)	Velocity (ft/s)	Depth (ft)	Left Side Slope (V : H)	Bottom Width (ft)	Right Side Slope (V : H)	Slope (ft/ft)	Mannings Coefficient
SPO-1 Max. Depth	2.20	2.83	0.12	0.50	6.00	0.50	0.100	0.040
SPO-1 Max. Velocity	2.20	4.10	0.09	0.50	6.00	0.50	0.330	0.040
SPO-2 Max. Depth	3.58	3.08	0.26	0.50	4.00	0.50	0.050	0.040
SPO-2 Max. Velocity	3.58	6.44	0.13	0.50	4.00	0.50	0.500	0.040



Routing Diagram for 10yr-24hr Soil Stockpiles
Prepared by EarthFax Engineering Group, LLC, Printed 8/18/2015

Summary for Subcatchment DW11:

Runoff = 0.03 cfs @ 12.00 hrs, Volume= 0.005 af, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=1.66"

Area (ac)	CN	Description
0.750	67	Sagebrush range, Poor, HSG B
0.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.2500	1.19		**Lag/CN Method,**

Summary for Subcatchment DW12:

Runoff = 0.03 cfs @ 11.98 hrs, Volume= 0.006 af, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=1.66"

Area (ac)	CN	Description
0.900	67	Sagebrush range, Poor, HSG B
0.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.5000	1.62		**Lag/CN Method,**

Summary for Pond SB1:

Inflow Area = 0.750 ac, 0.00% Impervious, Inflow Depth > 0.08"
Inflow = 0.03 cfs @ 12.00 hrs, Volume= 0.005 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,892.93' @ 24.00 hrs Surf.Area= 1,754 sf Storage= 221 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,890.90'	2,741 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,890.90	0	0.0	0	0
5,891.00	380	0.0	0	0
5,892.00	990	0.0	0	0
5,892.80	1,650	0.0	0	0
5,893.00	1,810	100.0	346	346
5,894.00	2,980	100.0	2,395	2,741

Summary for Pond SB2:

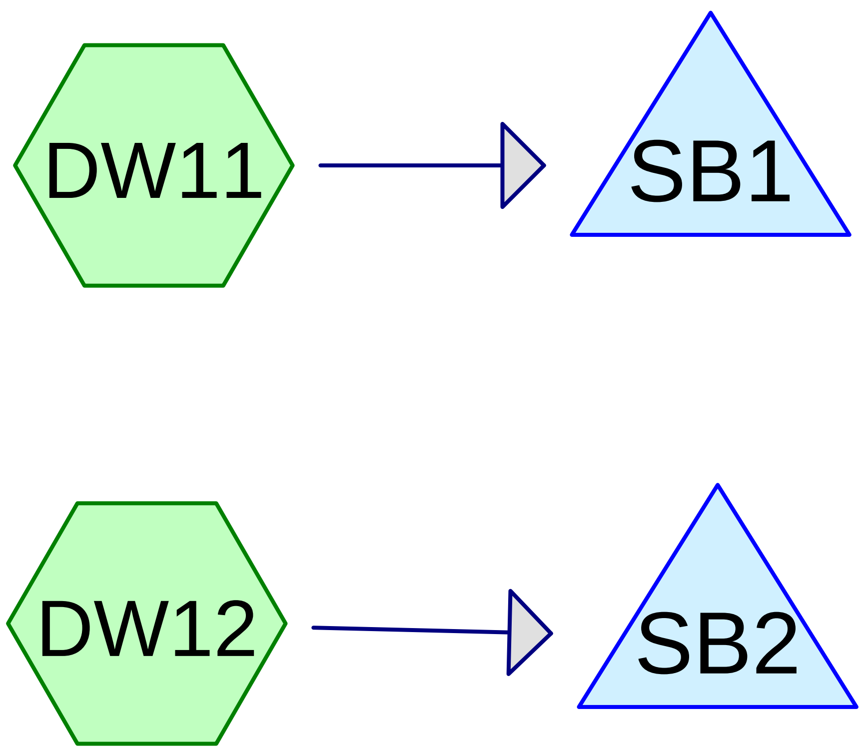
Inflow Area = 0.900 ac, 0.00% Impervious, Inflow Depth > 0.08"
Inflow = 0.03 cfs @ 11.98 hrs, Volume= 0.006 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

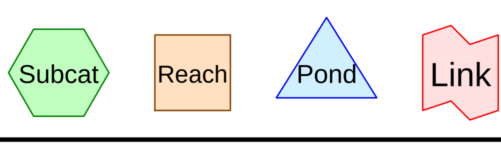
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,887.25' @ 24.00 hrs Surf.Area= 1,819 sf Storage= 265 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,883.90'	1,948 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,883.90	0	0.0	0	0
5,884.00	250	0.0	0	0
5,885.00	450	0.0	0	0
5,886.00	750	0.0	0	0
5,887.00	1,520	0.0	0	0
5,887.10	1,640	0.0	0	0
5,888.00	2,690	100.0	1,948	1,948





Routing Diagram for 25yr-6hr Soil Stockpiles
Prepared by EarthFax Engineering Group, LLC, Printed 8/18/2015
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Summary for Subcatchment DW11:

Runoff = 0.01 cfs @ 3.36 hrs, Volume= 0.002 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.750	67	Sagebrush range, Poor, HSG B
0.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	120	0.2500	1.19		**Lag/CN Method,**

Summary for Subcatchment DW12:

Runoff = 0.01 cfs @ 3.35 hrs, Volume= 0.002 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 6-hr Rainfall=1.38"

Area (ac)	CN	Description
0.900	67	Sagebrush range, Poor, HSG B
0.900		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.5000	1.62		**Lag/CN Method,**

Summary for Pond SB1:

Inflow Area = 0.750 ac, 0.00% Impervious, Inflow Depth = 0.03"
Inflow = 0.01 cfs @ 3.36 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,892.85' @ 6.15 hrs Surf.Area= 1,688 sf Storage= 80 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	5,890.90'	2,741 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,890.90	0	0.0	0	0
5,891.00	380	0.0	0	0
5,892.00	990	0.0	0	0
5,892.80	1,650	0.0	0	0
5,893.00	1,810	100.0	346	346
5,894.00	2,980	100.0	2,395	2,741

Summary for Pond SB2:

Inflow Area = 0.900 ac, 0.00% Impervious, Inflow Depth = 0.03"
Inflow = 0.01 cfs @ 3.35 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 5,887.14' @ 6.10 hrs Surf.Area= 2,290 sf Storage= 96 cf

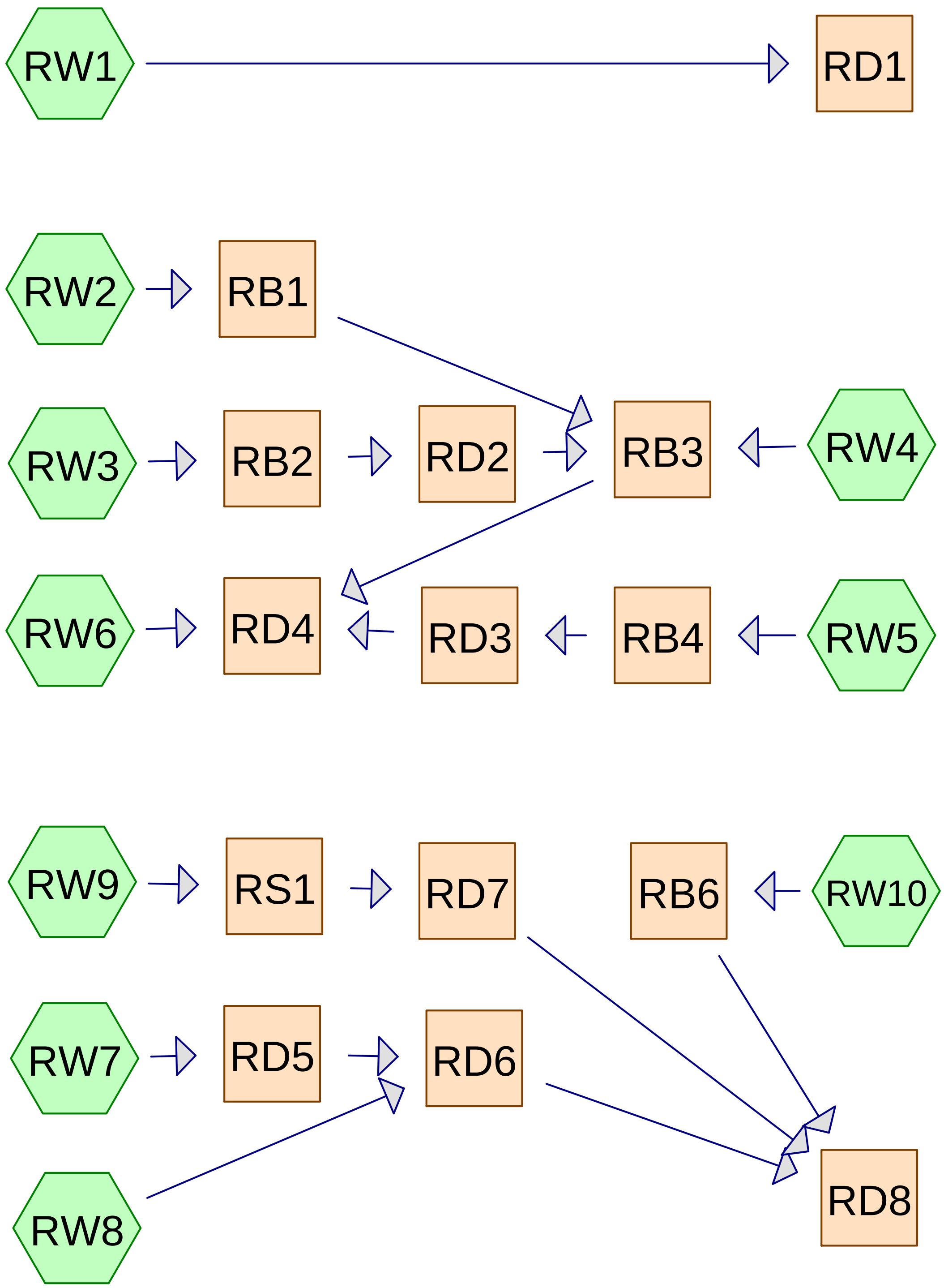
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

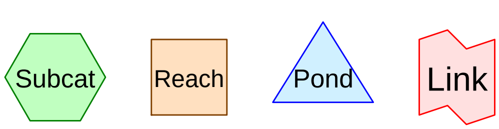
Volume	Invert	Avail.Storage	Storage Description
#1	5,883.90'	2,232 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
5,883.90	0	0.0	0	0
5,884.00	250	0.0	0	0
5,885.00	450	0.0	0	0
5,886.00	750	0.0	0	0
5,887.00	1,520	0.0	0	0
5,887.10	2,270	0.0	0	0
5,888.00	2,690	100.0	2,232	2,232

Sediment Basin Outfalls

Label	Discharge (cfs)	Depth (ft)	Velocity (ft/s)	Slope (ft/ft)	Left Side Slope (V : H)	Bottom Width (ft)	Right Side Slope (V : H)	Mannings Coefficient
SB-1/2 Overflow Bot	0.01	0.01	1.20	0.50	0.50	1.00	0.50	0.035
SB-1/2 Overflow Top	0.01	0.03	0.36	0.01	0.50	1.00	0.50	0.035





Routing Diagram for Reclamation
Prepared by EarthFax Engineering Group, LLC, Printed 1/13/2017
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Summary for Subcatchment RW1:

Runoff = 3.54 cfs @ 3.30 hrs, Volume= 0.342 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	19.686	71	Pinyon/juniper range, Poor, HSG B
	19.686		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.6	1,150	0.0300	0.72		**Lag/CN Method,**

Summary for Subcatchment RW10:

Runoff = 0.71 cfs @ 2.94 hrs, Volume= 0.023 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	1.313	71	Pinyon/juniper range, Poor, HSG B
	1.313		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	160	0.5000	1.98		**Lag/CN Method,**

Summary for Subcatchment RW2:

Runoff = 1.37 cfs @ 3.01 hrs, Volume= 0.055 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	3.176	71	Pinyon/juniper range, Poor, HSG B
	3.176		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	450	0.1300	1.24		**Lag/CN Method,**

Summary for Subcatchment RW3:

Runoff = 0.42 cfs @ 2.99 hrs, Volume= 0.016 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	0.914	71	Pinyon/juniper range, Poor, HSG B
	0.914		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	180	0.0500	0.64		**Lag/CN Method,**

Summary for Subcatchment RW4:

Runoff = 1.09 cfs @ 2.94 hrs, Volume= 0.035 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	2.006	71	Pinyon/juniper range, Poor, HSG B
	2.006		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	160	0.5000	1.98		**Lag/CN Method,**

Summary for Subcatchment RW5:

Runoff = 0.29 cfs @ 2.94 hrs, Volume= 0.009 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	0.527	71	Pinyon/juniper range, Poor, HSG B
	0.527		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	150	0.5000	1.95		**Lag/CN Method,**

Summary for Subcatchment RW6:

Runoff = 0.63 cfs @ 2.96 hrs, Volume= 0.021 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	1.234	71	Pinyon/juniper range, Poor, HSG B
	1.234		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	180	0.1300	1.03		**Lag/CN Method,**

Summary for Subcatchment RW7:

Runoff = 0.36 cfs @ 2.94 hrs, Volume= 0.011 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	0.657	71	Pinyon/juniper range, Poor, HSG B
	0.657		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	120	0.5000	1.87		**Lag/CN Method,**

Summary for Subcatchment RW8:

Runoff = 1.76 cfs @ 2.94 hrs, Volume= 0.056 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	3.247	71	Pinyon/juniper range, Poor, HSG B
	3.247		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	150	0.5000	1.95		**Lag/CN Method,**

Summary for Subcatchment RW9:

Runoff = 1.23 cfs @ 2.98 hrs, Volume= 0.045 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Type II 6-hr 100-yr, 6-hr Rainfall=1.85"

	Area (ac)	CN	Description
*	2.616	71	Pinyon/juniper range, Poor, HSG B
	2.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	150	0.0500	0.62		**Lag/CN Method,**

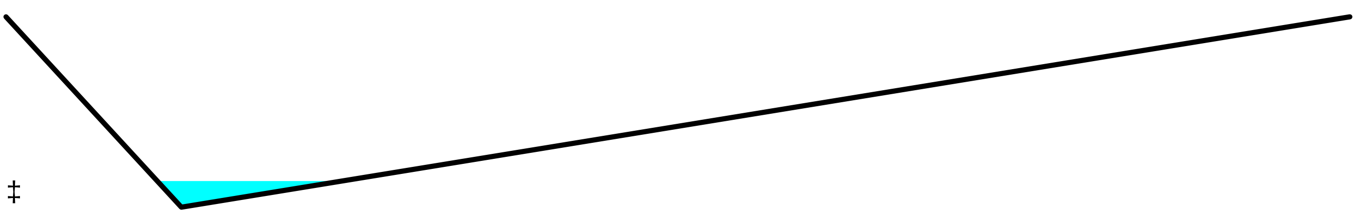
Summary for Reach RB1:

Inflow Area = 3.176 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 1.37 cfs @ 3.01 hrs, Volume= 0.055 af
Outflow = 1.09 cfs @ 3.11 hrs, Volume= 0.055 af, Atten= 21%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.57 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.25 fps, Avg. Travel Time= 6.9 min

Peak Storage= 225 cf @ 3.06 hrs
Average Depth at Peak Storage= 0.27'
Bank-Full Depth= 2.00' Flow Area= 23.0 sf, Capacity= 222.08 cfs

0.00' x 2.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 10.0 '/' Top Width= 23.00'
Length= 520.0' Slope= 0.0538 '/'
Inlet Invert= 5,955.00', Outlet Invert= 5,927.00'



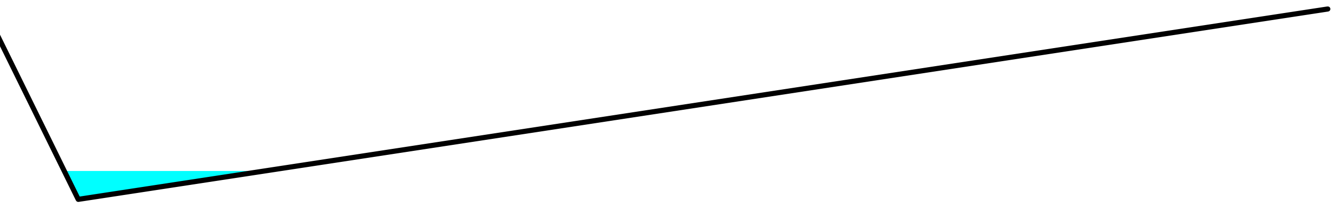
Summary for Reach RB2:

Inflow Area = 0.914 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.42 cfs @ 2.99 hrs, Volume= 0.016 af
Outflow = 0.24 cfs @ 3.18 hrs, Volume= 0.016 af, Atten= 43%, Lag= 11.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.06 fps, Min. Travel Time= 6.9 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 15.3 min

Peak Storage= 105 cf @ 3.06 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 40.71 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 440.0' Slope= 0.0205 '/'
Inlet Invert= 6,000.00', Outlet Invert= 5,991.00'



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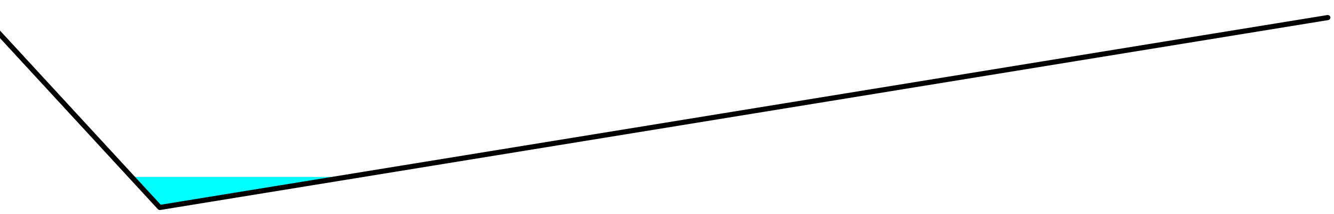
Summary for Reach RB3:

Inflow Area = 6.096 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 1.44 cfs @ 3.12 hrs, Volume= 0.106 af
Outflow = 1.25 cfs @ 3.25 hrs, Volume= 0.106 af, Atten= 13%, Lag= 7.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.14 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 9.6 min

Peak Storage= 334 cf @ 3.17 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 2.00' Flow Area= 23.0 sf, Capacity= 166.75 cfs

0.00' x 2.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 10.0 '/' Top Width= 23.00'
Length= 560.0' Slope= 0.0304 '/'
Inlet Invert= 5,927.00', Outlet Invert= 5,910.00'



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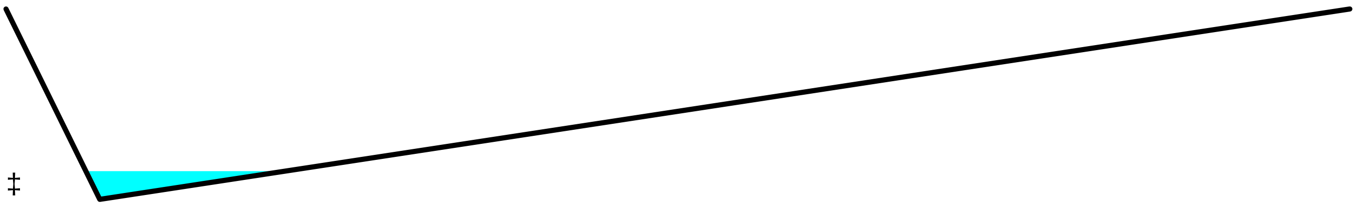
Summary for Reach RB4:

Inflow Area = 0.527 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.29 cfs @ 2.94 hrs, Volume= 0.009 af
Outflow = 0.17 cfs @ 3.10 hrs, Volume= 0.009 af, Atten= 41%, Lag= 9.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.74 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 12.3 min

Peak Storage= 59 cf @ 3.00 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 28.46 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 250.0' Slope= 0.0100 '/'
Inlet Invert= 5,927.50', Outlet Invert= 5,925.00'



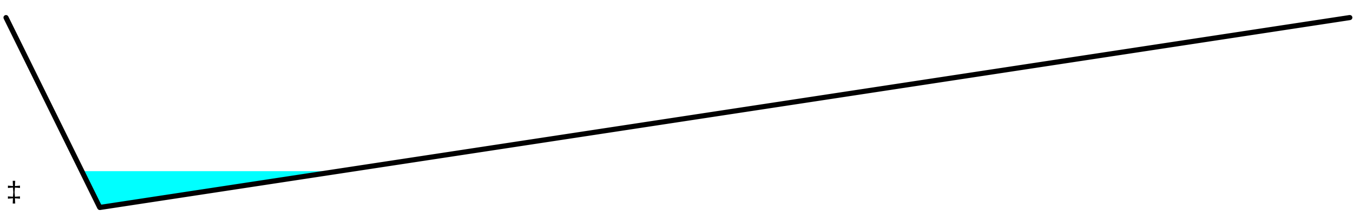
Summary for Reach RB6:

Inflow Area = 1.313 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.71 cfs @ 2.94 hrs, Volume= 0.023 af
Outflow = 0.27 cfs @ 3.24 hrs, Volume= 0.023 af, Atten= 63%, Lag= 18.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.71 fps, Min. Travel Time= 12.5 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 32.0 min

Peak Storage= 207 cf @ 3.02 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 1.00' Flow Area= 10.8 sf, Capacity= 23.13 cfs

0.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 1.5 20.0 '/' Top Width= 21.50'
Length= 530.0' Slope= 0.0066 '/'
Inlet Invert= 5,923.50', Outlet Invert= 5,920.00'



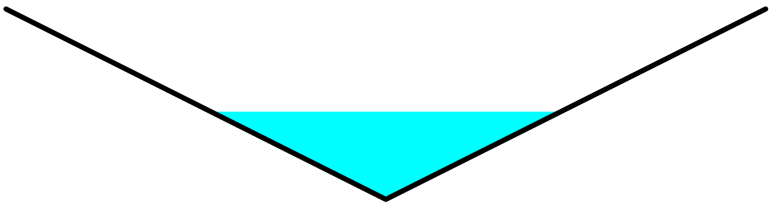
Summary for Reach RD1:

Inflow Area = 19.686 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 3.54 cfs @ 3.30 hrs, Volume= 0.342 af
Outflow = 3.29 cfs @ 3.48 hrs, Volume= 0.342 af, Atten= 7%, Lag= 10.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.45 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 14.1 min

Peak Storage= 1,101 cf @ 3.39 hrs
Average Depth at Peak Storage= 0.69'
Bank-Full Depth= 1.50' Flow Area= 4.5 sf, Capacity= 26.01 cfs

0.00' x 1.50' deep channel, n= 0.045
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 1,150.0' Slope= 0.0522 '/'
Inlet Invert= 5,943.00', Outlet Invert= 5,883.00'



Summary for Reach RD2:

Inflow Area = 0.914 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.24 cfs @ 3.18 hrs, Volume= 0.016 af
Outflow = 0.24 cfs @ 3.21 hrs, Volume= 0.016 af, Atten= 1%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.93 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 1.5 min

Peak Storage= 11 cf @ 3.19 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 75.65 cfs

2.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 130.0' Slope= 0.4923 '/'
Inlet Invert= 5,991.00', Outlet Invert= 5,927.00'

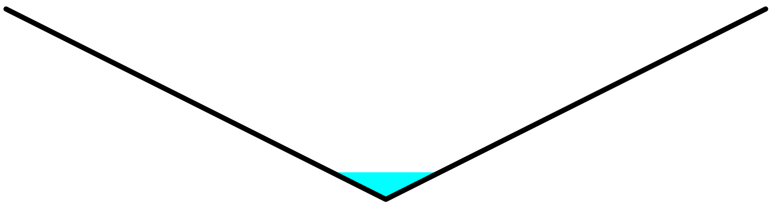
Summary for Reach RD3:

Inflow Area = 0.527 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.17 cfs @ 3.10 hrs, Volume= 0.009 af
Outflow = 0.17 cfs @ 3.10 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.20 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.17 fps, Avg. Travel Time= 0.2 min

Peak Storage= 1 cf @ 3.10 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.00' Flow Area= 2.0 sf, Capacity= 30.72 cfs

0.00' x 1.00' deep channel, n= 0.040 Earth, cobble bottom, clean sides
Side Slope Z-value= 2.0 '/' Top Width= 4.00'
Length= 30.0' Slope= 0.5000 '/'
Inlet Invert= 5,925.00', Outlet Invert= 5,910.00'



Summary for Reach RD4:

Inflow Area = 7.857 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 1.46 cfs @ 3.24 hrs, Volume= 0.137 af
Outflow = 1.41 cfs @ 3.33 hrs, Volume= 0.137 af, Atten= 3%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.41 fps, Min. Travel Time= 3.5 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 6.9 min

Peak Storage= 294 cf @ 3.28 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 2.00' Flow Area= 20.0 sf, Capacity= 288.00 cfs

6.00' x 2.00' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 14.00'
Length= 500.0' Slope= 0.0780 '/'
Inlet Invert= 5,910.00', Outlet Invert= 5,871.00'

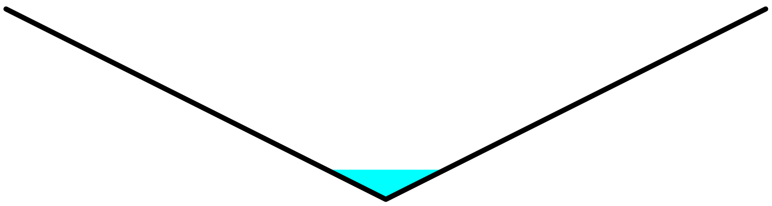
Summary for Reach RD5:

Inflow Area = 0.657 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.36 cfs @ 2.94 hrs, Volume= 0.011 af
Outflow = 0.28 cfs @ 3.01 hrs, Volume= 0.011 af, Atten= 20%, Lag= 4.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.51 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 4.8 min

Peak Storage= 43 cf @ 2.97 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 2.00' Flow Area= 8.0 sf, Capacity= 42.52 cfs

0.00' x 2.00' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 220.0' Slope= 0.0182 '/'
Inlet Invert= 5,939.00', Outlet Invert= 5,935.00'



Summary for Reach RD6:

Inflow Area = 3.904 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 1.89 cfs @ 2.95 hrs, Volume= 0.068 af
Outflow = 0.77 cfs @ 3.26 hrs, Volume= 0.068 af, Atten= 59%, Lag= 18.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.33 fps, Min. Travel Time= 12.4 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 33.0 min

Peak Storage= 583 cf @ 3.05 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.50' Flow Area= 10.5 sf, Capacity= 54.16 cfs

4.00' x 1.50' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 10.00'
Length= 990.0' Slope= 0.0152 '/'
Inlet Invert= 5,935.00', Outlet Invert= 5,920.00'

Summary for Reach RD7:

Inflow Area = 2.616 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 0.58 cfs @ 3.24 hrs, Volume= 0.045 af
Outflow = 0.57 cfs @ 3.27 hrs, Volume= 0.045 af, Atten= 1%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.00 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.41 fps, Avg. Travel Time= 2.2 min

Peak Storage= 36 cf @ 3.26 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 6.0 sf, Capacity= 110.87 cfs

4.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 2.0 '/' Top Width= 8.00'
Length= 185.0' Slope= 0.3919 '/'
Inlet Invert= 5,992.50', Outlet Invert= 5,920.00'

Summary for Reach RD8:

Inflow Area = 7.833 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 1.60 cfs @ 3.26 hrs, Volume= 0.136 af
Outflow = 1.56 cfs @ 3.32 hrs, Volume= 0.136 af, Atten= 2%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.98 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.22 fps, Avg. Travel Time= 4.1 min

Peak Storage= 157 cf @ 3.28 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 10.0 sf, Capacity= 162.50 cfs

8.00' x 1.00' deep channel, n= 0.035
Side Slope Z-value= 2.0 '/' Top Width= 12.00'
Length= 300.0' Slope= 0.1967 '/'
Inlet Invert= 5,920.00', Outlet Invert= 5,861.00'

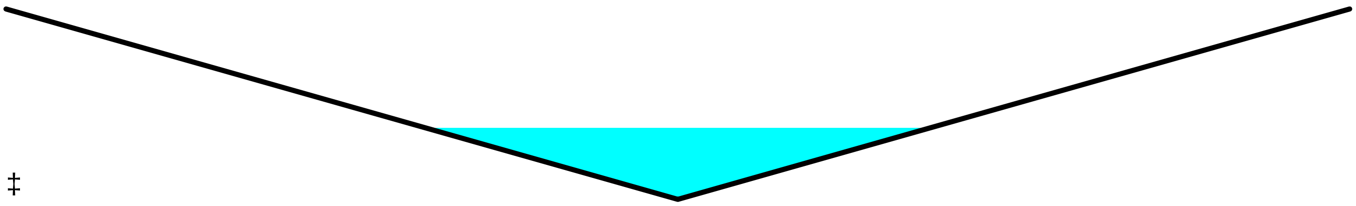
Summary for Reach RS1:

Inflow Area = 2.616 ac, 0.00% Impervious, Inflow Depth = 0.21" for 100-yr, 6-hr event
Inflow = 1.23 cfs @ 2.98 hrs, Volume= 0.045 af
Outflow = 0.58 cfs @ 3.24 hrs, Volume= 0.045 af, Atten= 53%, Lag= 15.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-12.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.86 fps, Min. Travel Time= 10.1 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 28.1 min

Peak Storage= 367 cf @ 3.07 hrs
Average Depth at Peak Storage= 0.19'
Bank-Full Depth= 0.50' Flow Area= 5.0 sf, Capacity= 8.25 cfs

0.00' x 0.50' deep channel, n= 0.035
Side Slope Z-value= 20.0 '/' Top Width= 20.00'
Length= 520.0' Slope= 0.0096 '/'
Inlet Invert= 5,997.50', Outlet Invert= 5,992.50'



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Runoff Conveyance System Details

Label	Discharge (cfs)	Velocity (ft/s)	Depth (ft)	Left Side Slope (V : H)	Bottom Width (ft)	Right Side Slope (V : H)	Slope (ft/ft)	Mannings Coefficient
RB-1 Max Depth	1.37	2.17	0.33	0.67		0.10	0.030000	0.035
RB-1 Max Velocity	1.37	3.14	0.28	0.67		0.10	0.080000	0.035
RB-2 Max Depth	0.42	0.92	0.21	0.67		0.05	0.010000	0.035
RB-2 Max Velocity	0.42	1.69	0.15	0.67		0.05	0.050000	0.035
RB-3 Max Depth	1.44	1.46	0.41	0.67		0.10	0.010000	0.035
RB-3 Max Velocity	1.44	2.67	0.31	0.67		0.10	0.050000	0.035
RB-4 Max Depth	0.29	0.65	0.20	0.67		0.05	0.005000	0.035
RB-4 Max Velocity	0.29	1.54	0.13	0.67		0.05	0.050000	0.035
RB-5 Max Depth	0.31	0.86	0.18	0.67		0.05	0.010000	0.035
RB-5 Max Velocity	0.31	1.56	0.14	0.67		0.05	0.050000	0.035
RB-6 Max Depth	0.71	0.81	0.29	0.67		0.05	0.005000	0.035
RB-6 Max Velocity	0.71	1.92	0.19	0.67		0.05	0.050000	0.035
RD-1 Max Depth	3.54	1.74	1.01	0.50		0.50	0.008000	0.045
RD-1 Max Velocity	3.54	5.47	0.57	0.50		0.50	0.170000	0.045
RD-2 Max Depth	0.24	2.59	0.04	0.50	2.00	0.50	0.330000	0.040
RD-2 Max Velocity	0.24	2.94	0.04	0.50	2.00	0.50	0.500000	0.040
RD-3 Max Depth	0.17	3.59	0.15	0.50		0.50	0.330000	0.040
RD-3 Max Velocity	0.17	4.19	0.14	0.50		0.50	0.500000	0.040
RD-4 Max Depth	1.46	2.63	0.09	0.50	6.00	0.50	0.100000	0.035
RD-4 Max Velocity	1.46	3.86	0.06	0.50	6.00	0.50	0.350000	0.035
RD-5 Max Depth	0.36	0.99	0.43	0.50		0.50	0.005000	0.035
RD-5 Max Velocity	0.36	2.26	0.28	0.50		0.50	0.045000	0.035
RD-6 Max Depth	1.89	1.59	0.26	0.50	4.00	0.50	0.010000	0.035
RD-6 Max Velocity	1.89	2.27	0.19	0.50	4.00	0.50	0.030000	0.035
RD-7 Max Depth	0.58	0.96	0.14	0.50	4.00	0.50	0.010000	0.040
RD-7 Max Velocity	0.58	3.22	0.04	0.50	4.00	0.50	0.500000	0.040
RD-8 Max Depth	1.60	2.26	0.09	0.50	8.00	0.50	0.100000	0.040
RD-8 Max Velocity	1.60	3.59	0.05	0.50	8.00	0.50	0.350000	0.035
RS-1 Max Depth	1.23	0.80	0.28	0.05		0.05	0.005000	0.035
RS-1 Max Velocity	1.23	1.35	0.21	0.05		0.05	0.020000	0.035

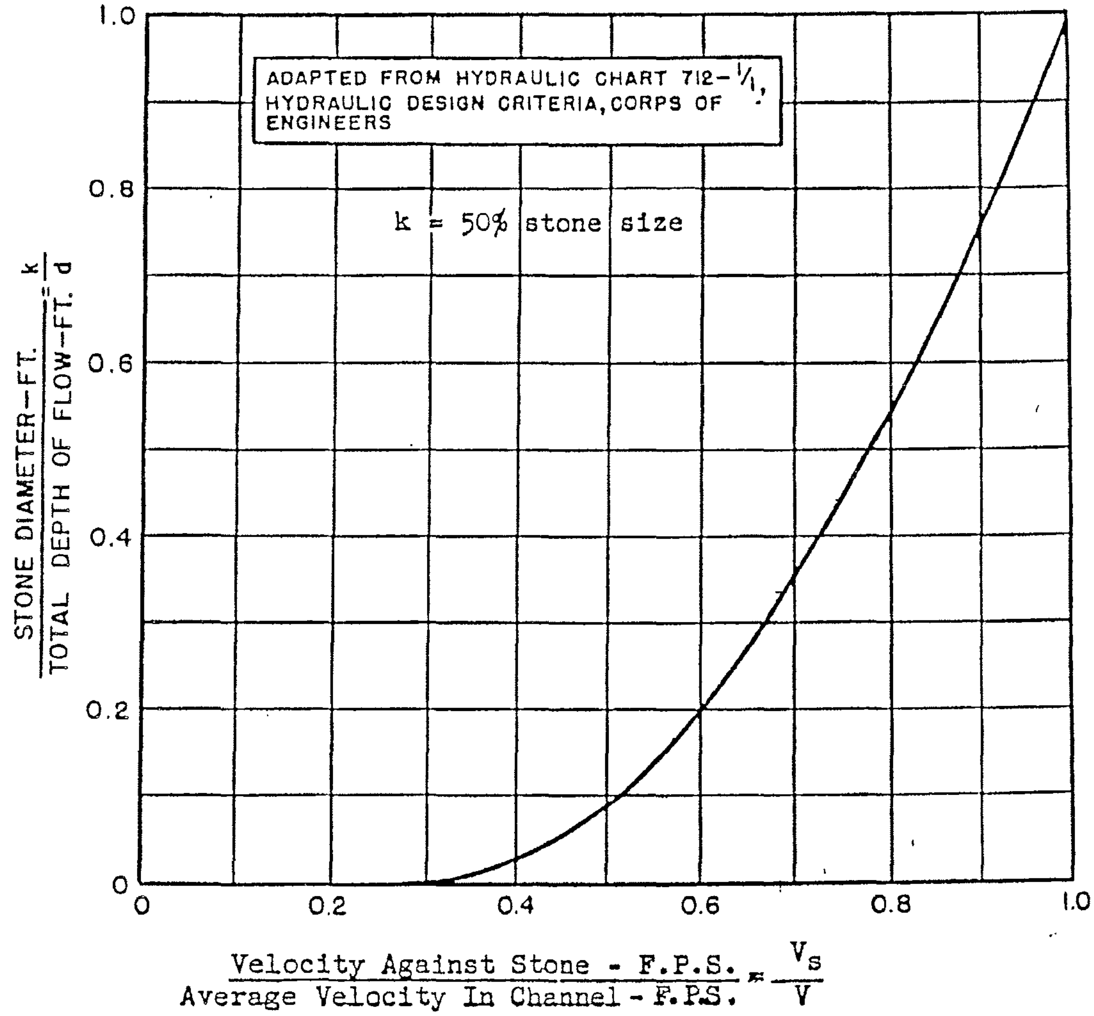

FIGURE 5-1 Velocity Against Stone on Channel Bottom (U.S. Department of Transportation, 1978).

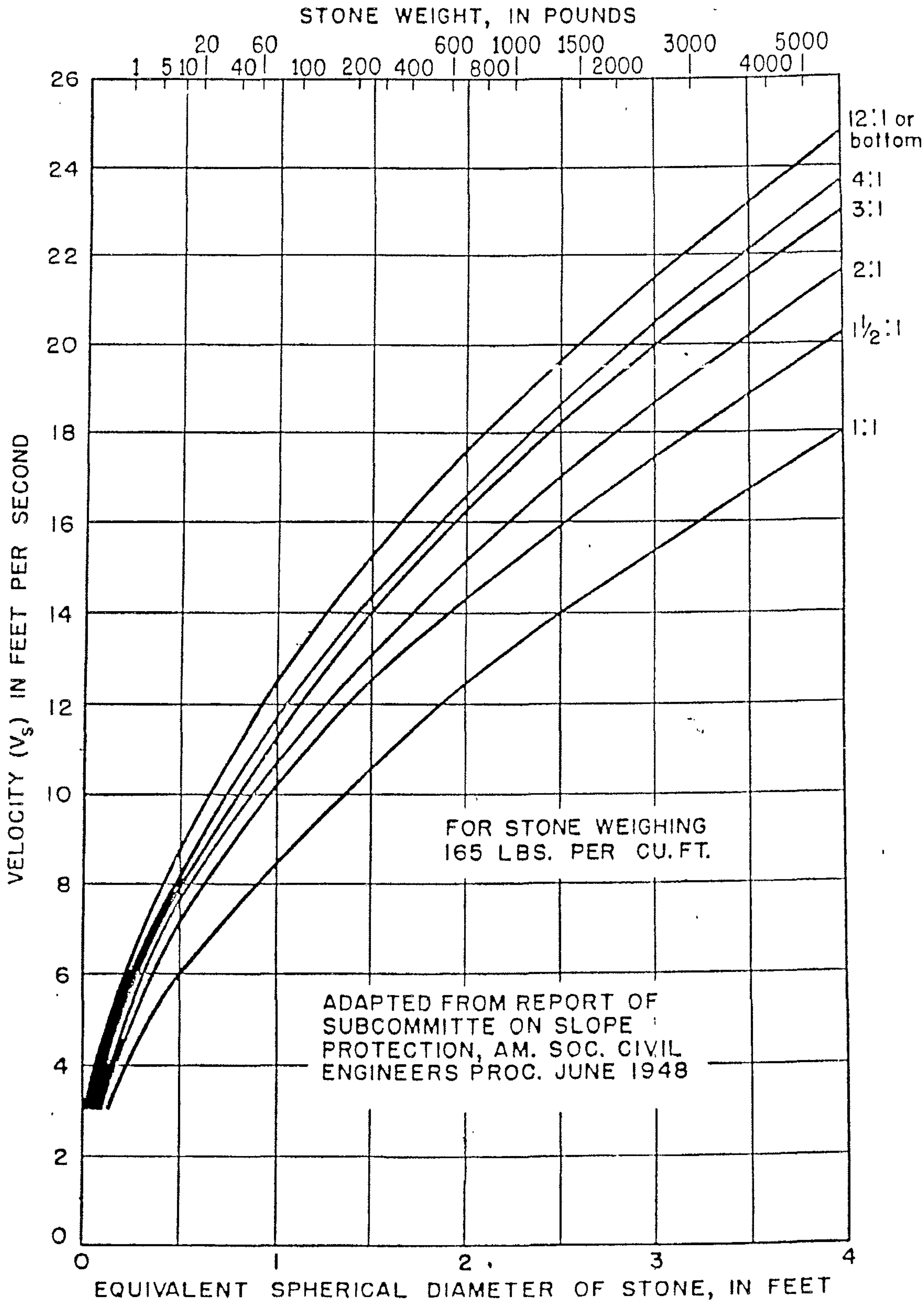

FIGURE 5-2 Size of Stone that will Resist Displacement for Various Velocities and Side Slopes (U.S. Department of Transportation, 1978).