CANYON FUEL COMPANY, LLC

DUGOUT CANYON MINE

C/007/039

PERMIT AREA EXPANSION

ADDITION OF ACREAGE TO FEDERAL LEASE U-07064-027821

OCTOBER 15, 2007

Revised April 2008

Revised July 2008

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No 0018 Date 07/2/2008
In C/0070039, 2008, Incoming
For additional information Expandable

Deficiency List Task ID #2873 Permit Expansion Area – 240 Acres

The members of the review team include the following individuals:

Priscilla Burton (PB)	Steve Christensen (SC)
Dave Darby (DD)	Jerriann Ernsten (JAE)
Pete Hess (PH)	Wayne Western (WW)

GEOLOGIC RESOURCE INFORMATION

R645-301-624.320 and 624.330, Prior to mining the IBC, the Permittee will provide chemical analyses for acid or toxic forming or alkalinity producing materials and their content in the strata above the coal seam, below the coal seam and the coal seam to be mined in the IBC. The parameters needed to make the assessment include; location, pH, pyritic sulfur, sulfate, organic sulfur, total sulfur, total iron, sodium absorption ratio (SAR), acid/base potential, electrical conductivity (EC), total calcium, total magnesium, total potassium, total sodium, total boron and total selenium, total arsenic, total cadmium, total chromium, total lead and total zinc. (DD)

Reference confidential folder Appendix 6-2

MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION

R645-301- 622: The Permittee needs to submit an overburden map Plate 6-4 (October 25, 2007) - Rock Canyon Seam/Gilson Seam Overburden Thickness map that can be read. (DD)

See Plate 6-4

R645-301-521.110, The Permittee will update Plate 5-1 so that it shows the entire permit area and all known active and abandoned mine workings in or near the permit area. (WW)

Plate 5-7 shows the information requested, a reference to plate 5-7 has been added to the text in Section 512.100.

R645-301-521, The Permittee will update all maps in the MRP to show the addition of the 560acre permit expansion. For example Plate 1-2 was not updated. (WW)

All drawings in the permit which show the permit boundary and include the permit expansion area have been updated.

R645-301-521.130, The Permittee will update the ownership maps to show the landowners within the 560-acre addition. (WW)

Plate 1-1 and 1-2 show the ownership within the permit expansion area.

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Refer to Record No 0018 Date 07/2/2008
In C/0070039, 2008 Incoming!
For additional information Expandable!

PERMIT APPLICATION FORMAT AND CONTENTS

R645-301-121.300, The Permittee must submit the archaeology report following proper protocol. The Division previously requested that all maps need to be submitted in color that have color-coded keys. This report does not include a map that clearly illustrates a color-coded key. (JAE)

The report has been resubmitted, please make sure the color copy is only placed in the confidential folder and any other files within the Division's record keeping system receive a copy not the original colored version.

HISTORIC AND ARCHEOLOGICAL RESOURCE INFORMATION

R645-301-411.140, The 2007 results show that there was one archeological site observed within the area surveyed. The report does not provide a recommendation on eligibility. Although DOGM ultimately provides the eligibility determination, this information must be provided in the MRP. (JAE)

Refer to Section 411.140

R645-301-411.142, There is no proof of "coordination efforts ....and clearances" from the SHPO for this extension. The Division will most likely submit, to the SHPO, a finding of "no potential to cause effects" to historic resources within or adjacent to the extension area once we receive an adequate report. The Permittee will submit a copy of the response letter to their Confidential Binder directly in front of the applicable archaeological report. (JAE)

Per a conversation with Joe Helfrich the Division will be responsible to put a copy of the response letter into the Confidential binder, which corresponds with current practices of the Division.

FISH AND WILDLIFE RESOURCE INFORMATION

R645-301-322.220, The archaeology report (Sinulus 2007; SPUT 555) states that there is a salt lick just above the permit area. The DOGM would like more information about this lick – is it natural, man-made, actively being used by domestic and wild animals, and is this lick within the angel of draw? (JAE)

Refer to Section 411.140

R645-301-322, The Permittee mentions a 2007 fly over raptor report, but did not provide the report with this Application. It is not clear to the Division whether Sections 16 W1/2 and 17 N1/2 were surveyed during the 2007 flyover survey for cliff dwellers. The Permittee must provide the 2007 report. (JAE)

2007 Raptor Survey report is provided for placement in the Confidential binder, behind tab "Raptor Survey 2007". Previously this raptor survey was included with the Mine's annual report, this submittal will fulfill this annual report requirement for 2007.

R645-301-332, -333, The Permittee does not provide information concerning this expansion action and these two stands. The Division considers that the Permittee must provide a protection or mitigation plan for possible tree-nesting raptors that may be impacted by subsidence. (JE)

The referenced stands of trees are no longer within the angle-of-draw and no surface disturbance is currently planned for either stand.

R645-301-330, The Permittee did not address whether there would be significant changes in operations that could change the current water consumption calculations. The Division will most likely issue a new set of guidelines that the Permittee must address for this 487acre extension. (JE)

The windy gap process calculations have been updated, see Section 322.300.

R645-301-333, Although the Permittee already adheres very strictly to exclusionary periods,there is no commitment in the MRP. The Permittee must provide this commitment. As standard operating procedure, the Division will always coordinate the Permittee and DWR to discuss any conflicts that may arise. This commitment must be located in the 333 section of the MRP. • The Division requires the Permittee to provide an update on the mitigation plans (two) discussed in Vol. Chap 3, Sec 322.200, pg. 3.24. This brief summary must be included just below the current insertion. (JE)

Refer to Sections 322.200 and 358.

RIGHT OF ENTRY

R645-301-121.200, Calculations of surface land ownership categories of fee and "other federal lands" on pages 1-9 and 1- 10 of Section 114 should be verified for accuracy. Calculations of coal ownership acreage for federal and state leases should be checked for accuracy. (PB)

Information has been reviewed and revised.

SUBSIDENCE CONTROL PLAN

R645-301-525.100 and R645-301-525.700, It appears from Plate 1-1 that landowners, George and Margaret Conover were inadvertently omitted from the subsidence surveynotification. Please verify the surface ownership boundary and notify George and Margaret Conover, if their surface falls within the federal coal lease area. (PB)

Letter has been sent to George and Margaret Conover, letter dated March 14, 2008. The letter was sent in care of the "family trust" address which is PO Box 83, Ferron, Utah 84523

COAL RECOVERY

R645-301-522, The Permittee must show that they will achieve maximum economic coal recovery on the 560-acre expansion. The Division does rely upon the Resource Recovery Protection Plan developed by the BLM in making that determination. If the Permittee included a copy of the R2P2 in the application or a letter from the BLM stating that they made a finding about maximum economic coal recovery that would help the Division make the finding. (WW)

A copy of the R2P2 was submitted in October 2007 as part of the confidential information to Appendix 5-12. Please refer to the confidential binder information submitted previously.

HYDROLOGIC RESOURCE INFORMATION

R645-301-724: Baseline Data Collection (Surface and Groundwater)

The Permittee must provide data that demonstrates seasonal variation in both surface water quality and surface water quantity for the Cow Canyon and unidentified drainage located in Sections 16 and 17 respectively of the proposed permit expansion area. The Division's Tech 004-Water Monitoring guideline recommends two years of baseline data collection. In order to establish seasonal variation and meet the baseline requirements, a minimum of one full calendar year of data is required. In addition, in order to adequately assess the potential for mining related impacts on the drainage, the Permittee needs to establish where the perennial flow begins in these drainages relative to the mine plan and projected subsidence impacts. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

The Permittee must provide additional groundwater baseline data or provide a scientifically justifiable reason for not doing so. Springs 211, 212, 213 and 214 are located within the Cow Canyon drainage. According to the approved MRP, they were sampled one time on November 21, 1998. Springs 261, 262 and 263 are located in the unidentified drainage in Section 17 and according to the approved MRP, were sampled one time on November 21, 1998. Attachment 1 of the Update to the Probable Hydrologic Consequences of Coal Mining at the Dugout Mine in Appendix 7-3 (PHC Update) contains the baseline spring field data for the proposed expansion. The spring data provided reveals that at the most, the springs were sampled two times during May and June of 2007. Some springs were sampled one time only. In addition, no sampling points are depicted on Figure 1 of Attachment 1. Furthermore, springs 260A, 262A, 263A, 300, 301 and 320 are not depicted on 7-1 or any other figure. The Permittee must provide an accurate representation of what was sampled and where. The submitted baseline data is not adequate to demonstrate seasonal variation. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

The Permittee must provide baseline data information for the water rights within the proposed permit expansion as depicted on Plate 7-2, Water Rights. Appendix 7-1 provides the general water right information obtained through the Division of Water Rights database, however, in order for the baseline data requirement to be met, data demonstrating seasonal variation in flow and quality must be submitted to the Division. Baseline data is necessary in the event that claims are made that mining activity has impacted these resources. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

R645-301-725: Baseline Cumulative Impact Area

The application does not meet the Baseline Cumulative Impact Area requirements as outlined in R645-301-725. Without adequate baseline data, a characterization of the hydrologic resources (both surface and ground water) within the proposed permit expansion and adjacent areas is not possible. The Permittee must provide the hydrologic information necessary to assess the probable cumulative hydrologic impacts of the proposed coal mining activity within the proposed expansion and adjacent areas. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

R645-301-728: Probable Hydrologic Consequences

The Permittee must provide a more detailed discussion (based on actual baseline data or data statistically representative of the site) as to the probable hydrologic consequences of the proposed mining activity on surface water, groundwater and water rights located within and adjacent to the proposed permit expansion. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

The Update to the Probable Hydrologic Consequences of Coal Mining at the Dugout Mine in Appendix 7-3 (PHC Update) does not discuss potential impacts to either the Cow Canyon Drainage or the un-named drainage located in Section 17 of the proposed permit expansion. Based upon their location relative to longwall activity, the Permittee must specifically address the potential for impacts to these drainages in Section 3.1.1 of the PHC Update. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

In addition, the PHC Update does not adequately discuss the impacts to groundwater resources. 5 springs (321, 260, 261, 262 and 263) are depicted on Plate 7-1 in the unnamed drainage of Section 17. 5 springs are depicted on Plate 7-1 in the Cow Canyon Drainage (211, 212, 213, 214 and 322). However, only three springs (260, 321 and 213) appear to be addressed/identified within the Hydrogeology section (2.8) of the PHC Update. The other springs are not identified nor their characteristics discussed. The Permittee must include these groundwater resources in the PHC Update and discuss the potential for them to be impacted by mining activity. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

The potential for mining related impacts to the water rights identified on Plate 7-2 need to be addressed in the Updated PHC. (SC)

Refer to Appendix 7-3, Addendum to PHC and text in Section 724

Section 2.2 of the Update To the Probable Hydrologic Consequences of Coal Mining at the Dugout Mine in Appendix 7-3, the Permittee states, "Baseline field data have been collected form surface and ground water sites in the expansion area". The submittal contains no surface water data from the proposed expansion area. The Permittee must address this discrepancy. (SC)

Data has been added to Appendix 7-3, Addendum to PHC

Section 2.3 of the Update To the Probable Hydrologic Consequences of Coal Mining at the Dugout Mine in Appendix 7-3, the Permittee states, "The 600 acre expansion sample locations are identified on PHC Update Figure 1". The submitted Figure 1 does not depict any sampling locations. The Permittee must address this discrepancy.

Sampling locations are shown on Plate 7-1.

Section 2.7.2. of the Update To the Probable Hydrologic Consequences of Coal Mining at the Dugout Mine in Appendix 7-3 states, "The segments of drainages that will be undermined in Cow Canyon are ephemeral in nature." However, subsequent discussions with a Dugout Canyon Mine representative revealed that the perennial flow begins in the east fork of the Cow Canyon Drainage. It was further discussed that perennial flow is evident north of the confluence of the west and east forks of the Cow Canyon Drainage in the southeast quarter of Section 16. The Permittee must clarify the aforementioned statement as to the nature and location of perennialflow in the

Cow Canyon Drainage. In addition, the Permittee must discuss the flow characteristics of the unnamed drainage in Section 17 of the proposed expansion area (See aforementioned deficiency regarding baseline data for surface water). (SC)

Refer to Section 724.200

The last paragraph of Section 2.8.2.1 of the Update To the Probable Hydrologic Consequences of Coal Mining at the Dugout Mine in Appendix 7-3 states "Two new Colton springs have been added to the water monitoring plan for Dugout Mine. These two springs are 213 and 321." According to Plate 7-1, Hydrologic Monitoring Stations and Table 7-4, Groundwater Monitoring Program, spring 213 is not slated for monitoring. In addition, it's stated that Spring 213 is located in Section 22. According to Plate 7-1, Spring 213 is in section 16. The Permittee must address these discrepancies. (SC)

The incorrect information has been corrected or removed.

R645-301-722, -731: Location and Extent of Subsurface Water

The application does not meet the Maps, Plans and Cross Sections requirements for Subsurface Water Resource Maps as required by R645-301-722.100. Page 7-2 of the application provides a reference to Figure 7-1 of the approved MRP. Figure 7-1, General Hydrostratigraphic Cross Section, is labeled as "Modified from Lines (1985)". Upon review, the Lines, 1985 technical paper is entitled "The Ground-Water System and Possible Effects of Underground Coal Mining in the Trail Mountain Area, Central Utah", USGS Water Supply Paper 2259. Trail Mountain is located in the Wasatch Plateau. The Permittee offers no discussion as to how the generalized hydrogeology of the Wasatch Plateau is comparable to the Book Cliffs region where the Dugout facility is located. As required by R645-301-722.100, the Permittee should provide the appropriate cross-sections and maps that depict the "location and extent of subsurface water, if encountered, within the proposed permit or adjacent areas". As required, the cross-sections and contour maps should also include "seasonal differences of head in the different aquifers". (SC)

See Appendix 7-3, Addendum, Attachment 1, Figure 2. Aslo see Section 724.100, Groundwater Systems – Perched Groundwater System.

R645-301-731: Ground and Surface Water Monitoring

The Permittee must add additional ground and surface water monitoring points. In order to make an accurate determination as to whether mining activity has impacted the ground and surface water resources within the proposed permit expansion, additional monitoring is required. Additional monitoring points will need to be added to the relevant plates and tables that outline Dugout's water monitoring program. (SC)

Refer to Plate 7-1, Section 731, and Tables 7-4 and 7-5

CHAPTER 1

LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

TABLE OF CONTENTS

Section — Page

110 MINIMUM REQUIREMENTS FOR LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION 1-1

111 Introduction 1-1

112 Identification of Interests 1-1

112.100 Business Entity 1-1
112.200 Applicant and Operator 1-1
112.300 Officers of the Applicant 1-2
112.400 Coal Mining and Reclamation Operation Owned or Controlled 1-2
112.500 Legal or Equitable Owner of the Surface and Mineral Properties 1-4
112.600 Owners of Record of Property Contiguous to Proposed Permit Area 1-4
112.700 MSHA Numbers 1-5
112.800 Interest in Contiguous Lands 1-6
112.900 Certification of Submitted Information 1-6

113 Violation Information 1-6

114 Right-of-Entry Information 1-6

115 Status of Unsuitability Claims 1-12

116 Permit Term 1-12

117 Insurance, Proof of Publication, and Facilities and Structures Used in Common 1-12

118 Filing Fee 1-13

120 PERMIT APPLICATION FORMAT AND CONTENTS 1-13

130 REPORTING OF TECHNICAL DATA 1-13

140 MAPS AND PLANS 1-13

150 COMPLETENESS 1-13

LIST OF PLATES

Plate

1-1 Surface Ownership

1-2 Coal Ownership

1-3 Surface Ownership Along County Road

1-4 Dugout Canyon Mine Permit Area

LIST OF APPENDICES

Appendix

1-1 Coal Lease Documents

1-2 Insurance and Proof of Publication

1-3 Surface Lease Documents

1-4 Disturbed Area Legal Description

CHAPTER 1

LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

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

111 Introduction

For information pertaining to this section(s) refer to General Chapter 1 binder for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112 Identification of Interests

112.100 Business Entity

The Dugout underground coal mining operation is located in Carbon County, Utah. The surface facilities for the Dugout Canyon Mine are within Section 23, Township 13 South, Range 12 East, SLBM approximately 11 miles northeast of Wellington, Utah.

For addition information refer to General Chapter 1 binder for Canyon Fuel Company, LLC Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.200 Applicant and Operator

For information pertaining to this section refer to General Chapter 1 binder for Canyon Fuel Company, LLC prepared for Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.300 Officers of the Applicant

For information pertaining to this section refer to General Chapter 1 binder for Canyon Fuel Company, LLC prepared for Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.400 Coal Mining and Reclamation Operation Owned or Controlled

The following list describes all permits held by Canyon Fuel Company, LLC, all pending applications for permits, and any permit recognized as necessary in the future for which no application has been filed. Identification numbers of applications or permits are contained in the following list. Many of the agencies listed, however, have review responsibility only and may not have submitted a numbered permit.

Permit	Issuing Authority	Approval Status/ Identification No.
Mining and Reclamation Permit C/007/039	State of Utah Department of Natural Resources Division of Oil, Gas and Mining Department of Interior U.S. Geological Survey and Office of Surface Mining Department of Agriculture U.S. Forest Service Manti La Sal National Forest	Approved
U.P.D.E.S. Permit UTG-040020/UT0025593	Environmental Protection Agency and Utah D.E.Q.	Approved
Business License	Carbon County	Approved
Mine Health and Safety Permits 42-01890 and 42-01888, 1211-UT-09-01890-01	Mine Safety and Health Administration - Utah	Approved

Radio Permits	Federal Communications Commission	Approved
Certificate of Insurance and Authorization to do Business in State	State Industrial Development Commission	Approved
Road Agreement	Carbon County	Approved
Air Quality Approval Order	State of Utah Utah Air Conservation Committee Department of Health Division of Environmental Health	Approved
Stream Channel Alteration Permit	State Engineer	Approved

The Canyon Coal Company, LLC mining permits and operations are:

SUFCO Mine	C/041/002
Skyline Mine	C/007/005
Soldier Canyon Mine	C/007/018
Banning Loadout	C/007/034
Dugout Canyon Mine	C/007/039

The issuing authority for the Canyon Fuel Company permits is the UDOGM.

Operations held by subsidiary companies of Arch Coal, Inc. and corporate structure are presented on Figure 1-1 in the General Chapter 1 for Canyon Fuel Company, LLC. Facility names, mailing addresses and permit numbers for these operations are provided in either Table 1-1 and/or Table 1-2. For additional information refer to the General Chapter 1 binder for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

112.500 Legal or Equitable Owner of the Surface and Mineral Properties

The legal and equitable owners of the surface and mineral properties to be affected by this mining operation during the duration of the permit period are the State of Utah, Bureau of Land Management and Canyon Fuel Company, LLC. Refer to Refuse Pile Amendment for additional ownership information.

Canyon Fuel Company, LLC
6955 South Union Park Center
Suite 540
Salt Lake City, UT 84047
Telephone: (801)569-4700

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

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

Milton & Ardith Thayne Trust
Sunnyside Star Route
Price, Utah 84501

George & Alice Conover Etal
2701 Georgia Way
Sandy, Utah 84092

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

No area within the lands to be affected by surface operations and facilities or within the area of coal to be mined is under a real estate contract.

Coal mining and reclamation operations are listed on Table 1-1 and the corporate structures is presented on Figure 1-1 in the General Chapter 1 binder.

112.600 Owners of Record of Property Contiguous to Proposed Permit Area

Owners of record for surface and mineral properties contiguous to the proposed permit area are shown on Plate 1-1 and 1-2, with the names and addresses listed below.

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

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

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

George & Alice Conover Et.al.
2701 Georgia Way
Sandy, Utah 84092

Milton & Ardith Thayn Trust
Sunnyside Star Route
Price, Utah 84501

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

J. George Conover
275 West Main
Ferron, Utah 84523

Surface ownership along the county road is shown on Plate 1-3. In addition refer to the Refuse Pile Amendment for additional information.

112.700 MSHA Numbers

The Dugout Canyon Mine MSHA numbers are:

MSHA No. 42-01890 Rock Canyon seam (west side of canyon)

MSHA No. 42-01888 Gilson seam (west side of canyon)

MSHA No. 1211-UT-09-01890-01 Dugout Canyon Mine Refuse Pile

112.800 Interest in Contiguous Lands

A State Institutional Trust Lands coal tract is contiguous to the east of the Dugout Canyon Mine permit boundary. Upon approval by UDOGM, Canyon Fuel Company, LLC intends to begin mining the coal reserves in this lease during the current term of this permit application.

112.900 Certification of Submitted Information

Canyon Fuel Company, LLC hereby attests that the information contained in this permit document is true and correct to the best of their knowledge.

113 Violation Information

For violation information refer to Table 1-2 in the General Chapter 1 binder for Canyon Fuel Company, LLC prepared for the Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

114 Right-of-Entry Information

The right to enter the leaseholds conveyed by the State coal leases is conferred to the lessee by the Mineral Leasing Act of 1920 and the leases themselves. Copies of State coal leases ML-42648 and ML-42649, and Federal Lease U07064-027821 which grant CFC the right to enter and conduct underground mining operations, are presented in Appendix 1-1.

The legal description of the CFC leases is:

State Lease ML-42648 - (3640 acres) - Approved

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

Section 8: E1/2

Section 10: S1/2

Section 11: S1/2

Sections 14 and 15: All

Section 17: NE1/4; 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

Section 23: W1/2NW1/4

State Lease ML-42649 - (2212 acres) - Approved

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

Section 3: Lots 1, 2, 3, 4, S1/2 (all)

Section 4: Lots 1, 2, 3, 4, S1/2 (all)

Section 5: Lots 1, 2, SE1/4

Section 9: All

Section 10: N1/2

Section 11: N1/2

Federal Coal Lease U-07064-027821 - (~~2,456.14~~ 2,903.71 acres) - Approved 1 January 1957, Expanded 2007

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

Section 13: S1/2

Section 23: E1/2E1/2, W1/2SE1/4, NE1/4SW1/4

Section 24: All

Section 25: N1/2N1/2

Section 26: N1/2NE1/4

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

Section 17: S1/2N1/2, N1/2SE1/4, E1/2SE1/4, SE1/4SE1/4

Section 18: Lots 2, 3, 4, E1/2SW1/4; SE1/4, S1/2NE1/4, SE1/4NW1/4

Section 19: Lots 1-4, E1/2W1/2, NE1/4, NW1/4SE1/4

Section 21: NW1/4NW1/4

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: NE/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

T. 14 S., R. 12 E., SLBM, Utah (Approximately 26.8 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), 30.4 acres (G-2, G-3, G-4, 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 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 acres (Refuse Pile area) totaling approximately 97.6 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 ~~9,511~~ 9,751acres which includes the following surface ownership and acreage: 10 acres in the BLM right-of-way, approximately 567 acres of other

federal lands, 920 acres of state lands, and fee acreage of approximately ~~8,014~~ 8,254 acres (Plate 1-1 and RA Plate 1-1).

Coal ownership acreage within the permit area includes approximately ~~2,844~~ 3084 acres of federal coal, approximately 5840 acres of state coal, and 827 acres of fee coal (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.

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 except N1/2N1/2
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
Section 24:	All
Section 25:	N1/2N1/2
Section 26:	N1/2NE1/4

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

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

~~Section 16~~	~~W1/2~~
Section 17	All except N1/2N1/2
Section 18	All except N1/2N1/2
Section 19	All
Section 20	All
Section 21	SW1/4; SW1/4NW1/4; NW1/4NW1/4
Section 28	NW1/4; N1/2SW1/4; SW1/4SW1/4
Section 29	All
Section 30	NW1/4NW1/4; E1/2; E1/2W1/2

T. 14 S., R. 12 E., SLBM, Utah

Section 18	Portion N1/2NE1/4

Topsoil is being stored in T14S, R12E, Section 8, a storage area permitted to Soldier Canyon Mine. See Chapter 2 for additional details concerning the topsoil storage.

As clarification, in 2007 acreage (487.57 acres) was added to existing Federal Coal Lease U-07064-027821, two hundred and forty-seven acres of this added acreage is already included as part of the Dugout permitted area. Acreage was previously added to the permit area in excess of the Federal leased acreage to act as a subsidence buffer zone (207.57 acres) and to accommodate a revised mine plan (40 acres). In addition, State Lease ML-50582-OBA (320 acres, more or less) was issued to Dugout Canyon Mine in 2007. Future surface disturbance of these leases will be permitted as needed to facilitate mining activities. The subsidence buffer zone acreage was added in T13S, R12E Section 13 and T13S, R13E Sections 17 and 18. The acreage added in T13S, R13E Sections 17 and 18 is now part of Federal Coal Lease U-07064-027821.

The refuse pile is located on property owned by Canyon Fuel Company, LLC. The property is located approximately 6.5 miles southwest of the Dugout Canyon Mine in portions of the NE1/4, SW 1/4 and SE 1/4 of the NE 1/4, in a portion of the NW 1/4 of the SE1/4, and in the NW1/4 of the NE 1/4 of Section 18, Township 14 South, Range 12 East, Salt Lake Base Meridian.

BLM Right-of-Way UTU-77985 grants the right-of-entry for the leach field and associated pipeline. Refer to the right-of-way description above.

115 Status of Unsuitability Claims

To the best knowledge of Canyon Fuel Company, LLC, no portion of the area to be permitted is designated, or under study for being designated, unsuitable for mining.

CFC does not propose to conduct coal mining or reclamation operations within 300 feet of any occupied dwelling. A description of operations to be conducted within 100 feet of a public road is provided in Chapter 5 of this M&RP, together with a discussion of plans to protect the interests of the public.

116 Permit Term

The anticipated mining progression during operation of the Dugout Canyon Mine is outlined on Plate 5-7. Rates of production for the permit term are presented in Section 523. Reclamation operations are discussed in Chapters 2, 3, 5, 7, and 8.

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

Certificates of Insurance issued to Canyon Fuel Company, LLC are located in General Chapter 1 binder for Canyon Fuel Company, LLC Dugout Canyon Mine, Soldier Canyon Mine and Banning Loadout operations.

The newspaper advertisement and the verification of the advertisement appearing in the appropriate newspapers are included in Appendix 1-2.

118 Filing Fee

The permit application was accompanied by a $5.00 filing fee. UDOGM retains a record of filing fee payments in their office in Salt Lake City, Utah.

120 PERMIT APPLICATION FORMAT AND CONTENTS

This permit application will comply with R645-301-120.

130 REPORTING OF TECHNICAL DATA

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

140 MAPS AND PLANS

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

150 COMPLETENESS

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

APPENDIX 1-1

Coal Lease Documents

GRANT: SCH

UTAH STATE LEASE FOR COAL
ML 50582-OBA
(Dugout Canyon Mine Deep-Cover Extension)

THIS COAL MINING LEASE AND AGREEMENT (the "Lease") is entered into and executed in duplicate as of February 1, 2007 (the "Effective Date") by and between the STATE OF UTAH, acting by and through the SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION, 675 East 500 South, Suite 500, Salt Lake City, Utah 84102 ("Lessor"), and

ARK LAND COMPANY
CITYPLACE ONE, SUITE 300
ST. LOUIS, MO 63141

having a business address as shown above ("Lessee").

WITNESSETH:

That the State of Utah, as Lessor, in consideration of the rentals, royalties, and other financial consideration paid or required to be paid by Lessee, and the covenants of Lessee set forth below, does hereby GRANT AND LEASE to Lessee the exclusive right and privilege to explore for, drill for, mine, remove, transport, convey, cross-haul, commingle, and sell the coal located within the boundaries of the following-described tract of land (the "Leased Premises") located in Carbon County, State of Utah:

T13S, R13E, SLB&M.
Sec. 16: W½

Containing 320.00 acres, more or less.

Together with the right and privilege to make use of the surface (but only to the extent owned by Lessor) and subsurface of the Leased Premises for uses incident to the mining of coal by Lessee on the Leased Premises or on other lands under the control of Lessee or mined in connection with operations on the Leased Premises, including, but not limited to, conveying, storing, loading, hauling, commingling, cross-hauling, and otherwise transporting coal; excavating; removing, stockpiling, depositing and redepositing of surface materials; and the subsidence, mitigation, restoration and reclamation of the surface.

This Coal Mining Lease and Agreement is subject to, and Lessee hereby agrees to and accepts, the following covenants, terms, and conditions:

1. LEASED MINERALS.

1.1 Coal. This mineral lease covers coal, which shall mean and include black or brownish-black solid fossil fuels that have been subjected to the natural processes of coalification, and which fall within the classification of coal by rank as anthracitic, bituminous, sub-bituminous, or lignitic, together with closely associated substances which include, but are not limited to other hydrocarbon substances physically contained within the same geologic strata as the coal. In the event that minerals other than coal are discovered during lease operations, Lessee shall promptly notify Lessor.

1.2 Coalbed Methane. To the extent that Lessor owns gas, coalbed methane or coal seam gas (collectively "coalbed methane") within the Leased Premises, Lessee may remove, vent, flare or capture such coalbed methane from the coal strata being mined and any overlying formations if such removal is necessary for safety reasons in the reasonable discretion of Lessee. If Lessee captures or uses such coalbed methane, it shall pay Lessor royalties on the value of such coalbed methane at the prevailing state royalty rate for

natural gas, unless such royalties are expressly waived by Lessor. In the event that Lessor does not own coalbed methane within the Leased Premises, Lessee must obtain the consent of the owner of such coalbed methane prior to removal or capture of such gas. Except as expressly granted herein, the right to extract gas, coalbed methane and coal seam gas is not granted by this Lease.

1.3 No Warranty of Title. Lessor claims title to the mineral estate covered by this Lease. Lessor does not warrant title nor represent that no one will dispute the title asserted by Lessor. It is expressly agreed that Lessor shall not be liable to Lessee for any alleged deficiency in title to the mineral estate, nor shall Lessee become entitled to any refund for any rentals, bonuses, or royalties paid under this Lease in the event of title failure.

2. RESERVATIONS TO LESSOR. Subject to the exclusive rights and privileges granted to Lessee under this Lease, and further provided that Lessor shall refrain from taking actions with respect to the Leased Premises that may unreasonably interfere with Lessee's operations, Lessor hereby excepts and reserves from the operation of this Lease the following rights and privileges (to the extent that Lessor has the right to grant such rights and privileges):

2.1 Rights-of-Way and Easements. Lessor reserves the right, following consultation with the Lessee, to establish rights-of-way and easements upon, through or over the Leased Premises, under terms and conditions that will not unreasonably interfere with operations under this Lease, for roads, pipelines, electric transmission lines, transportation and utility corridors, mineral access, and any other purpose deemed reasonably necessary by Lessor.

2.2 Other Mineral Leases. Lessor reserves the right to enter into mineral leases and agreements with third parties covering minerals other than coal, under terms and conditions that will not unreasonably interfere with operations under this Lease in accordance with Lessor's regulations, if any, governing multiple mineral development.

2.3 Use and Disposal of Surface. To the extent that Lessor owns the surface estate of the Leased Premises and subject to the rights granted to the Lessee pursuant to this Lease, Lessor reserves the right to use, lease, sell, or otherwise dispose of the surface estate or any part thereof. Lessor shall notify Lessee of any such sale, lease, or other disposition of the surface estate.

2.4 Previously Authorized Improvements. If authorized improvements have been placed upon the Leased Premises by a third party prior to the commencement of this Lease, Lessee shall allow the owner of such improvements to remove them within ninety (90) days after the Lease term commences. Nothing in this paragraph shall authorize Lessee to remove surface improvements where Lessor does not own the surface estate.

2.5 Rights Not Expressly Granted. Lessor further reserves all rights and privileges of every kind and nature, except as specifically granted in this Lease.

3. TERM OF LEASE; READJUSTMENT.

3.1 Primary Term. This Lease is granted for a "primary term" of ten (10) years commencing on the Effective Date and for a "secondary term" of an additional ten (10) years, subject to Lessee's compliance with the requirements of paragraph 3.3, Diligent Operations; Minimum Royalty.

3.2 Extension Beyond Secondary Term. Subject to Lessee's compliance with the other provisions of this Lease, this Lease shall remain in effect beyond the secondary term and for as long thereafter as coal is produced in commercial quantities from the Leased Premises, or from lands constituting either (i) a logical mining unit approved by the Bureau of Land Management containing the Leased Premises, or (ii) a mining unit, in which the recoverable coal reserves can be developed in an efficient, economical and orderly manner as a unit with due regard to the conservation of recoverable coal reserves. The second type of mining unit requires a determination by the Lessor that the criteria set forth in item (ii) have been satisfied. The satisfaction of either (i) or (ii) above shall mean that the Lease is contained within an "approved mining unit." For the purposes of this Lease, production of coal in commercial quantities shall mean production during each lease year of at least one per cent (1%) of the recoverable coal reserves within the Leased Premises or within lands constituting an approved mining unit which includes the Leased Premises, as such recoverable coal reserves are determined by Lessor after consultation with Lessee, subject to adjustment from time to time based upon reasonable justification from the Lessee.

3.3 Diligent Operations; Minimum Royalty. In the absence of actual production in commercial quantities as set forth in paragraph 3.2, Extension Beyond Secondary Term, this Lease shall remain in effect beyond the primary term only if the Lessee is engaged in diligent operations, or development activity (which development activity shall include, but not be limited to, pursuit of required permits and approvals), which in Lessor's reasonable discretion is calculated to advance development or production of coal from the Leased Premises or lands constituting an approved mining unit which includes the Leased Premises, and Lessee pays an annual minimum royalty in advance on or before the anniversary date of the Effective Date. The minimum royalty shall be calculated by determining the production royalty that would be payable upon production of one per cent (1%) of the recoverable coal reserves within the Leased Premises, as such recoverable coal reserves are determined by Lessor after consultation with Lessee, subject to adjustment from time to time based upon reasonable justification from the Lessee. The unit value of the recoverable coal reserves for purposes of determining the minimum royalty shall be determined by Lessor using the methodology set forth in 43 Code of Federal Regulations Section 3483.4(c)(1)-(3) (1998). Minimum royalties paid by Lessee pursuant to this paragraph may be credited against production royalties accruing during the term of this Lease.

3.4 Expiration; Cessation of Production. This Lease may not be extended pursuant to paragraph 3.3, Diligent Operations; Minimum Royalty, beyond the end of the twentieth year after the Effective Date except by the actual production of coal in commercial quantities from the Leased Premises or from lands constituting an approved mining unit which includes the Leased Premises. After expiration of the secondary term, this Lease will expire of its own terms, without the necessity of any notice or action by Lessor, if Lessee ceases production of coal in commercial quantities for an entire lease year, unless the Lease is suspended pursuant to paragraph 16.3, Suspension.

3.5 Readjustment. At the end of the primary term and at the end of each ten-year period that this lease is in effect, Lessor may readjust the terms and conditions of this Lease (including without limitation rental rates, minimum royalties, royalty rates and valuation methods, and provisions concerning reclamation). If

within thirty (30) days after submission of the readjusted lease terms to the Lessee, the Lessee determines that any or all of the proposed readjusted terms and conditions are unacceptable, then Lessee shall so notify Lessor in writing and the parties shall attempt to resolve the objectionable term or condition. If the parties are unable to resolve the matter and agree upon the readjusted terms and conditions submitted by Lessor at the end of such ten (10) year period, Lessee shall forfeit any right to the continued extension of this lease, and the lease shall automatically terminate, provided that nothing herein shall be deemed to preclude Lessee from appealing any readjustment by Lessor pursuant to applicable law

3.6 Relinquishment. Lessee may relinquish all or portions of this Lease at any time by filing a written notice of relinquishment with Lessor. Lessor may disapprove any relinquishment if Lessee has failed to pay all rentals, royalties, and other amounts due and owing to the Lessor, if the lease is otherwise not in good standing, or if relinquishment would in Lessors's reasonable determination cause waste of economically recoverable coal. Lessee may not relinquish parcels smaller than a quarter-quarter section or surveyed lot. Upon approval, relinquishment shall relieve the Lessee of all future rental obligations as to the relinquished lands effective as of the date of filing of the relinquishment, but shall not relieve Lessee from other obligations to the extent provided in paragraph 15.2, Effect of Termination.

4. BONUS BID. Lessee agrees to pay Lessor a bonus bid upon each ton of recoverable coal in the Leased Premises on the same basis of valuation and timeliness of payments as Lessee may agree to pay the federal government upon like quality federal coal subsequently added to federal coal lease U-07064 or leased upon nearby federal lands to extend the area of deep-cover coal mining within the Dugout Canyon Mine. Lessor may require Lessee to submit a bond or other sufficient surety to secure Lessee's obligation to pay the bonus bid. The bonus bid may not be credited against any other payments, annual rentals or royalties accruing under the lease.

5. RENTALS. Lessee agrees to pay Lessor an annual rental of three dollars ($3.00) for each acre and fractional part thereof within the Leased Premises. Lessee shall promptly pay annual rentals each year in advance on or before the anniversary date of the Effective Date. Lessee may not credit rentals against production royalties or against minimum royalties payable pursuant to paragraph 3.3, Diligent Operations; Minimum Royalty.

6. ROYALTIES.

6.1 Production Royalties. Lessee shall pay Lessor a production royalty of eight per cent (8%) of the value of all coal severed and removed from the Leased Premises. For all coal sold pursuant to an arm's-length contract, value shall be determined on the basis of the gross proceeds received by Lessee from the sale or disposition of such coal. Gross proceeds shall include all bonuses, allowances or other consideration of any nature received by Lessee for coal actually produced. For any coal that is sold or disposed of other than by an arms-length contract, or for coal that is used within the mine permit area containing the Leased Premises for generation of electricity or for gasification, liquefaction, in situ processing, or other method of extracting energy from such coal, the value of such coal shall be determined by Lessor with reference to (in order of priority): (i) comparable arms-length contracts or other dispositions of like-quality coal produced in the same coal field; (ii) prices reported for that coal to a public utility commission; (iii) prices reported to other governmental agencies; or (iv) other relevant information.

6.2 Allowable Deductions. It is expressly understood and agreed that none of Lessee's mining or production costs, including but not limited to costs for materials, labor, overhead, distribution, transportation within the mine permit area prior to the point of sale, loading, crushing, sizing, screening, or general and administrative activities, may be deducted in computing Lessor's royalty. All such costs shall be entirely borne by Lessee and are anticipated by the rate of royalty set forth in this Lease. In the event that the point

of sale for coal produced from this Lease is located outside the mine permit area boundary, Lessee may deduct the reasonable, actual costs of transportation of such coal from the mine permit area boundary to the point of sale from gross proceeds in computing Lessor's royalty; provided, however, that transportation deductions for coal transported by Lessee, Lessee's affiliates, or by non-arm's-length contract are subject to review and modification by Lessor. Lessee shall be allowed to deduct its actual, reasonable washing and treatment costs from gross proceeds in computing Lessor's royalty; provided, however, that, upon Lessor's request Lessee shall provide to Lessor appropriate justification to demonstrate that Lessee's costs are reasonable.

6.3 Reference to Federal Regulations. It is the intent of Lessor and Lessee that the calculation of the value of coal for royalty purposes be consistent with federal coal regulations governing the valuation of coal, except where this Lease expressly provides otherwise. In no event shall the value of coal used for calculation of royalties under this Lease be less than the value which would be obtained were federal royalty valuation regulations applied.

6.4 Royalty Payment. For all coal severed and removed from the Leased Premises that is used, sold, transported or otherwise disposed of during a particular month, Lessee shall pay royalties to Lessor on or before the end of the next succeeding month. Royalty payments shall be accompanied by a verified statement, in a form approved by Lessor, stating the amount of coal sold or otherwise disposed of, the gross proceeds accruing to Lessee, the calculation of allowable deductions, and any other information reasonably required by Lessor to verify production and disposition of the coal or coal products. In the event that Lessee uses or disposes of coal pursuant to a non-arm's-length contract, or uses coal for generation of electricity or for gasification, liquefaction, in situ processing, or other method of extracting energy from such coal, Lessee shall notify Lessor of such use or disposal on or before the end of the next succeeding month following such use or disposal, and shall pay royalties upon Lessee's good faith estimate of the value of such coal, subject to Lessor's right to determine the value of such coal pursuant to paragraph 6.1, Production Royalties.

6.6 Suspension, Waiver or Reduction of Rents or Royalties. Lessor, to the extent not prohibited by applicable law, is authorized to waive, suspend, or reduce the rental or minimum royalty, or reduce the royalty applicable with respect to the entire Lease, whenever in Lessor's sole judgment it is necessary to do so in order to promote development, or whenever in the Lessor's sole judgment the Lease cannot be successfully operated under the terms provided herein.

7. RECORDKEEPING; INSPECTION; AUDITS.

7.1 Registered Agent; Records. Lessee shall maintain a registered agent within the State of Utah to whom any and all notices may be sent by Lessor and upon whom process may be served. Lessee shall also maintain an office within the State of Utah containing originals or copies of all maps, engineering data, permitting materials, books, records or contracts (whether such documents are in paper or electronic form) generated by Lessee that pertain in any way to coal production, output and valuation; mine operations; coal sales and dispositions; transportation costs; and calculation of royalties from the Leased Premises. Lessee shall maintain such documents for at least seven years after the date of the coal production to which the documents pertain.

7.2 Inspection. Lessor's employees and authorized agents at Lessor's sole risk and expense shall have the right to enter the Leased Premises to check scales as to their accuracy, and to go on any part of the Leased

Premises to examine, inspect, survey and take measurements for the purposes of verifying production amounts and proper lease operations. Upon reasonable notice to Lessee, Lessor's employees and authorized agents shall further have the right to audit, examine and copy (at Lessor's expense) all documents described in paragraph 7.1, Registered Agent; Records, whether such documents are located at the mine site or elsewhere. Lessee shall furnish all conveniences necessary for said inspection, survey, or examination; provided, however, that such inspections shall be conducted in a manner that is in conformance with all applicable mine safety regulations and does not unreasonably interfere with Lessee's operations.

7.3 Geologic Information. In the event Lessee conducts core-drilling operations or other geologic evaluation of the Leased Premises, Lessor may inspect core samples, evaluations thereof, and proprietary geologic information concerning the Leased Premises.

7.4 Confidentiality. Any and all documents and geologic data obtained by Lessor through the exercise of its rights as set forth in paragraphs 7.2, Inspection., and 7.4, Geologic Information., may be declared confidential information by Lessee, in which event Lessor and its authorized agents shall maintain such documents and geologic data as protected records under the Utah Governmental Records Access Management Act or other applicable privacy statute and shall not disclose the same to any third party without the written consent of Lessee, the order of a court of competent jurisdiction requiring such disclosure, or upon termination of this Lease.

8. USE OF SURFACE ESTATE.

8.1 Lessor-Owned Surface. If Lessor owns the surface estate of all or some portion of the Leased Premises, by issuance of this Lease the Lessee has been granted the right to make use of such lands to the extent reasonably necessary and expedient for the economic operation of the leasehold. Lessee's right to surface use of Lessor-owned surface estate shall include the right to subside the surface. Such surface uses shall be exercised subject to the rights reserved to Lessor as provided in paragraph 2, RESERVATIONS TO LESSOR, and without unreasonable interference with the rights of any prior or subsequent lessee of Lessor.

8.2 Split-Estate Lands. If Lessor does not own the surface estate of any portion of the Leased Premises, Lessee's access to and use of the surface of such lands shall be determined by applicable law governing mineral development on split-estate lands, including without limitation applicable statutes governing access by mineral owners to split estate lands, and reclamation and bonding requirements. Lessee shall indemnify, defend and hold Lessor harmless for all claims, causes of action, damages, costs and expenses (including attorney's fees and costs) arising out of or related to damage caused by Lessee's operations to surface lands or improvements owned by third parties.

9. APPLICABLE LAWS AND REGULATIONS; HAZARDOUS SUBSTANCES

9.1 State of Utah and Trust Lands Statute and Regulations. This Lease is issued pursuant to Title 53C, Utah Code Annotated, 1953, as amended, and Lessee is subject to and shall comply with all current and future rules and regulations adopted by the School and Institutional Trust Lands Administration and its successor agencies.

9.2 Other Applicable Laws and Regulations. Lessee shall comply with all applicable federal, state and local statutes, regulations, and ordinances, including without limitation the Utah Coal Mining and Reclamation Act, applicable statutes and regulations relating to mine safety and health, and applicable statutes, regulations and ordinances relating to public health, pollution control, management of hazardous substances and environmental protection.

9.3 Hazardous Substances. Lessee [or other occupant pursuant to any agreement authorizing mining] shall not keep on or about the premises any hazardous substances, as defined under 42 U.S.C. Section 9601(14) or any other Federal environmental law, any regulated substance contained in or released from any underground storage tank, as defined by the Resource Conservation and Recovery Act, 42 U.S.C. Section 6991, *et seq*, or any substances defined and regulated as "hazardous" by applicable State law, (hereinafter, for the purposes of this Lease, collectively referred to as "Hazardous Substances") unless such substances are reasonably necessary in Lessee's mining operations, and the use of such substances or tanks is noted and approved in the Lessee's mining plan, and unless Lessee fully complies with all Federal, State and local laws, regulations, statutes, and ordinances, now in existence or as subsequently enacted or amended, governing Hazardous Substances. Lessee shall immediately notify Lessor, and any other Federal, State and local agency with jurisdiction over the Leased Premises, or surface thereof, or contamination thereon, of (i) all reportable spills or releases of any Hazardous Substance affecting the Leased Premises, (ii) all failures to comply with any applicable Federal, state or local law, regulation or ordinance governing Hazardous Substances, as now enacted or as subsequently enacted or amended, (iii) all inspections of the Leased Premises by, or any correspondence, order, citations, or notifications from any regulatory entity concerning Hazardous Substances affecting the Leased Premises, (iv) all regulatory orders or fines or all response or interim cleanup actions taken by or proposed to be taken by any government entity or private Party concerning the Leased Premises.

9.4 Hazardous Substances Indemnity. Lessee [or other occupant pursuant to any agreement authorizing mining] shall indemnify, defend, and hold harmless Lessor, its agencies, employees, officers, and agents with respect to any and all damages, costs, liabilities, fees (including attorneys' fees and costs), penalties (civil and criminal), and cleanup costs arising out of or in any way related to Lessee's use, disposal, transportation, generation, sale or location upon or affecting the Leased Premises of Hazardous Substances, as defined in paragraph 9.4 of this Lease. This indemnity shall extend to the actions of Lessee's employees, agents assigns, sublessees, contractors, subcontractors, licensees and invitees. Lessee shall further indemnify, defend and hold harmless Lessor and the United States from any and all damages, costs, liabilities, fees (including attorneys' fees and costs), penalties (civil and criminal), and cleanup costs arising out of or in any way related to any breach of the provisions of this Lease concerning Hazardous Substances. This indemnity is in addition to, and in no way limits, the general indemnity contained in paragraph 16.1 of this Lease.

9.5 Waste Certification. The Lessee shall provide upon abandonment, transfer of operation, assignment of rights, sealing-off of a mined area, and prior to lease relinquishment, certification to the Lessor and the Bureau of Land Management that, based upon a complete search of all the operator's records for the Lease, and upon its knowledge of past operations, there have been no reportable quantities of hazardous substances as defined in 40 Code of Federal Regulations Section 302.4, or used oil as defined in Utah Administrative Code R315-15, discharged (as defined at 33 U.S.C.Section 1321(a)(2)), deposited or released within the Leased Premises, either on the surface or underground, and that all remedial actions necessary have been taken to protect human health and the environment with respect to such substances. Lessee shall additionally provide to Lessor and the Bureau of Land Management a complete list of all

hazardous substances, hazardous materials, and their respective Chemical Abstracts Service Registry Numbers, and oil and petroleum products used or stored on, or delivered to, the Leased Premises. Such disclosure will be in addition to any other disclosure required by law or agreement.

10. BONDING.

10.1 Lease Bond Required. At any time after this Lease is executed, if requested by the Lessor, Lessee shall execute and file with the Lessor a good and sufficient bond or other financial guarantee acceptable to Lessor in order to: (a) guarantee Lessee's performance of all covenants and obligations under this Lease, including Lessee's obligation to pay royalties; and (b) ensure compensation for damage, if any, to the surface estate and any surface improvements. The form of the Lease Bond shall meet all federal mineral lease bond requirements as described in 43 Code of Federal Regulations Subpart 3474. Lessee shall also satisfy all reclamation bonding requirements of the Utah Division of Oil, Gas and Mining ("UDOGM") in connection with the issuance of a mine permit which includes the Leased Premises.

10.2 Reclamation Bonding. The bond filed with the Utah Division of Oil, Gas and Mining ("UDOGM") in connection with the issuance of a mine permit which includes the Leased Premises shall be deemed to satisfy Lessor's bonding requirements with respect to Lessee's reclamation obligations under this Lease; provided, however, upon notice to Lessee and a public hearing with respect to the basis for its decision, the Lessor may, in its reasonable discretion, determine that the bond filed with UDOGM is insufficient to protect Lessor's interests. In such an event the Lessor shall enter written findings as to the basis for its calculation of the perceived insufficiency and enter an order establishing the amount of additional bonding required. Lessee shall file any required additional bond with Lessor within thirty (30) days after demand by Lessor. Lessor may increase or decrease the amount of any additional bond from time to time in accordance with the same procedure.

10.3 Release of Additional Bond. Any additional bond required by Lessor pursuant to 10.2, Reclamation Bonding, may be released by Lessor at any time and shall be released no later than the time of final bond release by UDOGM with respect to the Leased Premises.

11. WATER RIGHTS.

11.1 Water Rights in Name of Lessor. If Lessee files to appropriate water for coal mining operations on the Leased Premises, the filing for such water right shall be made by Lessee in the name of Lessor at no cost to Lessor, and such water right shall become an appurtenance to the Leased Premises, subject to Lessee's right to use such water right at no cost during the term of this Lease.

11.2 Option to Purchase. If Lessee purchases or acquires an existing water right for coal mining operations on the Leased Premises, Lessor shall have the option to acquire that portion of such water right as was used on the Leased Premises upon expiration or termination of this Lease. The option price for such water right shall be the fair market value of the water right as of the date of expiration or termination of this Lease. Upon expiration or termination of this Lease, Lessee shall notify Lessor in writing of all water rights purchased or acquired by Lessee for coal mining operations on the Leased Premises and its estimate of the fair market value of such water right. Lessor shall then have forty-five (45) days to exercise its option to acquire the water by payment to Lessee of the estimated fair market value. If Lessor disagrees with Lessee=s estimate of fair market value, Lessor shall notify Lessee of its disagreement within the 45 day option exercise period. The fair market value of the water right shall then be appraised by a single

appraiser mutually acceptable to both parties, which appraisal shall be final and not subject to review or appeal. If the parties cannot agree upon the choice of an appraiser, the fair market value of the water right shall be determined by a court of competent jurisdiction. Conveyance of any water right pursuant to this paragraph shall be by quit claim deed.

12. ASSIGNMENT OR SUBLEASE; OVERRIDING ROYALTIES.

12.1 Consent Required. Lessee shall not assign or sublease this Lease in whole or in part, or otherwise assign or convey any rights or privileges granted by this Lease, including, without limitation, creation of overriding royalties or production payments, without the prior written consent of Lessor. Any assignment, sublease or other conveyance made without prior written consent of Lessor shall have no legal effect unless and until approved in writing by Lessor. Exercise of any right with respect to the Leased Premises in violation of this provision shall constitute a default under this Lease.

12.2 Binding Effect. All of the terms and provisions of this Lease shall be binding upon and shall inure to the benefit of their respective successors, assigns, and sublessees.

12.3 Limitation on Overriding Royalties. Lessor reserves the right to disapprove the creation of an overriding royalty or production payment that would, in Lessor's reasonable discretion, constitute an unreasonable economic burden upon operation of the Lease. In exercising its discretion to disapprove the creation of an overriding royalty, Lessor shall consult with Lessee and any third parties involved and shall prepare findings to evidence the basis of its decision. Cumulative overriding royalties of 2% or less shall be deemed presumptively reasonable unless special circumstances are shown by Lessor to exist.

13. OPERATIONS.

13.1 Permitting. Before Lessee commences exploration, drilling, or mining operations on the Leased Premises, it shall have obtained such permits and posted such bonds as may be required under applicable provisions of the Utah Coal Mining and Reclamation Act, the Surface Mining Control and Reclamation Act, and associated regulations, together with applicable regulations of the surface management agency. Lessee shall maintain any required permits in place for the duration of mining operations and reclamation. Upon request, Lessee shall provide Lessor with a copy of all regulatory filings relating to permitting matters.

13.2 Plan of Operations. Prior to the commencement of any underground mining operations on the Leased Premises, Lessee shall obtain Lessor's approval of a plan of operations for the Leased Premises. The plan of operations shall contain all information required to be contained in a federal Resource Recovery and Protection Plan, as described in 43 Code of Federal Regulations Section 3482.1(b) and (c) (1998). Lessor may modify the proposed plan of operations as is needed to insure that there is no waste of economically recoverable coal reserves contained on the Leased Premises. In this context "waste" shall mean the inefficient utilization of, or the excessive or improper loss of an otherwise economically recoverable coal resource. Lessor shall notify Lessee in writing of its approval or modifications of the plan of operations. The plan of operations submitted by Lessee shall be deemed approved by Lessor if Lessor has not otherwise notified Lessee within sixty (60) days of filing.

13.3 Plan of Operations - Modification. In the event that material changes are required to the plan of operations during the course of mining, Lessee shall submit a modification of the plan of operations to the Lessor. Routine adjustments to the plan of operations based upon geologic circumstances encountered during

day-to-day mining operations do not require the submission of a modification. If the proposed changes require emergency action by Lessor, then the Lessee shall so notify the Lessor at the time of submission of the modification and the parties shall use their best efforts to meet the Lessee's time schedule regarding implementation of the changes. Non-emergency modifications will be reviewed promptly by Lessor to insure that there is no waste of economically recoverable coal reserves pursuant to the plan of operations, as modified, and Lessor shall notify lessee in writing of its approval or modification of the proposed modification. Modifications shall be deemed approved by Lessor if Lessor has not otherwise notified Lessee within thirty (30) days of filing with Lessor.

13.4 Mine Maps. Lessee shall maintain at the mine office clear, accurate, and detailed maps of all actual and planned operations prepared and maintained in the manner prescribed by 43 Code of Federal Regulations Section 3482.3 (1998). Lessee shall provide copies of such maps to Lessor upon request.

13.5 Good Mining Practices. Lessee shall conduct exploration and mining operations on the Leased Premises in accordance with standard industry operating practices, and shall avoid waste of economically recoverable coal. Lessee shall comply with all regulations and directives of the Mine Safety and Health Administration or successor agencies for the health and safety of employees and workers. Lessee shall further comply with the performance standards for underground resource recovery set forth at 43 Code of Federal Regulations Section 3484.1(c) (1998); provided, however, that Lessor may waive such standards from time to time in its reasonable discretion, upon request by Lessee. Coal shall be mined from this Lease by underground methods only.

13.6 Mining Units. Lessor may approve the inclusion of the Leased Premises in a mining unit with federal, private or other non-state lands upon terms and conditions that it deems necessary to protect the interests of the Lessor, including without limitation segregation of production, accounting for commingled coal production, and minimum production requirements or minimum royalties for the Leased Premises.

14. EQUIPMENT; RESTORATION.

14.1 Equipment. Upon termination of this Lease, Lessee shall remove, and shall have the right to remove, all improvements, equipment, stockpiles, and dumps from the Leased Premises within six (6) months; provided, however, that Lessor may, at Lessor's sole risk and expense, and subject to Lessee's compliance with requirements imposed by UDOGM and MSHA, require Lessee to retain in place underground timbering supports, shaft linings, rails, and other installations reasonably necessary for future mining of the Leased Premises. All improvements and equipment remaining on the Leased Premises after six (6) months may be deemed forfeited to Lessor upon written notice of such forfeiture to Lessee. Lessee may abandon underground improvements, equipment of any type, stockpiles and dumps in place if such abandonment is in compliance with applicable law, and further provided that Lessee provides Lessor with financial or other assurances sufficient in Lessor's reasonable discretion to protect Lessor from future environmental liability with respect to such abandonment or any associated hazardous waste spills or releases. Lessee shall identify and locate on the mine map the location of all equipment abandoned on the Lease Premises.

14.2 Restoration and Reclamation. Upon termination of this Lease, Lessee shall reclaim the Leased Premises in accordance with the requirements of applicable law, including mine permits and reclamation plans on file with UDOGM. Lessee shall further abate any hazardous condition on or associated with the Leased Premises. Lessee and representatives of all governmental agencies having jurisdiction shall have the right

to re-enter the Leased Premises for reclamation purposes for a reasonable period after termination of the Lease.

15. DEFAULT

15.1 Notice of Default; Termination. Upon Lessee's violation of or failure to comply with any of the terms, conditions or covenants set forth in this Lease, Lessor shall notify Lessee of such default by registered or certified mail, return receipt requested, at the last address for Lessee set forth in Lessor's files. Lessee shall then have thirty (30) days, or such longer period as may be granted in writing by Lessor, to either cure the default or request a hearing pursuant to the Lessor's administrative adjudication rules. In the event Lessee fails to cure the default or request a hearing within the specified time period, Lessor may cancel this Lease without further notice to or appeal by Lessee.

15.2 Effect of Termination. The termination of this Lease for any reason, whether through expiration, cancellation or relinquishment, shall not limit the rights of the Lessor to recover any royalties and/or damages for which Lessee may be liable, to recover on any bond on file, or to seek injunctive relief to enjoin continuing violations of the Lease terms. No remedy or election under this Lease shall be deemed exclusive, but shall, wherever possible, be cumulative with all other remedies available under this Lease, at law, or in equity. Lessee shall surrender the Leased Premises upon termination; however, the obligations of Lessee with respect to reclamation, indemnification and other continuing covenants imposed by this Lease shall survive the termination.

16. MISCELLANEOUS PROVISIONS.

16.1 Indemnity. Except as limited by paragraph 7.2, Inspection, Lessee shall indemnify and hold Lessor harmless for, from and against each and every claim, demand, liability, loss, cost, damage and expense, including, without limitation, attorneys' fees and court costs, arising in any way out of Lessee's occupation and use of the Leased Premises, including without limitation claims for death, personal injury, property damage, and unpaid wages and benefits. Lessee further agrees to indemnify and hold Lessor harmless for, from and against all claims, demands, liabilities, damages and penalties arising out of any failure of Lessee to comply with any of Lessee's obligations under this Lease, including without limitation attorneys' fees and court costs.

16.2 Interest. Except as set forth in paragraph 4, BONUS BID, interest shall accrue and be payable on all obligations arising under this Lease at such rate as may be set from time to time by rule enacted by Lessor. Interest shall accrue and be payable, without necessity of demand, from the date each such obligation shall arise.

16.3 Suspension. In the event that Lessor in its reasonable discretion determines that suspension is necessary in the interests of conservation of the coal resource, or if Lessee has been prevented from performing any of its obligations or responsibilities under this Lease or from conducting mining operations by labor strikes, fires, floods, explosions, riots, any unusual mining casualties or conditions, Acts of God, government restrictions or orders, severe weather conditions, or other extraordinary events beyond its control, then the time for performance of this Lease by Lessee shall be suspended during the continuance of such acts which prevent performance, excepting any payments due and owing to Lessor.

16.4 Consent to Suit; Jurisdiction (i) Lessor and Lessee agree that all disputes arising out of this Lease shall be litigated only in the Third Judicial District Court for Salt Lake County, Utah; (ii) Lessee consents to the jurisdiction of such court; and (iii) Lessee shall not bring any action against Lessor without exhaustion of available administrative remedies and compliance with applicable requirements of the Utah Governmental Immunity Act.

16.5 No Waiver. No waiver of the breach of any provision of this Lease shall be construed as a waiver of any preceding or succeeding breach of the same or any other provision of this Lease, nor shall the acceptance of rentals or royalties by Lessor during any period of time in which Lessee is in default be deemed to be a waiver of such default.

16.6 Severability. The invalidity of any provision of this Lease, as determined by a court of competent jurisdiction, shall in no way affect the validity of any other provision hereof.

16.7 Entire Lease. This Lease, together with any attached stipulations, sets forth the entire agreement between Lessor and Lessee with respect to the subject matter of this Lease. No subsequent alteration or amendment to this Lease shall be binding upon Lessor and Lessee unless in writing and signed by each of them.

ML 50582-OBA-COAL

IN WITNESS WHEREOF, the parties have executed this Lease as of the date hereinabove first written.

APPROVED AS TO FORM:
MARK L. SHURTLEFF
ATTORNEY GENERAL

By _____

Form Approved: 3-14-07

THE STATE OF UTAH, acting by and through the SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION ("LESSOR")

KEVIN S. CARTER, DIRECTOR

By _____
THOMAS B. FADDIES
ASSISTANT DIRECTOR/MINERALS

ARK LAND COMPANY ("LESSEE")

By: _____
Its: PRESIDENT

ML 50582-OBA-COAL

STATE OF UTAH)
: ss.
COUNTY OF SALT LAKE)

On the 14th day of March, 2007, personally appeared before me Thomas B. Faddis who being by me duly sworn did say that he is Asst Director-Minerals of the School and Institutional Trust Lands Administration of the State of Utah and the signer of the above instrument, who duly acknowledged that he executed the same.

Given under my hand and seal this 14th day of March, 2007.

Becky Pritchett
Notary Public
Residing at:

My commission expires:

BECKY PRITCHETT
NOTARY PUBLIC • STATE of UTAH
675 E. 500 S., SUITE 500
SALT LAKE CITY, UTAH 84102
COMM. EXP. 10-10-10

STATE OF ~~UTAH~~ MISSOURI)
ST LOUIS : ss.
COUNTY OF ~~SALT LAKE~~)

On the 5th day of MARCH, 2007, personally appeared before me STEVEN E MCCURDY, PRESIDENT who being duly sworn did say that he is an officer of ARK LAND and that said instrument was signed in behalf of said corporation by resolution of its Board of Directors, and said that he acknowledged to me that said corporation executed the same.

Given under my hand and seal this 5th day of March, 2007.

Mary C. Hamilton
Notary Public
Residing at: St. Louis, MO

My commission expires

Notary Public Notary Seal State of Missouri

MARY C. HAMILTON
St. Louis City
My Commission Expires
September 14, 2007

JOINDER OF ML 50582-OBA
TO BOOK CLIFFS COAL UNIT

Recitals

1. The Book Cliffs Coal Unit agreement was entered into effective November 1, 2006 between the Utah School and Institutional Trust lands Administration, 675 East, 500 South, Salt Lake City, UT 840102 ("SITLA" of "Lessor") and Canyon Fuel Company, LLC, C/O Ark Land Company, CityPlace One, Suite 300, St. Louis, MO 63141 ("Lessee"), to unitize four trust land coal leases, ML 42648, ML 42649, ML 44365 and ML 48435-OBA, within the Soldier Canyon Mine/Dugout Canyon Mine coal mine complex for purposes of development and production.

2. Effective February 1, 2007, Trust Land coal lease ML 50582-OBA was entered into between the Utah School and Institutional Trust lands Administration, 675 East, 500 South, Salt Lake City, UT 840102 ("SITLA" of "Lessor") and Canyon Fuel Company, LLC, C/O Ark Land Company, CityPlace One, Suite 300, St. Louis, MO 63141 ("Lessee") with an.

3. The lands comprising coal lease ML 50582-OBA include the W2, Section 16, Township 13 South, Range 13 East, SLB&M, Carbon County which shares a common corner with the lands comprising coal lease ML 48435-OBA which is within the Book Cliffs Coal Unit. It is in the interest of both Lessee and Lessor to mine the coal within the lands within ML 50582 in conjunction with mining activity planned in the Book Cliffs Coal Unit area.

NOWTHEREFORE: It is agreed by the parties hereto that the lands within ML 50582-OBA are hereby joined to the Book Cliffs Coal Unit pursuant to the terms of ML 50582-OBA and the Book Cliffs Coal Unit Agreement, effective upon execution of this amendment, for all purposes of development and production. The terms and conditions of mineral lease ML 50582-OBA are superseded and governed by the terms and conditions of the Book Cliffs Coal Unit to the extent allowed by law.

Joinder of ML 50582-OBA
To Book Cliffs Coal Unit

IN WITNESS WHEREOF, the parties have executed this amendment as follows.

THE STATE OF UTAH, acting by and through the SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION ("LESSOR")

APPROVED AS TO FORM:
MARK L. SHURTLEFF
ATTORNEY GENERAL

By _____

Form Approved: 3/7/07

KEVIN S. CARTER, DIRECTOR

By _____
THOMAS B. FADDIES
ASSISTANT DIRECTOR/MINERALS

ARK LAND COMPANY ("LESSEE")

By: _____

Its: President

Joinder of ML 50582-OBA
To Book Cliffs Coal Unit

STATE OF UTAH)
COUNTY OF SALT LAKE)

On the 14th day of March, 20 07, personally appeared before me THOMAS B. FADDIES who duly sworn did say that he is Assistant Director of the School & Institutional Trust Lands Administration of the State of Utah and the signer of the above instrument, who duly acknowledged that he executed the same.

Given under my hand and seal this 14th day of March, 20 07.

NOTARY PUBLIC, residing at:

My Commission Expires:

BECKY PRITCHETT
NOTARY PUBLIC • STATE of UTAH
675 E. 500 S., SUITE 500
SALT LAKE CITY, UTAH 84102
COMM. EXP. 10-10-10

STATE OF ~~UTAH~~ MISSOURI)
COUNTY OF ST. LOUIS)

On the 15th day of March, 20 07, personally appeared before me STEVEN E. MCCURRY, PRESIDENT, who being duly sworn did say that he is an officer of and that said instrument was signed in behalf of said corporation by resolution of its Board of Directors, and said acknowledged to me that said corporation executed the same.

Given under my hand and seal this 15th day of March, 20 07.

NOTARY PUBLIC, residing at:

My Commission Expires

Notary Public Notary Seal State of Missouri

MARY C. HAMILTON
St. Louis City
My Commission Expires
September 14, 2007

CHAPTER 2

SOILS

CHAPTER 2
SOILS

210 INTRODUCTION

This chapter and associated appendices of this M&RP contain all pertinent information relating to identification, management, and reclamation activities associated with the soil resources present in the disturbed area of the Dugout Canyon Mine and the Pace Canyon Fan Portal Breakout. The information has been compiled from the previously approved soil sections for the Sage Point-Dugout Canyon Mine and Soldier Canyon Mine permits, ACT/007/009 and ACT/007/018, respectively, as well as new soil survey information gathered as part of this permit application. 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. All previous surveys fulfilled the requirements established by the U.S. Soil Conservation Service (SCS). 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 by horizon according to Table 1 of the Division's "Guidelines for the Management of Topsoil and Overburden for Underground and Surface Coal Mining" (Leatherwood, 1988).

Additional information can be found in the following amendments: Methane Degassification Amendment (August 2003), Refuse Pile Amendment (February 2003), and the Leachfield Addendum A-1 (March 2001). The remainder of the State Lease ML-48435-OBA (SITLA Lease) was incorporated into the Dugout Canyon Mine permit area in 2005.

A base map of the soils in the permit area has been created by compiling maps from the "Soil Survey of Carbon Area, Utah" prepared by the SCS (Jensen, 1988). The base map illustrates the locations and areal extent of the endemic soil resources within the permit area at an Order III level (Plate 2-1). In the disturbed area of the permit area, an Order I survey was conducted. The locations and areal extent of the endemic soil resources within the disturbed area identified during the Order I survey are illustrated on Plate 2-2.

This chapter provides a description of the pre-mining resources as specified under R645-301-221. Topsoil and subsoil to be saved under R645-301-232 will be removed and segregated from other material. After removal, topsoil will be immediately redistributed in accordance with R645-301-242, stockpiled pending redistribution under R645-301-234, or if demonstrated that an alternative procedure will provide equal or more protection for the topsoil, the Applicant will seek approval from the Division.

In 2007 acreage (487.57 acres) was added to existing Federal Coal Lease U-07064-027821, two hundred and forty-seven acres of this added acreage is already included as part of the Dugout permitted area. Acreage was previously added to the permit area in excess of the Federal lease acreage to act as a subsidence buffer zone (207.57 acres) and to accommodate a revised mine plan (40 acres). In addition, State Lease ML-50582-OBA (320 acres, more or less) was issued to Dugout Canyon Mine in 2007. Future surface disturbance of these leases will be permitted as needed, the disturbance may included degas and exploration well pads, etc. Refer to Plate 1-2 for the location of the acreage incorporated into the permit boundary.

220 ENVIRONMENTAL DESCRIPTION

The Dugout Canyon Mine facilities are located in the northern Book Cliffs - Roan Plateau region. More specifically, the mine is located within Dugout Canyon and Pace Canyon. The majority of the disturbed area is located in Dugout Canyon, with fan portal facilities located in Pace Canyon (Plate 2-1 and PC5-2). The elevation of the disturbed area ranges between approximately 7000 and 7150 feet above MSL. Soils in the mine area are not cultivated due to their thin nature and relatively steep slopes on which they lie. These soils have formed in colluvium derived from sandstone and shale. Soils in the area are usually shallow and consist predominantly of stony to gravelly sandy loams with moderate permeability. The soils are highly susceptible to water erosion. Rock outcrops consist of alternating layers of sandstone and shale. Subordinate amounts of coal are also present.

The Pace Canyon Fan Portal Breakout is located in Pace Canyon (T13S. R13E, Section 30, N1/2NW14). The elevation of the disturbed area ranges between approximately 6950 and 7060 feet above MSL. Soils in the mine area are not cultivated due to their thin nature and relatively steep slopes on which they lie. These soils have been previously disturbed by various activities in the canyon, such as road construction, exploration, mining, logging, etc. The fan area encompasses steep rocky canyon walls with unconsolidated sediment benches.

221 Prime Farmland Investigation

As part of the application for the Sage Point-Dugout Canyon Mine permit, ACT/007/009, a reconnaissance of the disturbed areas was conducted in 1980 to determine if prime farmland was present, and if present, whether it would be impacted by mining activities. The reconnaissance included the presently-proposed disturbed area within the Dugout Canyon Mine permit area. Copies of the applicable pages from the prime farmland investigation for the Sage Point-Dugout Canyon Mine permit and correspondence with the Soil Conservation Service have been included as Appendix 2-1. One area within the previous area of investigation was determined to potentially be prime farmland. However, this area was located near the mouth of Soldier Creek Canyon, outside of the presently proposed permit area. No prime farmland was found in Dugout Canyon or anywhere else within the presently-proposed permit area during the previous investigation.

As part of this permit application, a survey of the disturbed area of the Dugout Canyon Mine was conducted to determine whether the soils could be considered as prime farmland. The Dugout Canyon Mine disturbed area lies within the Rock outcrop-Rubbleland-Travessilla complex and Croydon loam soils area (Plates 2-1 and 2-2). Neither of these soils are considered suitable prime farmland as described by the SCS (Jensen, 1988). No evidence of past cultivation of the soils in the disturbed area was found during the site investigation. Hence, based on the results of both detailed investigations conducted within the area, it is concluded that no prime farmland exists within the proposed permit area.

The survey for prime farmland investigation for the fan portal site was completed by Leland Sasser of the NRCS. The area planned for disturbance is not considered prime farmland. Refer to Appendix 2-1 for a copy of Mr. Sasser's letter.

222 Soil Survey

Soil survey information for those portions of the permit area to be affected by surface operations at the Dugout Canyon Mine is presented in Sections 222.100 through 222.300.

222.100 Soils Map

A map delineating the areal extent of the endemic soils resources within the permit area at an Order III survey level is presented on Plate 2-1. A description of these soils has been reproduced from the SCS "Soil Survey of the Carbon County Area" (Jensen, 1988), and has been included as Appendix 2-2. An Order I soil survey was conducted of the Dugout Canyon Mine disturbed area in October and November 1995. Plate 2-2 illustrates the areal extent of the soils studied as part of the Order I soil survey, the location of the soil test pits excavated during the survey, and the extent of the identified soils.

Dan Larsen , Soil Scientist performed a survey of the Fan Portal area in 2003 and 2004. The 2003 survey was done in conjunction with a BLM environmental assessment for coal exploration holes. The 2004 survey was done on November 5, in conjunction with the proposed installation of the fan. A copy of the 2004 survey, test pit logs and a map showing the location of 2003 -2004 test pit locations is in Appendix 2-3.

The expansion of the permit area in 2007 to add acreage to Federal Coal Lease U-07064-027821 (40 acres, NW1/4NW1/4, Section 21, Township 13S, Range 13E) will include soils mapped as Units 62, 97, and 100 (see Plate 2-1). Area added in 2007 to Sections 16, 17 and 18, T13S R13E under leases U-07064-027821 and ML-50582-OBA will include soils mapped as Units 7, 62, 97,

100, and 101 (see Plate 2-1). Surface disturbance will be permitted as needed to facilitate mining activities.

222.200 Soil Identification

Following is a list of the soils found in and adjacent to the permit area. Their corresponding map units as illustrated on Plate 2-1 are also listed.

Map Unit	Soil Identification
3	Badland-Rubbleland-Rock outcrop complex
6	Beje-Comodore complex
7	Beje-Trag complex
13	Cabba family-Guben-Rock outcrop complex
21	Croydon loam, 8 to 30 percent slopes
23	Curecanti family - Pathead complex
26	Doney family, 50 to 70 percent slopes
32	Frandsen-Gullied land complex
33	Gerst-Badland-Rubbleland complex, 15 to 50 percent slopes
36	Gerst-Strych-Badland complex, 3 to 50 percent slopes
37	Gerst-Strych-Badland complex, 50 to 70 percent slopes
46	Guben-Pathead extremely stony loams
47	Guben-Rock outcrop complex
50	Haverdad loam, moist, 1 to 5 percent slopes
52	Hernandez family, 3 to 8 percent slopes
53	Hernandez family, moist, 1 to 6 percent slopes
62	Midfork family-Comodore complex
66	Mivida gravelly fine sandy loam, 3 to 8 percent slopes
72	Pathead-Corecanti family association
75	Perma family, 15 to 40 percent slopes
81	Persayo-Greybull complex
84	Podo-Rock outcrop complex
86	Rabbitex-Doney family-Midfork family complex
88	Rabbitex family-Datino Variant complex
96	Rock outcrop-Rubbleland-Travessilla complex
97	Rottulee family-Trag complex
100	Senchert loam, 3 to 15 percent slopes
101	Senchert loam, 30 to 50 percent slopes
103	Senchert-Toza family complex
105	Senchert family-Senchert complex
107	Supert-Winetti complex
109	Silas-Brycan loams

113 Strych very stony loam, 3 to 15 percent slopes

According to the SCS (Jensen, 1988), soils present on the east facing slopes of Dugout Canyon are part of the Rock outcrop-Rubbleland-Travessilla complex while those on the west facing slopes are part of the Croydon loam and Midfork family-Comodore complex.

However, observation of the soils present on the west and northwest facing slopes suggest that inclusions of the Comodore-Datino Variant complex are prevalent throughout. The conclusion that Comodore-Datino Variant complex soils are present in this area is based on the presence of characteristics typical of these soils such as: 40 to 60 percent slopes, elevations of slopes between 6800 and 8100 feet, 40 to 60 percent slopes, Douglas-fir and related vegetation, and very stony, relatively shallow soils. A telephone conversation between Mr. Chris D. Hansen of Canyon Fuel Company, LLC, Ms. Vicky Bailey of EarthFax Engineering, Inc. and Mr. Leland Sausser of the Natural Resources Conservation Service concerning the presence of Comodore-Datino Variant complex soils within areas mapped as Croydon loam occurred on March 3, 1998. Mr. Sausser briefly reviewed available maps and photos and agreed that this may indeed occur but the maps in the Soil Survey of Carbon Area, Utah (Jensen, 1988) are generally correct as published.

Soils present in the narrow V-shaped Dugout Canyon that lie within the disturbed area of the mine have been identified and characterized. A large portion of the mine area is covered with overburden that consists of soil mixed with coal waste and/or waste rock from previous mining operations at the site. In these areas, the original soil structure has been obliterated or the native soils have been deeply covered. The remainder of the disturbed area has soils that appear to be in-place or have been only slightly disturbed. The approximate boundary between the overburden and in-place and/or slightly disturbed soils is illustrated on Plate 2-2. The overburden has been labeled on Plate 2-2 as OB while the in-place soils have been labeled as TS.

The overburden is a mixture of rock and/or coal waste with Travessilla soils. The Travessilla soils are classified as loamy, mixed (calcareous) mesic, Lithic Ustic Torriorthents (Jensen, 1988). Soil type TS is a loamy, mixed, Typic Haploboroll.

APPENDIX 2-2

Soil Conservation Survey Descriptions of the Permit Area Soils

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

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

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

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

This unit is used as wildlife habitat and rangeland.

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

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

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

CHAPTER 3

BIOLOGY

TABLE OF CONTENTS

Section — Page

310 INTRODUCTION 3-1

311 Vegetative, Fish and Wildlife Resources 3-1

312 Potential Impact to Vegetative, Fish and Wildlife Resources 3-1

313 Description of Reclamation Plan 3-2

320 ENVIRONMENTAL DESCRIPTION 3-2

321 Vegetation Information 3-2

321.100 Plant Communities Within the Proposed Permit Area 3-2
321.200 Land Productivity Prior to Mining 3-10

322 Fish and Wildlife Information 3-10

322.100 Level of Detail 3-11
322.200 Site-specific Resource Information 3-11
322.300 Fish and Wildlife Service Review 3-24

323 Maps and Aerial Photographs 3-24
323.100 Location and Boundary of Proposed Reference Area 3-25
323.200 Elevations and Locations of Monitoring Stations 3-26
323.300 Facilities for Protection and Enhancement 3-26
323.400 Vegetation Type and Plant Communities 3-26

330 OPERATION PLAN 3-27

331 Measures Taken to Disturb the Smallest Practicable Area 3-27

332 Description of Anticipated Impact of Subsidence 3-27

333 Plan to Minimize Disturbances and Adverse Impacts 3-29

333.100 Minimized Disturbance to Endangered or Threatened Species 3-30

TABLE OF CONTENTS (Continued)

Section | Page

333.200 Species and Habitats 3-30
333.300 Protective Measures 3-31

340 RECLAMATION PLAN 3-33

341 Revegetation 3-33

341.100 Schedule and Timetable 3-34
341.200 Descriptions 3-34
341.300 Greenhouse Studies, Field Trials or Other Equivalent Studies 3-46

342 Fish and Wildlife 3-46

342.100 Enhancement Measures 3-46
342.200 Plants Used for Wildlife Habitat 3-46
342.300 Cropland 3-47
342.400 Residential, Public Service and Industrial Land Use 3-47

350 PERFORMANCE STANDARDS 3-47

351 General Requirements 3-47

352 Contemporaneous Reclamation 3-47

353 Revegetation: General Requirements 3-48

353.100 Vegetative Cover 3-48
353.200 Reestablished Plant Species 3-49
353.300 Vegetative Exception 3-50
353.400 Cropland 3-50

354 Revegetation: Timing 3-50

355 Revegetation: Mulching and Other Soil Stabilizing Practices 3-50

TABLE OF CONTENTS (Continued)

Section | Page

356 Revegetation: Standards for Success 3-50

356.100 Success of Revegetation 3-52
356.200 Standards for Success 3-53
356.300 Siltation Structure Maintenance 3-54
356.400 Removal of Siltation Structures 3-54

357 Revegetation: Extended Responsibility Period 3-55

357.100 Extended Period Begins 3-55
357.200 Vegetative Parameters 3-55
357.300 Husbandry Practices 3-55

358 Protection of Fish, Wildlife and Related Environmental Values 3-55

358.100 Existence of Endangered or Threatened Species 3-56
358.200 Bald and Golden Eagles 3-56
358.300 Taking of Endangered or Threatened Species 3-56
358.400 Replacement of Wetland and Riparian Vegetation 3-56
358.500 Manmade Wildlife Protection Measure 3-57

REFERENCES 3-58

LIST OF TABLES

Table

3-3 Reclamation Monitoring Schedule 3-44

LIST OF FIGURES

Figure

3-1 Reclamation Channel Slope Definitions 3-45

LIST OF PLATES

Plate

3-1 Vegetation

3-1A Range Site Classification of Disturbed Area

3-1B Dominant Vegetation Communities Sampled in 1996

3-1C Dominant Vegetation Communities Sampled in 1997

3-1D Fish Creek Range Site Area

3-1E Pace Canyon Fan Vegetation and Reference Area

3-2 Wildlife (Confidential Folder)

3-3 Potential Locations of Cliff Escarpments Within Permit Boundary and Adjacent Area

LIST OF APPENDICES

Appendix

3-1 Vegetation Data

3-2 UDWR Report

3-3 Fish and Wildlife Data

3-4 Pace Canyon Fan Portal - Vegetation and Wildlife Data

CHAPTER 3
BIOLOGY

310 INTRODUCTION

This chapter presents a description of the biological resources found on the Dugout Canyon permit and adjacent areas. Additional information can be found in the following amendments: Methane Degassification Amendment (August 20
03), Refuse Pile Amendment (February 2003), and the Leachfield Addendum A-1 (March 2001). The remainder of the State Lease ML-48435-OBA (SITLA Lease) was incorporated into the Dugout Canyon Mine permit area in 2005.

As clarification, in 2007 acreage (487.57 acres) was added to existing Federal Coal Lease U-07064-027821, two hundred and forty-seven acres of this added acreage is already included as part of the Dugout permitted area. Acreage was previously added to the permit area in excess of the Federal leased acreage to act as a subsidence buffer zone (207.57 acres) and to accommodate a revised mine plan (40 acres). In addition, State Lease ML-50582-OBA (320 acres, more or less) was issued to Dugout Canyon Mine in 2007. Future surface disturbance of these leases will be permitted as needed to facilitate mining activities. Refer to Plate 1-2 for the location of the acreage incorporated into the permit boundary.

The data used in preparation of this chapter have been gathered from the Sage Point-Dugout Canyon Mining and Reclamation Plan, Soldier Creek Coal Company Mining and Reclamation Plan, Environmental Research and Technology, Inc., Utah Division of Wildlife Resource (UDWR), Utah State Fish and Game, Eureka Energy Company (Nicolas Temnikov and Christopher A. Slaboszewicz), Soil Survey of Carbon Area, Utah, aerial photography, and Natural Gas Corporation of California.

311 Vegetative, Fish and Wildlife Resources

Vegetative, fish, and wildlife resource conditions in and adjacent to the proposed Dugout Canyon Mine are discussed in Section 320.

311 Vegetative, Fish and Wildlife Resources

Vegetative, fish, and wildlife resource conditions in and adjacent to the proposed Dugout Canyon Mine are discussed in Section 320.

312 Potential Impact to Vegetative, Fish and Wildlife Resources

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

313 Description of Reclamation Plan

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

320 ENVIRONMENTAL DESCRIPTION

321 Vegetation Information

This section contains the environmental descriptions of the vegetation for the permit and adjacent areas.

321.100 Plant Communities Within the Proposed Permit Area

Vegetation communities of the permit area were first investigated by Dr. Steven Richardson of Logan, Utah during 1979. These studies encompassed the 22,506 acres of the formerly proposed Sage Point - Dugout Canyon permit area. Dr. Richardson's studies were subsequently upgraded in 1980 by Mr. Steven R. Viert and presented in the Sage Point - Dugout Canyon permit application submitted December 8, 1980 and approved by the Division in May, 1984 (Permit No. ACT/007/009). The vegetation designations used on Plate 3-1 are a combination of their studies, aerial photography, in association with the Soil Survey of Carbon Area, Utah and field verification.

Plate 3-1 has been prepared using the following vegetation designations:

Barren Ground	(B)
Douglas Fir	(DF)
Deciduous Streambank	(DS)
Farmland-Weeds	(FW)
Greasewood-Sagebrush	(GS)
High Shrubs	(HS)
Mixed Conifer	(MC)

Mixed Conifer-Mountain Brush	(MCMB)
Pinyon-Juniper	(PJ)
Ponderosa Pine	(PP)
Quaking Aspen	(QA)
Sagebrush	(S)
Shrub-Grass-Juniper	(SGJ)
Deciduous Stream Bank Vegetation and limited riparian vegetation (Pace and Rock Creek)	(DSR)

As discussed in the report prepared by Mt. Nebo Scientific, the Dugout Canyon disturbed area contains riparian, rabbitbrush/yellow sweet clover, and Pinyon/Juniper vegetation designations (see Appendix 3-1).

The dominant vegetation communities occurring in the area are somewhere below the climax stage of succession. Historic livestock grazing practices have caused a decline, or disappearance, of many naturally occurring species and their replacement by others (often noxious weeds). Over several years, this effect has altered the composition of the floral communities of the area.

Other impacts to the vegetation communities of the area have resulted from the previous construction of roads. Roads and trails tend to follow drainages and have thereby impacted the riparian, sagebrush, mountain brush, and coniferous communities. Weeds usually dominate the disturbed road banks. Mining facilities in Dugout Canyon constructed prior to the enactment of SMCRA displaced an additional small amount of native vegetation.

Baseline sampling by Dr. Richardson only occurred on five of the ten communities existing within the permit area. These five communities are Douglas Fir, Mixed Conifer, Pinyon-Juniper, Shrub-Grass-Juniper, and Deciduous Streambank. Quantitative descriptions of floral communities presented in this M&RP are based on the former Sage Point-Dugout Canyon permit document. Appendix 3-1 presents data for the vegetation communities discussed in this section. The adequacy of the sampling effort is indicated in Appendix 3-1.

The farmland-weeds vegetation type resulted from abandoned agricultural activities (due to lack of water) and is significant only from the standpoint that mule deer tend to feed on remaining alfalfa

during the spring green-up. It should be noted that none of this community occurs within the permit boundary.

Due to multiple consultants/companies gathering vegetation data, the following table has been provided to clarify the plant communities names used by each.

Sampling Organization	Plant Community			
Natural Resources Conservation Service	Riparian	Pinyon-Utah Juniper	Douglas-fir	Disturbed
Richardson/Viert Study	Deciduous Streambank	Pinyon-Juniper	Mixed Conifer and Douglas fir	N/A
Mt. Nebo Scientific Study	Riparian	Pinyon/Juniper	N/A	Rabbitbrush/ yellow sweet clover
Pat Johnston Study	Riparian	Pinyon/Utah Juniper	N/A	N/A

Douglas Fir

The Douglas Fir community occurs on the north facing slopes at upper elevations in deeper productive soils. Floral and structural composition is that of a forest community consisting primarily of Douglas Fir with a few scattered Ponderosa pine, Rocky Mountain juniper, and quaking aspen trees in the overstory.

Ground cover of the overstory in the Douglas Fir community averages 65.0% and productivity of the trees was not determined. This community exhibits an average of 380.5 trees/ac comprised mainly of Douglas Fir (68.8% of all trees), Ponderosa pine (26.1%), and pinyon pine (4.1%). Examination of average basal diameters of the trees indicates a late-successional and mature community.

Ground cover of the understory is dominated by shrubs (18.4% cover), especially serviceberry, big sagebrush, snowberry, and creeping barberry with 4.2, 3.8, 3.8, and 2.5% cover, respectively. Grasses exhibit a sparse 0.8% cover while forbs only average 1.6% cover. Productivity of this understory totals 35.8 g/m^2 or approximately 320 lb/ac. Shrubs contribute 26.2 g/m^2 while grasses and forbs contribute 2.7 g/m^2 and 6.4 g/m^2, respectively. Creeping barberry, mountain mahogany,

big sagebrush, and snowberry shrubs dominate with 7.7, 5.0, 4.9, and 4.9 g/m^2, respectively. The adequacy of the sampling effort is indicated in Appendix 3-1.

Mixed Conifer

The mixed conifer vegetation type is an ecotonal community which occurs on the slopes of mid-elevational canyons that cut into the Book Cliffs. Floral and structural composition is that of a forest community consisting primarily of coniferous tree species in the overstory. These overstory tree species include Douglas Fir, Rocky Mountain maple, pinyon pine, and Utah juniper.

Ground cover of the overstory in the mixed conifer community averages 24.5% with Douglas Fir, Rocky Mountain juniper, and Rocky Mountain maple trees dominating with 10.0, 5.0 and 3.5% cover, respectively. Productivity of the trees was not determined; however, the community exhibits a density of 223.7 trees/ac. Examination of average basal diameters of the trees indicates a mid- to late-successional community with young Douglas Fir trees.

Ground cover of the understory is dominated by shrubs (11.5% cover), especially snowberry and big sagebrush with 4.5 and 3.5% cover, respectively. Grasses contribute another 4.5% cover, especially western wheatgrass (3.0% cover), while forbs exhibit only 2.5% cover. Productivity of this understory totals 38.5 g/m^2 or approximately 345 lbs/ac. Of this total, shrubs contribute 20.2 g/m^2, grasses 4.9 g/m^2, and forbs 13.1 g/m^2 with big sagebrush, Louisiana sagewort, and mountain mahogany dominating (7.7, 5.9, and 3.3 g/m^2, respectively).

Pinyon - Juniper

The pinyon - juniper community is primarily an open woodland of mature pinyon pine and Utah juniper with very sparse understory vegetation. The community occurs mainly on mesa tops and broad alluvial deposits at the foot of the Book Cliffs, as well as on the more southern exposed slopes of the lower canyons. Pinyon - juniper is one of the most important vegetation communities for mule deer during the winter.

Ground cover of the overstory in the pinyon - juniper community averages 20.0% and productivity of the trees was not determined. This community exhibits an average of 291.1 trees/ac comprised entirely of pinyon pine (43.0% of the trees) and Utah juniper (57.0%). Examination of average basal diameters of the trees indicates a near climax mature community.

Ground cover of the sparse understory is dominated by shrubs (5.2% cover), especially by mountain mahogany with 2.5% cover. Cover by grasses was non-existent in the sampled areas and forbs only averaged 3.4% cover with euphorbia (spurge family) the dominant forb with 2.2% of the cover. The productivity of this understory is very light with only 3.3 g/m^2 (30 lbs/ac) of total annual production. Black sagebrush, mountain mahogany, and buckwheat were the dominant plants with 0.7, 0.5, and 0.5 g/m^2, respectively.

The Pinyon-Utah Juniper community within the disturbed area boundary was surveyed during the Fall of 1997 by Patricia Johnston (see Appendix 3-1). During the survey the cover was 65.94%, with the woody species stems per acre being 2,334.4. George Cook of the Natural Resources Conservation Service (NRCS) surveyed the site to determine pre-mining productivity as defined in Item 4, Section IV, Productivity Measurements, UDOGM Vegetation Guidelines, Appendix A, February 1992. Productivity is discussed in Section 321.200.

Deciduous Streambank

The deciduous streambank community occurs only in a narrow band (usually less than 50 ft wide) along portions of Dugout Creek and other narrow valley bottoms with at least intermittent stream flows. This community differs from adjacent vegetation on canyon slopes (usually mixed conifer, Douglas fir, sagebrush, or mountain brush) in that deciduous trees and shrubs are more common on banks of stream channels. Floral and structural composition is that of a forest community consisting primarily of narrowleaf cottonwood, Rocky Mountain maple, and Douglas Fir trees in the overstory.

Total ground cover of the community averages 63.4% with 38.2, 14.6, 2.4, and 0.4% of the cover due to trees, shrubs, grasses, and forbs, respectively. Dominant trees in the overstory include Rocky Mountain maple, narrowleaf cottonwood, Douglas Fir, and water birch with 12.0, 11.3, 6.0, and 5.3% cover, respectively. Productivity of the overstory was not determined. However, the community exhibits an average of 216.1 trees/ac. Examination of average diameters of the trees indicates a mid- to late-successional community with only fair reproduction of the overstory species.

Ground cover of the understory is dominated by shrubs (14.6% cover), especially elderberry, snowberry and Wood's rose with 3.0, 3.0 and 2.7% cover, respectively. Cover by grasses (2.4%) and to a certain degree, forbs (8.2%), is subdued because of past grazing pressure by livestock,

but is still a viable component of the community. Productivity is known only for the community as a whole (102.5 g/m^2 or 912 lbs/ac), and despite past grazing pressures, it is still the most productive community in the area.

In Pace Creek and Rock Creek Canyons, heavy grazing and erosion has resulted in sections of the stream banks having little or no deciduous and/or riparian vegetation. The vegetation within these drainages has been identified on Plate 3-1 with the symbol DSR.

Riparian (1997)

During 1997 a study was performed on the riparian community of Dugout Creek by Patricia Johnston. The study covered approximately 2,100 feet of the creek channel. The study included the gathering of data on cover (84.83%) and woody species density (1,624.6 stems per acre) within the disturbed area boundary. George Cook of the Natural Resources Conservation Service surveyed the site to determine productivity and condition (see Section 321.200). Reports from Patricia Johnston and George Cook are included in Appendix 3-1.

The majority of the riparian vegetation and soils within the study area were disturbed during an earlier mining operation with debris evident along much of the length of Dugout Creek. As was common during early mining, the channel was most likely realigned as additional space for facilities was needed.

Shrub - Grass - Juniper

The shrub - grass - juniper vegetation type is another ecotonal community found between the greasewood - sagebrush and pinyon - juniper communities primarily on south and east facing steep rocky slopes along the base of the Book Cliffs. It can occasionally be found on upland benches and flats. This community exhibits a greater abundance of perennial grasses than any other vegetation type found within the area.

The shrub - grass - juniper community exhibits a sparse overstory of pinyon and juniper trees (2.9% ground cover) which at maturity do not obtain the size of the trees in the pinyon - juniper community. Density of these trees only averages 57.3 trees/ac, and productivity of this sparse overstory was not measured.

The understory of this community is dominated by grasses with 9.3% ground cover, while shrubs exhibit 6.4% cover and forbs exhibit a sparse 0.4% cover. Dominant species include creeping wildrye, galleta grass, and black sagebrush with 5.4, 3.2 and 4.6% cover, respectively. Productivity of this understory totals 59.3 g/m^2 or 528 lbs/ac with contributions by grasses, shrubs, and forbs of 40.9, 17.1, and 1.2 g/m^2, respectively. Dominant plants are the same as indicated for ground cover.

Ponderosa Pine

Quantitative information for the Ponderosa pine community does not exist as it is too limited in areal extent and it has not been, nor will it be, disturbed by mine facilities. The community is present in the high canyons of the Book Cliffs usually in association with Douglas Fir and mixed conifer vegetation types. Ponderosa pine is the predominant species present; however, Douglas Fir, pinyon pine, and Utah juniper occur with less frequency. A thin growth of mountain shrubs as well as grasses and forbs similar to the mixed conifer community is present in the understory.

Quaking Aspen

Quantitative information about the aspen community was not collected due to its limited areal extent within the upland benches of the Book Cliffs; and because it has not been, nor will it be, disturbed by the mining operation. Quaking aspen is the dominant species in the overstory with an occasional Rocky Mountain maple or Gambel's oak being present. The understory is often park like, dominated by grasses and forbs with only a few shrubs present (mainly snowberry).

Sagebrush

The sagebrush community occurs on the dip slope between 7,200 and 9,000 feet in elevation. Quantitative information was not collected for this community as no mining disturbance has occurred in the past nor is expected to occur in the future. This community often intergrades with other communities, making delineation difficult in certain instances. However, big sagebrush (usually the subspecies mountain big sagebrush) is the dominant species in the community, existing in characteristically dense stands. Common species existing in the understory include lupines, wheatgrasses, bluegrasses, and scarlet gilia.

In 1996, the mean total living cover for the mine's disturbed area (Plate 3-1B) and reference area were 36.90% and 47.50% respectively (Mt. Nebo Scientific, August 1, 1996). The area surveyed by Mt. Nebo was disturbed in a previous mining operation, with no indication that reseeding was completed when mining ceased. NRCS range site descriptions/conditions indicate that the area (surveyed by Mt. Nebo) prior to disturbance was most likely Pinyon/Utah juniper - upland very steep shallow loam.

Refer to Appendix 3-1 for the 1996 Mt. Nebo report discussing the vegetation sampling done at the Dugout Canyon Mine site within the proposed disturbed area. The Mt. Nebo report discusses the vegetation cover, composition, density, reference area, and includes photographs of the transects and reference area.

Pace Canyon - Disturbed Pinyon Juniper

On August 13 - 14, 2003, quantitative and qualitative data were taken on the vegetation of the Pace Canyon fan portal area and it's reference area, by Mt. Nebo. The transect placement technique was employed with the goal to adequately sample a representative subset of the site. The mean total living cover of the vegetation for the site was estimated at 52.50%, 44.67% of this total was from the understory and 7.83% was overstory. Pinyon pine and Utah juniper were the most common species in the overstory, big sagebrush was the most common woody species in the understory. The site had a host of forbs, nearly all of which were annual exotics or weedy species (most common was poverty weed). The only grass species inventoried was cheatgrass. The majority of the site has been previously disturbed by various activities, such as road construction, logging, exploration and mining. Refer to Appendix 3-4 for a copy of the Mt. Nebo report.

Federal Coal Lease U-07064-027821 and State Lease ML-50582-OBA

40 Acres - Federal Coal Lease U-07064-027821 Although, Plate 3-1 shows the area within T13SR13E, Section 21, NW1/4NW1/4 to be sagebrush the following descriptions are from examination of an aerial photograph taken November 2006. NW1/4NW1/4NW1/4 is sagebrush, with some scattered juniper throughout,SW1/4NW1/4NW1/4 is sagebrush in the center, with Douglas fir, juniper and pinion pine on the outside edges on the east and west, SE1/4NW1/4NW1/4 is sagebrush and quaking aspen with Douglas fir, juniper and pinion pine on the outside edges on the west and north. SE1/4NW1/4NW1/4 is approximately 30% disturbed and the

NE1/4NW1/4NW1/4 is approximately 50% disturbed by roads and logging. In the NE1/4NW1/4NW1/4 the west half is sagebrush and the east half is quaking aspen, Douglas fir, juniper and pinion pine. A spring in the NE1/4NE1/4NW1/4NW1/4, likely has a limited riparian vegetation community associated with it, the limiting factor would be the flow which has been measured at a maximum of 1 gpm and a minimum of 0.25 gpm (Appendix 7-2). On September 3, 2007 this spring was dry. The spring is located over an area where minimal subsidence is anticipated (Appendix 5-12, see figure entitled "Potential Subsidence.....") . The locations of the vegetation described are approximate.

The vegetation areas shown on Plate 3-1 have been extended or revised in T13S R13E, Sections 8, 9, 15, 16 and 21 to include the additional acreage in leases U-07064-027821and ML-50582-OBA. The vegetation information was taken from aerial photographs taken in November of 2006. Areas within these leases have been disturbed by logging, fences, trails and roads.

321.200 Land Productivity Prior to Mining

The land productivity of the area to be disturbed by mining was not measured in 1925 when mining first disturbed the area. Appendix 3-1 contains additional data pertaining to vegetation.
George S. Cook of the NRCS surveyed the condition and production of the range site areas within the disturbed area boundary in 1997, his findings were as follows:

PJ Sage	Condition - Good	Production - 800	Potential Production - 800
Riparian	Condition - Fair	Production - 1500	Potential Production - 2200

The production is based on air dry weight of total herbage produced per acre. Patricia Johnston accompanied Mr. Cook. See Appendix 3-1 for a copy of the December 3, 1997 letter from Mr. Cook.

<u>Pace Canyon - Disturbed PJ</u>

Since the site was previously disturbed, production estimates were provided by Dean Stacy of the NRCS (Natural Resources Conservation Service). A letter and attachments from Mr. Stacy are included in Appendix 3-4. Production estimates for High Mountain Loam with west facing slopes for a normal year with medium cover was 600, eastern facing slope with Upland very steep stony

loam was estimated at 550 annual production. Mt. Nebo estimated the total woody species density at the Pace Canyon site to be 444.

322 Fish and Wildlife Information

A summary of the fish and wildlife resource information for the permit and adjacent areas is contained in Sections 322.100 through 322.300. The data pertaining to wildlife in the following sections were collected by the UDWR (J. S. Burruss, L. B. Dalton, Larry J. Wilson, Ben Morris, Bill Bates, etc.), Eureka Energy Company personnel, EIS Environmental and Engineering Consulting and Environmental Research and Technology, Inc.

322.100 Level of Detail

The scope and level of detail within this M&RP are sufficient to design the protection and enhancement plan for wildlife and fish in the area.

This assessment of wildlife resources has been compiled pursuant to guidelines issued by the Division.

322.200 Site-specific Resource Information

Eight permanent experimental and four permanent control wildlife transects were established in the permit and adjacent areas by UDWR in December 1979. Appendix 3-2 contains a figure showing the transect locations. The transects were located within pinyon-juniper, desert shrub, and mixed conifer vegetation communities; and used to monitor wildlife habitats. The wildlife habitats included in the study were small mammals, medium-sized mammals, large mammals, raptors, game birds, song birds, reptiles, and amphibians. The four permanent control transects were located in areas not proposed for disturbance by mining operations. Appendix 3-2 contains the information pertaining to the transect studies.

<u>Macroinvertebrates and Fish</u>

Due to the variable nature of the stream flows in the project area and the limited number of species of macroinvertebrates identified by the UDWR and the Division, further study of aquatic macroinvertebrates was not pursued.

The low importance of the streams, as a fishery resource, has categorized them as being of little value for extensive aquatic study. Therefore, detailed aquatic studies were not performed on Dugout Creek in accordance with permission from the Division in 1979 (see letter from Mary Ann Wright, Appendix 3-3).

Small Mammals

Small mammals represent a significant part of the ecosystem. The majority are herbivores and are the primary source of food for higher trophic levels, particularly raptorial birds, canids, and felids. Small mammals, including shrews, mice, voles, chipmunks, and ground squirrels were sampled with live traplines within each transect. Relative abundance was determined for each species by transect, but not by habitat type, within the individual transects. Data concerning bats were not collected during this study, however a bat survey of the riparian and disturbed area in Dugout Canyon was performed in 1997 by Mark Perkins and included in Appendix 3-3.

Medium Mammals

The transect study did not attempt to make density estimates due to the extreme ecological variability of these mammals. The study did identify species and frequency of habitat use in the area.

Limited portions of Dugout Canyon provide habitats for weasels, badgers, and skunks. Even though the breeding and rearing activities of these non-migratory species and their dens and burrow systems are important to maintenance of their populations, the area to be disturbed is small and the species are widespread and adapt easily to the activities of man.

Large Mammals

Habitat use by all large mammals, other then mule deer, was determined in a quantitative manner. Plate 3-2 (confidential) exhibits the significant habitat for mule deer and elk in the area. Habitat use

in the proximity of the permit area was determined by pellet group count and observation of track frequency. Pellet counts were made in late spring, following movement to summer range. Track counts were made once each month in January through May on all transects.

The area to be disturbed parallels a water source and therefore is important to all wildlife species. The fact that elk and deer utilize some portion of the permit area during the year means that all activities must be considered.

Mule deer on the mine area are considered by the UDWR to be part of Herd Unit 32 and the elk as part of Herd Unit 24. The deer utilize the entire permit area but seasonally concentrate in and utilize specific habitat types. During the summer the mule deer generally utilize all of the habitats near water. The most heavily used communities are the sage, mountain brush-mixed conifer, and the composite of aspen, mountain mahogany, manzanita, and pine/fir. There is normally more browse in these communities than in the others.

With the onset of fall and winter, the mule deer latitudinally migrate. Initially (late fall and early winter) they concentrate on the plateau area where they intermingle with the elk; but when the snow gets too deep for them to traverse they move into the low elevation sage and pinyon-juniper areas. The wintering areas for mule deer make them susceptible to road strikes in the vicinity of the proposed haul and access road for the Dugout Canyon Mine. The access roads to Pace and Rock Canyon crosses area used by deer as winter range, however traffic is sporadic during the winter months and heavier during the summer and fall months.

Raptors

Golden eagles are a common year long resident of the area, with suitable nesting habitat spread throughout the permit area. The cooper's hawk is known to nest in the permit area.

A variety of falcons are year long residents of the area, utilizing cliffs for their nests. To date there are no known aerie sites for falcons within or immediately adjacent to the disturbed area.

Raptors were studied during the 1979 - 1980 UDWR transect study, in 1981 by Janet Lee Young and by Hayden-Wing Associates in 1984. These reports are provided in Appendix 3-3.

Raptor nest surveys were done by the UDWR in 1995, 1997, 1998, and 1999. The nest locations identified in 1997 and 1998 are shown on Plate 3-2 in the mine's UDOGM confidential folder (confidentiality required by UDWR). All nests located in the 1997 survey were cliff nests (Ben Morris, UDWR, January 20, 1998). All nests located in the 1998 and 1999 surveys were cliff nests.

Migratory and Song Birds

Birds were studied during the 1979 - 1980 UDWR transect study. However, a more extensive study was done by Hayden-Wing Associates in 1984. Their report can be found in Appendix 3-3.

Reptiles and Amphibians

Increasing elevation rapidly reduces the number and kind of reptiles and amphibians. Furthermore, in Utah the effects of the more northern latitude reduces the number of herptiles in much the same way as does the increase in elevation.

These geographical and associated climatic factors have eliminated most desert species, leaving species that are adapted either to mountain habitats or montane type habitats. Based on extensive literature review and limited field work, it was determined that potentially 8 species of amphibians and 18 species of reptiles inhabit the area. Of these species only 5 were recorded by the UDWR in 1980: Eastern fence lizard, Sagebrush lizard, Tree lizard, Short-horned lizard, and the Gopher snake. A WESTECH biologist observed two other species in 1979, the Western whiptail and the Midget faded rattlesnake. All amphibians and reptiles are legally protected, but since the species listed are all widespread throughout the mountains of Utah, none are treated as high-interest species. It is doubtful that the proposed action would seriously impact populations, but localized individuals may be involved in habitat destruction due to subsidence. An exception to this would be if subsidence caused drying of present wet habitats essential to reproduction. Refer to Section 332 for a discussion of "Possible Short-Term and Long Term Impacts to Species Dependent on Springs, Creeks and Drainages".

Pace Canyon

Wildlife indigenous to the general area of the project include amphibians, reptiles, birds and mammals. A copy of the 2004 raptor survey map for the area is included in the 2004 Annual

Report. Calling surveys of the area were also done in 2003 and 2004 for the Mexican spotted owl (Appendix 3-3).

Amphibians - There are six common species of amphibians known to occur within the general area (mesic area). These species could be present within the Pace Canyon area, but their occurrence is doubtful due to arid conditions that prevail over the majority of the area.

Reptiles - There are ten species of reptiles known to inhabit the region. The limited acreage of disturbance, however, should not be considered a threat to these species, due to the abundance of pinyon and juniper habitat, as well as sagebrush and grass habitat throughout the area.

Birds - There are approximately 185 bird species that could either be potential yearlong residents or frequent the site during portions of the year. Of these, loggerhead shrike (BLM Sensitive species) and raptors are discussed below.

A survey of the fan portal area indicated no nesting loggerhead shrikes, *Lanius ludovicianus*, near the proposed roads. This species is dependent upon the broad, open sagebrush and grass plain, as well as the presence of widely spaced pinyons and junipers. A summary of the inventory conducted for this species and a negative determination of its presence is included in Appendix 3-4 (BLM EA, UT-070-2003-55).

Raptor surveys, completed in May of 2004 by the UDWR, revealed a number of raptor nest sites on the open lower benches and cliff faces in and surrounding Pace Canyon. Two inactive golden eagles *(Aquila chrysaetos)* nests on the outer edge of one mile radius from the fan site were inventoried in 2004 (Section 24, R12E T13S) and two potential raven nests were located in previous years in Section 23, R12E T13S.

The 2004 spring inventory identified no active and or tended Golden Eagle nests within a 1/4 mile of the proposed site. An inventory in 2002, 2003 and 2004 for Mexican Spotted owl and Goshawk did not reveal the presence of these species within the fan project area.

Mammals - Ninety-two (92) species of mammals have the potential to inhabit the region. Of these, the following species; mule deer, *Odocoileus hemionus*, elk, *Cervus elaphus* and pronghorn antelope, *Antilocapra americana*, have been identified to live within or adjacent to the affected area.

As shown on Plate 3-2, the area of the fan site is designated summer range for mule deer and year-long range for elk.

Pronghorn antelope occupy the salt desert shrub habitat of the lower elevation ranges along the Clark Valley Road. This habitat is classified as high priority year-long range for pronghorn.

Threatened and Endangered Plant and Wildlife Species. Passage of the Endangered Species Act of 1973 (Public Law 23-20S) provided the legal basis for establishment of lists of endangered and threatened plant and wildlife species (Appendix 3-3).

Although three species (black-footed ferret, bald eagle, and peregrine falcon) on the list could potentially inhabit the area, an inventory of endangered wildlife species performed in 1979 by the UDWR recorded no threatened and endangered species within the proposed permit area. No confirmed sightings of black-footed ferrets have occurred within Carbon County during 1995, 1996, and the first quarter of 1997, however bald eagles have been seen flying in the vicinity of the mine (Bill Bates, UDWR).

A literature review and field studies for both the Soldier Canyon and the Sage Point - Dugout Canyon permit documents were performed to assess the possible presence of any threatened, endangered, or sensitive plant and wildlife species in the respective permit and adjacent areas.

These study areas included the proposed Dugout Canyon disturbed area. The literature review indicated that no species listed (or proposed as candidates) by the U.S. Fish and Wildlife Service (FWS) as threatened or endangered were likely to inhabit the area. In addition, the field investigations which occurred in 1979, 1980, 1983, and 1984 did not identify or locate any threatened or endangered species. No threatened or endangered plant species including Canyon sweetvetch were found within the disturbed area by Robert Thompson during his 1995 survey (see Robert Thompson letter, Appendix 3-1). Mr. Thompson is qualified and has performed threatened and endangered surveys for the U.S. Forest Service.

As reported in the 1997 bat survey "we noted no suitable habitat, did not record via detectors or capture, or note by indicators presence of *Corynorhinus townsendii*. It is our opinion the bat does not occur in the immediate vicinity of the proposed disturbance area. We also did not note suitable

habitat for or encounter *Euderma maculatum* by mist net, via detectors or during audible bat transects".

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

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

~~Mining Consumption:~~
~~Culinary Water is purchased from PRWID and hauled by D & D Trucking to the Mine.~~
~~Estimated **Purchased** Gallons/yr: 1,003,200~~
~~Ventilation Consumption/Evaporation:~~
~~29,354 gallons/day (3/05/04 ventilation survey)44,000 gallons/day (9/13/04 ventilation survey)~~
~~73,354 X 0.5 = 36,677 gallons/day (survey average)36,677 x 365 = 13,387,105 gallons/yr~~
~~Coal Producing Consumption/Coal Moisture Loss:~~
~~Water added to coal produced - 4.03% inherent moisture - source Dugout Geologist~~
~~5.80% run-of-mine moisture - year to date average 1.77% moisture added to coal by cutting operation Projected Tonnage 2004 4,245,737 tonsProjected Tonnage 6 year average~~
~~369,084 tons Tons water/yr 77,333 Pounds water/yr 154,665,562~~
~~Gallons water/yr 18,522,822~~
~~Sediment Pond Evaporation:~~
~~Mine Site Pond0.107 acres (surface area)18.1 in/yr (high estimate based on HCI Technical Memo, August 22, 2002)~~
~~0.16 ac/ft7030 gallons/yrRefuse Pile Pond 0.41 acres (surface area)9 in/yr~~
~~0.31 ac/ft 5612 gallons/yr (five month period, high estimate)~~
~~Spring and Seeps Effects From Subsidence - Not Applicable~~
~~Alluvial Aquifer Abstractions into Mines - Not Applicable~~
~~Alluvial Well Pumpage - Not Applicableeep Aquifer Pumpage - Not Applicable~~
~~Postmining Inflow to Workings - Not ApplicableDirect Diversions: - Not Applicable~~
~~Dust Suppression - 3,500 gallons per truck load, 3 loads per day, for 30 days = 315,000 gallons plus 3,000 per truck load, 1.25 loads per day, for 45 days = 168,750. Total: 483,750 gallons per year.~~
~~Mine Discharge: 6 Month Average 362,118 gpd = 132,172,948 gal/yr~~
~~Calculation estimates for water use in 2004 were necessary since we are using 2004 purchases and usage and the year is 2 months short.~~

Mining Consumption:

Culinary Water is purchased by Lee Water Management from Price River Water Improvement District (PRWID) and hauled and sold by Lee Water Management to Dugout Canyon Mine.

Estimated **Purchased** Gallons/yr: (Used in Longwall) 3,239,700

Ventilation Consumption/Evaporation (source Phil Patton, Ventilation Engineer):

52,790 gallons x 365 days = 19,268,350 gallons/yr

Coal Producing Consumption/Coal Moisture Loss:

Gallons water/yr 19,638,091

Projected Tonnage Annually 2008 - 2012 4,500,000 tons

Water added to coal produced - 4.03% inherent moisture - source Dugout Geologist
5.80% run-of-mine moisture - year to date average
1.77% moisture added to coal by cutting operation

Mine Discharge: Average 0.65 mgpd of which 3,000,000 gallons per year are purchased culinary water from Lee Water Management.

Sediment Pond Evaporation:

Mine Site Pond	0.107 acres (surface area)
	18.1 in/yr precipitation (high estimate based on HCI Technical Memo, August 22, 2002)
	0.16 ac/ft = 7030 gallons/yr
Refuse Pile Pond	0.41 acres (surface area)
	9 in/yr precipitation
	0.31 ac/ft = 5612 gallons/yr (five month period, high estimate)

Dust Suppression - 3,500 gallons per truck load, 3 loads per day, for 30 days = 315,000 gallons plus 3,000 per truck load, 1.25 loads per day, for 45 days = 168,750. Total: 483,750 gallons per year.

The Following are **Not Applicable**: Spring and Seeps Effects From Subsidence, Alluvial Aquifer Abstractions into Mines, Alluvial Well Pumpage, Deep Aquifer Pumpage, Postmining Inflow to Workings and Direct Diversions.

Pace Canyon

"In accordance with the United States Fish and Wildlife Service's (USFWS) protocols, and inventory for the presence of threatened, endangered, and sensitive fauna and floral species was conducted on August 13, 14, and September 29, 2003. Loggerhead, shrike, burrowing owl, Northern Goshaw, Despain foot cactus, Wright fishhook cactus and Creutzfeldt crypthantha and neo-tropical migratory birds were the sensitive species of concern within the area. A thorough search of all seven well sites and associated access roads did not reveal the presence of these species (BLM, Environmental Assessment, UT-070-2003-55)." A map of the area inventoried is provided in Appendix 3-4 within the referenced environmental assessment , it should be noted that the area covered by the aforementioned environmental assessment is the same area proposed for the construction of the Pace Canyon fan facilities. In addition a sensitive plant species survey was conducted by Mt. Nebo in August 2003. To initiate the study, appropriate agencies were consulted (e.g. Utah Natural Heritage Program) and other sources were reviewed for potential plant species that are know to be rare, endemic, threatened, endangered or otherwise sensitive in the area of study. The only plant identified was canyon sweetvetch. No rare, endemic, threatened, endangered or otherwise sensitive species were found in the area proposed for disturbance.

Federal Coal Lease U-07064-027821 and State Lease ML-50582-OBA

On January 19, 2007 Division of Wildlife Resources (DWR) personnel were contacted concerning the addition of approximately 600 acres to the permit area of the Dugout Canyon Mine. Dugout

personnel met with Mr. Wright at the DWR office in Price, Utah. Mr. Wright had requested that the mine provide their most recent aerial photography for his review of the areas for the existence of threatened and endangered wildlife species. Mr. Wright also reviewed other information, maps and aerial photographs owned by the DWR. Mr. Wright recommended a goshawk survey be done if surface disturbance is planned for a mature stand of firs in W1/2NW1/4NW1/4 of Section 21and at a mature stand of firs in N1/2NE1/4of Section 17.

Using the Utah Conservation Data Center repository web site (http://dwrcdc.nr.utah.gov/ucdc/) the leased areas were research to identify known locations of threatened and endangered plant and wildlife species, no locations were found within the leased areas.

Lease Modification U-07064-027821 Tony Wright and Leroy Mead of the Division of Wildlife Resources (DWR) were contacted on January 19, 2007 to determine the potential for threatened or endangered wildlife species to be present within the proposed lease modification area (NW1/4NW1/4 Section 21, Township 13S, Range13 East). Tony Wright reviewed an aerial photograph of the area on January 19th and Leroy Mead had visited the area in November 2006. Mr. Wright said there was potential for goshawks (species of concern for the DWR) to be in the general area describing their habitat as mature ponderosa pines or stands of mature firs. The 40 acre modification has a stand of mature firs which was identified by Mr. Wright as potential habitat for goshawks. Mr. Wright recommended a goshawk survey be done if surface disturbance is planned for the mature stand of firs in W1/2NW1/4NW1/4 of Section 21. Mr Wright also identified a potential mature stand of firs in N1/2NE1/4of Section 17.

No threatened or endangered wildlife species were identified as being in the area (Leases U-07064-027821and ML-50582-OBA) by either Mr. Wright or Mr. Mead. Mr. Wright consulted several sources before determining the lack of threatened and endangered species in the area. Mr. Wright inquired if there were any large ponds of water that would be impacted by disturbance within the lease modification area, the permittee is unaware of any large ponds within the propose lease modification area.

Patrick Collins of Mt. Nebo Scientific was contacted on January 19, 2007 to determine if threatened or endangered plant species were known to be present within the ~~proposed~~ lease ~~modification~~ area. Mr. Collins visited the lease modification area in November 2006, at the time no threatened or endangered plant species were located. Appropriate agencies were consulted (e.g. Utah Natural

Heritage Program) and other sources were reviewed for potential plant species that are know to be rare, endemic, threatened, endangered or otherwise sensitive in the lease modification area. A description of the research performed by Mt. Nebo Scientific and the conclusions are included in Appendix 3-1 (NW1/4NW1/4 Section 21, Township 13S, Range 13 East).

Habitats of Unusually High Value. High value habitats in Dugout Canyon include the riparian area and the cliff escarpments. Major portions of established habitat will not be disturbed, but the restricted access by wildlife to the water source within the area of disturbance could displace wildlife. The cliff areas adjacent to the disturbed area could harbor mountain lion, bobcat and bear; and with increased activity and noise they may avoid the area. Elk and deer who may frequent Dugout Canyon will likely avoid the area during the heaviest of activity, but resume their normal patterns once they become accustomed to it.

In a letter dated April 22, 1996 to James W. Carter the director of UDOGM, Robert G. Valentine director of the UDWR makes the following comment "much of the area is classified as critical deer winter range and is heavily used by deer and occasionally by elk and antelope". Use classification drawings of the Dugout Canyon area for large mammals (deer, elk, antelope, etc.) were requested from the UDWR in January of 1996 by SCM. The cover letter dated January 30, 1996 from the UDWR and the drawings are included in Appendix 3-3 for interpretation by UDOGM. SCM has interpreted and transferred the information (provided by UDWR) to Plate 3-2. The use classifications were extended on Plate 3-2 with the incorporation of Federal Lease U-07064-027821.

A survey for bats was performed by Mark Perkins in September of 1997. A report of this survey is included in Appendix 3-3 with a figure showing the bat survey locations.

No data or definition was available to determine the criteria for an area to be classified as of "unusually high value" for bats. However, since extensive rock faces, cliffs, and escarpments are present throughout the Book Cliffs Region, the land within the permit boundary is not unusual or unique to the area. The Castlegate Sandstone, Blackhawk, and Price River are the cliff forming formations present in the Dugout Canyon area. Refer to Chapter 6 for descriptions of these formations and Plate 3-3 for their locations.

In the Perkins-Dugout Mine Bat Survey the following statement was made "development plans for the proposed disturbance area contains some mitigation for resident bat species. A proposed runoff pond will likely provide accessible year round water and an associated bio-mass. Presently Dugout Creek is not classified as a perennial stream. In addition, plans include several outdoor flood lights which may act as an attractant for phototropic insects and provide a concentrated and stable food resource for local bat populations. Due to no cliff subsidence and mitigating actions noted above, it is our opinion that excepting the disturbance to and removal of 2,000 ft. of riparian zone, impact (either positive or negative) on local bat populations is minimal".

Raptor and Bat Survey

Raptor nest surveys will be conducted annually in the Spring prior to mining activities or potential subsidence within the permit area and in proposed expansion areas to the permit to obtain base line data. In addition, raptor nest locations will be monitored/surveyed the year following the first monitoring/survey if nests were observed during the survey and if operations result in subsidence. The permittee will contact the Division prior to any raptor nest protection efforts.

A bat survey for Utah sensitive bat species is planned for 2005 (May thru September), this survey will cover the cliff areas adjacent to a proposed fan breakout in Pace Canyon. Baseline bat surveys of Utah sensitive bat species will be conducted between May and September in riparian habitat expected to be impacted by subsidence. In addition, Utah sensitive bat species will be monitored/surveyed the year following the first monitoring/survey if Utah sensitive bat species were observed during the survey and if mining operations result in subsidence impact to the riparian habitat.

On the nights of May 21 and 22, 2007 JBR Environmental Consultants, Inc conducted bat surveys along the northern cliffs of Pace Creek Canyon. The inventory area of the survey included portions of Sections 16, 17, 18, 19, 20 and 21 T13SR13E. During the two night of recording bat calls, no bat call files were produced (Attachment 3-2).

Federal Coal Lease U-07064-027821 and State Lease ML-50582-OBA

The area was included in the areas requested to be surveyed by the DWR during the 2006 and 2007 raptor surveys. Raven nests were the only nests active during the 2007 survey of the leased

areas. A raptor survey of the leased areas will continue on an annual basis until mining in the area is discontinued. Due to the limited size of disturbance within the area of the leases, impacts to "Habitats of Unusually High Value" will be minimal.

40 Acres - Federal Coal Lease U-07064-027821 The 40 acres was included in the 2006 raptor survey performed by the DWR and will continue to be included on an annual basis until mining in the area is discontinued.

Tony Wright of DWR and Jerriann Ernstsen of UDOGM had a conversation on March 6, 2007, per a message from Ms. Ernstsen left on the phone of Vicky Miller, Dugout Canyon Mine's Environmental Engineer. According to Ms. Ernstsen, the conversation concerned bat habitat on the 40 acres described as NW1/4NW1/4 Section 21, Township 13S, Range 13 East. Mr. Wright stated in the conversation between himself and Ms. Ernstsen that he was not concerned with the loss or impact to bat habitat in the area described except for the loss of a water source, a spring in the NE1/4NE1/4NW1/4NW1/4 of Section 21, T13S, R13E. The spring (groundwater monitoring location 259A (Plate 7-1), added in 2007 in conjunction with the 40 acre permit area expansion, Task ID #2743) is located over an area where minimal subsidence is anticipated. To the best of the permittee's knowledge and understanding the 40 acre permit area expansion does not require a bat survey.

During June of 2005 the bat survey performed by JBR consultants, Pace Creek was surveyed. Site/stop #7 was in the S1/2SW1/4 of Section 21, Appendix 3-3 of M&RP, Figure 1, this stop was the closest to the proposed 40 acres. In the summary of the report it states "the nearly constant bat activity at the Stop #7 pond suggests that this water feature is an important resource for bats in terms of both water and feeding." The pond will not be effected by the mining proposed in the NW1/4NW1/4 Section 21, Township 13S, Range 13 East, (40 Acre addition to Federal Coal Lease U-07064-027821), but according to the JBR consultants is likely the water source used by the bats in the area.

Replacement

Since water and its corresponding vegetation are important throughout the state of Utah, regulatory agencies have been requiring mitigation for disturbance and eventual replacement from the coal

industry. SCM will comply with the requirements of mitigation and eventual replacement of the resources which may be lost or disturbed during this mining operation, refer to Sections 331, 340, 350, and 762.100.

As a mitigation effort SCM replanted 7,500 feet of disturbed riparian streambank above the northern disturbed area boundary with a modified version of Seed Mix No. 1 (mitigation seed mix), to assist in restoring vegetation which has been disturbed by the logging industry.

Mitigation Seed Mix (Hydroseed/Broadcast Quantities)

SPECIES	# pls/acre
Bluebunch wheatgrass	5.0
Intermediate wheatgrass	5.0
Slender wheatgrass	5.0
Smooth brome	5.0
Indian ricegrass	3.0
Blueleaf aster	1.0
Blue flax	1.5
Northern sweetvetch	1.5
Mountain big sagebrush	1.0
TOTAL	28.0

Willows were transplanted along the edges of the stream channel above the mine site disturbed area, with the mitigation seed mix being planted from the east edge of the stream channel to the outside edge of the logging road cut. The area between the edge of the stream channel and road cut varies from 10 to 45 feet as it travels the 7,500 feet planned for replanting. The west side of the channel was not disturbed by logging. For clarification the stream channel changes to the west side of the road upstream from the disturbed area boundary.

Due to the steepness and roughness of the slope the area was hydroseeded. The mitigation seed mix (listed above) was sprayed using hydroseeding equipment over the mitigation area. A second pass of the hydroseeding equipment sprayed the mulch/tackifier on top of the previously sprayed seed mix. Two thousand pounds per acre of the Division approved (Appendix 3-1) wood fiber mulch (Ecofiber, trade name) were used on the mitigation area. The seeding and planting was completed during 1998.

Additional mitigation for disturbance is being done to comply with the requirements of the UDWR. The mitigation included the cutting of grown pinyon and juniper trees to improve the growth of the understory adjacent to the Nine Mile Canyon Road. These mitigation efforts are being coordinated directly with the UDWR. In 2008 the area is a heavily grazed grassy area and pinyon and juniper have not invaded the area.

SCM will plant approximately 4,000 willows including both the mitigation described previously and during final reclamation. A portion of the willows were planted during the spring of 1998 to satisfy the mitigation commitment. Willows were planted wherever the channel afforded sufficient space. The channel above the mine site is covered with rock slides in several stretches of approximately 100 feet each. Additional willows will be planted to complete the commitment, however the numbers being planted may decrease since it was discovered during the Spring planting that the channel affords a limited environment for willows. CFC has discussed this matter with Paul Baker of UDOGM and a commitment made by CFC to continue to keep UDOGM involved in the mitigation process. Paul Baker was contacted in 2001 concerning the progression of the willows planted, photographs were taken and forwarded to Mr. Baker for his review. Survival rate for the willows planted was estimated at 75%. During an inventory of the willows planted along the edges of the stream channel in 2004, it was estimated that 40 - 50 % of the willows planted in 1998 had survived. The decrease in survival rate is attributed to drought conditions which have decreased the footprint of the creek. In the Fall of 2007 during a mine site visit by Jerriann Ernstsen of the Division several of the sites where willows had been planted were visited, in these locations the willows measure more than six feet in height.

During a site visit in December of 1997, Bill Bates of the UDWR requested that the riparian mitigation include the installation of habitat/stability enhancement structures within Dugout Creek upstream from the proposed disturbed area. SCM commits to the installation of structures similar to those identified in Figure 7-12 should all regulatory agencies and SCM be in agreement. The location and type of structure will be correlated with UDWR, U.S. Fish and Wildlife Service, and the Division.

Pace Canyon

Due to the limited size of disturbance associated with the fan portal facilities, impacts to "Habitats of Unusually High Value" will be minimal.

322.300 Fish and Wildlife Service Review

If requested, SCM authorizes the release of information pertaining to Section 322 and 333 to the U.S. Fish and Wildlife Service Regional and Field office for their review.

323 Maps and Aerial Photographs

The permit area was mapped by use of a mosaic of aerial photographs and assured by ground inspection in some areas. Maps are contained within the reports provided in Appendices 3-1, 3-2 and 3-3.

During a meeting with the UDWR on January 20, 1998 Ben Morris requested that "the nest locations and related data gathered in the 1997 raptor survey of the Dugout Canyon Mine area be kept confidential". Therefore this survey will not be discussed or presented in this permit document, but can be reviewed by Division personnel within the Dugout Canyon Mine "confidential binder". The confidential binder contains Plate 3-2 which shows the location of nests found during the raptor surveys conducted by UDWR. In a Technical Analysis (Task ID #1915) for the inclusion of the SITLA Lease into the permitted area, instructions were given by UDOGM personnel to remove this information from the confidential folder and include it in the M&RP. This information is currently contained in Appendix 3-3.

Vegetation drawings and appendices within the permit area not included in the M&RP are included in the following amendments:

<u>Refuse Pile Amendment</u>

RA Figure 3-1 Surrounding Representative Vegetation Communities
RA Figure 3-2 Vegetation at Site Prior to Mining Disturbance
RA Attachment 3-1 Vegetation Data

<u>Methane Degassification Amendment</u>

Figure 3-1 Vegetation Reference Areas
Figure 3-2 Adjacent Vegetation
Attachment 3-1 Vegetation Inventory

323.100 Location and Boundary of Proposed Reference Area

SCM will use range sites as described and designated by the NRCS Range Handbook and the UDOGM Vegetation Guidelines. Further description can be found in Section 356.100.

Mt. Nebo Scientific did sample a reference area during its 1996 vegetation survey, however SCM does not currently plan to use this data. Reference area(s) are not designated on any plate or figure within this M&RP, except as noted in Section 323.

Pace Canyon

The reference area for the fan facilities is shown on Plate 3-1E. The reference area was inventoried by Mt. Nebo Scientific in August of 2003 (Appendix 3-4). The total living cover was 57.43%, of which 26% was overstory and 31.43% was understory species. The most common overstory species were Douglas fir, Utah juniper and pinyon pine. The most common understory species was big sagebrush, with other native perennial species including Indian ricegrass and Salina wildrye. Species composition calculations reveal that woody species comprise 61.16% of the living understory cover, followed by grasses (33.36%) and forbs (5.47%). The number of woody species in the density measurements was estimated at 2,145 individuals per acre.

323.200 Elevations and Locations of Monitoring Stations

Raptor nest locations and elk and deer range are shown on Plate 3-2. The permit area contains no fish monitoring stations.

323.300 Facilities for Protection and Enhancement

Sections 333.300 and 358.500 contain additional discussion pertaining to protective measures to be taken by SCM in behalf of wildlife.

323.400 Vegetation Type and Plant Communities

Vegetative types and plant communities are outlined on Plate 3-1 and 3-1A of this application.

Vegetation types and plant communities on Plate 3-1 were interpreted directly from aerial .photographs except for selected areas. The inclusion of small vegetation units was limited and included the exclusion of small, long or narrow units of vegetation within other units. Vegetation depicted on Plate 3-1A represents vegetation ground surveyed and identified in the field.

Additional information pertaining to vegetation type and plant communities in Pace Canyon is provided in Appendix 3-4.

330 OPERATION PLAN

331 Measures Taken to Disturb the Smallest Practicable Area

No vegetative disturbance is anticipated beyond that encountered during construction of the surface facilities and fan facilities. The area to be disturbed by operational facilities will be kept to a minimum. Only facilities required to maintain the coal operation or satisfy environmental or safety requirements will be built.

Disturbed areas will be seeded with a mixture which will meet the requirements necessary to stabilize and provide cover; and with sufficient production and diversity characteristic to satisfy regulatory requirements.

Sections 341 describes the seed mixes to be used in both interim and final reclamation of the disturbed areas. For both the interim and final reclamation mixes, the vegetation data were evaluated to determine seed mixture constituents in light of production, cover, and diversity requirements. The soils report was reviewed to select species adapted to the soil's physical and chemical condition. Plant species were selected on the basis of wildlife needs and requirements. In addition, the operations plan was reviewed to determine the need for species with quick establishment, rapid spreading, and high erosion control potentials.

332 Description of Anticipated Impacts of Subsidence

Subsidence and its anticipated impacts are discussed in Sections 333 and 525 of this M&RP.

The potential effects of subsidence on nests could be one or several of the following:

- Displacement and relocation of nesting raptor(s)/birds,
- Injury to or death of nest inhabitants,
- Nest destruction.

Subterranean changes caused by subsidence to wildlife habitat is not currently understood. Subsidence could disrupt burrow systems destroying the home and habitat of burrowing mammals, reptiles, and amphibians and possibly cause death to some species in the immediate area. Since subsidence occurs systematically and in small areas at a given time, only localized populations will be impacted and only for a short period of time. Reproductive potential coupled with dispersal will facilitate recovery and negate the temporary population reduction.

Possible Short-Term and Long Term Impacts to Species Dependent on Springs, Creeks and Drainages

Impact to species dependent on springs, creeks and drainages could include disturbance of shelter, food, increased evaporation, rise and/or decrease in water temperature, water flow, and bank stability. Most species of wildlife are highly adaptable, while others with limited mobility are not. The mollusk (Physella virgata) and tiger salamander, mentioned in the TA on Task ID #1915) are dependent on water resources and may have been impacted by the drought conditions in Utah since 1999. Studies have shown that when habitat changes amphibians have either died or have moved to locations where water and habitat are more abundant. If they have moved, then should their habitat change again, they will likely move to a more suitable area..(Joseph M. Kiesecker - Dept. Of Biology, Pennsylvania State University; Andrew R. Blaustein and Lisa K. Belden - Dept. of Zoology, Oregon State University; Global Amphibian Assessment, Amphibia WebAmphibiaWeb (http://elib.cs.berkeley.edu; Alex Kirby, BBC News Online "Global amphibians in deep trouble" October 14, 2004; U.S. Water News Online, "Georgia drought harming wetland species" January 2002; UPI Science News, "Wildlife suffering from record drought" 8/30/02). There have been no impacts identified to springs, creeks or drainages within the Dugout Mine permitted area. Subsidence could in the future impact mullusk and salamander individuals. In the event of subsidence-related impact, the subsidence plan details measure that should repair material damage, including habitat for the state-listed sensitive mollusk and salamander species.

It is anticipated that streams within the permit area will not be significantly impacted as discussed in Chapter 5, Section 525.100. Interruptions of flow within perennial, intermittant, and ephemeral

streams is not anticipated. Therefore, flows sustaining riparian and stream bank vegetation should continue during and after subsidence. Refer to Section 731.200 for a proposed monitoring and mitigation plan.

333 Plan to Minimize Disturbances and Adverse Impacts

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

- Minimizing the total area of disturbance,
- Design, construction, and operation of facilities to minimize biological impacts including barriers to wildlife movements,
- Design and installation of electrical equipment to minimize electrocution hazards,
- Establishment of stream buffer zones,
- Control and monitoring of surface discharges and water quality,
- Exclusion of wildlife from potentially hazardous areas, and
- Reclamation of disturbed areas when they are no longer needed.

The raptor survey by the UDWR in 1997 lists the three nests within Section 16, T13S, R12E, as being two inactive hawk nests and an old dilapidated golden eagle nest. The dilapidated nest and an inactive hawk nest are located over a area planned for mining during 2001 to 2005 (comparison of Plates 3-2 and 5-7). The second inactive hawk nest is within the area of potential subsidence but not over mining. Since the condition of these nests may change by the time mining reaches their location a plan for their protection or taking will not be determined at this time.

The nests in Section 16 will be monitored in the annual raptor survey. Nine months or the summer prior to the period of potential subsidence a determination by SCM, UDWR (Fish and Wildlife) and UDOGM will be made as to the method(s) to be used for the protection of the nest(s).

Section 22, T13S, R12E contains a raven nest and an active golden eagle nest. Bill Bates and Ben Morris concurred that "the raven nest in Section 22 was not of particular concern, but that the golden eagle nest should be monitored." See Sections 322.200, 333.300 and 358.100 for the raptor monitoring commitments. The golden eagle nest is located over a area planned for mining during 2000 to 2001 (comparison of Plates 3-2 and 5-7). This nest will most likely continue to be

active. The plan to protect the nesting birds will include a survey of the nest location the year prior to second mining to determine activity. In addition, the potential for laying, incubation or existence of young will be evaluated. The spring prior to the period of potential subsidence a determination by SCM, UDWR (Fish and Wildlife) and UDOGM will be made as to the method(s) to be used for the protection of the nest(s) (see Section 333.300).

Only one of the old dilapidated golden eagle nests surveyed in Section 23 during 1997 was surveyed during the 1998 raptor survey. The UDWR in Price and Salt Lake and the Fish and Wildlife Service both in Salt Lake and Denver have been contacted to determine the need for a "take permit" for this nest.

According to a comparison of the raptor surveys performed in 1995 and 1997, the nest inhabitants, conditions and existence may change. Therefore each nest should be evaluated separately and not as a collective. Methods of protection will be determined on a case by case basis using the "best technology available". Regarding exclusionary periods refer to Section 358.

The raptor nests located in the survey taken in 1998 are plotted on Plate 3-2.

333.100 Minimized Disturbance to Endangered or Threatened Species

SCM will apply all methods necessary to minimize disturbances or any adverse effects to endangered and threatened species listed on the tables in Appendix 3-3.

333.200 Species and Habitats

All species and habitats within the permit area will be protected to the best of SCM ability. Wildlife habitat protection will be considered in the construction of facilities. For additional information, see Section 333.300.

333.300 Protective Measures

Upon notification or suspicion of raptor nests within the permit boundary cliff escarpment subsidence zone the following inventory will be taken to determine the potential actions to be taken by SCM.

- Verify the existence of a nest or nests,
- Verify occupation by birds/raptors, eggs or young,
- Determine the condition of nest or nests,
- Location of nest in relationship to recoverable resource (creation of table with nest location number and planned year for undermining).

The information collected in the inventory will be discussed with various agency personnel (i.e., UDOGM, USFWS, DWR, etc.). SCM and the various agencies will determine:

- a method of avoidance when possible,
- determine seasons/months for nests to be covered/uncovered,
- explore alternative methods of protection or removal, and
- develop a mitigation plan when needed.

The method(s) to be used will be determined prior to the period of potential subsidence.

SCM does not currently know the exact locations or thicknesses of recoverable resource, therefore to determine the potential loss of revenues is premature in relation to the avoidance of a raptor nest or nests. Each nest(s) and its corresponding occupant(s) and circumstances will be evaluated by a qualified person nine months or the summer prior to the period of potential subsidence. A determination by SCM, UDWR (Fish and Wildlife) and UDOGM will be made as to the method(s) to be used for the protection/avoidance/removal of the nest(s) (refer above to inventory listing in this section).

SCM commits to include wildlife awareness and protection training in it's annual training curriculum for employees and request the haulage contractors to provide the same training for it's employees.

Wildlife accustom to their current sources of food may be endangered with a change or enhancement of plant species. The improvement or addition of water developments can act to concentrate wildlife in a specific area, thus causing compaction to soils and over grazing of vegetation in an area. Areas which may be fenced to exclude livestock from an area, may also exclude wildlife, thus causing increased competition for food and territory in another area. Since SCM is unaware of the possible advantages or disadvantages to change in an area of habitat, we commit to use the best technology currently available to handle specific concerns, and which will benefit the greatest range of wildlife. Should the enhancement of habitat outside the disturbed area become necessary to attract wildlife away from the mining facilities, efforts will be coordinated with the UDWR.

Revegetation of disturbed areas, as part of the reclamation effort, will include a mixture of grasses, forbs, shrubs and trees which are beneficial to wildlife.

As part of the overall surface water monitoring program, SCM will monitor surface water flow to determine it's relationship to area subsidence. See Chapter 7 of this M&RP for a discussion of the water monitoring program.

Areas of potential mining will be surveyed for raptor nests prior to the beginning of mining and two seasons after mining has ceased. Pertinent data gathered in these surveys will be included in this M&RP and evaluated by qualified personnel to determine the method(s) to be used to avoid, protect, or take the raptor's nest(s).

Before a pesticide is used, the type and concentration will be approved in conjunction with UDWR or the Division.

During the construction of the Dugout Mine, wildlife in the area will most likely be displaced due to the noise and added human activity. Construction, mining, supplier personnel and their corresponding equipment will be required to stay within the disturbed area boundary during construction activities. Loading, unloading, and staging of materials and equipment designated for the construction of the Dugout Canyon Mine facilities will be done within the disturbed area boundary. Fluids used to maintain construction equipment will be stored in a safe method, to prevent contamination.

340 RECLAMATION PLAN

The reclamation plan will include the following: seed mix, rate of seedlings per acre, stocking rates for shrub and tree plantings, planting techniques, fertilization methods, and amount and frequency of application. The fish and wildlife plan for the permit area is outlined in Section 342.

341 Revegetation

The reclamation plan for final revegetation is included in this section for lands to be disturbed by coal mining and reclamation operations.

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

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

341.100 Schedule and Timetable

The reclamation timetable is outlined in Figure 5-3. The reclamation monitoring schedule is outlined in Table 3-3.

The planting of seeds and seedlings will be undertaken at the most feasible time following disturbance activities. Planting will begin after the plant growth medium has been replaced. Final reclamation grasses, forbs, shrubs, and seedlings will be planned for planting in late August through early October. Should the planting window close prior to completion of seeding, a sterile, quick growing ground cover will be planted to control erosion during the winter months. The final reclamation seed mixture will be planted the following spring and fall.

341.200 Descriptions

Species and Amounts of Seed. All revegetated areas within the disturbed area boundary will be planted with the seed mixes listed below:

Interim Seed Mix (Drilled Quantities)

SPECIES	# pls/acre
Indian ricegrass	2
Western wheatgrass	3
Slender wheatgrass	3
Thickspike wheatgrass	4
Kentucky Bluegrass	1
TOTAL	13

Final Reclamation Seed Mix #1 (Drilled Quantities)

SPECIES	# pls/acre
Grasses, Forbs, and Shrubs	
Bluebunch Wheatgrass	3.0
Western wheatgrass	4.0
Slender wheatgrass	1.0
Thickspike wheatgrass	1.0
Idaho fescue	1.0
Indian ricegrass	2.0
Blueleaf aster	0.5
Blue flax	1.0
Palmer Penstemon	0.5
Northern sweetvetch	1.0
Mountain big sagebrush	0.5
Louisiana sagebrush	1.0
Fourwing saltbrush	1.0
Bitterbrush	1.0
Curl-leaf mountain mahogany	1.0
TOTAL	19.5
Transplants and/or seedlings per acre	
Snowberry	75
Utah serviceberry	75
Pinyon pine	200
Utah juniper	200
TOTAL	550

The rate of seeding per acre when broadcast will be doubled of the rate of seeding when drilled.

Final Reclamation Seed Mix #2 (Drilled Quantities)

SPECIES	# pls/acre
Grasses, Forbs, and Shrubs	
Mountain brome	3.0
Western wheatgrass	5.0
Indian ricegrass	3.0
Slender wheatgrass	3.0
Thickspike wheatgrass	3.0
Kentucky bluegrass	1.5
Columbine	1.0
Blue flax	1.0
Palmer penstemon	1.0
Northern sweetvetch	.5
Louisiana sagebrush	1.0
TOTAL	23.0

Transplants and/or seedlings per acre

Carex spp.	500
Horsetail	500
TOTAL	1000

Streambanks/channel bottom will receive the following trees[a] and shrubs

	Seedlings/acre
Narrowleaf cottonwood	250
Rocky Mountain maple	250
Willow [b]	4000
Woods rose	1000
Snowberry	250
Utah serviceberry	250
Blue elderberry	250
Chokecherry	250
Golden current	250
TOTAL	6750

* UDWR requested no conifers be included in the riparian seed mix.

(b) Cuttings/transplants and/or seedlings will be used. The quantity of willows to actually be planted may vary due to the availability of suitable area within the channel for planting. CFC requests permission to consult with a botanist and UDOGM at the time of reclamation to determine the final number of willows to be planted and to prepare a plan for potential planting and replanting should seedling be lost due to pestilence. It may be beneficial to plant the willows over a period of years as the stream has time to deposit sediment, thus providing natural areas for planting. If deemed appropriate by the botanist and UDOGM at the time of reclamation the 4,000 willows per acre commitment will be met.

The rate of seeding per acre when broadcast will be doubled of the rate of seeding when drilled.

Final Reclamation Seed Mix #3 (Broadcast Quantities)

SPECIES	# pls/acre	# pls/sq. ft.**
Grasses, Forbs, and Shrubs		
Salina Wildrye (379,500 seeds/lb)*	2.5	22
Indian Rice Grass (162,000 seeds/lb)*	3.5	13
Galleta Grass (150,000 seeds/lb)*	3.5	12
Muttongrass (2,000,000 seeds/lb)*	0.5	23
Mtn. Snowberry (54,000 seeds/lb)*	4.0	5
Wyoming Big Sage (2,500,000 seeds/lb)*	0.5	29
Rocky Mountain Penstemon (260,000 seeds/lb)*	0.5	14
Yarrow (2,770,000 seed/lb)*	0.1	6
Louisiana Sagewort (3,000,000 seed/lb)*	0.1	6
TOTAL	15.2	130

* Native Plants

** Rounded nearest whole seed

Seed Mix No.1 will be used on the majority of the Dugout Canyon disturbed area (Pinyon-Utah juniper - upland very steep shallow loam, Plate 3-1A) . Seed Mix No. 2 will be used to reseed the riparian area of Dugout Creek (Plate 3-1A). Hydrophytic vegetation will be planted during the low flow of the reclamation channel. Seed Mix No. 3 will be used to reclaim the Pace Canyon Fan

Portal facilities. Although, native forbs were found in the reference area for the proposed Pace Canyon disturbance, the species were not readily available for purchase, therefore they have not been included in the seed mix.

Method Used for Planting and Seeding. The surface will be ripped to between 6 and 24 inches to reduce surface compaction. Ripping will be completed on approximately 4-foot centers. Final ripping depths will be determined by the soil materials being ripped. On slopes too steep for ripping the soil materials will be at a minimum pocked/gouged.

Following ripping, topsoil (or substitute topsoil) will be applied to the ripped surface and left in a roughened state. Topsoil samples will be collected and sent to the laboratory for analysis to determine fertilizer requirements. The area will be broadcast fertilized if recommended using a hand held "cyclone-type" seeder in smaller areas, and applied with hydroseeding equipment in larger areas. Where possible, a ripper equipped tractor or other appropriate equipment will be used to incorporate the fertilizer into the soil. On slopes too steep to accommodate the use of a tractor or other appropriate equipment the fertilizer will be incorporated with the track hoe bucket teeth or other Division approved technology. All nutrients will be applied in a single application.

Seeding for grasses, shrubs, and forbs will be accomplished by drilling and/or broadcasting. All equipment used will be equipped with metering devices. Except as noted below all areas will be fertilized and seeded using the same methodology.

Broadcast seeding will be used on slopes too steep to accommodate a tractor.

Seedlings/transplants will be planted by first clearing a circle of 12 to 24 inches in diameter from which mulch materials and grasses will be cleared. The hole will be dug 4 to 6 inches deeper than the seedling roots to accommodate positioning of the seedling. Fertilizer will either be mixed with the loose soil from the hole or a fertilizer tablet will be planted with each seedling. After seedling placement, the hole will be backfilled with soil and fertilizer then lightly tamped. A gently sloped basin will be formed around the seedling to catch water. The basin will be mulched to aid in moisture retention.

Technical notes (No. 23, September 1993) and project information data published by the NRCS were consulted to provide detail for planting the riparian area, willows, and cottonwoods.

"Rhisomatous willows usually should be planted on inside curves of a stream channel, they are rarely found on sharp outside curves in nature. Shrubby species are normally planted on outside curves of a stream channel as a continuous barrier. Plant the entire reach with the same species. Taller shrubby species may also be planted mid-bank to upper bank and on the floodplains for diversity and additional stabilization or as a buffer zone. Plant tree species up the bank from the shrubby species or on top of the bank."

"Plug, containerized, bare-root, potted and paper-sleeve planting are best used on mid-bank to upper bank or floodplains where long periods of inundation or water erosion is minimized, but where adequate moisture is available through natural precipitation. Where plant have a low risk of physically being pulled or eroded out due to shallow rooting systems during establishment and where there is no competing vegetation."

Transplants (cuttings, whips, plugs, bare-root, potted) "less than 3/8" inch diameter are not recommended because energy reserves in the stems are limited. Pole cutting (3/4" large diameter unrooted stems) are recommended for most planting from water line to mid-bank. Pole cuttings of willows and cottonwoods are also recommended on upper-banks and flood plains where the water table is relatively deep."

"Cutting length is largely determined by the depth to the mid-summer water table and erosive force of the stream at the planting site. Planting can occur at the water line, up the bank, and on top of bank in relatively dry soil, as long as cuttings are long enough to reach into the mid-summer water table. Make sure, several inches of cutting are in the mid-summer water table, 3-4 buds are above ground, and no less than ½ the total length is in the ground"

"However the larger the cutting diameter, the longer the cutting should be, and the deeper the hole should be. Larger diameter and longer cuttings will be needed for more severely eroding sites and where the water table is deeper."

"Plant the cuttings about 1 - 3 feet apart for shrubby types and 6-12 feet apart for tree types. In areas where you expect erosion, plant shrubby types 1 - 1.5 feet apart to better protect the banks. Exact spacing between tree-types further up the bank and shrubby types below should be based on crown characteristics and height. General ideas on spacing can be found in the Idaho Tree Planting Handbook."

"A tractor-mounted post hole digger, a one or two man post hole digger, a soil auger, a large bar, a planting shovel, or just punching the cutting into most soil have all been used successfully in the past to plant willows."

The reclaimed riparian area will be planted with cuttings/transplants/seedlings using the following guidelines as suggested by NRCS literature.

- The Idaho Tree Planting Handbook or similar instructional material will be consulted during reclamation to determine the spacing for the planting of shrubs and tree cuttings/transplants/seedlings. Trees and shrubs will be interspersed with areas seeded with grasses and forbs.
- Species will be planted with a tractor-mounted post hole digger, a one or two man post hole digger, a soil auger, a large bar, a planting shovel, or punching into soil.
- Tree species will be planted up the bank from the shrub species or on top of the channel slope.
- Shrubs species will be planted between the top of the riprap and the top of the channel slope.
- Willows will be planted in the riprap on the channel side slopes and the edges of the channel bottom.
- Stems for planting will be 3/8" diameter or larger.
- Length of cuttings will be determine by where they are planted (i.e. water line, top of slope or etc.), but will be long/large enough to reach into the anticipated water table, with 3-4 buds above ground.

The cuttings/transplants/seedlings will be interspersed with areas of grass and forbs in a mosaic pattern as in the current riparian area. The shrub density data from the 1997 survey designates the trees within the riparian area to be: 27.2 maples, 96.5 junipers, 107.4 cottonwoods and 28.8 firs per acre. SCM proposes to plant 250 maples and 250 cottonwoods per acre. Junipers and firs have not been included in Seed Mix #2 at the requested of the UDWR. The 500 maples and cottonwoods should be sufficient to achieve bond release if the mortality rate is between 10 and 25% (Dan Ogle, NRCS Plant Material Specialist). NRCS guidelines are considered

recommendations and SCM understands they are ultimately responsible for meeting revegetation success standards.

If cottonwoods are planted as cuttings or poles they will be long enough to reach the water table and large enough in size (1 - 3" diameter) to have sufficient energy reserves for survival. An irrigation program will be considered if the cottonwoods are planted as transplants. The particular character of cottonwood to be planted will be determined at the time of reclamation.

Transplants with root balls will be planted as described previously and with the recommendations of published literature available at the time of reclamation. Channel slopes as currently designed, vary between 3 and 4 feet.

Figure 3-1 is provided to approximate the location of each planting zone described above, not as a typical design of the stream channel slopes, their height, width or length.

Seeding methods are discussed previously in this section.

The Division has requested information concerning the average high and low water mark for the reclaimed Dugout Creek channel as a means of evaluating the potential survivability of phreatophytes which will be planted during reclamation. However, from a hydrologic standpoint the concept of average high and low water marks in vague for a channel since the levels are both time- and probability-dependent. For example, it is common to speak of the water-surface profile, which might be expected during the 10-year, 7-day low-flow periods or the 25-year, 6-hour precipitation event, but not the "average" low flow or the "average" high flow. SCM will provide such data if it can be meaningfully defined and will assist with revegetation success. In any event, cuttings/transplants will be planted to facilitate successful re-establishment of the riparian vegetation, with the depth of planting being determined by a consensus of the published literature which is available at the time of reclamation and the drilling of periodic holes along the reclamation channel to determine the depth to the water table.

Mulching Techniques. Following seeding, the disturbed areas will be mulched with a Division-approved mulching material. For bonding calculations, wood fiber mulch will be the assumed mulching application. Application will be initiated at the tip of the slope and working downhill. Mulch will be applied at the rate of 2000 pounds per acre and anchored with a tackifier.

In consultation with the Division, should a determination be made that a slope(s) is too steep to retain a mulch application, the slope(s) will be pocked/gouged and will receive no mulch application. Mulching and revegetation will not be attempted on sheer rock outcrops.

Mulch used for the mitigation project in 1998 of the upper portion of Dugout Canyon is discussed in Section 322.200.

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

Measures Proposed for Revegetation Success. SCM will plant species of the same seasonal variety as those existing prior to the proposed disturbance.

To effect bond release at the end of the 10-year responsibility period, SCM will measure required vegetation variables (ground cover, herbaceous productivity, and woody plant density) as outlined on Table 3-3. Measurement will occur during the same time each year using appropriate techniques.

Productivity sampling will involve use of a sample random technique whereby 1 to 2 m^2 plots (rectangular in shape) will be clipped by life form for all current annual production. Sample parameters determined for these variables will be used to test the success of revegetation during each of these years and will prove establishment of adequate cover, suitable productivity, reasonable density, and adequate species composition.

The estimated parameters for the variables of ground cover, herbaceous productivity, and woody plant density will be obtained in a statistically-adequate manner. Refer to Section 356.200 for a discussion on revegetation success standards.

The revegetative success standard for cover in the Pinyon-Juniper area is 66% and 85% for the riparian area in Dugout Canyon.

Pace Canyon

Method Used for Planting and Seeding. The surface will be ripped to approximately 18 inches. On slopes too steep for ripping the soil materials will be at a minimum pocked/gouged.

Following ripping, a minimum of 12" of topsoil/growth medium will be applied to the ripped surface and left in a roughened state. One ton of certified noxious weed free hay/straw per acre will be crimped into the topsoil. The surface will then be pocked and gouged, the pocking will be done with the bucket of a backhoe, the holes(pocks) will be approximately the width and depth of the bucket. The area soils will then be sprayed with Seed Mix #3 mixed with a small amount of wood fiber mulch by hydroseeding equipment. Following the seeding the area soils will be sprayed with wood fiber mulch (one ton per acre) mix with tackifier (60 lbs. per acre). Mulching and revegetation will not be attempted on sheer rock outcrops.

Success of revegetation and stabilization of the fan portal facilities area will be evaluated during each growing season as outlined on Table 3-3, when cover and compositions studies are most feasible. Sample parameters determined from reference area data will be used to test the success of revegetation and will prove establishment of adequate cover, suitable productivity, reasonable density, and adequate species composition. Student's t-tests were employed to compare the total living cover and total woody species density of the proposed disturbed area and it's reference area (Mt. Nebo, Appendix 3-4).

TABLE 3-3
RECLAMATION MONITORING SCHEDULE

	YEAR									
	1	2	3	4	5	6	7	8	9	10
QUALITATIVE SAMPLING	X	X	X	X	X	X	X	X	X	X
QUANTITATIVE SAMPLING										
Cover		X	X		X				X	X
Frequency		X	X		X				X	X
Woody Plant Density		X	X		X				X	X
Transplant Survival	X	X	X		X					
Productivity									X	X

Figure 3-1

341.300 Greenhouse Studies, Field Trials or Other Equivalent Studies

SCM will comply, should the Division provide evidence to support additional testing to demonstrate that reclamation as required by the State Program can be accomplished according to information provided in this M&RP.

342 Fish and Wildlife

Revegetation to sustain and improve wildlife habitat will be SCM's primary concern following the termination of mining operations. High value habitats will be restored and enhanced beyond their pre-mining conditions since the area is being redisturbed after previous mining. The plan is consistent with Sections 330 and 358.

342.100 Enhancement Measures

Enhancements of the stream channel are discussed in Sections 322.200 and 762.100. No additional enhancements are planned.

342.200 Plants Used for Wildlife Habitat

The plant species in the reclamation seed mix are consistent with those presently grown in the permit area, with additional species added for diversity as requested by the Division. Section 341.200 contains the proposed reclamation seed, tree, and shrub mix.

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

Cover. The goal of SCM is to establish plant species which will provide sufficient cover for the fish and wildlife of the area. See Section 341 for additional discussion.

Ability to Support and Enhance. The plant species included in the proposed reclamation mixes have the ability to support and enhance the fish or wildlife habitat after the release of the performance bonds. Shrubs and trees will be planted to enhance survival and provide wildlife habitat. The trees and shrubs in the final reclamation seed mix will be used to ensure

establishment of an enhanced vegetation community within the disturbed site. The disturbed riparian community will be restored and enhanced during reclamation efforts.

342.300 Cropland

Cropland is not a postmining land use.

342.400 Residential, Public Service and Industrial Land Use

No residential, industrial or public service use is planned at the present time for the permit area following the termination of mining.

350 PERFORMANCE STANDARDS

351 General Requirements

SCM 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 mining operations. Areas to receive interim reclamation will be seeded with the interim seed mix.

The interim seed mix (Section 341.200) will be used to establish a shallow rooting cover of grasses for those areas disturbed during the development of the Gilson Well pad and relocation of Dugout Creek (west fork). The riparian area associated with the disturbance will receive reclamation as dictated in the stream channel alteration permit and Section 341 of the M&RP. The Pace Canyon Fan Portal topsoil stockpiles will be contemporaneously reclaimed using the only the grass seeds specified in Seed Mix No. 3.

Revegetation will not be done in areas required to be kept barren of vegetation such as areas around mine ventilation openings.

353 Revegetation: General Requirements

A vegetative cover will be established on all reclaimed areas to allow for the designated postmining land use of livestock grazing and wildlife habitat. Other than a road which will be retained through the facilities area following reclamation to allow access to private land within the permit area, all roads within the disturbed area boundary will be reclaimed. The vegetative cover will be in accordance with the approved permit and reclamation plan. All species of vegetation to be used in reclamation activities, whether planted by seed or seedling, will be approved by the Division (i.e. interim, mitigation, #1 and #2 seed mixes). Seed Mix No. 3 will be used at the Pace Canyon Fan Portal facilities during reclamation, the entire reclaimed surface will receive this seed mix except for the realigned road segment. The road is used as access by the BLM and private land owners.

353.100 Vegetative Cover

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

Native Species. The reclamation vegetative mixture (seeds, shrubs, and trees) will be comprise of species indigenous to the area, capable of achieving the postmining land use as approved by the Division. Diversity of species should allow ultimate utilization of plants by wildlife and domestic livestock.

The revegetative species will be purchased from suppliers who will certify their percentages of purity, germination, hard seed, and percentages of maximum weed seed content.

Extent of Cover. The vegetative cover will be at least equal in extent to the cover as determined by the range site sampling as discussed in Section 341.200. The Pace Canyon Fan Portal area will be compared to the reference area shown on Plate 3-1E.

Stabilizing. The vegetative cover mixture is capable of stabilizing the soil surface from erosion.

353.200 Reestablished Plant Species

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

Seasonal Characteristics. The revegetation plant species will have the same growing season as the original vegetation, or in this instance, as the adjacent areas.

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

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

Federal and Utah Laws or Regulations. The seed mixture purchased to revegetate the mine area will contain no poisonous or noxious plant. No species will be introduced in the area without being approved by the Division.

353.300 Vegetative Exception

SCM does not require vegetative exception at this time.

353.400 Cropland

The permit area contains no land designated as cropland.

354 Revegetation: Timing

SCM will follow the recommended guidelines for revegetation as discussed in Section 341.100.

355 Revegetation: Mulching and Other Soil Stabilizing Practices

Mulch and/or other soil stabilizing practices (pocking, gouging, roughening, etc.) will be used on all areas that have been regraded and covered by topsoil or topsoil substitutes (see Section

341.200). SCM will exercise care to guard against erosion during and after application of topsoil and will employ the necessary measures to ensure the stability of topsoil on graded slopes.

356 Revegetation: Standards for Success

The standards for revegetation success are discussed in this section and in Section 341.200.

Range Site Success Standards for Reclamation (Dugout Canyon Facilities):

	Pinyon/Utah Juniper	Riparian
Ground Cover	66%	85%
NRCS Production	800 lbs/acre	1500 lbs/acre
Shrub-Tree Density/Stocking	2200 stems/acre	2200 stems/acre
Diversity	2 Tree/shrub species 3 Grass species 2 Forb species	2 Tree/shrub species 3 Grass species 2 Forb species

For a species to be counted as one of the species that constitute vegetation diversity it must exist in the actual plant community at a minimum of 5%.

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

During the Fall of 1997, productivity for the disturbed area was determined by George Cook, a range conservationist for the NRCS. Mr. Cook determined the Pinyon/Utah Juniper area to be in good condition with 800 lbs/acre air dry weight production. The riparian area was determined to

be in fair condition with 1500 lbs/acre of air day weight production. Should the NRCS determination of production be insufficient to satisfy the requirement for standards of success, SCM commits to sample productivity at a corresponding range site.

Range sites for reclamation comparison purposes were chosen by a qualified person contracted by SCM and in cooperation with the Division. Range sites in Fish Creek Canyon representing both the pinyon/juniper and riparian vegetation types were sampled for cover in September, 1998 (Appendix 3-1). These specific range sites correspond with the cover quantities sampled for the pinyon/juniper and riparian areas within the Dugout Mine disturbed area boundary. The cover data for each range site was submitted to the Division for evaluation and approved for reclamation comparison (Appendix 3-1). The designated range sites will be used as a reference area until final revegetative bond release has been issued. The location of the area to be used for range site comparison is designated on Plates 3-1 and 3-1D .

The sites for sampling were chosen (September, 1998) in cooperation with Paul Baker (UDOGM).

356.100 Success of Revegetation

The success standards for approval will be judged on the effectiveness of the vegetation for postmining land use and the standards outlined in Section 353.

Within the Utah Division of Oil, Gas and Mining Vegetation Guidelines (Revised February, 1992) three methods for sampling vegetation are discussed; reference areas, range sites and the baseline data method. Each method describes the requirements for its subsequent use, however the sampling of diversity was not discussed within any of these methods.

The baseline data method could not be used at the Dugout Canyon Mine site due to previous disturbance by mining. Likewise the reference areas method could not be used since reference areas were not approved by the Division. Therefore the range site method has been adopted for use at the Dugout Canyon Mine.

The range site number used for comparison of revegetation success is 033XY342UT, upland very steep shallow loam (Pinyon-Utah Juniper). The area sampled by Patricia Johnston in 1997 met the requirements of Method #2 - Range Sites of the UDOGM Vegetation Guidelines, February 1992. Legible copies of data sheets from the sampling are included in Appendix 3-1.

Sampling Techniques (Dugout Canyon) . SCM will comply with the standards for success, statistically valid sampling techniques for measuring success, and the approved methods outlined in the Division's "Vegetation Information Guidelines" for sampling.

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

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

Standards for Success. The standards for success will include criteria representative of unmined lands in the area of the permit and as discussed in Section 356.200. In **Pace Canyon,** the standards for success will include criteria representative of undisturbed lands in the area of the disturbance (reference area), as means to evaluate ground cover, production and stocking of the reclaimed site. The sampling techniques for success in Pace Canyon will use a 90 percent statistical confidence interval as required by R645-301-356.120.

356.200 Standards for Success

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

Grazing Land or Pasture Land. The ground cover and production of living plants on the revegetated area will be at least equal to the specified success standards.

Cropland. There is no area designated as cropland within the permit area.

Fish and Wildlife Habitat. The success of revegetation for fish and wildlife habitat will be determined on the basis of tree and shrub stocking and vegetative ground cover. Minimum stocking and planting arrangements will be those approved by the Division on the basis of local and regional conditions. Cover success will not be less than that required to achieve the approved postmining land use.

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

Previously Disturbed Areas. Dugout Canyon contains the remains of earlier mining operations. The site was not reclaimed or revegetated following the earlier operations. Pace Canyon contains the remains of earlier mining, disturbance by logging activities, and road access disturbance. The area was neither reclaimed or revegetated following the aforementioned disturbance.

Due to the previous disturbance of the sites, SCM will restore the vegetative ground cover to that of the surrounding area as discussed in Section 341.200 and the ground cover will be adequate to control erosion.

356.300 Siltation Structure Maintenance

Siltation structures will be maintained until removal is authorized by the Division and the disturbed areas have been stabilized and revegetated. Siltation structures will be removed

no sooner than two years after the last augmented seeding. For additional details on siltation structures, see Section 542 of this M&RP.

356.400 Removal of Siltation Structures

The land on which siltation structures are located will be revegetated in accordance with the reclamation plan discussed in Sections 353 through 357 of this M&RP.

357 Revegetation: Extended Responsibility Period

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

357.100 Extended Period Begins

The period of extended responsibility will begin the year after the disturbed area has been reseeded.

357.200 Vegetative Parameters

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

357.300 Husbandry Practices

SCM will comply with Division-approved husbandry practices which will be normal conservation practices within the region of the mine. These practices may include disease, pest, and vermin control; and any pruning, reseeding, and transplanting required.

358 Protection of Fish, Wildlife and Related Environmental Values

SCM will minimize disturbances and adverse impacts on fish, wildlife, and their related environments as outlined in Section 333.

The intermittent flow of streams within the lease area does not support a population of game fish; therefore, there are no fisheries within the disturbed area to protect. In addition, the streams in Pace and Rock Canyons have intermittent flow and do not support a population of game fish. See Chapter 7 of this M&RP for methods to protect water sources in the area.

Proposed surface disturbance associated with mining activities will be reviewed by the DWR and UDOGM in reference to wildlife exclusionary periods. When and where applicable exclusionary periods will be adhered to unless approved otherwise by UDOGM and DWR. A letter concerning mitigation for drilling disturbance in 2004 - 2006 is located in Appendix 3-3.

358.100 Existence of Endangered or Threatened Species

Coal mining will not be conducted where it's operation might jeopardize the existence of any endangered or threatened species. The mining of coal will not result in the planned destruction or adverse modification of these species critical habitat, unless approved by appropriate agency(ies).

Any state or federally listed endangered or threatened specie will be reported to the Division upon its discovery. A ground nest survey for raptors and bird species of special interest was performed prior to site disturbance by a qualified person. A letter report of the ground nest survey is included in Appendix 3-3. Mining operations will proceed in accordance with Division stipulations. These stipulations also apply to reclamation operations at the Dugout Canyon Mine.

Lists of threatened, endangered, and sensitive species are included in Appendix 3-3. In addition, Appendix 3-3 contains 2003 and 2004 survey data for Mexican Spotted Owls and a letter from the DWR concerning installation of nesting boxes to satisfy mitigation requirements.

358.200 Bald and Golden Eagles

Coal mining and reclamation operations will be conducted in a manner protective of bald and golden eagles. SCM will promptly report any golden or bald eagle nests found within the permit boundaries and will proceed with operations in accordance with the Division's stipulations for protection of those nests. Refer to Section 333 for a discussion of methods of nest protection during potential subsidence.

358.300 Taking of Endangered or Threatened Species

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

358.400 Replacement of Wetland and Riparian Vegetation

The Division will be consulted on the best technology to replace and enhance the riparian vegetation to be disturbed.

358.500 Manmade Wildlife Protection Measure

Electric Power Lines. All power lines within the Dugout Canyon Mine disturbed area will comply or be modified to be raptor safe and comply with the guidelines of REA Bulletin 61-10, "Power Line Contacts by Eagles and Other Large Birds". Refer to Plates 4-1 and 5-2 for power pole locations.

Potential Barriers. When possible, structures built by SCM in Dugout Canyon will be designed and built to provide corridors of passage to large mammals.

Pond Protection. Fences or other appropriate methods will be used to exclude wildlife from ponds containing hazardous or toxic materials. However, SCM does not intend to store hazardous or toxic materials in ponds.

REFERENCES:

Blumer, Ralph J., 1979. Environmental Analysis, pp 25-26.

Hoag, Chris J. , How to Plant Willows and Cottonwood Dormant Pole Cuttings for Riparian Rehabilitation. Riparian/Wetland Project Information Series No. 4

Kuchler, A.W. 1975. Potential Natural Vegetation of the Conterminous United States. Amer. Geo. Soc., Spec. Publ. No. 36. Map.

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

USDA, 1993. How to Plant Willows and Cottonwoods for Riparian Rehabilitation. Soil Conservation Service, Technical Notes Plant Materials No. 23.

Utah Division of Wildlife Resources, 1990. Fauna of Southeastern Utah and Life Requisites Regarding Their Ecosystems. Pub. No. 90-11.

Utah Division of Wildlife Resources, 1979. Study to Determine Effects of Coal Development on Wildlife in Southeastern Utah. Prepared for Eureka Energy Company.

Utah Division of Wildlife Resources, 1979a. Fish and Wildlife Resources Information - Sage Point-Dugout Canyon Project. Prepared for Eureka Energy Company.

CHAPTER 4

LAND USE AND AIR QUALITY

TABLE OF CONTENTS

Section — Page

410 Land Use 4-1

411 Environmental Description 4-1

411.100 Premining Land Use 4-1
411.110 Land Use Map 4-2
411.120 Land Capability 4-3
411.130 Land Use Description 4-4
411.140 Cultural and Historical Resources Information 4-5
411.200 Previous Mining Activity 4-7

412 Reclamation Plan 4-8

412.100 Postmining Land Use Plan 4-8
412.200 Land Owner or Surface Manager Comments 4-9
412.300 Suitability and Capability 4-9

413 Performance Standards 4-10

413.100 Postmining Land Use 4-10
413.200 Determining Premining Uses of Land 4-10
413.300 Criteria for Alternative Postmining Land Uses 4-10

414 Alternative Land Use 4-10

420 Air Quality 4-10

421 Air Quality Standards 4-11

422 Compliance Efforts 4-11

423 Monitoring Program 4-11

424 Fugitive Control Plan for Production Rates Less than One Million Tons Per Year 4-12

TABLE OF CONTENTS (Continued)

Section | Page

425 Additional Division Requirements 4-12

REFERENCES 4-13

LIST OF PLATES

Plate

4-1 Land Uses

LIST OF APPENDICES

Appendix

4-1 Air Quality Approval Order and Information

4-2 Land Uses

4-3 Cultural and Historical Studies - SITLA Lease and Adjacent Area

4-4 Miscellaneous Land Use

CHAPTER 4

LAND USE AND AIR QUALITY

410 LAND USE

This section of the permit application includes descriptions of the premining and proposed postmining land use(s). Additional information can be found in the following amendments: Methane Degassification Amendment (August 2003), Refuse Pile Amendment (February 2003), and the Leachfield Addendum A-1 (March 2001). The remainder of the State Lease ML-48435-OBA (SITLA Lease) was incorporated into the Dugout Canyon Mine permit area in 2004. Refer to Plate 1-2 and 4-1 for the location of the acreage incorporated into the permit boundary.

In 2007 acreage (487.57 acres) was added to existing Federal Coal Lease U-07064-027821, two hundred and forty-seven acres of this added acreage is already included as part of the Dugout permitted area. Acreage was previously added to the permit area in excess of the Federal leased acreage to act as a subsidence buffer zone (207.57 acres) and to accommodate a revised mine plan (40 acres). In addition, State Lease ML-50582-OBA (320 acres, more or less) was issued to Dugout Canyon Mine in 2007. Future surface disturbance of these leases will be permitted as needed to facilitate mining activities.

Appendix 4-4 in the M&RP and in the confidential folder contains letters authorizing land use by Dugout Canyon Mine for data collection, exploration and degasification drilling and water monitoring

411 Environmental Description

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

411.100 Premining Land Use

The permit area has been primarily utilized as rangeland for livestock and wildlife habitat. Some crops related to the livestock industry have been developed along the creek bottoms adjacent to Soldier Creek Road. However, no crops have been raised within the permit area. Recreational use of the permit area is limited due to lack of access through private property.

The predisturbed area boundary outlined on Plate 5-4 reflects disturbance prior to 1965. The boundary was compiled from a 1980 map of the pre-mining topography prepared by Eureka Energy Company. According to historical data the Dugout Canyon area was last mined in 1964.

Pace Canyon

Archaeological inventories in the area were completed in 1980 by AERC who surveyed the access road into Pace Canyon to the Snow Mine site which is the currently proposed location of the fan site facility. The proposed fan site does not encompass the mine itself, but merely the facility area associated with the Snow Mine. The Snow Mine (42CB292) facility was active in 1906 but had its primary production period from 1932 - 1940. When inventoried the site was in moderately fair condition and avoidance was recommended in the 1980 inventory, however the site was **not** recommended for nomination to the National Register of Historic Places (Hauck &Weder: 1980). During an inventory by Senco-Phenix in 2001 the BLM requested a second evaluation of the Snow Mine site utilizing current National Register of Historic Places (NRHP) criteria. Senco-Phenix recommendation was "the area has been heavily logged since the initial recordation and the area around the mine extensively disturbed by heavy equipment, probably dozed. The foundation has been destroyed and the coal loadout has been collapsed and pushed into the bed of Pace Creek. The rock-covered adit and adjacent stonewall are still there on the other side of Pace Creek (east).....Other than recent trash no artifacts were observed. The integrity of the site has been basically destroyed. The site is not recommended for the NRHP" (Senulis: 2001). The 2001 evaluation also stated "no historic properties will be affected and no further cultural resource inventory is necessary".

In October 2003, Senco-Phenix performed an additional survey of the Snow Mine area in conjunction with a exploration drilling project proposed and approved by the BLM in 2003. The surveys mentioned in this section are on file with the BLM an/or in the Confidential Binder.

411.110 Land Use Map

Plate 4-1 designates the prominent land uses within and adjacent to the permit boundary. Pace Canyon has a corral just above a locked gate in Section 25, Township 13 South Range 12 East (Plate 4-1). The main livestock watering source is Pace Creek and it's tributaries in Sections 19, 20, 21 and

22, Township 13 South Range 13 East (Plate 4-1) and the Clark's Valley Reservoir, approximately 3 miles southwest of the Pace Fan Portal site (outside of area covered by Plate 4-1).

411.120 Land Capability

The area surrounding Dugout Canyon supports a variety of land uses including industrial, agricultural, and recreational. Carbon County has zoned the permit area for mining and grazing.

Energy resource development occurs throughout the region in the form of coal mining, oil and gas production and tar sands development. A methane gas recovery operation was formerly running in conjunction with the Soldier Canyon Mine which lies west of the Dugout Canyon Mine permit boundary. The Soldier Canyon Mine has been in operation since 1976.

The major plant communities in the Dugout Canyon lease area are identified in Section 321. No cultivated lands lie within the permit boundary, due to the limiting terrain and lack of water for irrigation. Refer to Section 321.100 for forage production per acre.

The permit area is used for grazing cattle, but sheep have grazed in the area previously. Valley bottoms receive little grazing due to their limited forage and narrowness except in the vicinity of water sources. Steep slopes receive limited grazing pressure from livestock because of the steep inclines and the lack of water. Flatter mesa tops and rolling terrain receive heavier pressure because of easier movement by livestock and more available forage. Grasses are preferred forage for cattle; however, cattle will eat forbs and shrub species.

The use of land for grazing is dictated by the condition of and access to the specific areas. At the land owners discretion land may be used for grazing one year and not used again for five years. However, grazing should continue to be considered a potential land use for the permit and adjacent areas.

The permit area supports limited recreation due to inaccessibility to privately owned lands.

411.130 Land Use Description

The permit area lies within undeveloped lands used primarily as wildlife habitat and for livestock grazing. Five grazing allotments are located in or adjacent to the permit area (Plate 4-1). The allotments support 429 head of cattle from May through October. The grazing allotments as listed below are administered by the U. S. Bureau of Land Management (BLM): Pine Canyon Allotment No. 24089 supports 50 head of livestock, Dugout Allotment No. 34039 supports 60 head, Pole Canyon Grazing Allotment No. 34092 supports 144 head, Cow Canyon Allotment No. 34032 supports 95 head, and Pace Canyon Allotment No. 24085 supports 80 head of livestock. The grazing allotment within the vicinity of the fan portal facilities is the Pace Canyon Allotment No. 24085, both the existing road and proposed facility site occur within this allotment. The existing Pace Canyon road passes near the main watering sources and holding corral for livestock on this allotment.

Recreation in the permit and adjacent areas includes camping, hunting, and hiking from Spring to late Fall. Recreational use is light due to restricted access to privately-owned lands. There are no developed or inventoried recreation campgrounds within the permit boundary. No impact is expected to the current recreational uses of the area. SCM will preserve these uses into the postmining period.

During deer and elk hunting seasons, the accessible lands are used extensively by the public. Fishing is limited at best, with restricted access and no known game fish populations existing in the permit area streams.

Logging operations completed in 1996 by Cascade Resources within and adjacent to the permit boundary are shown on the Sale Area Map "Exhibit A" in Appendix 4-2. Exhibit A was prepared by Cascade Resources of Wellington, Utah who estimated harvesting six million board feet from the areas designated on the exhibit. Their logging contract expired on 12/31/96.

Timber within the disturbed area is very limited and therefore not economical for recovery by the logging industry. Exhibit B included in Appendix 4-2 shows SCM's timber inventory including areas logged and areas yet to be logged.

The nearest crop production (alfalfa) is approximately 4 miles southwest of the permit boundary adjacent to the Soldier Creek Road. Cultivation occurs on a year to year basis, depending upon the water available for irrigation.

411.140 Cultural and Historic Resources Information

Cultural resource information and maps identifying cultural and historical study areas are located within the confidential folder of information pertaining to this permit. An intensive cultural resource evaluation of the permit area has been conducted by Dr. Richard Hauck, Ph.D. of Archeological-Environmental Research Corporation (AERC). As part of this evaluation he also made a record search at the State Historic Preservation Office (SHPO) and the National Register of Historic Places (NRHP).

Cultural resource evaluations were performed on two sites within the permit boundary. Field evaluations on the historic Dugout Creek Mine (42CB 205/291) and on a prehistoric rock art site (42CB 92) were conducted by the AERC staff on November 20 - 22, 1995. Site 42CB 92, situated in the SE1/4 of Section 22, T13S, R12E, contains a series of pictograph panels first documented by Dale Berge in 1977. The historic Dugout Creek Mine locus is situated in the NW1/4 of Section 23.

The historic components of the Dugout Creek Mine (42CB 205/291) are not considered to be significant and do not need to be avoided or mitigated prior to the development of the mine site. The prehistoric rock art site (42CB 92) is a significant resource and is eligible for nomination to the NRHP. Site 42CB 92 has been reported to the NRHP and BLM offices during previous cultural and historical studies of the area in 1977, 1980, and 1995 but is not currently listed on the NRHP.

The rock art panels are unstable and could be destroyed if blasting for road expansion is done within a 600-foot radius of the panels. SCM will make every effort to protect these rock art panels without drawing unnecessary attention to their location. The panels have been preserved primarily because the general public does not know of their existence. SCM will strive to maintain this condition.

The AERC report provides descriptive and valuational information for the two sites.

Cultural and historical inventories associated with the SITLA lease tract and adjacent areas are located in Appendix 4-1 and 4-3. This information should be held confidential by the Division.

The information in Appendix 4-3 was collected starting in 1980 and the last report was completed in 2003. According to information collected from the Price office of the BLM on March 23, 2004 and conversations with Mr. David Miller, there were no sites with artifacts considered for registration found in the areas surveyed and reported in 1980 through 1991. The conclusions were the same in the surveys conducted in 2001 - 2003. A letter from John Senulis, Archeologist with Senco Phenix detailing their file search and surveys of the area has been incorporated into Appendix 4-3. The letter is addressed to Kenny Wintch, the SITLA Archeologist and a copy has been sent to Mr. Dykman at SHPO. The letter states " No sites eligible for nomination to the National Register of Historic Places have been found in or adjacent to the permit expansion area. It is very unlikely that future survey will reveal sites eligible.....Furthermore all activity will be underground with no surface disturbance. For these reasons a finding of "no effect on historic properties" is appropriate and archeologic clearance without stipulations is recommended."

Federal Lease Modification U-07064-027821 and ML-50582-OBA

Senco-Phenix (Archeological Consulting Services) conducted a Class 1 file search for the NW1/4NW1/4, Section 21, Township 13S, Range 13E (approximately 40 acres). The 40 acres has privately owned surface and federal coal.

The Class 1 file search results listed a survey in 2006 conducted by Senco-Phenix which included a walking survey of a portion of the NW1/4NW1/4, Section 21, Township13S Range 13East. The survey area and a road surveyed in 2005 are shown on a drawing attached to a letter addressed to Vicky Miller, dated January 23, 2007 from Senco-Phenix. Copies of the letter and drawing have been provided to the Division for inclusion into Appendix 4-1 of the confidential folder as has a copy of the walking survey listed in the letter. **No cultural resources** were located during either of the surveys located by the file search, listed in the aforementioned letter.

During the June of 2007, an area of 580 acres were surveyed by Senco Phenix, an intensive walking survey was performed on 270 of these acres. The area surveyed includes parts of Section 16, 17, 18 and 21, T13S, R13E. A record search was performed on June 19, 2007. A salt lick was located during the walking survey, the lick consisted of 12"x12" block of commercially produced salt. The cultural resource located during the study was in the form of an isolated aspen art inscription, **no other cultural resources** were located during the survey. According to the study written report "a finding of no effect is appropriate and archeological clearance without stipulation is recommended".

Cultural and Historic Resource Maps. Maps and photographs for the evaluated cultural and historical sites are contained in the confidential folder.

There are no cemeteries, public parks, or units of the National System of Trails or the Wild and Scenic Rivers System located within the Dugout Canyon Mine permit boundary. The National Register of Historic Places was consulted by AERC and no registered historic or prehistoric properties will be affected by the proposed mine development.

SCM agrees to notify the Division and SHPO of previously unidentified cultural resources discovered in the course of mining operations. Arch Coal Company has a registered professional geologist on staff assigned to Dugout Canyon Mine available to confirm vertebrate fossil material discovered during earth moving activities during construction of the Pace Canyon Fan Portal site. SCM also agrees to have any such cultural resources evaluated in terms of NRHP eligibility criteria. Protection of eligible cultural resources will be in accordance with Division and SHPO requirements.

Coordination with State Historic Preservation Officer. AERC contacted SHPO concerning the Dugout Canyon Mine site and a copy of their report was forwarded to SHPO. The National Register of Historic Places was consulted by AERC and no registered historic or prehistoric properties will be affected by the proposed mine development.

411.200 Previous Mining Activity

Coal mining has occurred within Dugout Canyon since 1925. D. J. Collins prospected for and initially hand-developed the Red Glow Mine in the Gilson seam on the east side of Dugout Canyon in 1925. The west side of Dugout Canyon was first mined in 1952 by E.S.O. Coal Company when they mined the Rock Canyon seam.

The Knight Ideal Coal Company mined the Rock Canyon and Gilson coal seams located on both sides of the canyon between 1958 and 1964. Knight Ideal Coal Company extracted 1,326,000 tons of coal by conventional room and pillar method with partial pillar recovery. The area in Dugout Canyon disturbed by mining has changed hands through the years but no coal has been extracted since 1964.

Limited exploration within existing portals was conducted by Pacific Gas and Electric in 1979 and by Sunedco in 1982. Following each exploration, the portals were resealed with earthen fill. During 1995, SCM reopened four portals, two on the east and two on the west side of Dugout Canyon. The portals on the east side were resealed but the portals on the west side were left open and fenced for security and safety.

Remnants of the Fish Creek and Pace Canyon Mine which operated in the early 1900's also exist within the permit boundary. Both mine sites have been considered for preservation by SHPO but were ineligible for nomination to the National Register of Historic Places. Pace Canyon contains the remains of earlier mining, disturbance by logging activities, and road access disturbance. The area was neither reclaimed or revegetated following the aforementioned disturbance.

412 Reclamation Plan

412.100 Postmining Land Use Plan

All uses of the land prior to mining and the capability of the land to support prior alternate uses will remain available throughout the life of the mine except within the disturbed-area boundary.

SCM intends the postmining land use to be consistent with the present land use, which is livestock grazing and wildlife habitat. Final reclamation activities such as grading and seeding as detailed within this M&RP will be completed in a manner to provide lands able to parallel the premining land use. In areas where surface disturbance will result from mining operations, soil reclamation and revegetation will restore the areas to wildlife habitat and livestock grazing capabilities.

The activities associated with the mining operation will follow accepted standards or proven techniques. Erosion hazards will be minimized and, where possible, eliminated. Evidence of abandoned improvements will be removed. Reclamation will restore the land and vegetation to as near a natural and productive condition as possible.

Efforts to restore wildlife habitat are discussed in Chapter 3 of this M&RP. Specific periods of habitation by wildlife species of the disturbed and adjacent area are discussed in Appendices 3-2 and 3-3. Since the disturbed area is privately owned the timing and extent of use for grazing will be made after reclamation by the landowner.

412.200 Land Owner or Surface Manager Comments

The land surface within the permit boundary is owned by various entities, including the State of Utah and Canyon Fuel Company, LLC (CFC). The disturbed area is on surface lands owned by both CFC , BLM and the State.

The leases contained in Appendix 1-1 list responsibilities accepted by CFC in regard to the State of Utah's lands within the permit boundary. The leases contain requirements concerning use and maintenance of their administered lands. CFC is obligated by these leases to notify the Division for their determination as to whether this mining operation will be detrimental to the State of Utah's interest. By submitting this M&RP, CFC is indicating that the operation will not be detrimental to the State's interests and the obligation is being met. A letter of affirmation from the State of Utah concerning proposed land use is included in Appendix 4- 2.

The Bureau of Land Management (BLM) Right-of-Way application (UTU-76601) in Appendix 1-3 lists the responsibilities accepted by CFC concerning the BLM lands included in the permit boundary. A letter from the BLM concerning proposed land use for Pace Canyon Fan Portal area and UTU-76601 will be included in Appendix 4-2.

Refer to Chapter 1 for responsibilities CFC accepts in association with Federal Lease U-07064-027821.

For clarification as to relationship of SCM to CFC, refer to Section 112.

412.300 Suitability and Capability

Final fills will not contain excess spoils.

413 Performance Standards

The performance standards for the areas to be reclaimed for postmining land use are contained in this section.

413.100 Postmining Land Use

Postmining land uses are discussed in Section 412.100. The postmining lands will be reclaimed in a timely manner and capable of supporting such land uses (see Chapters 2, 3, 5, and 7). The postmining roads are discussed in Section 542.600.

413.200 Determining Premining Uses of Land

Postmining land uses will be as stated in Section 412.

413.300 Criteria for Alternative Postmining Land Uses

No alternative postmining land uses have been planned.

414 Alternative Land Use

No alternative postmining land uses have been planned.

420 AIR QUALITY

This section includes descriptions of plans to comply with the Clean Air Act and applicable Utah or federal statutes and regulations pertaining to air quality standards.

Dugout Canyon Mine (called the Sage Point-Dugout Canyon Mine under previous ownership by Eureka Energy Company) was granted a PSD permit by EPA on December 17, 1979. On February 12, 1982 the EPA approved air quality regulations adopted by the State of Utah. Subsequently, an Approval Order (AO) was issued on September 28, 1983 by the Utah Air Conservation Committee for the Sage Point-Dugout Canyon Mine. However the planned mining operations were never implemented.

Information collected for the PSD and the 1983 AO have been submitted to the Utah Division of Air Quality in a request for an amended approval order. This amendment was requested because

of a change in surface equipment and a decrease in proposed coal removal from 5.2 million tons to 2 million tons per year.

421 Air Quality Standards

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

422 Compliance Efforts

No mining activities will be conducted without a current AO from the Utah Division of Air Quality (DAQ). All activity will be conducted in compliance with the conditions established in the AO. A Notice of Intent (NOI) to construct has been submitted in accordance with DAQ document "Preparing Your Notice of Intent". Preconstruction conferences will be held as required by DAQ personnel. Emissions will be estimated using procedures and factors supplied by DAQ. A copy of the Approval Order and supporting information can be found in Appendix 4-1.

423 Monitoring Program

An NOI was submitted to DAQ requesting approval for a production rate of 7 million tons per year. This rate exceeds immediate production plans, but approval at this level will preclude the necessity of reapplying if future production plans should increase. This approach is appropriate since an AO is subject to specific operating conditions rather than to a time period and thus does not expire at the end of a 5-year period as does the approval of the mining permit. If operating conditions change sufficiently to invalidate the AO, a new NOI will be prepared.

The operating conditions are specified in the NOI and form the basis of the AO. All monitoring requirements and fugitive dust control practices as established by the AO will be followed by SCM. Should additional requirements be established under the provisions of R645-301-244.100 or R645-301-244.300, these requirements will also be followed by SCM.

424 Fugitive Control Plan for Production Rates Less than One Million Tons Per Year

During startup, or other situations where production is less than one million tons per year, the same procedures established in Section 423 will be followed and will be subject to the conditions of the AO issues by DAQ. See Section 523 of this M&RP for coal extraction estimates for the first 5 years of mining.

425 Additional Division Requirements

Should an air quality monitoring program be required by the Division while operating at a production rate of less than one million tons per year, SCM will provide sufficient data to judge the effectiveness of the fugitive dust control plan.

REFERENCES:

Berge, D. L., 1976. The archaeological potential of the sage point coal mine, surface facilities and railroad spur, central Utah.

Division of Air Quality, 1994. Preparing Your Notice of Intent, Fifth Edition.

Hauck, F.R. and Dennis G. Weder, 1980. Intensive archeological surface evaluations of the proposed Sage Point-Dugout Canyon project in Carbon County, UT. Archeological Environmental Research Corporation paper No. 19. Salt lake city, UT.

Julander, 0. 1955. Deer and cattle range relations in Utah. Forest Science 1 (2):130-139.

CHAPTER 5

ENGINEERING

LIST OF APPENDICES (Continued)

Appendix

5-8 Dugout Canyon Mine Blasting Plan

5-9 Sewer Pipeline Blasting Plan

5-10 Pace Canyon Fan Facilities

5-11 Subsidence Report

5-12 Miscellaneous Information - Permit Area Expansion

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 Dugout Canyon Mine. The proposed coal mining and reclamation activities associated with the mine have been or will be designed, located, constructed, maintained, and reclaimed in accordance with the operation and reclamation plans.

Additional information can be found in the following amendments: Methane Degassification Amendment (August 2003), Refuse Pile Amendment (February 2003), and the Leachfield Addendum A-1 (March 2001). The remainder of the State Lease ML-48435-OBA (SITLA Lease) was incorporated into the Dugout Canyon Mine permit area in 2005. In 2007, 40 acres was added to Federal Coal Lease U-07064-027821 to accommodate a revised mine plan. Refer to Plate 5-7 for the location of the acreage (NW1/4NW1/4, Section 21, Township13S, Range 13E) incorporated into the permit boundary. Surface disturbance will be permitted as needed to facilitate mining activities.

In 2007 acreage (487.57 acres) was added to existing Federal Coal Lease U-07064-027821, two hundred and forty-seven acres of this added acreage is already included as part of the Dugout permitted area. Acreage was previously added to the permit area in excess of the Federal leased acreage to act as a subsidence buffer zone (207.57 acres) and to accommodate a revised mine plan (40 acres). In addition, State Lease ML-50582-OBA (320 acres, more or less) was issued to Dugout Canyon Mine in 2007. Future surface disturbance of these leases will be permitted as needed to facilitate mining activities.

511 General Requirements

This permit application includes descriptions of the proposed coal mining 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 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

Previously Mined Areas. A certified map showing the location of previously mined areas within the permit and adjacent areas is provided as Plate 5-1 and Plate 5-7. Plate PC5-4 in Appendix 5-10 shows the portal location for an abandoned mine in the vicinity of the Pace Canyon Fan Portal Site.

Surface Facilities. Underground development waste which is generated at the Dugout Canyon Mine will be disposed of either:

- Underground within the Dugout Canyon Mine (without bringing this waste to the surface), at the approved waste-rock disposal facility at the Dugout Canyon Mine;
- At the approved waste-rock disposal facility at the SUFCo Mine (a sister operation of SCM); or
- At the approved waste-rock disposal facility at the Skyline Mine (also a sister operation of SCM).

Copies of the Division correspondence approving the SUFCo and Skyline waste-rock disposal facilities for receipt of Dugout Canyon waste rock are provided in Appendix 5-2.

Certified maps and cross sections concerning the disposal of underground development waste at the SUFCo and Skyline Mines are provided in the respective Mining and Reclamation Plans

of the permit and adjacent areas, Plate 6-2 shows the locations of the coal-seam outcrops in the vicinity of the proposed surface facilities, and Figure 6-1, Plate 6-3, 6-3A and 6-3B provide geologic cross sections based on data collected from drill holes in the area. Furthermore, information related to the physical conditions which may affect mining is presented in Sections 622 (a discussion of the cross sections), 624.100 (a discussion of stratigraphic and structural conditions), and 624.300 (a discussion of rock clay content), as well as Appendix 6-1 (drill-hole logs).

Subsidence Control Measures. Most of the land within the permit area will eventually be affected by subsidence. Anticipated areas of subsidence are shown on Plate 5-7. This subsidence boundary was projected to the surface based on an angle of draw of 30 degrees as measured from the vertical as required in R645-301-525.542. It is presumed that the actual angle of draw will be less, based upon results of mining and subsidence in the general area. Plate 5-7 illustrates the projected extent of subsidence based on a 30 degree angle of draw . The primary areas where future subsidence is not anticipated are the areas overlying the previous workings shown on Plate 5-1 and 5-7(since these areas will not be re-mined). Plate 5-7 also illustrates a subsidence buffer zone that extends beyond the limits of Federal Lease U7064-027821 and State Lease ML-48435. This buffer zone does not suggest that CFC will mine outside of the lease boundaries, however, it does indicate the limit of projected subsidence.

Appendix 5-11 contains a report entitled "Prediction of Surface Deformation Resulting from Longwall Mining" which discusses subsidence. The specific sections within the report discuss, subsidence mechanism; mining, geologic conditions and subsidence characteristics; predicted ground movements and the monitoring program. This information is provided per deficiencies in the 2005 mid-term review of the M&RP.

In the "Prediction of Surface Deformation Resulting from Longwall Mining" report study "subsidence calculations (consisting of vertical movements and horizontal trains) were completed for four longwall panels of interest to this study, as illustrated in Figure 1." Mining panels GIL-5, GIL-6, GIL-7 and GIL-8 were part of the subsidence study for the Gilson Block 2 in this report located in Appendix 5-11. "The type of subsidence mechanism predicted for the study area is the trough-type

subsidence. In the Gilson Block 2, CFC is utilizing panel-barrier designs to control overburden caving, seismicity and surface deformation. Considering panel width to average overburden depth rations for the project area (0.4 to 1.0), these longwall panels are considered to have a subcritical widths (Figure 3), and thus the majority of subsidence is expected during the mining of the individual longwall panels."

Section 3.3 on page 10 of the "Prediction of Surface Deformation Resulting from Longwall Mining" report discusses subsidence engineering parameters and measurements descriptions/calculations. Measured subsidence factor verses panel width to depth ratio for Utah operations is shown on Figure 5, typical subsidence profiles for the GIL- 5 through GIL-7 panels are shown on Figures 6 and 7.

Subsidence Monitoring. Numerous control points have been established within the permit and nearby areas to assist in subsidence surveys (see Plate 5-7). Coordinates and elevations of these control points (as established in January 1984) are provided in Table 5-2. Coordinates and elevations of control points are also provided in the Mine's Annual Reports. The control points consist of traverse monuments, benchmark monuments, and survey stations which have been constructed generally as follows:

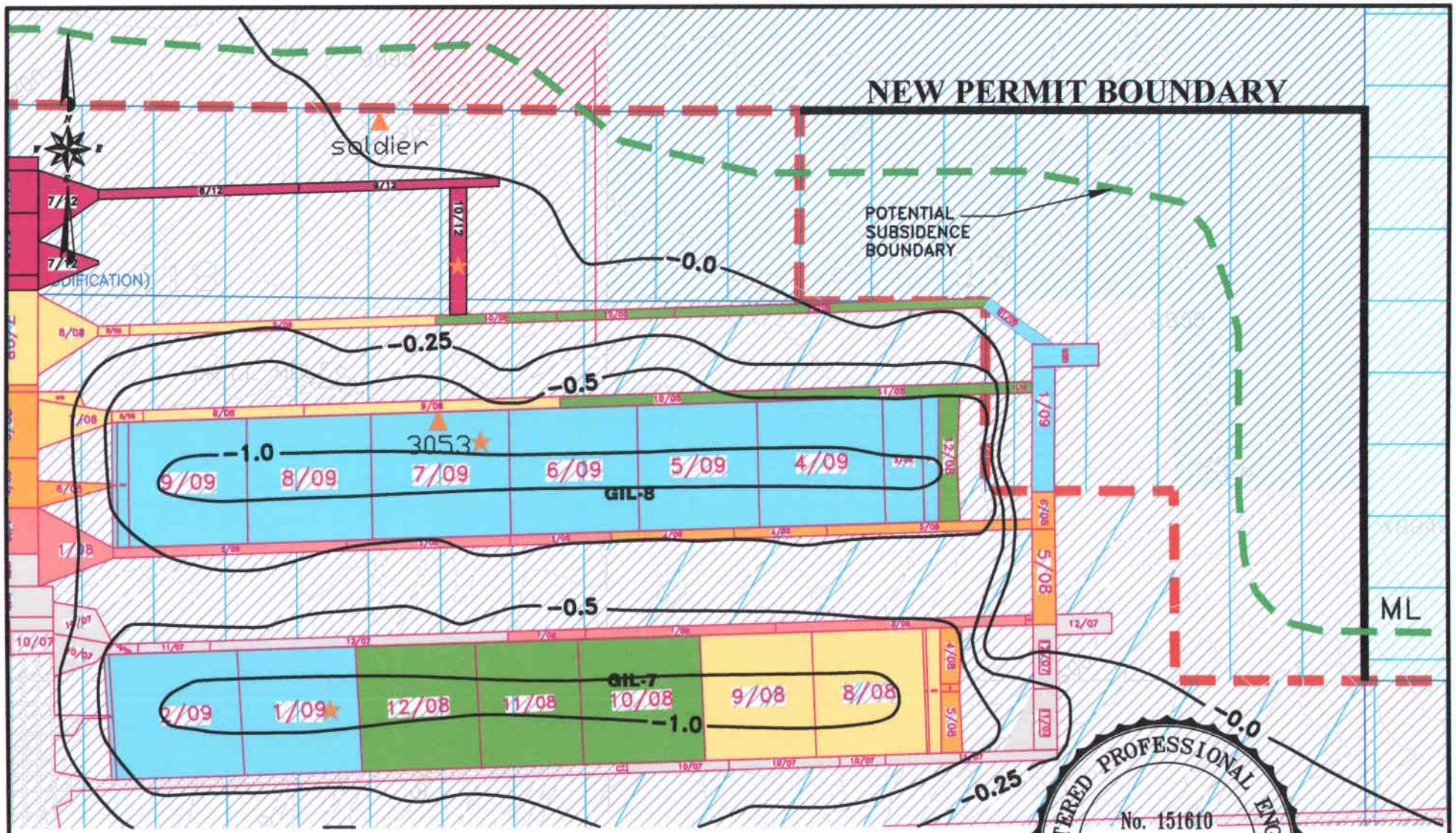
- Traverse and Benchmark Monuments - These monuments are constructed with tap-on convex cap with a center punch mark and a center rod. The center rod has been emplaced in a 5.5- to 6-foot deep poured concrete casing. Where rock was encountered before the required depth, the rock was broken with a stone rod and an anchor point was grouted into the rock using a concrete patching material. Alternatively, monuments in rock were emplaced as described below ("Rock Monuments and Stations").

- Survey Stations - These stations consist of rebar rods with a length of 5 feet. Each rebar has been fitted with a aluminum cap. The caps are plain with a center punch mark and a concave label across the top. Where survey stations are installed in boulders or rock which did not allow the use of rebar, they were installed as indicated below ("Rock Monuments and Stations").

- Rock Monuments and Stations - Where survey monuments and stations are established in boulders and rock which do not allow the installation of a rod in a

APPENDIX 5-12

Miscellaneous Information - ~~40 Acre~~ Permit Area Expansion



APPENDIX 5-12 FIGURE 1. POTENTIAL SUBSIDENCE

APPENDIX 5-12 - Figure 1

Area and depth of potential subsidence were calculated/estimated by considering the following information and data:

Prediction of Surface Deformation Resulting from Longwall Mining Over the Gilson North-East Block, prepared by Maleki Technologies, Inc, located in Appendix 5-11 of this M&RP

Geologic features of the area such as cover and structure, including information in Chapter 6 of this M&RP.

Barrier pillars between longwall panels, 425' pillar between the GIL-6 and GIL-7 panel, 600 foot barrier pillar between the GIL-7 and GIL-8 panel and 528 foot pillar between the GIL-8 and GIL-9 panel.

Subsidence data submitted to UDOGM in annual reports (2004 - 2006) by coal mines both in the Bookcliff mining area and the Wasatch Plateau mining area.

Bookcliff Mining Area

Dugout Canyon Mine: Reports cover of 1800 - 1900 feet with a surveyed subsidence depth of 0.29 feet **or less**

Tower Mine: Reports cover of 2000 - 2500 feet with a subsidence survey depth averaging **less than** 1.0 foot

Reports cover of 2500 or greater with a subsidence survey depth averaging **less than** 0.5 feet

West Ridge Mine: Reports cover of 400 feet to 2500 feet with a subsidence survey depth of **less than**1.0 foot

Subsidence prediction method developed by the British National Coal Board.

CHAPTER 7
HYDROLOGY

CHAPTER 7
HYDROLOGY

710 INTRODUCTION

711 General Requirements

This chapter presents a description of:

- Existing hydrologic resources within the permit and adjacent areas;
- Proposed operations and the potential impacts to the hydrologic balance;
- Methods of compliance with design criteria and the calculations utilized to show compliance;
- Applicable hydrologic performance standards; and
- Hydrologic reclamation plans for the Dugout Canyon Mine.

Additional information can be found in the following amendments: Methane Degassification Amendment (August 2003), Refuse Pile Amendment (February 2003), and the Leachfield Addendum A-1 (March 2001). ~~The remainder of the State Lease ML-48435-OBA (SITLA Lease) was incorporated into the Dugout Canyon Mine permit area in 2005.~~ Refer to Plate 1-2 for the location of the acreage incorporated into the permit boundary.

The probable hydrologic consequences associated with construction of the AMV Access Road are addressed in the Methane Degassification Amendment (July 2006), Wells G-1 through G-19 and G-31.

The remainder of the State Least ML-48435-OBA (SITLA Lease) was incorporated into the Dugout Canyon Mine permit area in 2005. In 2007 acreage (487.57 acres) was added to existing Federal Coal Lease U-07064-027821, 240 acres of this added acreage is already included as part of the Dugout permitted area. Acreage was previously added to the permit area in excess of the Federal leased acreage to act as a subsidence buffer zone (207.57 acres) and to accommodate a revised mine plan (40 acres). In addition, State Lease ML-50582-OBA (320 acres, more or less) was issued to Dugout Canyon Mine in 2007. Future surface disturbance of these leases will be permitted as needed to facilitate mining activities.

712 Certification

All maps, plans, and cross sections presented in this chapter have been certified by a qualified, registered professional engineer.

713 Inspection

Impoundments associated with the mining and reclamation operations will be inspected as described in Section 514.300 of this 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.

722 Cross Sections and Maps

722.100 Location and Extent of Subsurface Water

A generalized hydrostratigraphic cross section of the permit and adjacent areas is presented in Figure 7-1 and in Appendix 7-4, Figure 19. A description of baseline groundwater conditions within the permit and adjacent areas, together with appropriate cross sections and maps as well as a discussion of seasonal variations in water levels, is provided in Section 724.100 of this M&RP.

722.200 Location of Surface Water Bodies

A description of baseline surface-water conditions within the permit and adjacent areas, together with appropriate maps and cross sections, is provided in Section 724.200 of this M&RP. A map showing the location of surface-water bodies and groundwater sources for which water rights exist or for which there are pending water rights applications is provided as Plate 7-2. A listing of water rights is presented in Appendix 7-1.

722.300 Locations of Monitoring Stations

Surface water and groundwater monitoring stations from which data have been collected within the permit and adjacent areas of the Dugout Canyon Mine are located as shown on Plate 7-1. Approximate surface elevations of the monitoring stations are also indicated by the topographic contours provided on Plate 7-1.

722.400 Location and Depth of Water Wells

The Gilson water supply well is located approximately 450 feet southwest of the water tanks along the side of the water tank access road. The well depth is 300 feet and intercepts water collecting in the Gilson seam at the location shown on Plate 7-5. Groundwater monitoring wells in the area are located as shown on Plate 7-1. Depths of these wells and other completion details of the monitoring wells are summarized in Table 7-1. Refer to Appendix 7-9 for details pertaining to the Gilson water well.

722.500 Surface Topography

Surface topographic features in the permit and adjacent areas are shown on the base map used for Plate 7-1.

723 Sampling and Analysis

Where possible, all water samples collected for use in this M&RP have been analyzed according to methods in either the "Standard Methods for the Examination of Water and Wastewater" or 40 CFR parts 136 and 434. Where feasible, these same references have been used as the basis for sample collection.

724 Baseline Information

Surface water, groundwater, and climatic resource information is presented in this section to assist in determining the baseline hydrologic conditions which exist in the permit and adjacent areas. This information provides a basis to determine if mining operations can be expected to have a significant impact on the hydrologic balance of the area.

724.100 Groundwater Information

This section presents a discussion of baseline groundwater conditions in the permit and adjacent areas. The location of wells and springs in the mine area are presented on Plates 7-1 and 7-2. The wells in the mine area are all, water monitoring wells except for the Gilson water well. No additional water supply wells have been identified. Water rights for the mine and adjacent areas are addressed in Section 722.200 of this M&RP. All groundwater use (seeps and springs) within the permit and adjacent areas is confined to wildlife and stock watering.

Table 7-2 provides a summary of the period of record and selected additional information regarding groundwater sources that have been monitored within the permit area and the nearby vicinity. These sources include wells, springs, and mine-water inflows from the Soldier Canyon Mine. The geologic source for the springs presented in Table 7-2 was determined by comparing Plates 6-1 and 7-1. These data have been collected from over 100 locations within the permit and adjacent areas beginning as early as 1976 and extending through the present, as indicated in the data base contained in Appendix 7-2.

The data provided in Appendix 7-2 were obtained from multiple sources, including (but not limited to) the Soldier Creek Coal Company M&RP and annual reports, U.S. Geological Survey publications, the Sage Point-Dugout Canyon permit application filed by Eureka Energy Company in 1980, Appendix 7-3 of this M&RP, and various consultant reports. Since not all monitoring parties were responsible to adhere to UDOGM or SMCRA rules, the laboratory parameters varied between reports. However, the data are still considered valid and appropriate for determining baseline conditions within the permit and adjacent areas. It should be noted that much of the manganese data presented in Appendix 7-3 represent total (as opposed to dissolved) concentrations.

Additional baseline and operational data for sampling sites within the SITLA tract addition to the Dugout Mine permit are also available on the Division's Electronic Water Monitoring Database.

A hydrologic evaluation of the area was published by Mayo and Associates (1996). This evaluation, which is presented in Appendix 7-3 of this M&RP was initially used together with published reports of the area and the extensive data base contained in Appendix 7-2, to prepare this description of baseline hydrologic conditions within the permit and adjacent areas. While the Mayo report does not specifically include the SITLA tract area, the geologic and hydrogeologic conditions within the tract are similar enough to the area studied by Mayo to assume the conclusions reached by Mayo would apply to the SITLA tract. An update to the PHC document

originally written by Mayo and Associates and included in Appendix 7-3 was prepared by the mine in October 2007 to address additional baseline data collected for the ~~600~~ 240 acre expansion in the northeast portion of the permit area. The update also includes the results of surface and ground water monitoring by the mine since 1998. This information is included in Appendix 7-3 and titled "Update to the Probable Hydrologic Consequences of Coal Mining at the Dugout Canyon Mine".

Groundwater Systems

Geologic conditions in the permit and adjacent areas are described in detail in Chapter 6 of this M&RP. Formal aquifer names have not been applied to any groundwater system in the permit and adjacent areas because the geometry, continuity, boundary conditions, and flow paths of the groundwater systems in the area are not fully understood. However, the data do suggest that groundwater systems in each of the bedrock formations are sufficiently different from each other to justify the informal designation of groundwater systems based on bedrock lithology. Thus, the informal designation of Colton, Flagstaff, North Horn, Price River, Blackhawk, Star Point, and Mancos groundwater systems is adopted herein.

Perched Groundwater Systems in the Colton Formation, Flagstaff Limestone, North Horn Formation, Price River Formation, and the Castlegate Sandstone

The nature and occurrence of groundwater systems in the Wasatch Plateau and Book Cliffs coal fields are described in a Geological Society of America Bulletin publication (Mayo et al., 2003). The Dugout Canyon Mine permit and adjacent area is included in the study area for this publication. This publication describes active and inactive groundwater flow systems in stratified mountainous terrains. Mayo et al. describe groundwater systems in the Dugout Canyon Mine area as occurring in one of two fundamental groundwater flow regimes. These include "active" groundwater flow systems, and "inactive" groundwater flow systems. Active zone groundwater flow paths are continuous, and responsive to annual recharge and climatic variability. Active zone groundwater systems support springs discharging at the surface in the area. Inactive zone groundwater systems have extremely limited or no communication with annual recharge. Inactive zone groundwater systems may be partitioned, occur as discrete bodies, and may occur in hydraulically isolated regions that do not have hydraulic communication with each other (Mayo et al, 2003; See also Mayo and Morris, 2000).

In the vicinity of the Dugout Canyon Mine, discharge of groundwater from geologic formations overlying mining areas occurs primarily from localized perched groundwater systems (See

Appendix 7-3 for further information on shallow groundwater systems). Perched groundwater systems in the near-surface bedrock formations overlying the Dugout Canyon Mine (including the region near the permit expansion area) were noted by Waddell et al. (1986). It is noteworthy that Waddell reports perched groundwater systems encountered in some drill holes, while perched groundwater systems were not encountered in some other nearby drill holes (See Figure 19 in Waddell et al., 1986). This condition demonstrates the lack of lateral continuity in the local perched groundwater systems present in the area and also highlights the fact that meaningful potentiometric surface maps cannot be constructed for these isolated perched groundwater systems.

The presence of local perched groundwater systems overlying unsaturated strata and the hydraulic disconnect between the shallow perched groundwaters and the deep Blackhawk Formation groundwater systems encountered during mining operations is fundamentally the result of the heterogeneity of the rock sequence in the region (Mayo et al, 2003). The flow of bedrock groundwater in quantities sufficient to support discharge to springs occurs primarily within permeable sandstone strata. Groundwater flow along fault planes, bedding planes, and through rocks with fracture-enhanced permeability also occurs locally. In the rock sequence overlying the Dugout Canyon Mine area, the permeable sandstone units commonly exist as discontinuous sandstone paleochannels. Annotated photographs showing sandstone fluvial channels in the Colton Formation near Colton, Utah are presented in Figures X and Y. Also shown on Figures X and Y are the fine-grained sediments with lower hydraulic conductivities that encase the more permeable sandstone rocks in the fluvial channels. Because of the depositional environments in which these rocks were formed, the fluvial sandstone paleochannels are commonly encased both vertically and horizontally by low-permeability rocks (shales, mudstones, and claystones; Mayo et al., 2003). Although the permeability of individual sandstone bodies may be of aquifer quality, the overall ability of these rocks to transmit water horizontally over great distances is low because of the discontinuous nature of the sandstones (Mayo et al., 2003). The surrounding low-permeability rocks impede the outward migration of groundwater from permeable strata both vertically and horizontally. The abundant presence of low-permeability strata in the rock sequence, and the discontinuous character of permeable strata prevent the appreciable downward migration of groundwater from the perched systems into deeper horizons (or into the underground mine environment; Mayo et al., 2003). As indicated in Appendix 7-3 and based on drilling data (Appendix 7-4 and Appendix 6-1, Confidential), large portions of the rock sequence overlying mining areas in the Dugout Canyon Mine area do not appear to be fully saturated in the vicinity of the Dugout Canyon Mine.

Unlike the Colton, Flagstaff, North Horn, and Price River formations, which consist largely of low-permeability rocks with interbedded sandstone strata, the Castlegate Sandstone in composed

primarily of sandstone rocks. However, for several reasons, large aquifers do not form in the Castlegate Sandstone. The Castlegate Sandstone is not a uniform sand deposit. Rather, interbedded with the lenticular fluvial braided sandstone horizons are repeating sequences of mudstone drapes or depositional bounding surfaces (Mayo et al., 2003). The permeabilities of the mudstone drapes are typically many times lower than that of the surrounding sandstone. Consequently, although portions of the Castlegate Sandstone are sufficiently permeable to facilitate groundwater flow, the interbedded mudstones drapes partition and isolate these sandstone units such that the overall ability of the formation to transmit water both laterally and vertically over significant distances is poor (Mayo et al., 2003). Where Castlegate Sandstone discharge is present, it is most commonly associated with the presence of fracturing or jointing. Additionally, the potential for recharge to the Castlegate Sandstone is low. The pervasiveness of low-permeability strata in the geologic formations overlying the Castlegate prevents appreciable recharge to the formation from vertical leakage from the overlying formations. Additionally, because of the limited surface exposure of the Castlegate Sandstone in the area, the potential for groundwater recharge directly onto the Castlegate is low. As discussed above, the observation that the Castlegate Sandstone does not support many springs in the region and that much of the formation was dry when drilled supports these conclusions (See Appendix 7-4 and Appendix 6-1, Confidential). Because geologic and hydrogeologic conditions in the Castlegate Sandstone in the proposed expansion area are believed to be very similar to those in surrounding areas in the Book Cliffs coal field, it is considered probable that the hydrogeologic behavior of Castlegate Sandstone groundwater systems in the proposed expansion area will be consistent with the Castlegate Sandstone groundwater flow conditions described regionally by Mayo (2003).

It should be noted that although there appear to be large areas of unsaturated low-permeability rock surrounding the perched groundwater systems, saturated low-permeability strata are likely also present locally in the rock sequence. However, the rate of movement of water in the low permeability strata is commonly several orders of magnitude less than that in the permeable sandstone horizons (Mayo et al., 2003; Waddell, 1986). Consequently, groundwater in these horizons likely exists mostly under relatively stagnant conditions and is not of much consequence to the hydrologic balance.

The shallow, perched groundwater systems in the Dugout Canyon Mine area are likely recharged where the up-dip ends of the sandstone beds or fractured bedrock strata are exposed at the land surface in wet areas, or where the beds are directly overlain by water-bearing alluvial or colluvial sediments. Recharge to the sandstones from overlying saturated shallow fractured bedrock may also occur. Recharge to the sandstone strata via direct vertical leakage from overlying, competent, low-permeability strata is probably low (Waddell, 1986).

Discharge rates from shallow, perched groundwater systems overlying mining areas in the Dugout Canyon Mine generally exhibit both seasonal and climatic variability (see Appendix 7-3 and flow information submitted to the Division's online hydrology database). Most springs discharging from perched systems respond rapidly to the annual snowmelt recharge event, followed by a rapid waning of discharge rates later in the year. These conditions are indicative of shallow groundwater systems that are in good hydraulic communication with shallow, active recharge sources (i.e., active zone groundwater systems). These conditions are not commonly observed in springs discharging from large aquifers with large storage volumes (Waddell, 1986).

Groundwater flow directions in the perched groundwater systems are constrained largely by the geometry of the permeable sandstone strata through which the groundwater is conveyed. In the general sense, it may be stated that perched groundwaters flow from up-dip recharge areas to topographically lower discharge areas. However, because the sinuous geometries and subsurface locations of individual three-dimensional sandstone paleochannels (or other fractured or permeable strata) are difficult to delineate in the subsurface, the determination of concise groundwater flow directions within these bodies is problematic.

Discharge from the perched groundwater systems commonly occurs where the down-dip ends of the permeable sandstones or bedrock fractures or bedding planes intersect the land surface (Waddell, 1986; Mayo et al., 2003). In some localities, the presence of bedrock fracturing or jointing within sandstone channels enhances the hydraulic conductivity locally. It is not uncommon for the spring discharge locations from perched groundwater systems to coincide with the occurrence of local bedrock fracturing (Mayo et al., 2003). Where fracturing of the bedrock is present at groundwater discharge locations, spring discharge locations are commonly focused into discrete spring locations rather than as diffuse seepage through porous rock.

Potentiometric Surface Maps

A fundamental assumption underlying the construction of a potentiometric surface contour map is that there is a continuously saturated, interconnected aquifer that is present over a substantial aerial extent. Because there are no identified aerially extensive groundwater regimes in the strata overlying coal mining areas in the Dugout Canyon Mine area (See Appendix 7-3), and the probable lack of connection between the individual small perched groundwater systems, it is not possible or scientifically correct to draw potentiometric surface contour maps for these groundwater systems at a reasonable scale. While potentiometric surface contour maps of individual small, perched groundwater systems could conceivably be created at a local scale, it would be impractical and of

limited value to do so. Consequently, potentiometric surface contour maps depicting groundwater conditions cannot be presented here.

Groundwater in the permit and adjacent areas occurs within perched aquifers overlying the coal-bearing Blackhawk Formation as well as within the Blackhawk Formation and the underlying Star Point Sandstone. Hydrogeologic conditions within the permit and adjacent areas are summarized below.

Colton Formation. The Colton Formation outcrops in the northeast portion of the permit and adjacent areas. This formation consists predominantly of fine-grained calcareous sandstone with occasional basal beds of conglomerates and interbeds of mudstone and siltstone. Data presented in Table 7-2 and Appendix 7-2 indicate that six springs issue from the Colton Formation within the permit and adjacent areas.

Waddell et al. (1986) evaluated the discharge of spring G-96 for the period of June to September 1980. At spring G-96 the measured discharge rate declined from 103 to 6.3 gpm during the 4-month period of evaluation. The slope of the hydrograph recession curve (which provides a relative index of the seasonal variability of discharge) was calculated by Waddell et al. (1986) to be 24 days per log cycle for the initial slope following snowmelt (designated as "S1") and greater than 365 days per log cycle for base-flow conditions (designated as "S2"). This suggests that, at this location, the groundwater system has a good hydraulic connection with surface recharge and that most of the annual recharge quickly drains out of the system.

Groundwater issuing from the Colton Formation has a total dissolved solids ("TDS") concentration of 300 to 500 mg/l (as measured by specific conductance and laboratory analyses of TDS). The pH of this water is slightly alkaline (7.5 to 8.1). Collected data suggests TDS concentrations do not significantly vary seasonally. The pH of the water appears to shift toward becoming more alkaline during periods of drought.

Based on one sample collected from G-96, the water is a calcium-magnesium-bicarbonate type (see Figure 7-2 and Appendix 7-2). This solute composition is consistent with the dissolution of calcite and dolomite in the presence of soil-zone carbon dioxide, together with ion exchange. The G-96 data also indicated a dissolved iron concentration of 0.02 mg/l. No total iron or manganese data are available for this spring. Samples obtained and analyzed from springs SC-65 and 260 support the conclusions the water discharging from the Colton Formation is a calcium-magnesium-bicarbonate type.

Flagstaff Formation. The Flagstaff Formation outcrops across much of the northern portion of the permit area. This formation consists of an interbedded sequence of sandstone, mudstone, marlstone, and limestone. Most springs and a major portion of the volume of groundwater discharging from the permit and adjacent areas issue from the Flagstaff Formation. According to Table 7-2 and Appendix 7-2, more than 40 springs issue from the Flagstaff Formation within the permit and adjacent areas.

Groundwater discharge rates for springs issuing from the Flagstaff Formation are greatly influenced by seasonal variations in precipitation and snowmelt, with most discharge corresponding to the melting of the winter snow pack during the spring months. Some springs in the Flagstaff Formation, which have been found to discharge 100 to 300 gpm following the spring snowmelt, decrease to flows of 15 gpm or less by the fall (Appendix 7-2). Many springs issuing from the Flagstaff Formation have been noted to dry up each year.

In an effort to quantify the seasonal variability of discharge rates of springs issuing from the Flagstaff Formation, Waddell et al. (1986) prepared hydrograph recession curves for several springs in the permit and adjacent areas. The hydrograph data summarized in Table 7-3 show an S1 recession average of 69 days and an average S2 recession 246 days. The longer duration of the S1 recession relative to the data collected from G-96 in the Colton Formation indicate that the storage capacity of the Flagstaff Formation is greater than that of the Colton Formation. Nonetheless, the data indicate that most of the annual recharge to the Flagstaff Formation drains out of the system within about two months, while the remainder of the annual recharge drains out prior to the next snowmelt recharge event. This conclusion was verified by isotopic data collected by Mayo and Associates, 1996, Appendix 7-3.

The groundwater regime in the Flagstaff Formation appears to be influenced predominantly by the combined effects of lithology and topographic expression. Because the Flagstaff Formation forms much of the upland plateau of the permit and adjacent areas, this formation is capable of receiving appreciable groundwater recharge from precipitation and snowmelt.

Waddell et al. (1986) concluded that the Flagstaff groundwater system is perched. They indicate that approximately 9 percent of the average annual precipitation recharges the Flagstaff groundwater system and that recharge water entering the Flagstaff Formation moves downward until it encounters low permeability shale or claystone layers in the North Horn Formation, where almost all of the water is forced to flow horizontally to springs. The hydrograph and isotopic data support this conclusion

Data presented in Appendix 7-2 indicate that groundwater issuing from the Flagstaff Formation has a mean TDS concentration of 335 mg/l. This water tends to be slightly alkaline and, similar to conditions encountered in the Colton Formation, is of the calcium-magnesium-bicarbonate type (Figure 7-3). The solute compositions of these groundwaters appears to be dominated by the dissolution of calcite and dolomite in the presence of soil zone carbon dioxide, together with ion exchange.

The data presented in Appendix 7-2 indicate that the dissolved iron concentration of groundwater discharging from springs in the Flagstaff Formation is generally less than 0.1 mg/l. Total iron concentrations of this water are typically about one order of magnitude higher. Total manganese concentrations in Flagstaff groundwater are generally less than 0.03 mg/l. These data do not exhibit seasonal trends.

North Horn Formation. The North Horn Formation outcrops across the center of the permit and adjacent areas but eventually pinching out in the eastern portions of the permit and adjacent areas. This formation consists of interbedded sandstone and calcareous mudstone.

According to Table 7-2 and Appendix 7-2, 27 springs issue from the North Horn Formation within the permit and adjacent areas. Although the number of reported springs is large, the maximum measured discharge from most of these springs is less than 5 gpm and the total maximum measured discharge is small compared to the total maximum measured discharge from the Flagstaff Formation. Given the gradational nature of the contact between the North Horn Formation and the overlying Flagstaff Formation (see Section 624.100), it is possible that some of the reported North Horn Formation springs may represent discharge from the lower part of the Flagstaff Formation.

Hydraulic and chemical conditions vary widely within the North Horn Formation. This variability caused Waddell et al. (1986) to conclude that water discharging from the North Horn Formation is probably recharged by upward leakage from the underlying formations, including the Blackhawk Formation. This conclusion was based on water levels in wells perforated in the Blackhawk Formation and on the solute chemistry of spring SP-10. However, this conclusion is considered to be in error since the Price River Formation and the Castlegate Sandstone, which are situated between the North Horn Formation and the Black Formation, are not saturated in the vicinity of Soldier Creek just downstream from SP-10. Furthermore, Soldier Creek loses water as it flows across the Price River Formation and the Castlegate Sandstone (see Waddell et al., 1986). Hence, the upward flow from the Blackhawk Formation does not appear to be the primary source of recharge to the North Horn Formation.

Sufficient data have been collected from two springs (SP-8 and SP-10) to provide diagnostic information regarding the groundwater system of the North Horn Formation in the permit and adjacent areas. The discharge from SP-8 is hydraulically and chemically similar to groundwater in the Flagstaff groundwater system. The spring exhibits substantial variability in discharge in response both to spring snowmelt events and to drought and wet years (Figure 7-4). Discharge rates as great as 20 gpm have been recorded from this spring during the high-flow season, and discharge rates as low as 1 gpm are not uncommon during late summer. The effects of the drought occurring in the late 1980s and early 1990s are clearly evident in the hydrograph.

Groundwater issuing from SP-8 typically has a mean TDS concentration that varies from 250 to 300 mg/l with a pH of 8.5 to 8.9. This water is of mixed cation-bicarbonate type (Figure 7-5) and is chemically distinct from most groundwater in the Blackhawk Formation.

Although spring SP-10 issues from the North Horn Formation, the spring may be fracture controlled and contain water from a deeper groundwater system. Although fracture systems have not been mapped on the surface in the vicinity of SP-10, the long-term hydrograph of SP-10 (Figure 7-4) is not consistent with hydrographs of "shallow-source" springs issuing from the Flagstaff, North Horn,

or Price River groundwater systems, in that the discharge rate of SP-10 shows only limited seasonal variability.

According to Mayo and Associates (1996), the isotopic and solute compositions of SP-10 discharge water are more similar to groundwater encountered in the Blackhawk Formation. Groundwater discharging from SP-10 is of the sodium-bicarbonate type (Figure 7-5), which suggests that ion exchange of calcium and magnesium has occurred for sodium in a zone containing clay minerals or zeolites. This could occur in the Blackhawk Formation since the zeolite analcime has been identified in coal at the Skyline Mine located approximately 35 miles west of the proposed Dugout Canyon Mine (Mayo and Associates, 1994).

Groundwater issuing from SP-10 has an elevated sulfate content (Appendix 7-2 and Figure 7-5). In fact, this spring has been locally referred to as Sulfur Spring due to the odor of hydrogen sulfide gas which lingers in the air. The source of the gas is likely near-surface sulfate reduction caused by bacterial activity (Appendix 7-3). Sulfate reduction is consistent with the measured reducing potential of the water (Appendix 7-3).

According to information presented in Appendix 7-3, water issuing from SP-10 has a meteoric origin but an old age. Furthermore, the data indicate that water issuing from SP-10 is similar to water encountered in Soldier Canyon Mine, suggesting that the water issuing from the spring is mixed with water from the Blackhawk Formation (Appendix 7-3).

The old age of groundwater issuing from SP-10 relative to water from other springs in the North Horn and overlying formations is confirmed by the mean radiocarbon age of the water which has been calculated as 10,000 years (see Appendix 7-3). As a point of comparison, a mean radiocarbon age of 21,500 years has been calculated for a groundwater sample collected from the Blackhawk Formation in the 3rd West pillar area inside Soldier Canyon Mine (see Appendix 7-3).

It is likely that groundwater discharging at SP-10 flows upward from depth along a fracture. The major water-bearing fracture identified in the Soldier Canyon Mine is approximately coincident with the location of SP-10, validating this conclusion (see Appendix 7-3).

Wahler Associates (1982) indicate that monitoring well GW-19-1 (Plate 7-1) was initially completed within the North Horn Formation. However, according to Waddell et al. (1986), the well was initially unperforated and was then perforated on two separate occasions (first opening the well to the North Horn Formation and then later to the underlying Price River Formation, Castlegate Sandstone, and Blackhawk Formation). As a result, water levels have reportedly varied significantly in the well over very short periods of time due to the various conditions within the well. Due to these changing well conditions and multiple-zone perforations, the data cannot be used to ascertain water-level fluctuations in the North Horn Formation. However, given the decrease in water levels which occurred following the second round of well perforations (a decline in head of about 540 feet), it is apparent that the head in the North Horn Formation is several hundred feet greater than the composite head of the underlying formations. This suggests that groundwater in

the North Horn Formation is probably not insignificant hydraulic connection with groundwater in the underlying formations.

The data presented in Appendix 7-2 indicate that the dissolved iron concentration of groundwater issuing from the North Horn Formation is generally less than 0.07 mg/l. Total iron concentrations of this water is slightly higher. Total manganese concentrations in North Horn groundwater are generally less than 0.02 mg/l. These data do not exhibit seasonal trends.

Price River Formation. The Price River Formation consists of interbedded mudstone and siltstone with some fine-grained sandstone and carbonaceous mudstone. Within the permit area, no springs have been found issuing from the Price River Formation, suggesting that it is not a significant aquifer. The absence of springs is of great significance, since this formation is situated between the overlying Flagstaff groundwater system and the underlying coal zone (in the Blackhawk Formation). The absence of springs is most likely the result of two factors: 1) clay horizons in overlying formations inhibit vertical recharge from groundwaters in the Flagstaff and North Horn Formations, and 2) the exposed recharge area of the Price River Formation is limited primarily to areas of steep cliff faces.

Wahler Associates (1982) indicate that monitoring well GW-11-2 (Plate 7-1) is completed within the Price River Formation. Data collected from this well (Appendix 7-4) indicate that water levels varied by approximately 8 feet during the period of December 1979 through November 1982, but showed no consistent trend. A measurement collected in September 1995 indicated that the water level was 1.2 feet lower than the last time it was measured nearly 13 years earlier. Hence, although a slight decline in water levels has occurred during the period of record, this decline is not considered significant. Since 1997, when this well became part of the mine's monitoring program, the water level dropped approximately 8 feet until 2005 when it rose about 12 feet. Mining activities do not appear to be the cause of the rise and fall of the water level within the well nor do cycles between wet and dry periods. The cause for these changes are unknown at this time.

Castlegate Sandstone. The Castlegate Sandstone consists of a fine- to medium-grained sandstone that is cemented with clay and calcium carbonate. The outcrops of this sandstone form prominent cliffs in the area.

Data presented in Table 7-2 and Appendix 7-2 indicate that only two springs (SC-80 and SC-81) have been found issuing from the Castlegate Sandstone within the permit and adjacent areas. The flow of these springs was 1 gpm or less in September 1995, with no measurable flow being observed in October 1995. Based on specific conductance measurements collected from these springs, the TDS concentration of water issuing from the Castlegate Sandstone varies from about 360 to 430 mg/l. The water is slightly alkaline, with a pH of 7.7 to 8.0. Subsequent field studies found another spring, 227, that appeared to discharge from the Castlegate Sandstone. However, since this site was added to the water monitoring program, this spring has not had measurable discharge. Therefore, this formation is not considered to be a significant aquifer.

Wahler Associates (1982) indicate that monitoring wells GW-10-2 and GW-24-1 (Plate 7-1) are completed in the Castlegate Sandstone. With the exception of early measurements which were likely influenced by the presence of drilling fluids prior to perforation of the casing (Waddell et al., 1986), data collected from GW-24-1 indicate that water levels varied by 4.5 feet during the period of March 1980 through November 1982 (Appendix 7-4), but no consistent trend was noted. The cap could not be removed from this well for a water-level measurement in September 1995. During the Winter of 1999-2000, Monitoring Well 24-1 became blocked. The water level in the well has been inaccessible since that time and was permanently removed from monitoring after the 4th Quarter of 2004.

Data collected from GW-10-2 indicate that water levels have declined approximately 30 feet during the 27-year period of record following an initial stabilization of drilling fluids after casing perforation (January 1980 through May 2007). The rate of this decline has been gradual.

The potentiometric surface of groundwater flow in the Castlegate Sandstone is to the north-northwest at an average gradient of 0.024 ft/ft based on measurements reported by Wahler Associates (1982) for November 1982. The datum reported for GW-11-2, under the assumption that the Price River Formation is in hydraulic connection with the Castlegate Sandstone was also used to determine the potentiometric gradient.

Groundwater recharge to the Castlegate Sandstone is from precipitation and snowmelt. However, as evidenced by the fact that the surface exposure of the Castlegate within the permit and adjacent areas is generally limited to steep cliffs within minimal horizontal surface area, total recharge is probably low. Recharge to the Castlegate Sandstone is further limited by the lack of significant developed soil resources over the formation to encourage infiltration and the presence of low-permeability shales in the overlying Price River Formation (see Waddell et al., 1981).

Discharge from the Castlegate Sandstone probably occurs mainly as springs along the outcrop and as through-flow to the underlying Blackhawk Formation. As indicated above, spring flow from the unit is limited in flow and in occurrence. Besides the monitoring wells completed in the Castlegate Sandstone, no known wells are completed in the formation.

Blackhawk Formation. The Blackhawk Formation underlies the Castlegate Sandstone and consists of interbedded sandstone, siltstone, shale, and coal. The Rock Canyon and Gilson coal seams, to be mined by Dugout Canyon Mine, are located in the lower portion of the Blackhawk Formation.

Only three springs have been identified as issuing from the Blackhawk Formation (SC-61, SC-62, and G-100 - see Table 7-2). Springs SC-61 and SC-62 issue near a stream channel in a tributary of Dugout Canyon. Limited data collected from these springs (Appendix 7-2) indicate that flows are typically less than 2 gpm, with a TDS concentration of 700 to 800 mg/l. The pH of this water is slightly alkaline (7.5 to 8.0).

Visits to spring G-100 in September and October 1995 indicated that this spring was dry on one visit and seeping at a sufficiently low rate on the second visit that it could not be sampled. Previous attempts by Mayo and Associates (1996) could not locate this spring. A sample collected by Waddell et al. (1986) indicated that water discharging from G-100 has a TDS concentration of approximately 650 mg/l and a pH of 7.2. The water is of the calcium-magnesium-bicarbonate-sulfate type (Figure 7-6). The solute composition of this water is chemically distinct from all other springs in the area. It has an elevated sulfate content relative to overlying groundwater and may be distinguished from Blackhawk Formation groundwater associated with coal seams inside Soldier Canyon Mine by its relatively low sodium and bicarbonate contents (Appendix 7-3 and Figure 7-6). The solute composition of water issuing from G-100 is consistent with the dissolution of calcite and dolomite in the presence of soil zone carbon dioxide and the dissolution of appreciable amounts of gypsum.

Four monitoring wells (GW-5-1, GW-6-1, GW-32-1, and G-58.5) have been completed in the Blackhawk Formation in areas north and northeast of the permit area (see Plate 7-1). As noted in Table 7-1, well GW-5-1 is perforated opposite the Sunnyside and Rock Canyon Coal seams in the Blackhawk Formation. Early water-level measurements in this well show the residual influence of drilling fluids in the hole immediately following casing perforation. Subsequently, in November 1982, Wahler Associates (1982) conducted a slug test in the well by filling it with water to within about 20 feet of land surface. Hence, early water-level measurements in this well are not indicative of hydraulic heads in the formation.

SCM began monitoring well GW-5-1 in June 1987. Between June 1987 and June 1993, water levels declined at a slow and nearly constant rate of about 0.02 ft/day (Figure 7-7). The initial water level in June 1987 was about the same as the water level prior to the slug test in 1982.

By mid-year 1993, development of the Soldier Canyon Mine, within the Sunnyside seam, had expanded to a point immediately adjacent to well GW-5-1. Well monitoring data show a slight rise in water level elevation between June 3, 1993 and August 24, 1993 which corresponded to mine development in the vicinity of the well. This rise in water level can be explained by the redistribution of vertical stress acting on the nearby coal (see Appendix 7-3). Following completion of the 1993 development, a sustained moist area was identified on the floor of the Soldier Canyon Mine No. 5 entry, adjacent to GW-5-1.

Furthermore, subsequent monitoring of the water level in the well indicated that, between August 24, 1993 and November 1, 1995, the average rate of water level decline increased to approximately 0.09 ft/day (an increase of about 4.5 times the previously observed rate). This decline was likely due to dewatering of the Blackhawk Formation in the immediate vicinity of the monitoring well.

Wahler Associates (1982) calculated a transmissivity of 0.009 gpd/ft (1.2×10^{-3} ft^2/day) from the falling-head slug test which they performed in GW-5-1. Sergent, Hauskins & Beckwith (1986) reported transmissivities of 2.3×10^{-3} to 6.7×10^{-4} cm^2/s (2.1×10^{-1} to 6.2×10^{-2} ft^2/day) for slug tests conducted in holes drilled into the Blackhawk Formation from within the Soldier Canyon Mine.

Based on monitored thicknesses of 22 feet in GW-5-1 (Table 7-1) and 120.8 feet in each of the in-mine holes (Sergent, Hauskins & Beckwith, 1986), the hydraulic conductivity of the Blackhawk Formation is calculated to vary from 5.5×10^{-5} to 1.7×10^{-3} ft/day, with a median of 5.1×10^{-4} ft/day.

Well GW-6-1 is perforated over a 200-foot long interval which includes the Sunnyside seam (see Table 7-1). Initial water level measurements collected from this well are believed to be associated with residual water remaining from drilling and casing operations and are, therefore, probably not representative of natural conditions. Water levels declined between November 1989 and August 1991 (Figure 7-7). From August 1991 through August 1993, water levels in GW-6-1 remained relatively stable at a depth of approximately 425 feet. Monitoring on June 3, 1994 found the well to be dry and plugged at a depth of approximately 470 feet. All subsequent attempts to monitor this well have found the plugged/dry condition unchanged.

Monitoring well GW-32-1 is perforated in the Blackhawk Formation immediately above the Sunnyside seam (see Table 7-1) in a location which is down dip of Soldier Canyon Mine workings. Water level monitoring information shows a fairly consistent rise in water elevation.

From November 1994 through August 1995, the water level appears to have stabilized at a depth of approximately 291 feet (Figure 7-7). There is no information at this time that would suggest that underground mining activities in the nearby Soldier Canyon Mine are effecting the water levels observed to date.

Monitoring well G-58.5 was completed by Mountain Fuel Supply Company into the Blackhawk Formation in 1979. Waddell et al. (1986) reported a depth-to-water in March 1980 in this well of 502.8 feet. Waddell et al. (1982) reported depths to water of 501.7 to 502.4 feet in April and September 1880. No additional water-level data are available for this well.

Attempts for this M&RP to construct a potentiometric surface for the Blackhawk Formation in the Soldier Canyon area based on data collected from GW-5-1, GW-6-1, and GW-32-1 proved fruitless. The difficulty in preparing this potentiometric surface may have been due to the influence of outcropping in the adjacent Soldier Canyon, the influence of mining in the nearby Soldier Canyon Mine, and/or varying lengths and stratigraphic locations of the perforated sections of the monitoring wells within the discontinuous strata which comprise most of the Blackhawk Formation. However, based on water-level data collected from one of the existing Dugout Canyon portals and from monitoring wells GW-5-1 and G-58.5, Waddell et al. (1986) concluded that the flow of groundwater in the Blackhawk Formation within the permit and adjacent areas is to the north away from the face of the cliffs (i.e., down dip as generally seen in the Castlegate Sandstone). They estimated the hydraulic gradient in the Blackhawk Formation to be 42 feet per mile (0.008 ft/ft). Waddell et al. (1986) indicate that the coal bearing zone to be mined in the Dugout Canyon operations will probably be saturated in most areas and will require dewatering during mining. However, since mining was initiated at the Dugout Mine, saturated coal zones have not been encountered. The majority of the water encountered during mining both the Rock Canyon and Gilson seams has

entered the mine through the roof as discharges from isolated sandstone channels within the Blackhawk Formation and from the roof and floor through fractures and minor faults.

Recharge to the Blackhawk Formation is of limited magnitude, due primarily to the limited area of exposure on steep outcrops and the presence of low-permeability units in overlying formations. Data presented in Appendix 7-3 indicate that Blackhawk Formation groundwater which discharges into the Soldier Canyon Mine is of ancient meteoric origin (greater than 20,000 years), thereby supporting the conclusion that the rate of recharge to the formation is minimal. Mayo and Associates (1996) concluded that the old groundwater age and the isotopic compositions of water encountered in the Soldier Canyon Mine are evidence that the groundwaters are not part of actively flowing, shallow groundwater systems. The groundwater ages also demonstrate that the hydraulic connection between these old groundwaters and the overlying active (and younger) groundwater systems in the Flagstaff and North Horn Formations is very limited or does not exist.

The quality of groundwater in the Blackhawk Formation has been evaluated by Mayo and Associates (1996) based on data collected from leakage into the Soldier Canyon Mine (see Appendix 7-3). These data indicate that Blackhawk Formation groundwater has a mean TDS concentration of about 750 mg/l and is of the sodium-bicarbonate type (Figure 7-6). These waters are chemically distinct from groundwater in overlying groundwater systems. The solute compositions of mine groundwaters suggest a complex series of rock-water and gas-water reactions (Mayo and Associates, 1996).

The dissolved iron concentration of groundwater flowing into the Soldier Canyon Mine has historically been less than 0.5 mg/l and is generally less than 0.1 mg/l (see Appendix 7-2). The total iron concentration of this water has historically been less than 2.0 mg/l and generally less than 0.5 mg/l. The total manganese concentration of Blackhawk Formation water (as measured in the Soldier Canyon Mine) has historically been less than 0.5 mg/l and is typically less than 0.1 mg/l (see Appendix 7-2).

Four exploration holes (DUG0104, 0204, 0101, and 0201) were drilled within or immediately adjacent to the Dugout Canyon Mine SITLA Lease area and completed in the Blackhawk Formation. All holes were completed below the Gilson Coal Seam. No water was encountered in any of the exploration holes per personal communication with Mike Stevenson, Project Geologist, Ark Land Company, November 22, 2004.

Exploration Hole Number	Location (approximate)	Year Drilled
DUG0104	T13S, R13E, Section 20, NW1/4SE1/4	2004
DUG0204	T13S, R13E, Section 19, SE1/4NE1/4	2004
DUG0101	T13S, R13E, Section 30, NE1/4NW1/4	2001

DUG0201	T13S, R13E, Section 19, SE1/4SE1/4	2001

Star Point Sandstone. In those locations where the Star Point Sandstone exists within the permit and adjacent areas, it consists of a fine-grained calcareous sandstone with layers of siltstone and mudstone. In keeping with regional practice (see Lines, 1985), the Star Point Sandstone and Blackhawk Formation are considered to be hydraulically connected. However, only one spring (SC-64) has been discovered issuing from the Star Point Sandstone within the permit and adjacent areas. The near absence of springs in this formation suggests that the Star Point does not receive appreciable annual recharge and that it does not support active groundwater systems in the area.

Recharge to the Star Point Sandstone probably occurs via leakage from the overlying Blackhawk Formation. Hence, this water is likely of ancient origin.

Data collected from SC-64 indicated that the discharge of this spring declined from 2 gpm to 0.5 gpm in the period of September 1995 to October 1995 (see Appendix 7-2). The TDS of this water, as estimated from the specific conductance data, is approximately 700 mg/l, with a pH of about 7.5.

Mancos Shale. The Mancos Shale is exposed south of the permit area. This formation is a relatively impermeable marine shale and is not considered to be a regional or local aquifer. Groundwater samples collected from four monitoring wells located approximately 2 miles south of Soldier Canyon Mine have a mean TDS concentration of approximately 10,000 mg/l and is of the sodium-sulfate-chloride type (Appendix 7-3). Chemical compositions are consistent with the dissolution of halite and gypsum as well as cation exchange.

Recharge and Discharge Relations

Recharge within the permit area occurs primarily on the exposed upland outcrops of the Flagstaff Formation and the North Horn Formation. Waddell et al. (1986) estimated that the annual recharge to the Flagstaff Formation is 9 percent of the total annual precipitation. Recharge is probably greatest where surface fractures intersect the topographic highs where the Colton, Flagstaff, and North Horn Formations outcrop. Recharge to the Blackhawk Formation and the Star Point Sandstone probably occurs primarily from vertical movement of water through the overlying formations. The rate of recharge to the Blackhawk Formation and the Star Point Sandstone is very slow, as evidenced by the ancient age of groundwater within those formations (see Appendix 7-3).

Assuming mass-balance and stable hydrologic conditions, recharge will equal discharge over the long term. The relatively young age of groundwater discharging from the Flagstaff and North Horn Formations as compared with the underlying Blackhawk Formation suggests that the stratigraphically-higher water discharges rapidly and is not hydraulically connected with the Blackhawk Formation. Waddell et al. (1986) conclude that the perched nature of the Flagstaff Formation protects it from the influence of dewatering of the coal-bearing zone unless the upper zone is influenced by subsidence.

Waddell et al. (1986) performed seepage studies in Pine Canyon (located immediately north of the permit area) and found that significant increases in the flow of Pine Canyon occur near the contact of the North Horn Formation and the overlying Flagstaff Formation. They concluded that downward percolation from the Flagstaff Formation is impeded by the claystones and mudstones of the North Horn Formation, forcing the water to move laterally and emerge along the outcrop in the canyon bottom.

Expansion Area (240 acres, Section 17, T13S, R13E) - While it is not possible to precisely delineate the recharge areas for individual springs using the existing hydrogeologic data, a determination of the most probable recharge area is possible using existing geologic, hydrogeologic, and topographic information. A discussion of the most probable recharge areas for springs in the expansion area is presented below.

Two springs (260 and 260A) have been identified within the boundaries of the expansion area that has the possibility of being impacted by subsidence. The Division of Water Rights (DWRi) has indicated two other springs are located in the eastern portion of Section 17, T 13 S R 13 E and within the permit expansion area. However, these springs were not found in the original seep and

spring survey or subsequent surveys. Dugout has committed to take the water right owners to the DWRi mapped locations to verify whether or not these springs do indeed exist.

A few other springs, 261, 262, 262A, 263, 263A, have been identified in the nearby surrounding areas outside the permit area. These springs are outside the area where subsidence would potentially occur and are separated from the underlying coal seams by more than 2,000 feet of cover. Mining impacts to the recharge area of these springs will only occur in a very small portion of the recharge area and will likely be similar to spring 260. Because of this, the impacts to the springs outside the permit and subsidence area have not been considered individually. The potential for impacting these springs is considered negligible.

Spring 260 is part of the mine's water monitoring program and thus has several years of data that can be analyzed. Spring 260A is not part of the water monitoring program. Both springs appear to discharge from the same shallow groundwater system as they are in close proximity to one another and discharge at similar elevations. Therefore, it is assumed that mining induced impacts to these two springs would be similar in nature.

Spring 260 discharges from the east side of the canyon wall near the bottom of the local surface-water drainage. The spring discharges from the Colton Formation at an elevation of about 8600 feet above sea level. Because groundwater must recharge in an area topographically higher than the spring discharge location in order to provide driving hydraulic head, the recharge area for the spring must lie at an elevation greater than 8600 feet. As shown on Plate 7-1 and Figure 2 (Appendix 7-3), areas higher than 8600 feet in elevation that could potentially be recharge areas for spring 260 are present in the region to the southeast of the spring and also in the region to the northwest of the spring. Both of these areas are situated along the crest of the Book Cliffs escarpment and are truncated on both the north and south by incised drainages and escarpments.

Because of the considerable discharge from spring 260, which averaged 20.0 gpm between 2000 and 2007, it seems unlikely that sufficient recharge to support the spring could occur on the small surface area situated on the very steep slopes of the south-facing Book Cliffs escarpment above an elevation of 8600 feet immediately south of the spring area (see Plate 7-1, Figure 2 and Memorandum from Alex Papp in Appendix 7-3). Rather, it seems more likely that the relatively flat and broad high-elevation plateau surfaces above 8600 feet as depicted could provide recharge in sufficient quantities to support the observed discharge at the spring.

The sedimentary rocks in the vicinity of the Dugout Canyon Mine area dip at about 8 degrees to the north-northeast (Appendix 7-3). The strike of the rock formations in the area is approximately

coincident with the trend of the Book Cliffs escarpment. Similarly, most minor fracture orientations in the coal seams and in the adjacent rock formations trend in roughly the same direction as the strike of the Book Cliffs escarpment (Appendix 7-3). Assuming a primarily northerly component to the bedrock dip in the area, the high-elevation area situated to the southeast of the spring (see Plate 7-1, Figure 2 and Memorandum from Alex Papp in Appendix 7-3) seems more likely to be the recharge area for spring 260 than the high-elevation area to the northwest. This conclusion is based on the assumption that most of the northwest area would be stratigraphically down-dip of the spring area. The observation that spring 260 emanates from the east side of the canyon seems to support this conclusion. Consequently, the area to the southeast of spring 260 at an elevation above 8600 feet and stratigraphically up-dip of the spring location is considered the most likely recharge area for the spring. While the maximum lateral extent of the recharge area from the spring discharge location is not known, an arbitrary (and likely conservative) estimate of about 1.6 miles.

It is interesting to note that the maximum possible depth of circulation for the groundwater system that supports spring 260 is less than about 350 feet (maximum topographic elevation in the probable recharge area minus the spring discharge elevation). This observation supports the conclusion that spring 260 originates from a shallow, perched groundwater system and not from a large aquifer of regional extent.

It should be noted that although the spring discharges from the east side of the canyon, it is possible that the sandstone channel or fracture network that focuses discharge to the spring is continuous on both the east and west sides of the canyon near spring 260. Consequently, it is possible that the groundwater recharge area could also include portions of the high-elevation region to the northwest of the spring, although this is considered a less likely scenario.

Spring 261 discharges from near the bottom of the canyon a short distance north of the expansion area boundary. As discussed above, the potential for impact to this spring is considered negligible and consequently a delineation of a most probable recharge area for this spring has not been performed. However, it is likely that this spring, as well as other similar nearby springs, recharge by mechanisms similar to that at spring 260. Like spring 260, the springs further north in the unnamed tributary of Cow Canyon (springs 261 and 262) are likely not recharged from infiltration on the steep slopes of the north facing slopes of the Book Cliffs escarpment. Again, similar to spring 260, these springs probably receive recharge from broad upland areas to the east-southeast.

Surface runoff from the majority of the land surface in Section 16 (T13S R13E) drains to the Cow Canyon drainage. Discharges from the localized perched Colton Formation groundwater systems in the vicinity contribute baseflow discharge to streams in the expansion area and sustain discharges in portions of the drainage during the summer and fall months and during wet years. During the spring snowmelt event and in response to torrential precipitation events, streamflow in the drainages are augmented by surface runoff. After the spring runoff season is complete, there is typically not a sufficient contribution of groundwater to the surface water systems and many reaches of the stream drainages in the expansion area are dry. There is no discharge from a regional type aquifer system to the stream drainages in the Cow Canyon drainage area. Consequently, because impacts to the localized perched Colton Formation groundwater systems are not anticipated, detrimental impacts to baseflow in the stream drainages are likewise not anticipated.

Mining Impacts to Subsurface Water Resources

As presented previously, exploration drilling in the SITLA tract has not encountered significant volume of water in the Gilson seam or overlying strata. As discussed in previous paragraphs, the formations that overlie the coal seams do not include extensive units of rock that would form large aquifers. The Blackhawk Formation can discharges water from isolated channel sandstones in the roof of the mine. However, very few springs have been found on the surface in the Dugout Canyon Mine area that discharge from Blackhawk units. Springs that do discharge from the Blackhawk Formation typically have very low flows. In-mine flows that are encountered as a result of mining have typically discharged from the roof, are initially much less than 100 gpm, and have flow rates that decrease rapidly as mining progresses. The sandstone channels that hold water in the Blackhawk are typically lenticular, have low to moderately low transmissivity rates, of limited areal extent, and contain waters older than 50 years and typically older than a few thousand years. Since the Blackhawk Formation in the Dugout Canyon Mine area, including the SITLA Tract, is very similar throughout, it is unlikely that mining will encounter large volumes of water from isolated perched sandstone channel aquifers as coal is removed from the Gilson seam in the permit area as a whole.

Mining within the SITLA tract has recently encountered fractures and minor faults, a few containing ground water. Water initially discharges from these structures at a significant rate from floor and roof followed by a slow decline in flow rates. It is likely these fractures are draining both isolated perched aquifers located near the roof of the mine but also sandstone channels containing water under potentiometric pressure beneath the mine floor.

The Price River and Castlegate Sandstone formations are also poor aquifers in the mine area as described in the previous sections. Only two springs have been found within the Dugout Mine area, including the SITLA tract, issuing from these formations. These formations do not conduct water readily, do not contain extensive aquifers, and do not appear to be saturated. Subsidence of these formations will not cause significant changes to subsurface water resources since these resources are apparently not present.

Water bearing strata within the North Horn and Flagstaff Formations (the contact between the two formations is indistinguishable in most of the SITLA tract) and the Colton Formation should not be significantly affected. Subsiding these formations may result in locally increased hydraulic conductivity within the strata but water loss to the underlying formations will be minimal, if at all. The fine grained units (siltstones and shales) that perch the aquifers within the North Horn/Flagstaff and Colton Formations should easily seal subsidence induced fractures and limit downward migration of water from the isolated aquifers. Additionally, the Price River Formation consists of interbedded mudstone, siltstone, and fine-grained sandstones. The finer-grained siltstone and mudstones would seal fractures within the formation and inhibit downward movement or loss of water from the North Horn/Flagstaff and Colton aquifers.

724.200 Surface Water Information

Water Quantity

The permit area exists within portions of the Dugout Creek, Soldier Creek, Pace Creek, and Rock Creek watersheds. ~~The 600 acre expansion (addition of State Lease ML-50582-OBA and expansion of Federal Coal Lease U-07064-027821) will include in the permit area a small portion of the Cow Canyon watershed.~~ Major tributaries of Soldier Creek whose watersheds extend into the permit area include Fish Creek and Pine Canyon. Based on observations and flow data obtained during the collection of water-quality samples within the permit and adjacent areas, portions of Dugout, Fish Creek and Pace Creek, ~~and Cow Canyon~~ are considered perennial within the permit area. Pine Canyon appears to be perennial in its upper reaches near the northern border of the permit area. Prior to 1999, Rock Creek appeared to be perennial in its upper reaches above the Castlegate Sandstone and only intermittent below the formation. Field observations from 2001 thru 2007 have shown the upper reaches to be functioning as intermittent by UDOGM regulations, however the reaches below the formation have functioned as ephemeral. Several tributaries of these streams within the permit and adjacent areas, are ephemeral.

Waddell et al. (1981) estimated that the average flow of Dugout Creek is approximately 7 cubic feet per second (5,100 acre-feet per year) and that up to 70 percent of the streamflow occurs during the period of May through July each year. The seasonal record of a stream gaging station which was installed on Dugout Creek during the period of October 1, 1979 through October 2, 1981 suggest that this estimate of the seasonal variation is correct (see Appendix 7-5). The location of this stream gaging station is in the vicinity of monitoring site DC-1~~) is~~ noted on Plate 7-1.

During the 1980 water year, Waddell et al. (1986) estimated that the total flow of Dugout Creek at station DC-1 (referred by them as station S60) was 1,900 acre-feet. They further estimated that 53 percent of this flow (1,000 acre-feet) was contributed by springs issuing from the Flagstaff Formation, 10 percent (200 acre-feet) was contributed by springs issuing from the Blackhawk and other formations, and 37 percent (700 acre-feet) was contributed as surface runoff.

The average flow of Soldier Creek has been estimated by Waddell et al. (1981) to be approximately 8 cubic feet per second (5,800 acre-feet per year). This flow is expected to vary seasonally in a manner similar to that reported for Dugout Creek (i.e., the majority of the flow occurring during the late spring and early summer months in response to snowmelt runoff).

During the 1980 water year, Waddell et al. (1986) estimated that the total flow of Soldier Creek at station G-5 was 4,200 acre-feet. The source of this runoff was estimated to be as follows:

- 43 percent (1,800 acre-feet) from springs issuing from the Flagstaff Formation;
- 24 percent (1,000 acre-feet) from springs issuing from the Blackhawk and other formations; and
- 33 percent (1,400 acre-feet) as surface runoff.

Hence, the relative contribution of the Flagstaff Formation to streamflow in Soldier Creek is lower than that in Dugout Creek, while the contribution of the Blackhawk and other formations to Dugout Creek is lower than that to Soldier Creek.

Seasonal fluctuations in the discharge of streams in the area are readily apparent in the hydrographs of Solider Creek (Figure 7-8) and Dugout Creek (Figure 7-9). Locations of these stations are noted on Plate 7-1. As indicated, the discharge of local streams is greatest in the late spring and early summer months when influenced predominantly by snowmelt runoff.

Waddell et al. (1986) performed seepage measurements along Pine Canyon and Soldier Creek in the autumns of 1979 and 1980, in an effort to evaluate the effects of bedrock formations on the

baseflow of the creeks. The seepage measurements demonstrated significant inflow to Pine Canyon occurs from the Flagstaff Formation near the contact with the underlying North Horn Formation. In Soldier Creek, the investigation found that 1) base flow more than tripled as Soldier Creek crossed the North Horn Formation, 2) base flow decreased about 20 to 30 percent as the creek crossed the Price River Formation and Castlegate Sandstone, and 3) base flow increased 10 to 25 percent as the creek crossed the Blackhawk Formation.

Figure 7-10 presents semilog plots of streamflow in Soldier Creek (station G-5) and Dugout Creek (station DC-1) for the latter portion of 1980, as reported by Waddell et al. (1986). Included in this figure are plots of discharge rates for springs issuing from the Flagstaff Formation and from the underlying Blackhawk Formation, Castlegate Sandstone, and Price River and North Horn Formations (Waddell et al., 1986). At Soldier Creek, the curves are approximately parallel for streamflow and the composite flows issuing from the Flagstaff Formation through August.

Thereafter, the recession curve for the streamflow flattens, while that for the Flagstaff Formation continues to decrease. Based on this condition, Waddell et al. (1986) concluded that the discharge of Soldier Creek is controlled predominantly by seepage from the Flagstaff Formation during the spring and early summer and by seepage from the underlying formations (Blackhawk, Castlegate, Price River, and North Horn) during the late summer and fall.

The data presented in Figure 7-10 indicate that discharge from the Flagstaff Formation dominates the flow of Dugout Creek throughout the year. Seepage from the underlying formations may slightly influence the flow of Dugout Creek during the autumn months, but this influence appears to be minimal. The lack of seepage from the Blackhawk and immediately-overlying formations to Dugout Creek supports the conclusion presented in Section 724.100 that the flow of groundwater within the permit and adjacent areas is to the north-northwest (i.e., away from Dugout Canyon).

Limited flow data is available from monitoring points within Pace Canyon and Rock Canyon Creeks. However, the data included in Appendix 7-7 suggests that flow within Pace Canyon Creek varies seasonally. Data collected at points PC-1A and PC-2 since June 1999, which are included in the Division's water database and in the updated spreadsheets found in Appendix 7-7, supports this determination. Flows in spring/early summer are typically several times greater than in late summer/fall. Also, it is interesting to note that in 2002 and 2003 there have been periods when there is no flow at station PC-2 and flows measured in late summer/fall at PC-1A have been significantly less than in previous years. The drop in flow is undoubtedly related to the prolonged drought the area has been suffering through since 1999. Base flow within this drainage appears to originate from springs discharging from the Price River, Flagstaff/North Horn, and Colton

Formations. The majority of the flow appears to originate from springs within the North Horn and Flagstaff Formations. A surface water monitoring point (Fan) has been added on Pace Creek at a location approximately 600 feet upstream from the top of the Pace Canyon Fan facilities disturbed area boundary. Surface flows measured at monitoring point Fan indicate that the stream is intermittent and likely fluctuates in flow volume seasonally.

Rock Canyon Creek base flow in its upper reaches appears to originate from springs discharging from the Northhorn Formation. Flow data from monitoring site RC-1 near the mouth of Rock Canyon indicates the lower sections of Rock Creek generally flow in response to spring runoff and after summer precipitation events. In 2002 and 2003, flow measured at RC-1 occurred only after a significant precipitation event. Again, the lack of flow in this creek is most likely related to the drought conditions that appear to have begun in the area in 1999.

Springs within Cow Canyon were included in the original baseline survey conducted in the mid-1990's and again in the summer of 2007. The field parameters were measured at the springs in Cow Canyon (Plate 7-1) and the results are included in Attachment 1 of the "Probable Hydrologic Consequence Addendum, October 2007, Revised April 2008" in Appendix 7-3. Seasonal field data was collected in 2007 at the junction of two small drainages (323) in the unnamed tributary of Cow Canyon. Monitoring site 323 was inaccessible until mid-May. Three samples of pH, conductivity, temperature and flow were taken between May and August. The flow ranged from 13 to 20.5 gallons per minute, pH ranged from 7.8 to 8.4, conductivity ranged from 591 to 675 and temperature ranged from 11 to 14 degrees centigrade.

Observations were made in 2007 during sampling of the unnamed tributary of Cow Canyon that the surface water in the fork below monitoring site 260 ran intermittently between spring site 260 and spring site 261 (Plate 7-1). This tributary appears to become perennial a short distance above site 261. In 2008, during monitoring activities the perennial nature of the tributary will again be evaluated.

The fork of the unnamed tributary of Cow Canyon which contains monitoring sites 321, 263 and 263A is neither perennial or intermittent. The discharge from the three spring's runs for a short distance and disappears. Flow associated with storm events in this fork has not been observed, however a defined channel does not exist from site 321 to site 263.

No streamflow data are available for ephemeral drainages in the permit and adjacent areas. When it does occur, ephemeral runoff in the area is expected to occur predominantly in the months of April and May in response to snowmelt runoff and in the months of August and September as a result of thunderstorm activity. Snowmelt may result in flow durations of a few weeks, while thunderstorms are expected to result in runoff with a short duration and high intensity.

Several small impoundments have been constructed in the permit and adjacent areas to capture water for stock watering. Those impoundments where water rights applications have been filed are located as shown on Plate 7-2. The impoundments capture water either from an adjacent spring or from snowmelt.

A UPDES permit application has been issued by the Utah Division of Water Quality as indicated in Appendix 7-6. This application applies to discharge from the sedimentation pond. Discharge from this point occurs only infrequently as a result of pond dewatering or after significant precipitation events. The application also applies to discharges from the underground mine workings.

Surface-water quality samples have been periodically collected in the permit and adjacent areas from stations located on Soldier Creek, Dugout Creek, Pine Canyon, Pace Creek, and Rock Canyon Creek (Plate 7-1). Analytical data from these sources are summarized in Appendix 7-7. These data were obtained from multiple sources, including (but not limited to) the Soldier Creek Coal Company M&RP and annual reports, U.S. Geological Survey publications, the Sage Point-Dugout Canyon permit application filed by Eureka Energy Company in 1980, Appendix 7-3 of this M&RP, and various consultant reports. Since not all monitoring parties were responsible to adhere to UDOGM or SMCRA rules, the laboratory parameters varied between reports. However, the data are still considered valid and appropriate for determining baseline conditions within the permit and adjacent areas. It should be noted that most of the manganese data presented in Appendix 7-3 represent total (as opposed to dissolved) concentrations.

In general, TDS concentrations of surface waters in the permit and adjacent areas vary inversely with the discharge rate. These concentrations also tend to increase in the downstream direction (Waddell et al., 1986). Total suspended solids concentrations in the local surface waters tend to vary directly with the flow rate (Waddell et al., 1986).

The data presented in Appendix 7-7 indicate that the dominant ions in surface water during high-flow periods are calcium and bicarbonate, whereas the dominant ions in the low-flow periods are sodium, magnesium, sulfate, and bicarbonate. During high-flow periods, runoff is rapid and most surface waters only interact chemically with the uppermost regions of the soil zone. Thus, they are dominated by calcium and bicarbonate ions. Furthermore, groundwater contributions from the Flagstaff Formation (where calcium and bicarbonate are the primary ions) dominate the chemical quality of surface water during high-flow periods (see Figure 7-10).

During low-flow periods, groundwater contributes a larger percentage of the flow in the stream (see Figure 7-10). With its higher TDS concentrations and different solute types (particularly in the Blackhawk Formation), the solute composition of the surface water is altered during low-flow periods.

Data presented in Appendix 7-5 indicate that the TDS concentration of water in Dugout Creek at station DC-1 has varied from about 350 to 500 mg/l with a pH of 8.0 to 8.5. Total suspended solids concentrations have varied from 5 to 1,000 mg/l during the period of record.

Dissolved iron concentrations in Dugout Creek at station DC-1 have typically been less than 0.1 mg/l, while total iron concentrations are generally less than 1.0 mg/l. Dissolved manganese concentrations have typically been less than 0.01 mg/l, while total manganese concentrations are normally less than 0.1 mg/l. No seasonal variations in dissolved metals were noted. Total metals concentrations tend to vary directly with total suspended sediment concentrations.

It is important to note, the water chemistry data referenced was collected for Dugout Creek at DC-1 was obtained prior to the start of mine water discharge in 2002. Since mine water has been discharged, the TDS concentration in the water at DC-1 has varied between a minimum of 330 mg/L and maximum of 2160 mg/L and averages about 1000 mg/L. The pH has also varied in that time between a minimum of 7.3 and a maximum of 9.2 but typically is between 7.7 and 8.4. No appreciable increase in the total suspended solids concentration has been noted since the mine began discharging. Dissolved iron concentrations have risen slightly but average 0.11 mg/l. Total iron concentrations have also risen and average 0.74 mg/L. Dissolved manganese concentrations have risen but average 0.05 mg/L while total manganese concentrations average 0.06 mg/L. Additional discussions regarding the mine water discharge and participation in a total dissolved solids reduction project are included in the "Update to the Probable Hydrologic Consequences of Coal Mine at the Dugout Canyon Mine" in Appendix 7-3.

Historic data collected from Soldier Creek (Appendix 7-7) indicate that the total suspended solids concentration generally increases in the downstream direction and has varied from less than 10 to greater than 10,000 mg/l. Dissolved iron concentrations are typically less than 0.1 mg/l at stations G-1 and G-4, and less than 0.2 mg/l at G-5 (see Plate 7-1). The data do not indicate a seasonal variation in the concentration of dissolved iron. Total iron concentrations, which generally vary in accordance with the total suspended solids concentration, are typically less than 10 mg/l at all stations. Total manganese concentrations in Soldier Creek are generally less than 0.01 mg/l at G-1 and less than 0.10 mg/l at G-4 and G-5.

Data collected from Pine Canyon (Appendix 7-7) indicate that the total suspended solids concentration also tends to increase in the downstream direction and has varied from less than 10 to greater than 100 mg/l. Dissolved iron concentrations are typically less than 0.1 mg/l in Pine Canyon, with total iron concentrations typically being less than 1.0 mg/l. The data do not indicate a seasonal variation in the concentration of dissolved iron. However, total iron concentrations tend to vary in accordance with the total suspended solids concentration. Total manganese concentrations in Pine Canyon are generally less than 0.01 mg/l at G-2 and less than 0.03 mg/l at G-3.

Data collected from Pace Creek (Appendix 7-7) indicate dissolved iron concentrations are typically less than 0.1 mg/l, with total iron concentrations typically being less than 1.0 mg/l. The limited data do not indicate a seasonal variation in the concentration of dissolved iron. Total manganese concentrations in Pace Creek are generally less than 0.01 mg/l.

Surface runoff from the majority of the land surface in Sections 16 and 17 (T13S R13E) drains to the Cow Canyon drainage. Discharges from the localized perched Colton Formation groundwater systems in the vicinity contribute baseflow discharge to streams in the expansion area and sustain discharges in portions of the drainage. During the spring snowmelt event and in response to torrential precipitation events, streamflow in the drainages are augmented by surface runoff. Once the spring runoff season is complete many reaches of the stream drainages in the expansion area are dry. There is no discharge from a regional type aquifer system to the stream drainages in the Cow Canyon drainage area. Consequently, because impacts to the localized perched Colton Formation groundwater systems are not anticipated, detrimental impacts to baseflow in the stream drainages are likewise not anticipated.

724.300 Geologic Information

Geologic information related to the permit and adjacent areas is presented in Chapter 6 of this M&RP.

724.400 Climatological Information

Climatological data are summarized in Appendix 4-2 of this M&RP.

724.500 Supplemental Information

All information pertinent to a determination of the probable hydrologic consequences of the proposed Dugout Canyon Mine operation and reclamation are presented in this M&RP.

724.600 Survey of Renewable Resource Lands

The existence and recharge of groundwater systems in the permit and adjacent areas is discussed in Section 724.100 of this M&RP. A discussion of the potential for material damage or diminution of these groundwater systems and their recharge areas due to subsidence is provided in Section 728 of this 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 this M&RP.

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 this M&RP 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 M&RP, other than that which has been published by others and referenced herein.

727 Alternative Water Source Information

No surface mining will be conducted in the permit and adjacent areas. Therefore, this section does not apply to the Dugout Canyon Mine.

728 Probable Hydrologic Consequences

This section addresses the probable hydrologic consequences of coal mining and reclamation operations in the mine permit and adjacent areas. Mitigating measures are discussed generally in this section and in detail in Section 730 of the M&RP.

728.100 Potential Impacts to Surface and Groundwater

Potential impacts of coal mining 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;
- Flooding or stream flow alteration;
- Impacts to groundwater or surface water availability;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area;
- Contamination of surface and groundwater from road salting; and
- Contamination of surface water from coal spillage due to hauling operations.

These potential impacts are addressed in the following sections of this M&RP.

728.200 Baseline Hydrologic and Geologic Information

Baseline geologic information is presented in Chapter 6 of this M&RP. Baseline hydrologic information is presented in Sections 724.100 and 724.200 of this 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 permit and adjacent areas are addressed in the following subsections of this M&RP.

Acid- or Toxic- Forming Materials. Information on acid-and toxic-forming materials is presented in Chapter 6. These data show that no acid- or toxic-forming materials are present at the Dugout Canyon Mine. Thus, no significant potential exists for the contamination of surface and groundwater in the permit and adjacent areas by acid- or toxic-forming materials.

Sediment Yield. The potential impact of mining and reclamation on sediment yield is an increase in sediment in the surface waters downstream from disturbed areas. Sediment-control measures (such as sedimentation ponds, diversions, etc.) will be installed to minimize this impact. These facilities will be regularly inspected (see Section 514) and maintained to ensure that they remain in proper operating condition.

Sediment yields may increase locally due to subsidence. Subsidence cracks which intersect stream channels with steep gradients could, for a short period of time, cause an increase in the sediment yield of the stream. However, this sediment increase would cause the crack to quickly fill, recreating pre-subsidence stream channel conditions. Thus, the potential impact to sediment yield from subsidence in the permit area would be minor and of short duration.

Various sediment-control measures will be implemented during reclamation as the vegetation becomes established. As discussed in Section 542.200 of this M&RP, these measures will include installation of silt fences and straw-bale dikes in appropriate locations to minimize potential contributions of sediment to Dugout Creek and Pace Creek. These measures will reduce the amount of erosion from the reclaimed areas, thereby precluding adverse impacts to the environment.

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.

Data presented in Appendix 7-2 and summarized in Section 724.100 of this M&RP indicate that the average TDS concentration of water in the Blackhawk Formation (as measured in inflow to the nearby Soldier Canyon Mine) is approximately 750 mg/l and is of the sodium-bicarbonate type. As noted in Section 724.200, the TDS concentration of water in Dugout Creek ranges from 350 to 500 mg/l without mine discharge. The TDS concentration in Pace Creek ranges between 525 and 840 mg/l with an average TDS of about 620 mg/l. The dominant ions in these waters are calcium, magnesium and bicarbonate during high-flow periods, whereas the dominant ions during low-flow periods are sodium, magnesium, sulfate, and bicarbonate.

During periods of low streamflow, the dominant ions in the Blackhawk Formation water, Pace Creek and Dugout Creek should be similar. However, during periods of high streamflow, the dominant cation will be sodium in the Blackhawk water, magnesium in the Pace Creek water, and calcium in Dugout Creek. It should be noted that Dugout Canyon Mine uses powdered limestone or dolomite (i.e., calcium-magnesium-carbonate) for rock dust. It is not anticipated that gypsum rock dust (calcium-sulfate) will be used in the mine. Hence, dissolution of rock dust by water in the mine should not influence the chemical type of water in Dugout Creek or Pace Creek if mine water is discharged to the creek.

Typical iron and manganese concentrations in the Blackhawk Formation, Pace Creek and Dugout Creek (as summarized in previous sections) are:

	Blackhawk Formation	Dugout Creek	Pace Creek
Dissolved iron	<0.1 mg/l	<0.01 mg/l	<0.1 mg/l
Total iron	<0.5 mg/l	<1.0 mg/l	<1.0 mg/l
Dissolved manganese	--	<0.01 mg/l	–
Total manganese	<0.1 mg/l	<0.1 mg/l	<0.01 mg/l

As discussed previously in Section 724.200 discharge of mine water has increased the TDS, total and dissolved iron and dissolved manganese concentration is Dugout Creek below the mine site. Not enough data is yet available regarding the changes to the chemistry of Pace Creek water as a result of discharging mine water. However, the impacts are anticipated to be similar to those observed at Dugout Creek. The TDS concentration in Dugout Creek averages about 1000 mg/L

since the mine started discharging. Dissolved and total iron average 0.11 mg/L and 0.74 mg/L respectively. Dissolved and total manganese average 0.05 mg/L and 0.06 mg/l respectively.

Dugout Creek and Pace Creek, as part of the lower Price River basin, is classified according to Section R317-2-13 of the Utah Administrative Code (Standards of Quality for Waters of the State) as a class 2B (secondary contact recreation use), 3C (nongame fish and other aquatic life use), and 4 (agricultural use) water. No TDS standards exist for class 2B and 3C water. The TDS standard for class 4 water is 1,200 mg/l.

It should also be noted that the dissolved iron standard for class 3C water is 1.0 mg/l. No dissolved iron standard exists for class 2B or 4 waters. The data presented above indicate that average discharge water from the mine does not exceed the dissolved iron standard of Dugout Creek or Pace Creek. No standards exist in the R317 regulations for total iron, dissolved manganese, or total manganese. The quality of the water discharged from the mine normally meets the limits set forth in its UPDES permit. Excursions from those limits occur when an upset condition exists within the mine. The upsets are typically related to power outages that allow the mine sections to flood followed by large volumes of water discharging from the mine.

One notable excursion from the UPDES limits occurred when mining in the Gilson seam on the east side of the Right Fork of Dugout Creek resulted in the operator draining the flooded old Knight Ideal Mine working in August 2002 and again in May 2003 to prevent catastrophic flooding of the current Dugout Canyon Mine operations. The old workings contained water with total iron in excess of 1 mg/l and this water was discharged to Dugout Creek at a rate that at times reached 1117 gpm. As a result of draining the old workings, the water discharged to Dugout Creek did have a total iron concentration in excess of the UPDES permit limit of 1mg/l for a short period of time. It appears that water will be continuously drained from the Knight Ideal Mine for the foreseeable future to maintain safe underground working conditions but at a discharge rate expected to be much less than 100 gpm.

No hydrologic impacts have been noted at the adjacent Soldier Canyon Mine nor at the Dugout Canyon Mine due to subsidence. Although tension cracks may locally divert water into deeper formations, resulting in increased leaching of the formation and increased TDS concentrations, the potential of this occurring is considered minimal. This conclusion is based on experience at both the Soldier Canyon and Dugout Canyon Mine and on the fact that the shale content of the North Horn Formation, the Price River Formation, and the Blackhawk Formation should cause these subsidence cracks to heal quickly where they are saturated by groundwater flow. Thus, potential impacts on TDS concentrations would be minor and not of significant concern. To date (October

2007), mining and subsidence within the Dugout permit area has not resulted in the loss of surface flows in the Dugout Creek drainage or impacts to ground water discharge rates at the monitored seeps and springs.

Flooding or Streamflow Alteration. Runoff from all disturbed areas will flow through a sedimentation pond or other sediment-control device prior to discharge to Dugout Creek or Pace Creek. Three factors indicate that these sediment-control devices will minimize or preclude flooding impacts to downstream areas as a result of mining operations:

1. The sedimentation pond and sediment traps have been designed and will be constructed to be geotechnically stable. Thus, the potential is minimized for breaches of the sedimentation pond to occur that could cause downstream flooding.
2. The flow routing that occurs through the sedimentation pond and other sediment-control devices reduces peak flows from the disturbed areas. This precludes flooding impacts to downstream areas.
3. By retaining sediment on site in the sediment-control devices, the bottom elevations of Dugout Creek and Pace Creek downstream from the disturbed area will not be artificially raised. Thus, the hydraulic capacity of the stream channel will not be altered.

The volume of streamflow has increased in Dugout Creek and Pace Creek as water is discharged from the mine to the creeks. Potential impacts to the creek channels could include the displacement of fines on the channel bottom, and minor widening of the channel. However, the degree of widening will likely be minimized by the increased vigor and quantity of vegetation which will be sustained along the stream channel by the increased availability of water. In particular, it is anticipated that the deciduous streambank vegetative community (see Section 321.100) will increase in density and vigor as a result of mine-water discharges. This effect will occur for the distance downstream that surface flows can be sustained above channel transmission losses. Care will be taken during discharge of this water to avoid flooding of downstream areas. Once mining ceases, the mine will be sealed and no discharges will occur. The streamflow in Dugout Creek and Pace Creek will then return to pre-mining discharge levels.

Following reclamation, stream channels which have been altered by mining operations will be returned to a stable state (see Section 762.100). The reclamation channels have been designed to safely pass the peak flow resulting from the 10-year, 6-hour or the 100-year, 6-hour precipitation event as appropriate for the channel and in accordance with the R645 regulations (Appendix 7-11). Thus, flooding in the reclaimed areas will be minimized. Interim sediment-control measures and

maintenance of the reclaimed areas during the post-mining period will preclude deposition of significant amounts of sediment in downstream channels following reclamation, thus maintaining the hydraulic capacity of the channels and precluding adverse, off-site flooding impacts.

Subsidence tension cracks that appear on the surface will increase the secondary porosity of the formations overlying the Dugout Canyon Mine. During the period prior to healing of these cracks, this increased percolation will decrease runoff during the high-flow season (when the water would have rapidly entered the stream channel rather than flowing into the groundwater system). During low-flow periods, the result of this increased percolation will be an increase in the base flow of the stream. Hence, the net result will be a decrease in the flooding potential of the affected stream.

Subsidence under the main fork of Dugout Creek will occur in areas where overburden ranges from 600 to 1200 feet thick. The area of the least amount of overburden, approximately 600 feet, occurs in the southern half of Section 14, Township 13 South Range 12 East. Additionally, subsidence on the right hand fork of Dugout Creek may occur where overburden ranges from 500 feet to 2000 feet. The least amount of overburden on this fork of the creek occurs in the northeast quarter of Section 23, Township 13 South, Range 12 East. In both areas where the least amount of overburden occurs, the stream channels are lined with several feet of soils and fine grained sediments. Also, the upper Blackhawk Formation, which consists of interbedded shale, mudstone, siltstone, and sandstone, is exposed at the surface in a portion of these low overburden areas. The Castlegate Sandstone is present in the two low overburden areas but is rarely exposed in the channel floors.
To date, a short segment of the right hand fork has been undermined and subsided as the Gil 2 panel was mined in April 2005. The subsided area is located in the SW1/4 of Section 13 and the NW1/4 of Section 24, Township 13 South, Range 12 East. Monitoring of surface flows at DC-3 indicates no decrease in surface water flows in this channel.

The current mine plans include mining gate roads and entries under several sections of Pace Creek. However only limited subsidence will occur under Pace Creek in portions of Section 20, Township 13 South, Range 13 East where a longwall panel, Gil 5, has been mined (Plate 5-7). The panel was mined between September 2006 and May 2007. To date, no impacts due to mining have been observed in the channel for in-stream flow. The stream channel in this area is lined with several feet of soils and fine grained sediments. Surface cracks if they occurred in the sediments due to subsidence, likely quickly filled with fine grained material and restricted the water from entering the fractures. The upper units of the Price River Formation which consists of sandstone, and the lower units of the North Horn Formation which consist of interbedded sandstone and mudstone, underlie the stream in this area. The overburden above the Gilson seam where

subsidence has occurred under Pace Creek is at least 1000 feet thick or more. As mining progresses to the east, the overburden becomes thicker due to changes in topographic elevation and the dip of the coal beds. Current mine plans do not include subsiding any perennial portion of Rock Canyon Creek.

A subsidence study performed at Burnout Canyon, a perennial stream drainage subsided by long wall mining at the Canyon Fuel Company, LLC Skyline Mines, suggests that thick fine grained soil mantles overlying bedrock appear to prevent noticeable stream flow losses to the bedrock (Rocky Mountain Research Station, 1998). Though the climatic regime and regional stratigraphy are not identical to the Burnout Canyon area, enough similarities exists to suggest that the bedrock, soils, and channel floors should react to subsidence in a similar fashion. As discussed in preceding sections, fractures related to subsidence within the fine grained sediments of the upper Blackhawk Formation in the Soldier Canyon Mine area tend to heal relatively rapidly. Also, fractures within the channel floor would be expected to fill quickly with fine grained sediments and become relatively impermeable. Therefore, the loss of stream flow to the mine is highly unlikely and losses to bedrock beneath the channel, or in the limited areas where bedrock is exposed in the channel floor, would be short lived.

Groundwater and Surface Water Availability. Potential impacts to the availability of surface and groundwater from the Dugout Canyon Mine operations include both decreased and increased stream flows and spring discharges caused by mine-related subsidence, bedrock fracturing, and aquifer dewatering. These potential impacts are discussed below.

Potential for Decreased Spring and Stream Flows

To date, limited surface subsidence has been identified as a result of coal mining in the Dugout Canyon Mine. However, bedrock fracturing routinely occurs in the rock units overlying the mined coal seams. Given the limited number of springs and limited groundwater resources of the Blackhawk, Castlegate, and Price River Formations in the permit and adjacent areas, subsidence or fracturing would affect the hydrologic balance in the area only if zones of increased vertical hydraulic conductivity were created which extended through the Price River Formation into the North Horn and Flagstaff Formations.

Several lines of evidence suggest that mining-related subsidence and bedrock fracturing have not resulted in decreased stream flows or groundwater discharge in the vicinity of the Dugout Canyon Mine. While to-date no monitored discharging springs have been undermined at Dugout Creek, several springs in the upper tributaries of Fish Creek were undermined in 2001 - 2003. These

springs are numbered SC-15, SC-16, SC-17, and SC-18. These springs were originally identified as flowing springs in the 1980s. Subsequent visits to these sites in the fall of 1995 and summer of 2006 did not observe flows from these spring locations. It has been speculated these springs were originally identified after a significant wet cycle and the spring locations appear to represent re-emergence of flow from spring SC-14.

Ephemeral portions of Fish Creek and Dugout Creek drainages have been subsided and no significant adverse effects to those drainages have been noted. Active groundwater systems in the Flagstaff and North Horn Formations are separated from the Blackhawk groundwater system by the Price River Formation. As discussed in Section 724.100, this formation contains very few springs and is not considered to be a major groundwater resource. Past mining in the Soldier Canyon Mine has not increased the rate of spring discharge from the Price River Formation, indicating that groundwater is not being diverted into this formation. The absence of increased saturation in the Price River Formation due to coal mining indicates that vertical zones of artificially-increased hydraulic conductivity do not extend into the Price River Formation and from thence into the active groundwater systems of the North Horn and Flagstaff Formations.

Data presented in Appendix 7-3 and summarized in Section 724.100 indicate that the Blackhawk groundwater system, in the vicinity of mined coal seams, contains ancient groundwater which is compartmentalized both vertically and horizontally. Coal mining locally dewaters overlying rock layers in the Blackhawk Formation but does not appear to draw additional recharge from overlying or underlying groundwater systems (see Appendix 7-3).

The strong vertical gradients in Blackhawk Formation rock layers underlying actively mined coal seams in the Soldier Canyon Mine and the absence of significant discharge into the mine from these layers indicates that mining does not draw groundwater from the underling Mancos Shale. Additionally, the distinctive solute composition of Mancos Shale groundwater has not been observed inside the Soldier Canyon Mine (see Appendix 7-3).

Ground water has discharged to the Dugout Canyon Mine through fractures in the floor of the mine. Initial water chemistry of the mine water does not indicate this water is sourced from the underlying Mancos Shale. It is much more likely the fractures are draining isolated aquifers beneath the coal but hydaulically connected by the fractures. Flows from these fractures typically have steadily decreased after initially being encountered during mining.

From the above discussion, it appears that the Soldier Canyon Mine has not decreased groundwater discharge in overlying or underlying groundwater systems. Additionally, monitoring

in the Dugout Canyon Mine area indicates mining within that area has not decreased groundwater discharge in overlying or underlying ground water systems.

Potential for Increased Stream Flows

Sufficient water has been encountered in the Dugout Canyon Mine workings requiring the mine to discharge water to Dugout Creek and Pace Creek. Originally, to estimate the potential quantity of inflow to the Dugout Canyon Mine, an investigation of Lines (1985) was reviewed. In this investigation, Lines (1985) evaluated groundwater conditions in the Trail Mountain Area, located in the hydrogeologically-similar Wasatch Plateau approximately 23 miles southwest of the proposed Dugout Canyon Mine permit area. Using a finite-difference model, Lines (1985) evaluated potential inflows into a hypothetical coal mine in the Blackhawk Formation. Initially, this model was used by the mine to predict the potential mine inflows. The results of this model indicated the flows would equal about 214 gpm. Mayo and Associates, while preparing the PHC for this mine, predicted a potential inflow of about 800 gpm of inflow. This calculation was based on the ground water inflow rates observed in the Soldier Canyon Mine and related to the rate of coal production. Mayo's calculations led him to believe that if approximately one million tons of coal are mine per year in the Dugout Mine, then the mine could expect an inflow rate of approximately 800 gpm. Dugout Mine typically mines three to four million tons of coal per year. Ground water production from the Dugout Mine has ranged from 0 gpm during the first four years of production to as high as 2800 gpm under emergency conditions. The average current rate of ground water production from the mine appears to be about 1900 gpm. This rate appears to be closer to that which Mayo predicted. It is anticipated that as mining continues down dip for the next several years, mine inflow rates may increase. This is based on the assumption that channel sandstones in the roof and floor will contain proportionately larger volumes of water as the distance from outcrop is increased. Also, as the panels are mined in the area between Rock and Pace Canyons and updip of current workings, it is likely the volume of ground water flowing into the mine will decrease.

Potential Hydrocarbon Contamination. Diesel fuel, oils, greases, and other hydrocarbon products will be stored and used at the site for a variety of purposes. Diesel and oil stored in above-ground tanks at the mine surface facilities may spill onto the ground during filling of the storage tank, leakage of the storage tank, or filling of vehicle tanks. Similarly, greases and other oils may be spilled during use in surface and underground operations.

The probable future extent of the contamination caused by diesel and oil spillage is expected to be small for three reasons. First, because the tanks will be located above ground, leakage from the tanks will be readily detected and repaired. Second, spillage during filling of the storage or vehicle tanks will be minimized to avoid loss of an economically valuable product.

Finally, the Spill Prevention Control and Countermeasure Plan ~~which will be~~ developed for the site will provide inspection, training, and operation measures to minimize the extent of contamination resulting from the use of hydrocarbons at the site. This plan is not required to be submitted. However, a copy will be maintained at the mine site as required by the Utah Division of Water Quality.

Road Salting. When necessary for safety purposes, salt and/or ice melting compounds will be used on paved road areas. The paved road areas report to the sediment pond for treatment.

Coal Haulage. Coal will be hauled over the county road from the mine portal area to the Soldier Creek Road and thence to its ultimate destination. In the event of an accident which causes coal to spill from the trucks, residual coal following cleanup of the spill may wash into local streams during a runoff event. Possible impacts to the surface water are increased total suspended solids concentrations and turbidity from the fine coal particulates. The probability of a spill occurring in an area sufficiently close to a stream channel to introduce coal to the stream bed is considered small.

In addition to spills, wind may carry coal dust or small pieces of coal from the open top of the coal trucks into creeks near the roads. The impact from fugitive coal dust is considered to be insignificant due to the small amounts lost during haulage in the permit and adjacent areas.

Water Replacement. The water consumed in operating underground equipment, dust suppression, and evaporation is obtained from ground water sources. These underground water sources are not connected to the surface waters in the area. Research has been performed by the mine to verify that water currently entering the mine is not coming from the surface or depleting surface waters. Continued monitoring by the mine of the surface waters and seeps and springs flows in the permit and adjacent areas have shown no discernable impacts due to mining activities. It is the operator's position that the water consumed in operating Dugout Canyon Mine is not depleting surface water sources. In fact, there is an overall net gain to local river systems discharging to the Colorado River as a result of the mine's discharge.

The Permittee will replace the water supply of any land owner if such a water supply proves to be contaminated, diminished or interrupted as a result of the mining operations. First, a determination will be made by the Division in accordance with R645 - 301- 731.800 as to whether or not material damage has occurred. Then, in accordance with Regulation R645-301-525.510, Dugout Canyon Mine will correct any material damage resulting from subsidence caused to surface lands (which includes water rights), to the extent technologically and economically feasible, by restoring the land to a condition capable of maintaining the value and reasonably foreseeable uses that it was capable of supporting before subsidence damage. Negotiations will be held with the water right holders to determine the best plan of action and implementation of water replacement.

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

This permit application includes an operation plan which addresses the following:

- Groundwater and Surface Water Protection and Monitoring Plan;
- Design Criteria and Plans;
- Performance Standards; and
- Reclamation Plan.

731.100 Hydrologic-Balance Protection

Groundwater Protection. To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acidic, toxic, or other harmful infiltration to the groundwater system. Additionally, the permittee will manage excavations and disturbances to prevent or control discharges of pollutants to the groundwater.

Water will be discharged from the mine in a controlled manner, in accordance with an approved UPDES permit, via a pipeline from the mine to the creek. The Dugout Creek discharge point is located at the upstream inlet to the Dugout Canyon culvert, UC-6. Riprap has been placed at the

outlet of the pipe to prevent erosion. The Pace Creek discharge point is located southeast of the fan shaft. The pipe discharges directly to the creek. The pipe outlet is riprapped to prevent erosion. Any erosion that occurs at the points of discharge will be repaired as soon as practical.

Surface Water Protection. To protect the hydrologic balance, coal mining and reclamation operations will be conducted to handle earth materials and runoff in a manner that minimizes acidic or toxic drainage, prevents, to the extent possible, additional contributions of suspended solids to streamflow outside the permit area, and otherwise prevents water pollution. Additionally, the mine will maintain adequate runoff- and sediment-control facilities to protect local surface waters.

During initial construction to develop the surface facilities, and prior to installation of all runoff- and sediment-control facilities as outlined in Section 732 of this M&RP, silt fences will be installed along the top bank of Dugout Creek and its eastern tributary in areas prior to disturbance. These silt fences will be installed in accordance with Figure 5-4. If required for control of local erosion, straw-bale dikes may also be installed at the site during initial construction. These dikes will also be installed in accordance with Figure 5-4. The silt fences and straw-bale dikes will be periodically inspected, and accumulated sediment will be removed as needed to maintain functionality. Once the sedimentation pond, ditches, and culverts are installed, the silt fences and straw-bale dikes may be removed.

During initial construction to develop the surface facilities in Pace Canyon, and prior to installation of all runoff- and sediment-control facilities as outlined in Appendix 7-12 of this M&RP, silt fences will be installed along the disturbed area boundary and along the tributary drainages upstream and downstream of the surface facilities. These silt fences will be installed in accordance with Figure 5-4. If required for control of local erosion, straw-bale dikes may also be installed at the site during initial construction. These dikes will also be installed in accordance with Figure 5-4. The silt fences and straw-bale dikes will be periodically inspected, and accumulated sediment will be removed as needed to maintain functionality. Once the sedimentation trap, ditches, and culverts are installed, the interim silt fences and straw-bale dikes will be removed.

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 M&RP.

731.200 Water Monitoring

Groundwater Monitoring. Groundwater monitoring to be conducted in the permit and adjacent areas will consist of data collection from monitoring wells, springs, and mine-water discharges. Locations of wells and springs to be monitored are noted on Plate 7-1. The groundwater monitoring plans presented herein were developed based on information presented in the PHC determination, the baseline hydrologic data, the geologic data presented in Chapter 6 of this M&RP, and operational changes at the mine.

Monitoring wells included in the groundwater monitoring program are GW-10-2, GW-11-2, and GW-24-1. The remaining monitoring wells in the general vicinity are either too remote from the permit area to be indicative of impacts occurring from the Dugout Canyon operations (i.e., GW-5-1, GW-6-1, GW-32-1, and G-58.5) or are completed across multiple aquifers (i.e., GW-19-1), making data interpretation difficult.

The monitoring wells are all completed in the Price River Formation or the underlying Castlegate Sandstone. Because the Castlegate Sandstone immediately overlies the Blackhawk Formation, data collected from these wells allow hydrologic impacts of mining to be evaluated in groundwater systems which overlie the mine workings but underlie the Flagstaff and North Horn groundwater systems.

Water-level measurements will be collected on a quarterly basis when the wells are accessible. Given the ages of the wells and the probable deterioration of the casing materials, no attempts will be made to collect water-quality data from the monitoring wells.

The springs to be included in the operational and post-mining groundwater monitoring program are:

Spring	Formation
SC-65	Colton
SP-20	Flagstaff
SC-14	North Horn
SC-100	Flagstaff (at North Horn FM. Contact)
SC-116	North Horn
200	North Horn
203	North Horn
227	Castlegate Sandstone
259	North Horn
260	Colton
259A	Colton
321	Colton

322	Colton - Operational quarterly flow measurements only	

Locations of these springs are noted on Plate 7-1.

If deemed necessary with the addition of 240 acres associated with Federal Coal Lease U-07064-027821, groundwater monitoring location(s) associated with existing water rights identified by an authorized representative of the Conover Trust may be added in 2008.

The purpose of monitoring the above-listed springs will be to assess potential impacts to groundwater systems overlying the Blackhawk Formation due to subsidence and mine dewatering. Springs have been selected for monitoring in the Colton, Flagstaff, North Horn, and Castlegate Sandstone Formations. These springs are reasonably accessible and, based on the historical data, are representative of conditions within their respective formations.

It should be noted that reliable data have been difficult to collect from the limited number of springs issuing from the Blackhawk Formation within the permit and adjacent areas. As a result, no springs issuing from this formation have been included in the long-term monitoring program.

The ground water monitoring and sampling protocols to be implemented are described in Table 7-4. These protocols are based on the probable hydrologic consequences (PHC) of mining as presented in Section 728 and Appendix 7-3 of this M&RP and the requirements put forth in the Division's regulations. Table 7-4 is the same as that presented in Coal Regulatory Program Directive Tech-004, with the exception that total hardness and total alkalinity are not included. Total hardness, which is primarily of concern in water supplies being developed for domestic use, was not added to the list because summer-home development of the permit area is not an identified post-mining land use. Total alkalinity was not added to the list because the baseline data indicate that acid-generating materials, which may affect the alkalinity of the water, are not present within the permit and adjacent areas.

The protocols set forth in Table 7-4 will be followed during years of normal precipitation as defined in the PHC. Wet or dry (not normal) years for the mine area are defined based on the Natural Resources Conservation Services snow-pack measurements as of March 1 for the Price River-San Rafael River Basin. A wet year occurs when the snow pack water content is greater than 110% of normal and a dry year when the snow pack is less than 70% of normal. After the permit is issued, the following monitoring protocol will be implemented for the first wet or dry year occurrence:

1. Weekly measurements of flow during the first wet year and the first dry year following permit issuance will be obtained. The purpose of these measurements will be to prepare base-flow hydrographs of the monitored springs. Flow measurements during the first wet year and the first dry year will be collected weekly between April 1 and August 31 as conditions permit.

2. Water samples will be obtained during high- and low-flow season in conjunction with the quarterly sampling, if applicable. The samples will be analyzed in accordance with Table 7-4 with the addition of tritium analysis.

In addition to the above regular monitoring, one water sample will be collected at each spring sampling point during low flow period every fifth year, during the year preceding re-permitting, to be analyzed for baseline parameters (Table 7-4).

Groundwater was discovered discharging from old Gilson coal seam workings located on the east side of Dugout Canyon during construction of the Dugout Canyon Mine in September 1998. Prior to construction, this water seeped unnoticed through unconsolidated fill and into Dugout Creek. The water discharging from these old workings will be monitored on a quarterly basis for the parameters listed in Table 7-4 beginning in the fourth quarter of 1998. The monitoring point is labeled MD-1 on Plate 7-1.

Data will be collected from the Dugout Canyon Mine and Pace Canyon Fan Portal mine-water discharge point in accordance with the UPDES permits. No water will be discharged prior to obtaining the necessary UPDES permits. The monitoring requirements proposed herein, including the analytical parameters and the sampling frequency, may be modified in the future in consultation with the Division if the data demonstrate that such a modification is justified.

Data will be collected under the groundwater monitoring program every year following the completion of surface reclamation activities. During the post-mining period, water levels will be collected from the monitoring wells and data/samples will be collected from the identified springs once each year during September or October (i.e., the low-flow season while the sites are still accessible). Groundwater monitoring during the post-mining period will continue until bond release.

All groundwater monitoring data will be submitted to the Division by the end of the quarter following sampling. If analyses of any groundwater sample indicates noncompliance with the permit conditions, the permittee will promptly notify the Division and take immediate appropriate actions. UPDES reporting requirements will be met for the mine-water discharge points. The Snotel data

used to determine "wet" or "dry" years, as described previously in this section, will be submitted with the first quarter water monitoring data beginning in the year 2001 or in the annual report.

Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of groundwater in the permit and adjacent areas have been or will be installed, maintained, and operated in accordance with accepted procedures. Where feasible, this equipment will be removed or properly abandoned by the permittee when no longer needed.

Surface Water Monitoring. Surface water monitoring to be conducted in the permit and adjacent areas will consist of data collection from streams and sedimentation pond discharges. Locations of streams to be monitored are noted on Plate 7-1. The surface water monitoring plans presented herein were developed based on information presented in the PHC determination, the baseline hydrologic data, and the geologic data presented in Chapter 6 of this M&RP.

Station DC-1 will be monitored to evaluate surface-water conditions downstream from the proposed surface facilities. Stations DC-2 and DC-3 will provide data concerning background surface-water conditions immediately upstream from the proposed surface facilities. Stations DC-4 and DC-5 will be located at the Castlegate Sandstone-Blackhawk Formation contact and will provide data that will be used to determine the relationship between the Blackhawk Formation and the base flow of Dugout Creek.

PC-1a and PC-2 are located on Pace Creek and will be monitored to evaluate surface-water conditions up gradient and down gradient, respectively, of the permit area. Monitoring point (Fan) has been added on Pace Creek at a location approximately 600 feet upstream from the top of the Pace Canyon Fan facilities disturbed area boundary. Monitoring locations Fan and PC-2 will be monitored to evaluate surface water conditions up gradient and down gradient , respectively, of the Pace Canyon Fan facilities. RC-1 has also been established as monitoring point to obtain baseline data for future mine expansion. Baseline data was obtained from the aforementioned three sites (PC-1a, PC-2 and RC-1) for three years prior to initiating operational sampling.

PC-3 is located on Pace Creek below the confluence of an unnamed ephemeral drainage with Pace Creek (Plate 7-1). Degas Wells G-18, G-19 and the AMV road are located adjacent to the unnamed drainage at various elevations. Surface water monitoring location PC-3 was added during the permitting of the AMV road and Degas Wells G-18 and G-31, baseline data was not gathered for this monitoring location. The operational monitoring of PC-3 will begin the 4th quarter of 2007.

Protocols for surface-water monitoring within the permit and adjacent areas are:

- DC-1, FAN, PC-3 - Quarterly data collection in accordance with Table 7-5 (operational parameters). This table is the same as that presented in Coal Regulatory Program Directive Tech-004, with the exception that total hardness and total alkalinity are not included. As explained above, total hardness, which is primarily of concern in water supplies being developed for domestic use, was not added to the list because summer-home development of the permit area is not an identified post-mining land use. Total alkalinity was not added to the list because the baseline data indicate that acid-generating materials, which may affect the alkalinity of the water, are not present within the permit and adjacent areas.

- DC-2, DC-3, PC-1a, PC-2, and RC-1 - Quarterly data collection in accordance with Table 7-5. Collection of gain-loss hydrograph data during the first wet year and the first dry year following permit issuance. Wet and dry years will be defined as noted in the previous groundwater monitoring discussion. The hydrograph will be generated by collecting flow measurements during the first wet year and the first dry year on a weekly basis between April 1 and August 31 as conditions permit.

- DC-4 and DC-5 - Collection of gain-loss hydrograph data during the first wet year and the first dry year following permit issuance, as described above. Collect flow measurements during the first wet year and the first dry year on a weekly basis between April 1 and August 31 as conditions permit. Samples will also be collected for laboratory analyses during the first wet year and the first dry year following permit issuance. Wet and dry years will be defined as noted above. These samples will be collected during the high-flow and low-flow seasons. The samples will be analyzed for tritium and the operational parameters contained in Table 7-5.

- 323 - Quarterly data collection in accordance with Table 7-5.

In addition to the above regular monitoring, one water sample will be collected at each sampling point during low flow period every fifth year, during the year preceding re-permitting, to be analyzed for baseline parameters (Table 7-5).

The monitoring requirements proposed herein, including the analytical parameters and the sampling frequency, may be modified in the future in consultation with the Division if the data demonstrate that such a modification is justified. Data will be collected from the sedimentation

pond discharge point in accordance with the UPDES permit. Data will be collected under the surface water monitoring program every year until bond release.

All surface water monitoring data will be submitted to the Division by the end of the quarter following sampling. If analyses of any surface water sample indicates noncompliance with the permit conditions, SCM will promptly notify the Division and take immediate appropriate actions. UPDES reporting requirements will be met for the sedimentation pond discharge point.

Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of surface water in the permit and adjacent areas have been or will be installed, maintained, and operated in accordance with accepted procedures. Where feasible, this equipment will be removed or properly abandoned by SCM when no longer needed.

Monitoring and Mitigation Plan Pace Creek

Dugout Canyon Mine plans to leave a barrier under the majority of Pace Creek within the permit boundary. The stretches of Pace Creek (10/04 mine map) which are planned for undermining are above entry development, not longwall panels. There is approximately 1000 feet of stream channel having over 500 feet of cover planned for mining in 2007, 400 feet has approximately 900 feet of cover planned for mining in 2008 and approximately 100 feet has 1250 feet of cover planned for mining in 2008-2009. A surface water monitoring and mitigation program will be initiated in this area prior to potential subsidence occurring. This monitoring program will include conducting a pre-mining subsidence photographic survey of the stream channel from surface water monitoring location PC1A to where Pace Creek leaves the SW1/4SW14 Section 20, T13S, R13E and a single reference site below the Pace Canyon fan site. The purpose of the photographs will be to provide a visual record of the stream channel prior to mining disturbance. Five reference sites will be identified within the photographed portion of Pace Creek where the monitoring of surface ground water flows, channel width and general geomorphology will occur. These reference sites will be established during low flow in the creek and monitored as outlined by the USDA Forest Service (Stream Channel Reference Sites: An Illustrated Guide to Field Technique. General Technical Report RM-245, Harrelson et. Al., 1994). The photographing of Pace Creek and the selection of monitoring sites will be done no later than the Spring of 2006 and submitted as part of the 2006 annual report.

The surface water flows and channel width at these stations will be monitored on a monthly basis, when accessible, while mining is occurring within the 15 degree angle-of-draw of the stream

channel. The Division will be notified if the area is inaccessible due to road or climatic conditions and the monitoring could not be accomplished. Once mining has been completed within the angle-of draw, the sites will be monitored annually for up two years following undermining. A report on the subsidence related impacts, if any, to the surface water flows, will be provided monthly to the Division during monthly monitoring and annually during annual monitoring.

Mitigation will implement the Best Technology Currently Available in association with the repair of damage to the Pace Creek stream channel. The repairs may include the use of bentonite/soil mixes to fill persistant cracks that appear to be diverting water. Bentonite may also be used to line portions of the creek floor where leakage appears to be occurring. Other methods or chemicals, if environmentally safe and available, may be employed if bentonite and/or bentonite/soil mixes are ineffectual.

731.300 Acid- and Toxic-Forming Materials

Analyses presented in Chapter 6 of this M&RP indicate that acid- and toxic-forming materials are not present within the permit area. Parameters defining acid- and toxic-forming materials will periodically be monitored as described in Chapter 6 of this M&RP. In the event that acid- or toxic-forming materials are identified, they will be disposed of in appropriate waste-rock disposal facilities as described in Chapter 5 of this M&RP.

731.400 Transfer of Wells

Before final release of bond, exploration or monitoring wells will be sealed in a safe and environmentally sound manner in accordance with R645-301-631, R645-301-738, and R645-301-765. Ownership of wells will be transferred only with prior approval of the Division. The conditions of such a transfer will comply with State and local laws. The permittee will remain responsible for the management of the wells until bond release in accordance with R645-301-529, R645-301-551, R645-301-631, R645-301-738, and R645-301-765.

731.500 Discharges

Discharges into an Underground Mine. No discharges of surface water will be made to an underground mine in the permit and adjacent areas.

Gravity Discharges from an Underground Mine. No gravity discharges will be made from an underground mine in the permit and adjacent areas.

731.600 Stream Buffer Zones

The surface facilities for the Dugout Canyon Mine will be constructed within 100 feet of Dugout Creek (a perennial stream, intermittent adjacent to mine facilities) and Pace Creek (an intermittent stream adjacent to fan facilities). However, surface runoff- and sediment-control facilities designed for the site (as discussed in subsequent sections of this chapter) will ensure that coal mining and reclamation operations will not cause or contribute to the violation of applicable Utah or federal water standards and will not adversely affect the water quantity and quality or other environmental resources of the stream.

Stream Channel Diversions. Temporary or permanent stream channel diversions will comply with R645-301-742.300.

Buffer Zone Designation. The area surrounding the streams that is not to be disturbed will be designated as a buffer zone, and SCM will mark those zones as specified in Section 521.200 of this M&RP.

731.700 Cross Sections and Maps

The locations of water rights for current users of surface water flowing into, out of, and within the permit and adjacent areas is provided on Plate 7-2. The locations of each water diversion, collection, conveyance, treatment, storage, and discharge facility to be used in the Dugout Canyon area is presented on Plate 7-5 or in Addendum A to Appendix 7-9.

Locations and elevations of each station to be used for water monitoring during coal mining and reclamation operations are presented on Plate 7-1. The design details and cross sections for the sedimentation pond are provided on Plate 7-4. Other relevant cross sections or maps are presented and discussed in Chapter 5 of this M&RP.

731.800 Water Rights and Replacement

No surface mining will occur in the Dugout Canyon Mine permit area.

732 Sediment Control Measures

The sediment control measures within the permit area have been designed to prevent additional contributions of sediment to streamflow or to runoff outside the permit area. In addition, they have been designed to meet applicable effluent limitations, and minimize erosion to the extent possible.

The structures to be used for the runoff-control plan for the permit area include disturbed and undisturbed area diversion channels, a sedimentation pond, containment berms, silt fences, and road diversions and culverts.

Sediment control measures for the Pace Canyon Fan Portal Area are discussed in Appendix 7-12.

732.100 Siltation Structures

The siltation structure within the permit area will be a sedimentation pond as described in Section 732.200.

732.200 Sedimentation Ponds

There will be a single sedimentation pond operating at the mine facility located at the southwest end of the disturbed area. The sedimentation pond topography and cross sections are presented on Plate 7-4 of this M&RP. Details regarding sedimentation pond design are presented in Appendix 7-8. The staff gauge in the pond will be marked to indicate the 60% clean-out elevation as defined in Section 742. The sedimentation pond is defined as a Class A pond in accordance with TR-60 (U.S. Soil Conservation Service, 1976).

If sediment has accumulated to the 60% clean-out elevation, the pond will be cleaned. The sediment will be transported and either stored at the Banning Loadout or disposed of at the approved waste rock disposal sites as described in Chapter 5 of this M&RP or pumped back into the sealed, abandoned "Gilson West - Old Workings".

The sedimentation pond is within the disturbed area boundary and is subject to final reclamation. The area is included in the calculation of the disturbed area subject to bonding and in the calculation of final reclamation costs.

Compliance Requirements. The sedimentation pond will be maintained until removal in accordance with the reclamation plan (see Section 540 of this M&RP). When the pond is removed, the land will be revegetated in accordance with the reclamation plan defined in Section 540.

The sedimentation pond was designed to contain 0.40 acre-foot of sediment accumulation before being cleaned out. The sedimentation pond will fully contain the runoff from the 10-year, 24-hour storm event in addition to sediment accumulation. The primary spillway for the sedimentation pond will adequately pass the peak flow resulting from the 25-year, 6-hour precipitation event. The pond has also been designed with an emergency spillway to release water from the pond in the event that the primary spillway becomes blocked.

Additional design standards for the pond are presented in Section 742.

MSHA Requirements. MSHA requirements defined in 30 CFR 77.216 are not applicable since the sedimentation pond will not impound water or sediment to an elevation of 20 feet or more above the upstream toe of the structure. The pond will also store a volume 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:

- Allowing all upstream runoff in Dugout Creek to bypass the disturbed area through the use of culverts;
- Routing runoff from the adjacent undisturbed areas above the facilities through culverts and diversion ditches where feasible to bypass the disturbed area; and
- Routing any runoff from undisturbed areas which enters the disturbed area into the sediment control system.

The location of each diversion ditch or culvert for the main facility area is presented on Plate 7-5 or in Addendum A to Appendix 7-9. Details regarding design of the diversions are presented in Appendix 7-9. A brief list of the proposed diversion structures follows (refer to Plates 7-6 through 7-8 for the location of each watershed boundary):

<u>Diversion Ditches:</u>

- Interception ditch UD-1 along the southeast border of the disturbed area will collects runoff from adjacent undisturbed watersheds and direct the runoff into Dugout Creek.

- Disturbed drainage ditches DD-1a through DD-3care located within the main portion of the facility pad, directing disturbed-area runoff from this pad toward the sedimentation pond.
- Disturbed drainage ditch DD-3a through DD-3c are located along the north edge of the road that accesses the large and small substation pads. Runoff from ditches DD-3a through DD-3c is conveyed to the sedimentation pond via culvert DC-5 and ditches DD-2a through DD-2d.
- Disturbed drainage ditches DD-4 through DD-7 are located along the west side of the water-tank access road. These ditches convey runoff from the water tank access road to culverts DC-7 through DC-9. Culverts DC-8 and DC-9 discharge to the slope above Dugout Creek because crests in the road prevent runoff from reaching the sedimentation pond. Ditch DD-4 and Culvert DC-7 also discharge to the slope above Dugout Creek. Although runoff in DD-4 could reach the sediment pond it has been diverted because the runoff was creating large puddles and mud holes in front of the principle access portal. Alternate sediment control is provided for discharge from these ditches and culverts (see Section 742.200 of this M&RP).

Diversion Culverts:

- Culvert DC-4is located along the northwest portion of the main facility pad. This culvert conveys runoff from DD-2e to DD-2d and to the sedimentation pond.
- Culvert DC-6 will convey runoff from the portal pad via a drop inlet to the lower facility pad. This runoff will ultimately discharge to the sedimentation pond via ditches DD-9 and DD-2 and culvert DC-5.
- Culvert DC-1 will convey water from ditches located on the south side of the facility pad to the sedimentation pond.
- Culvert DC-5 will convey water from the substation access road into ditch DD-2 and then to the sedimentation pond. A drop inlet is used on this culvert.
- Culverts DC-7 DC-8 and DC-9 are located along the water-tank access road, conveying runoff from the roadside ditches to Dugout Creek. Because of the presence of the crest in the road between the facility pad and these culverts, this runoff cannot be conveyed to the sedimentation pond. Hence, alternate sediment control has been provided as noted in Section 742.200 of this M&RP.
- Culverts DC-2 and DC-3 convey runoff from the parking area and truck loop to ditches DD-2b and DD-2c respectively. Both culverts have drop inlets.
- Culverts UC-1 through UC-4convey undisturbed-area runoff from undisturbed watersheds to the Dugout Creek bypass culvert (UC-6). Culvert UC-4 conveys undisturbed-area runoff from ditch UD-1 to the Dugout Creek culvert (UC-6).

- Culvert UC-5 is located on the eastern tributary of Dugout Creek. Containing this tributary in a culvert will prevent uncontrolled sediment from the adjacent disturbed area from impacting this water during the operational period. Gabion baskets will be installed adjacent to the culvert as shown on Dwg. No. B101 in Appendix 7-9.
- Culvert UC-6 is located on the main branch of Dugout Creek, containing the creek through the disturbed area and allowing coal-haul trucks to enter and leave the loadout pad and mine access/haul road. Installation of this culvert will protect Dugout Creek from sediment which may be generated from the adjacent disturbed areas.
- Culvert DC-10 conveys runoff from the sediment basin beneath the storage racks west of the office/warehouse building into ditch DD-1a.
- Culvert DC-11 conveys runoff from the sediment trap to the sediment pond.

All diversion ditches will be maintained with adequate riprap or alternative erosion protection in the ditch sections where flow velocities are predicted to be sufficiently high to require a ditch lining. Adequate ditch capacities will be maintained in all ditch sections. Culverts will be kept free of debris and each outlet will be protected with riprap where deemed necessary. Detailed diversion design is presented in Section 742.

732.400 Road Drainage

Road drainage facilities will include diversion ditches, culverts, and containment berms. The road drainage diversion ditches and culverts for the mine site 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 to original condition following the occurrence of a large storm event. Culvert inlets and outlets will be kept clear of sediment and other debris. Culverts to be installed on Dugout Creek to permit turning of the coal haul trucks are discussed in Section 742.300.

733 Impoundments

733.100 General Plans

There will be a single sedimentation pond operating at the mine facility as described in Section 732.200. The sedimentation pond will be located in the southwest corner of the disturbed area. The sedimentation pond topography and cross sections are presented on Plate 7-4 of this M&RP.

Detailed design information is presented in Appendix 7-8. Details regarding the impoundments at the Pace Canyon Fan Portal Site can be found in Appendix 7-12.

Certification. All maps and cross sections of the sedimentation pond 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 pond are provided on Plate 7-4 of this M&RP.

Narrative. A description of the sedimentation pond is presented in Sections 732.200 and 742 of this M&RP.

Subsidence Survey Results. No underground coal mining will occur beneath the proposed sedimentation pond. Therefore, there will be no effects on the pond or pond embankment from subsidence.

Hydrologic Impact. The hydrologic and geologic information required to assess the hydrologic impacts of the proposed sedimentation pond are presented in Section 724 and Chapter 6 of this M&RP, respectively.

Design Plans and Construction Schedule. There are no additional structures proposed for the mining operation 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 pond has been designed using current, prudent engineering practices. Specific foundation design and construction criteria are presented in Chapter 5 of this M&RP. 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 pond as a temporary impoundment at the mine as part of coal mining and reclamation operations.

Hazard Notifications. The sedimentation pond 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 Dugout Canyon Mine facilities area will consist of the primary and emergency spillway on the sedimentation pond and a discharge line from the underground workings. Discharge structures at the Pace Canyon Fan Portal Site will consist of a spillway from the sediment trap and discharge line (UPDES) from the underground workings. All discharge structures will be constructed and maintained to comply with R645-301-744.

735 Disposal of Excess Spoil

There will be no excess spoil generated at the mine.

736 Coal Mine Waste

Coal mine waste will be stored and disposed of as described in Chapter 5.

737 Noncoal Mine Waste

Noncoal mine waste will be stored and disposed of as described in Chapter 5.

738 Temporary Casing and Sealing of Wells

Each groundwater monitoring well identified on Plate 7-1 will be operated and maintained as described in Section 748.

740 DESIGN CRITERIA AND PLANS

741 General Requirements

This M&RP includes site-specific plans that incorporate minimum design criteria for the control of drainage from disturbed and undisturbed areas. The design criteria and plans for the Pace Canyon Fan Portal Site can be found in Appendix 7-12.

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; 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 runoff away from the disturbed area;
- Diversion of runoff using channels or culverts through disturbed areas to prevent additional erosion;
- Provision of silt fences, riprap, contemporaneous revegetation, vegetative sediment filters, a sedimentation pond, and other measures that reduce overland flow velocities, reduce runoff volumes or trap sediment; and
- Treatment of mine drainage in underground sumps.

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 pond. The pond will be constructed before mining operations begin. The structures will be certified by a qualified registered professional engineer.

The sedimentation pond has been designed and will be constructed and maintained as described in Chapter 5 and Sections 733 and 743.

Some areas within the disturbed area boundary will not flow to the sedimentation pond. Areas not contributing runoff to the sedimentation pond would be impractical, if not impossible, to divert to the sedimentation pond due to their location. The proposed disturbed areas which will not flow to

the sedimentation pond can be generally described as areas downstream from the sedimentation pond, areas along the water-tank access road, and the area occupied by the water tanks.

Areas of alternate sediment control (ASCAs) are shown on Plate 7-8 and in Addendum A to Appendix 7-9. These include ASCA-1 (a small portion of the primary haul road downstream from the sedimentation pond), ASCA-2 (the water-tank access road upstream from the crest in the road below watershed WS-9 and upstream of culvert DC-8), ASCA-3 (the water-tank access road upstream from culvert DC-9 including the water tank area), ASCA-4 (the water-tank access road upstream of culvert DC-7), and ASCA-5 (the topsoil storage area) .

ASCA-1 consists of a small portion of the primary haul road adjacent to and downstream from the sedimentation pond. Sediment control in this area is provided by paving the road, thus precluding the production of sediment from the ASCA.

Runoff from ASCA-2 is precluded from flowing to the sedimentation pond because of a crest in the water-tank access road at the downstream edge of this ASCA. Instead, runoff from this area flows to Dugout Creek via culvert DC-8 (see Plate 7-5). Sediment generated from this ASCA is controlled by installing silt fences or straw-bale dikes in ditch DD-5 immediately upstream from the inlet to culvert DC-8. These sediment-control devices have been installed in accordance with Figure 5-4. Sediment which accumulates behind these devices will be periodically removed and either spread on the adjacent road or disposed of with waste-rock generated from the mine.

Runoff from ASCA-3 is precluded from flowing to the sedimentation pond for the reasons outlined above. This runoff will flow to Dugout Creek via culvert DC-9 (see Plate 7-5). Sediment generated from this ASCA will be controlled by installing silt fences or straw-bale dikes in ditch DD-6 immediately upstream from the inlet to culvert DC-9. These sediment-control devices were installed in accordance with Figure 5-4. Sediment which accumulates behind these devices will be periodically removed and either spread on the adjacent road or disposed of with waste-rock generated from the mine.

ASCA-3 also includes the water-tank area and the adjacent cut slope. Sediment yield from this area will be controlled by placing a layer of gravel around the water tanks and the explosives magazines. The cut slope west of the water tanks will also be contemporaneously reclaimed using the interim seed mix identified in Section 341.200 of this M&RP. Runoff which is generated from this ASCA will also flow through culvert DC-9, with additional sediment control being provided at the inlet to this culvert as discussed above.

An additional alternate sediment control measure (ASCA-5) is implemented at the topsoil storage area. Sediment contributions from this stockpile will be controlled by placing a berm around the stockpile to prevent both runoff from the pile and run-on to the pile. The location of this berm is indicated on Plate 2-3 and the design of the berm is noted in Appendix 7-9. Furthermore, erosion from the stockpile will be minimized through the establishment of a vegetative cover on the pile, as indicated in Section 234.200 of this M&RP.

Runoff from ASCA-4 is on the water-tank access road. Instead of runoff flowing to the sediment pond, runoff from this area will flow to Dugout Creek via culvert DC-7 . Sediment generated from this ASCA will be controlled by installing silt fences or straw-bale dikes in the ditch immediately upstream from the inlet to culvert DC-7. These sediment-control devices were installed in accordance with Figure 5-4. Sediment which accumulates behind these devices will be periodically removed and either spread on the adjacent road or disposed of with waste-rock generated from the mine.

Sediment-control measures were implemented during the relocation of the west fork of Dugout Creek. These measures will include installation of three straw-bale dikes and/or reinforced silt fences in appropriate locations within the creek channel below the relocation site to minimize potential contributions of sediment to Dugout Creek. The straw-bale dikes/silt fences will remain in-place until channel relocation and pad construction is completed.

Pace Canyon Fan Portal Facilities

The entire site is an ASCA area. Sediment from the site will be controlled by a combination of contemporaneous reclamation, revegetation, gravel, and the use of a sediment trap. Plate Figure 7-12E identifies the various alternative sediment control methods that will be used and where the methods will be implemented. Other than the realigned road and a small area on the outslope of the sediment trap embankment the entire site will drain to the sediment trap. Although calculations in Appendix 7-12, Attachment 2 demonstrate that the contemporaneous reclamation, gravel, and revegetation will reduce the sediment yield to less than pre-mining conditions a sediment trap was constructed to contain sediment generated by the site.

Sedimentation Ponds. A single sedimentation pond has been designed for the Dugout Canyon Mine facilities. The sedimentation pond is located in the southwest corner of the disturbed area. This pond will function individually.

The sedimentation pond will be located as near as possible to the disturbed areas as indicated on Plates 7-4 and 7-5. The pond will not be located within a perennial stream channel.

Design, Construction, and Maintenance

Sediment Storage Volume. The sedimentation pond has been designed to control sediment from disturbed and undisturbed areas. The disturbed area contributing runoff to the sedimentation pond contains 16.9 acres from watersheds DWS-1 through DWS-7 (portions of which will be undisturbed or contemporaneously reclaimed - see Appendix 7-9). The undisturbed area contributing runoff to the sedimentation pond contains 33.7 acres from watersheds WS-1, -3, -5, -6, -7, -8, -9a, and -11. Refer to Plates 7-7 and 7-8 for a delineation of watershed boundaries.

The sedimentation pond was designed to fully contain the sediment generated by disturbed and undisturbed areas. Based on calculations presented in Appendix 7-8, the sedimentation pond has been designed with a sediment storage capacity of 0.40 acre-foot. The elevation of the maximum sediment level will be 6954.4 feet. The 60% sediment clean-out volume of 0.24 acre-foot will have an elevation of 6951.7 feet.

Detention Time. An adequate detention time will be provided in the pond to allow the effluent to meet UPDES and 40 CFR Part 434 limitations. The decant water will be sampled and discharged from the pond in accordance with the above referenced effluent limitations.

Design Event. The sedimentation pond has been designed to fully contain runoff resulting from the 10-year, 24-hour precipitation event.

Pond Description. Several drainage areas, identified on Plates 7-7 and 7-8, will contribute runoff to the sedimentation pond. The disturbed drainage areas contributing to the pond will be DWS-1 through DWS-7 and the pond itself. The undisturbed drainage areas contributing to the pond will be WS-1, -3, -5, -6, -7, -8, -9a, and -11, as well as portions of the above-mentioned "disturbed" watersheds. These undisturbed drainage areas will discharge to the pond because construction of diversion ditches along the top of cut slopes may create cut-slope stability problems. Also, constructing ditches on steep slopes is expensive and disturbs a larger area. The selected course of action was to allow undisturbed runoff to flow onto the disturbed area and be treated in the sedimentation pond.

The curve numbers used to determine the runoff volumes were based on information presented in Appendix 7-8 and Appendix 7-9. The curve number for the pond area was assumed to be 100. Refer to Table 7-6 for a list of all disturbed and undisturbed watershed areas contributing to the sedimentation pond and their associated curve numbers.

The storm runoff volume to the sedimentation pond resulting from the 10-year, 24-hour storm event was calculated to be 69,913 cubic feet (1.60 acre-feet). The calculations, presented in Appendix 7-8, are based on hydrologic design methods described in Appendix 7-10. As presented above, the maximum sediment storage volume is 0.40 acre-foot (17.424 cubic feet). Thus, the capacity of the pond at the elevation of the primary spillway is 87,337 cubic feet (2.00 acre-feet), assuming the spillway does not spill during the 10-year, 24-hour storm.

In order to fully contain the runoff from the 10-year, 24-hour storm event and the maximum sediment storage, the primary spillway on the sedimentation pond will be set at an elevation of 6964.4 feet. The stage-capacity curve for the sedimentation pond is contained in Appendix 7-8 and summarized in Table 7-7.

The sedimentation pond has been designed with a 24-inch diameter primary spillway CMP riser attached to a 24-inch diameter CMP pipe barrel that is together capable of safely discharging the peak flow resulting from the 25-year, 6-hour precipitation event. The 25-year, 6-hour storm event was routed through the sedimentation pond to determine an adequate primary spillway. The computer software SEDCAD+ was used to design the primary spillway. SEDCAD assumes that the pond is full to the spillway elevation at the beginning of the storm event. The SEDCAD input and output for the sedimentation pond is contained in Appendix 7-8.

From the final analysis of the 25-year, 6-hour storm event, the maximum inflow rate to the sedimentation pond from storm runoff under design conditions was calculated to be 5.90 cubic feet per second (cfs), with a maximum outflow rate of 3.93 cfs. The corresponding high water elevation in the sedimentation pond will be 6964.3 feet, 1.7 feet below the top of the embankment and 0.2 foot below the crest of the emergency spillway. Hence, the pond has been designed with adequate freeboard.

An open-channel emergency spillway has been designed for the pond to allow discharge from the pond in the event that the primary spillway becomes plugged. Details regarding this emergency spillway are discussed in Appendix 7-8. As noted in that appendix, the emergency spillway was designed assuming that the primary spillway is nonfunctional. Under this scenario, the peak discharge from the pond will be 4.12 cfs, with a peak stage elevation of 6964.7 feet (0.2 foot above the crest of the emergency spillway and 1.3 feet below the crest of the pond embankment). Hence, freeboard on the pond will remain adequate even if the primary spillway plugs and becomes nonfunctional.

The emergency spillway has been designed with a median riprap diameter of 3 inches along the crest and 6 inches down the slope of the spillway. This riprap will be underlain with a geofabric

liner. The maximum velocity exiting from the emergency spillway under design conditions will be 5.0 feet per second, which velocity is not considered to be erosive of the adjacent Dugout Creek channel.

Dewatering Device. A valved dewatering device will be installed on the riser of the primary spillway as indicated on Plate 7-4. The inlet to this device will be down turned to preclude the entry of oil from the surface of the pond. The inlet to the non-clogging dewatering device on the sedimentation pond will be at the elevation of the maximum sediment level (elevation 6954.8 feet). Water will be discharged from the pond in accordance with UPDES guidelines.

Short Circuiting. Short circuiting will be minimized in the sedimentation pond because the pond will fully contain the runoff from the 10-year, 24-hour precipitation event. Also, the sedimentation pond spillway will be approximately 150 feet from the primary inlet of the pond when the pond is at discharge stage, thereby increasing the residence time for storms which are larger than the 10-yr 24-hr event.

Sediment Removal. Sediment removal from the sedimentation pond will occur when the sediment level reaches the 60% clean-out level. From the stage-capacity curve presented on Plate 7-4, the 60% clean-out elevation is 6951.7 feet. The sediment will be transported and disposed of as discussed in Chapter 5, and Chapter 7, Section 732.200 of this M&RP. Water that meets the quality standards set forth in the UPDES permit will be discharged to Dugout Creek before sediment cleanout begins. Water not meeting the standards will either be used for dust suppression on mine roadways or be pumped into the sealed, abandoned, "Gilson West - Old Working" as shown on the MSHA approved map (Waste Water Disposal Appendix 5-3A). The Gilson seam is a closed system and does not discharge to the surface. Adding relatively small volumes of surface runoff water will not cause a disturbance in the hydrologic balance in the permit area. Water stored in the "Gilson West - Old Working" is planned to provide process and fire fighting water for the Dugout Canyon Mine.

When the pond is cleaned out potentially 87,120 cu. ft. or 651,657 gallons of water and sediment will be pumped underground. Samples of the slurry will be taken before pumping begins and will be tested using Table 6 of the Division's approved Soil and Overburden Handling Guidelines. This will be done to eliminate the potential of a hazardous substance entering the Gilson seam. A water sample will be obtained and analyzed for the UPDES discharge parameters. The only UPDES effluent limitation that should be exceeded will be the amount of total suspended solids. Since the water will not be discharged to Dugout Creek or off the mine site, no violation of the mines various permits will occur.

Excessive Settlement. The sedimentation pond is to be excavated from native undisturbed material, thereby making settlement highly unlikely. Less than 2 feet of the embankment will be constructed. The portion of the embankment to be constructed will be constructed in a manner to minimize settlement. Stability analyses presented in Chapter 5 indicated that the pond embankment will be stable under both normal and rapid drawdown conditions.

Embankment Material. During construction of the sedimentation pond, any material to be used in the embankment will be inspected to ensure the material is free of sod, large roots, frozen soil, and acid- or toxic forming coal-processing waste.

Compaction. The sedimentation pond will be primarily excavated out of native undisturbed ground, thereby eliminating the need for additional compaction. Any portion of the embankment that will be constructed 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 mot applicable at this mine since the proposed sedimentation pond will not impound water or sediment to an elevation of 20 feet or more above the upstream toe of the structure. The pond 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 permit area will consist of drainage ditches and culverts. All diversions within the permit area have been designed to minimize adverse impacts to
the hydrologic balance, to prevent material damage outside the permit area, and to assure the safety of the public.

All diversions and diversion structures have been designed and will be constructed, and maintained and used to:

Be stable;
Provide protection against flooding and resultant damage to life and property;

Prevent, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area; and
Comply with all applicable local, state, and federal laws and regulations.

All diversions within the permit area will 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 permit area were calculated for use in designing diversion ditches and culverts. With the exception of the culverts on Dugout Creek, the storm runoff calculations for the temporary diversion structures were based on the 10-year, 24-hour precipitation event of 1.95 inches. For the design of the Dugout Creek culverts, a 100-year, 6-hour precipitation event was used, with a storm depth of 2.05 inches.

Curve numbers were based on those defined in Appendix 7-9 and professional judgement. A description of the methods used to determine the peak discharge rates is presented in Appendix 7-10.

A precipitation gauge will be installed at the mine site in the summer of 2001 to monitor and assess the types of precipitation events occurring at the mine site. The information will be used to determine if precipitation events exceed design parameters.

The disturbed and undisturbed drainage areas within and above the facilities area are presented on Plates 7-6 through 7-8. A summary of the characteristics of watersheds contributing to the diversions is presented in Table 7-6.

All proposed diversions are presented on Plate 7-5 or in Addendum A to Appendix 7-9. The minimum capacity and freeboard of each diversion ditch 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 or culvert slope. Slopes were measured from a contour map with a scale of 1" = 50'. A description of the methods used to determine diversion capacities, flow velocities, and riprap sizes is presented in Appendix 7-10. All diversion calculations are presented in Appendix 7-9.

Diversion of Perennial and Intermittent Streams. Dugout Creek will be diverted through culverts within the disturbed area. UC-6 and UC-5 consist of 60-inch diameter CMPs with mitered inlets. Both culverts are designed to pass the peak flow, of approximately 90 cfs with a combined flow of approximately 180 cfs below their confluence, from a 100-year, 6-hour storm event without creating an excess headwater above the top of the culvert. The justification for diverting the creek with

respect to the stream buffer zones is discussed in Section 731.600. To the extent feasible, these culverts will be installed during a season of the year other than the high-flow season.

Culvert UC-5 is located on the eastern tributary of Dugout Creek. This culvert will have a constant slope of 4.9% and an approximate length of 160 feet. This culvert will merge with UC-5 approximately 115 feet downstream from the inlet of UC-6.

Culvert UC-6 is installed on the main branch of Dugout Creek, with a slope that varies from about 2.2% to 8.0% and an approximate length of 2140 feet. This culvert will also consist of a 60-inch diameter CMP. To reduce the velocity at the culvert outlet below the velocities under natural conditions, a riprap basin was constructed in the channel immediately downstream from the outlet. This riprap basin will extend a minimum of 56.25 feet downstream from the culvert outlet and will be underlain with a geofabric to prevent piping of the soil beneath the riprap (see Appendix 7-9). This riprap section will be periodically monitored and modified if necessary to prevent erosion.

Detailed design calculations for culverts UC-6 and UC-5 can be found in Appendix 7-9. All designs have been prepared by or under the direction of, and certified by a qualified registered, professional engineer. The location of each culvert can be found on Plate 7-5 or in Addendum A to Appendix 7-9.

Calculations presented in Appendix 7-9 indicate that the capacity of Dugout Creek upstream and downstream of culverts UC-6 and UC-5 is in excess of 3,000 cfs. This high natural capacity of the stream channel has been caused by a combination of factors, including steep natural gradients, narrow valleys which preclude the development of flood plains, and erosion of the channels due to headcutting following failure of an old culvert located near the center of the operational facility prior to construction of the Dugout Canyon Mine. Hence, although UC-6 and UC-5 have been designed with a capacity of 180 cfs (see Appendix 7-9), the combined conditions of the stream channel noted above indicate that it is not feasible to design these culverts to have a capacity at least equal to that of the natural channel up- and downstream from the culverts.

The west fork of Dugout Creek near the Gilson water well will be relocated for approximately 50 feet. This will be necessary to protect the retaining wall that stabilizes the well site and other support facilities for the well, mainly the well house. Refer to Appendix 7-11 design calculations and typical channel drawing for RD-4, the relocated portion of Dugout Creek will mimic this design.

Diversion of Miscellaneous Flows. Diversion ditches and culverts have been utilized within the permit area to divert miscellaneous flows from disturbed and undisturbed area drainages.

Diversion Ditches. A summary table of the minimum channel geometry, channel slope, peak discharge, minimum riprap requirements, maximum flow velocity and minimum freeboard values for each diversion ditch within the facilities area is presented in Table 7-8. All calculations are contained in Appendix 7-9. Within the main facility area, diversion ditches will generally be lined with concrete if required for erosion protection, thereby aiding long-term maintenance of the ditches. Each ditch has adequate capacity and erosion protection to safely pass the peak flow resulting from the 10-year, 24-hour precipitation event. A description of the diversion ditches within the facilities area is presented in Section 732.300.

Diversion Culverts. A summary table of the culvert size, slope, peak discharge, outlet riprap, and outlet flow velocity for each culvert within the facilities area is presented in Table 7-9.

All calculations are contained in Appendix 7-9. Except for culverts UC-6 and UC-5, each culvert has adequate capacity and outlet erosion protection to safely pass the peak flow resulting from the 10-year, 24-hour precipitation event. Culverts UC-6 and UC-5 were designed to convey the peak runoff resulting from the 100-year, 6-hour precipitation event. A description of the diversion culverts within the facilities area is presented in Section 732.300.

Diversion Berms. Although several berms are noted on Plate 7-5, these will be installed primarily to meet MSHA requirements for safety concerns adjacent to slopes. However, these berms may also locally convey runoff from higher-elevation pads to lower-elevation pads, where it will be conveyed via diversion ditches to the sedimentation pond. Since none of the berms have been designed specifically to convey runoff, no calculations concerning the hydraulic characteristics of these berms are provided in Appendix 7-9.

742.400 Road Drainage

All Roads. The proposed roads within the facilities area are the county road which accesses the mine site and the additional roads noted on Plate 5-2. All of the roads will be constructed to include adequate drainage control with the use of diversion ditches and culverts. 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.

A generic cross section showing a typical diversion ditch adjacent to a road is provided in Figure 5-1. This cross section is typical of the ditches to be installed at the Dugout Canyon Mine. As noted in Table 7-8, each of the ditches to be installed at the site will have positive freeboard when

flowing at the design rate. Hence, the ditches have been designed to avoid spreading of water on the adjacent roads during the design event.

Primary Roads. The location of primary roads is discussed in Section 527 and presented on Plate 5-2 of this M&RP. The county road which accesses the mine site will be located by Carbon County, where practical, along the alignment of the existing dirt road to minimize erosion and be on stable ground. The access road will not ford Dugout Creek. However, prior to entering the disturbed area, the county road will cross Dugout Creek using a 10' diameter circular corrugated metal pipe culvert with headwalls. As this culvert is located outside the disturbed area boundary and part of the county road, design of this structure was handled by Carbon County. Within the disturbed area, Dugout Creek will be diverted through culverts UC-5 and UC-6 to prevent uncontrolled sediment from reaching the stream and to allow for efficient use of the site. A riprap-lined energy dissipater will be constructed downstream from the outlet of culvert UC-6 to withstand the peak flow from a 100-year, 6-hour storm event. Calculations regarding the design of the energy dissipater can be found in Appendix 7-9.

The drainage control system for the primary roads within the permit area includes diversion ditches and culverts. Except for culverts UC-5 and UC-6, the diversions will adequately pass the peak runoff from the 10-year, 24-hour precipitation event. Culverts UC-6 and UC-5 have been designed to convey the peak flow resulting from the 100-year, 6-hour precipitation event. Culverts will be constructed to avoid plugging or collapse and erosion at the inlet or outlet. Drainage details for the access road are presented in Section 732.300.

Pace Canyon Road

Runoff and erosion on the road will be controlled by the use of water bars. The water bars will divert any runoff from the road before an erosive volume of water can accumulate. Four water bars will be placed approximately 200 feet apart on the road. The water bars were placed as shown on Figure 7-12A. The first water bar will be placed approximately 5 feet upgradient of the start of the realigned road to prevent any runoff rom the existing road from flowing onto the road. The other three water bars will divert any runoff that has fallen on the realigned road off the road into well vegetated areas. Due to the berm running parallel to the road only precipitation falling directly on the realigned road could impact the road. Therefore, very little runoff is expected to be generated. The little runoff generated by the realigned road will be controlled by the water bars.

743 Impoundments

All pertinent information regarding the sedimentation pond is presented in Sections 732.200 and 742.200.

744 Discharge Structures

The discharge structures within the permit area will be the primary and emergency spillways on the sedimentation pond and a discharge line from the underground workings. The spillways on the sedimentation pond will adequately pass the peak discharge from the 25-year, 6-hour precipitation event. Detailed information concerning the sedimentation pond is presented in Sections 732.200 and 742.200.

The primary spillway on the sedimentation pond will consist of a 24-inch steel riser with an oil-skimmer connected to a 24-inch diameter CMP barrel. The emergency spillway will consist of a riprap-lined open channel. The spillways will discharge directly to Dugout Creek. The design calculations for the spillways are presented in Appendix 7-8. The spillway details are presented on Plate 7-4.

744.100 Erosion Protection

The only discharge structures associated with an impoundment will be the spillways from the sedimentation pond. The primary spillway will consist of a 24-inch riser connected to a 24-inch diameter CMP barrel. The 24-inch CMP barrel will discharge directly to Dugout Creek. The slope of the 24-inch CMP barrel has been designed to be 2.2%. The peak discharge from the sedimentation pond during a 25-year, 6-hour storm event is 3.93 cfs. The flow velocity at the spillway outlet under peak flow conditions is 4.50 fps. This velocity is not considered to be erosive. The natural channel will be evaluated during construction to verify that materials in the native channel can withstand the projected peak flow velocity. The calculations for the spillway outlet are presented in Appendix 7-8.

744.200 Design Standards

All discharge structures within the permit area have been designed and will be constructed according to standard engineering procedures.

745 Disposal of Excess Spoil

There will be no excess spoil within the permit 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 Dugout, SUFCo or Skyline waste-rock disposal facility as described in Chapter 5.

746.200 Refuse Piles

A detailed description of the refuse piles at the Dugout, SUFCo and Skyline waste-rock disposal sites can be found in their respective M&RPs.

746.300 Impounding Structures

No impounding structures within the permit 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.

748 Casing and Sealing of Wells

Each water 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 permit and adjacent area. The drill logs and completion diagrams for the water wells are contained in Appendix 7-4.

If a water well is exposed by coal mining and reclamation operations, it will be permanently closed unless otherwise managed in a manner approved by the Division.

750 PERFORMANCE STANDARDS

All mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area, and support approved post-mining land uses.

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 M&RP.

A sediment trap was constructed in the ditch on the southeast side of the disturbed area as shown on Figure 1 in Addendum A to Appendix 7-9. The trap was installed to collect sediment prior to it reaching the pond, therefore requiring less frequent sediment pond cleaning. The sediment trap has been fully designed to pass design flows, regardless of the quantity of sediment and/or ice collected in the trap. Sediment accumulations within the trap would not be considered a compliance concern. If the trap is unable to direct the water to the pond through culvert DC-11 (24" CMP), the water will flow through the trap and proceed down the existing ditch into the sediment pond.

A sediment basin was constructed above the inlet to culvert DC-10. The function of the sediment basin and sediment trap will be the same, both will pass the design flow regardless of the quantity

of sediment in the trap/basin and sediment accumulation will not be a compliance concern. The trap/basin designs are located in Addendum A to Appendix 7-9.

A sediment trap was constructed in association with the Pace Canyon Fan Portal site. Contemporaneous reclamation and gravel should adequately control sediment at the site, with the sediment trap providing an extra measure of protection. Details regarding this sediment trap can be found in Appendix 7-12.

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 M&RP.

752.200 Road Drainage

All roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to plans and designs presented in Sections 732.400, 742.400, and 762 of this M&RP. All roads have been designed to:

- Control or prevent erosion, siltation and the air pollution attendant to erosion by vegetating or otherwise stabilizing all exposed surfaces in accordance with current, prudent engineering practices;
- Control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area;
- Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under Section 751;
- Minimize the diminution to or degradation of the quality or quantity of surface- and groundwater systems; and
- Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

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 M&RP.

755 Casing and Sealing of Wells

All wells will be managed as described in Sections 551, 748 and 765 of this M&RP.

760 RECLAMATION

761 General Requirements

A detailed reclamation plan for the mine is presented in Section 540. In general, SCM will ensure that all temporary structures are removed and reclaimed. Other than for restoration of natural drainage patterns and drainage features associated with the water-tank access road (which will be retained for access to private land as part of the post-mining land use), no permanent diversions are included in the reclamation plan.

762 Roads

A road not to be retained for use under an approved post-mining land use will be reclaimed immediately after it is no longer needed for coal mining and reclamation operations.

762.100 Restoring the Natural Drainage Patterns

All natural drainage patterns will be restored during reclamation. Details regarding the reclamation of stream channels are provided in Appendix 7-11. As noted in that appendix and on Plate 5-5, the following channels will be restored during reclamation:

Channel	Location
RD-1	Upstream ephemeral tributary on the west side of Dugout Creek
RD-2	Middle ephemeral tributary on the west side of Dugout Creek
RD-3	Eastern perennial tributary of Dugout Creek
RD-4	Upper Dugout Creek
RD-5	Dugout Creek below confluence of RD-3 and RD-4
RD-6	Ephemeral channel across the reclaimed survey monument access road
RD-7	Upstream ephemeral tributary on the east side of Dugout Creek
RD-8	Middle ephemeral tributary on the east side of Dugout Creek
RD-9	Downstream ephemeral tributary on the west side of Dugout Creek
RD-10	Downstream ephemeral tributary on the east side of Dugout Creek

In accordance with R645-301-742.333, channels RD-1, RD-2, and RD-6 through RD-10 were designed to safely convey the peak flow resulting from the 10-year, 6-hour precipitation event. With the exception of RD-10, each channel was designed with a bottom width of 1 foot, a channel depth of 1 foot, 2H:1V side slopes, and a median riprap diameter of 3 inches. The riprap will be installed in these ephemeral drainages as an extra erosion-protection measure, even though design velocities are not expected to be erosive. RD-10 was designed with a similar cross section, but with a median riprap diameter of 6 inches.

During reclamation of the Pace Canyon Fan Portal Site two drainages will be affected. Both drainages had been disturbed by the road building activities prior to the construction of the Dugout Canyon Mine and Pace Canyon Fan Portal Facilities. In both drainages a section of the channel had been destroyed by the road construction. During reclamation these drainages will be reestablished. Reclamation channel PCRD-1 will be constructed in the drainage south of the portal with the exception of where the channel crosses the road. At the road crossing a swale will be constructed. The swale will have side slopes of 7.5:1 and a depth of 1 foot. Reclamation channel PCRD-1 will be constructed with a bottom width of 2.5 feet, side slopes of 2:1, depth of 1 foot and D_{50} = 6 inch riprap. The reclaimed channel (PCRD-1) will follow the preexisting natural channel meanders where a natural channel exists. Upper portions of the reconstructed channel will be constructed on native materials while lower portions of the channel will be constructed on regarded materials. The top and bottom of the reconstructed channel will tie into the natural undisturbed

channel. The culvert in the drainage north of the site will be replaced by a swale with a bottom width of 5 feet, side slopes of 7.5:1 and a depth of 1 foot. In accordance with R645-301-742.333, these channels were designed to safely convey the peak flow resulting from the 10-year, 6-hour precipitation event. See Plate PC5-5 in Appendix 5-10 and Attachment 3 in Appendix 7-12 for the reclamation channel location and calculations respectively.

As a result of pre-SMCRA disturbances at the site, Dugout Creek and its eastern tributary have experienced significant instability. This instability is especially noteworthy in a 300-foot section of Dugout Creek near the central portion of the proposed disturbed area. In this section, past blockage of a culvert installed by prior operators resulted in a re-routing of the creek, together with extensive downcutting (both up- and downstream from the blockage) and erosion of the site. The results of this damage are evident throughout, as well as up- and downstream from, the proposed disturbed area as headcutting and deposition have occurred.

SCM is committed to restoring the Dugout Creek channel to a more natural functioning condition as a result of site reclamation. In an effort to determine the best means for accomplishing this channel restoration, Dugout Creek was evaluated within the proposed disturbed and adjacent areas by Mr. Galen W. Williams of EarthFax Engineering, Inc. Mr. Williams, who is a registered Professional Geologist in the state of Wyoming, received a Master of Science degree in Applied Geomorphology from the University of Utah in 1981. Since that time, he has performed multiple stream and river channel morphology studies as they relate to proposed hydroelectric projects and dams. His geographical area of expertise includes Utah, Idaho, Oregon, Washington, and Hawaii. Past work performed by Mr. Williams has included evaluations of the long-term morphological changes which occur to streams as a result of water development, including the development of designs to minimize the impacts of reduced flows resulting from diversion into penstocks and increased flows downstream from spillways and hydroelectric plant discharges.

Mr. Williams concluded from his site visit that Dugout Creek can currently be classified as a Type A4 stream (using the stream classification system of Rosgen, 1996). The "A" in the classification indicates that this stream type is generally entrenched and is characterized by a steep gradient (typically 4 to 10 percent) with a low width-to-depth ratio and low sinuosity. The "4" in the classification indicates that the channel material is generally composed of gravel, with lesser amounts of boulders, cobbles, sand, and fines. In its current form, the channel is very unstable and

appears to be undergoing frequent change. Based on measurements collected by Mr. Williams in the existing truncated bend of the stream within the proposed disturbed area (i.e., that section of the stream which was largely abandoned when the upstream culvert blockage occurred), the natural stream at bankfull stage had a width of approximately 3 feet and a depth at the thalweg of approximately 1 foot within the disturbed area. This low-flow channel exists within a larger channel that has a width of approximately 8 to 12 feet at the top of the low-flow channel.

Mr. Williams concluded from his field observations that the high-energy system associated with Dugout Creek will require the establishment of a stable macro channel during reclamation to provide protection against mass wasting of the site by future runoff events. Within this macro channel, however, the formation of a micro channel should be encouraged through the establishment of selectively-placed "obstructions," such as boulders and logs which are anchored into the bank.

Mr. Williams cautioned that, due to the high energy associated with the Dugout Creek system, it would not be wise to physically construct a low-flow channel within the macro channel. To do so would likely be futile, since it would be essentially impossible to predetermine the morphological hydraulics of the micro system which would best fit the site. Hence, he recommended that the enhancement features be placed during reclamation, then allowing the stream to deposit sediment upstream from the obstructions. By this action, the stream would construct its own micro channel, with its associated "step-pool" system which is typical of Type A streams. If future runoff events cause variations within the micro system, Mr. Williams concluded that these changes will be in keeping with the morphological processes which are also typical of Type A streams. However, with the stability provided by the macro channel, the site should be protected, even if minor local changes occur within the reclaimed reaches of Dugout Creek.

To accomplish the above morphological goals, Dugout Creek will be reclaimed by first constructing a riprap-lined macro channel to serve as a stable base for future flows. Thus, the macro portion of channels RD-3, RD-4, and RD-5 have been designed to safely convey the peak flow resulting from the 100-year, 6-hour precipitation event (in accordance with R645-301-742.323). Both RD-3 and RD-4 were designed with a bottom width of 8 feet, a depth of 3 feet, and 2H:1V side slopes. The macro portion of each channel has been designed with a median riprap diameter of 12 inches.

The macro portion of channel RD-5 (downstream from the confluence of RD-3 and RD-4) was designed with a bottom width of 8 feet, a depth of 4 feet, and 2H:1V side slopes.

The cross sections for all 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 Plate 5-5. In each case, the thickness of the installed riprap will be equal to twice the median diameter or 6 inches, whichever is greater. 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. Calculations indicating the expected volume of riprap and filter materials are provided in Appendix 7-11.

Since the site materials will be reworked during construction 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 M&RP regarding filter blanket sizing. Following regrading of the materials at the location of each 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.

Upon construction of the macro channel, the stream type will change from an A4 to an A3 classification (the latter being a Type A stream, with the bed materials changing from predominantly gravel to primarily cobbles). According to Rosgen (1996) the following stream-channel stability enhancements are rated as fair to good when applied to an A3 stream:

- Low-stage check dams
- Bank-placed boulders
- Rock or log spurs

Figure 7-12 provides typical drawings of the above applications.

Rosgen (1996) also lists other applications which are appropriate for the enhancement of fish habitat in Type A3 streams. However, since Dugout Creek is not a fishery, only the above applications are considered appropriate.

As noted previously, Dugout Creek is estimated to have had a bankfull stage of approximately 1 foot within the low-flow (micro) channel prior to the damage created by the blocked culvert. Hence, to restore the channel to a more natural condition, the stream-channel stability enhancements noted above will be installed during reclamation to allow for the local upstream accumulation of approximately 1 foot of sediment. As the stream deposits the sediment behind the obstructions and cuts the micro channel, this will create an overbank flow section which will approximate natural conditions. Vegetation which becomes established on these overbank sections will aid in stabilizing them. Furthermore, with 2H:1V sideslopes on the macro channel, the macro channel will have a width of 12 feet at the top of the accumulated sediment in which the micro channel has formed. This 12-foot width is consistent with the dimensions of the natural channel as noted above.

According to Heede (1976), within the range of channel gradients anticipated for RD-3, RD-4, and RD-5, the slope of sediment deposits behind a channel obstruction are approximately 70 percent of the slope of the underlying channel. Based on a typical reclaimed channel slope of 5 percent (see Plate 5-5), the sediment deposits will have a surface slope of approximately 3.5 percent. Using equations developed by Heede (1976), these channel and sediment slopes indicate that placing the obstructions at an approximate spacing of every 60 feet will keep the upstream feature from being submerged by the sediment which accumulates behind the downstream feature (see Appendix 7-11). This approximate spacing will be used to place the stability features in RD-3, RD-4, and RD-5.

Plate 7-9 provides details concerning the proposed layout of the main reclamation channel at the site, including potential locations of the low-stage check dams, bank-placed boulders, and rock or log spurs. The exact location and type of obstruction at any individual point may vary from that indicated on Plate 7-9, depending on local conditions encountered at the time of reclamation. However, in any case, obstructions of the type noted above will be installed approximately every 60 feet within the reclaimed channel.

In general, Plate 7-9 indicates that the log or rock spurs noted in Figure 7-12 will be installed on sweeping bends in RD-5, with the spur pointing upstream at an angle of 20 to 30 degrees, as recommended by Rosgen (1996). The low-stage check dams and bank-placed boulders will be interspersed in the remaining locations of the stream. Based on a review of conditions in the abandoned portion of the natural stream channel, more bank-placed boulder enhancements will

be used than low-stage check dams.

Table 7-10 presents an evaluation of the stability of Dugout Creek in its January 1998 condition and its predicted post-reclamation condition. This evaluation was prepared using the Pfankuch method as presented by Rosgen (1996). According to Table 7-10, the reclamation efforts presented herein will improve the stability of Dugout Creek from an overall rating of "poor" to a rating of "excellent." Furthermore, with the installation of the micro-channel features, the stream will be returned to a morphological condition which approximates its assumed pre-mining condition. Hence, the reclamation efforts described herein will result in a significant improvement to Dugout Creek.

The reclamation channels will be constructed in each area as soon as regrading of the area has been completed, but prior to placement of topsoil and revegetation. Channel construction will generally proceed from the upstream end to the downstream end. Where channels RD-1, RD-2, and RD-9 cross the road that will be retained following reclamation, the side slopes may be flattened to permit vehicular access across the channel. However, the minimum depths and cross sections noted above will be maintained in any case.

As noted on Plate 5-5, the reclamation channels will be aligned in their assumed premining locations. Of particular note, channel RD-5 will be aligned to follow the assumed premining meanders, even though the primary bypass culvert will be installed along a straighter path.

No toxic- or acid-forming materials will be used to grade areas where reclamation channels will be constructed. Furthermore, neither construction debris, nor grease, oil, joint coating, or other potential pollutants will be disposed of in areas underlying reclamation channels. Construction materials, bedding material, excavated soil, etc. will not be stockpiled in riparian or channel areas during reclamation.

Buffer Zone Designation. As part of the post-mining land use, an existing public road will be relocated across the reclaimed mine site. Due to the narrowness of the canyon, a portion of the road alignment will be located within the 100 foot zone that would normally be designated as a buffer zone for Dugout Creek. Following reclamation, the area surrounding the reconstructed Dugout Creek Channel that is not to be used for the public road will be designated as a buffer zone until bond release, and SCM will mark those zones, as specified in Section 521.200 of this M&RP.

762.200 Reshaping Cut and Fill Slopes

All cut and fill slopes will be reshaped to be compatible with the post-mining land use and to complement the drainage pattern of the surrounding terrain.

763 Siltation Structures

763.100 Maintenance of Siltation Structures

All siltation structures will be maintained until removed in accordance with the approved reclamation plan.

763.200 Removal of Siltation Structures

When a siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan presented in Section 540.

764 Structure Removal

A timetable for the removal of structures at the site is presented in Figure 5-3.

765 Permanent Casing and Sealing of Wells

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effects, or unless approved for transfer as a water well, each well will be capped, sealed, backfilled, or otherwise properly managed, as required by the Division. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid or other toxic drainage from entering ground or surface waters.

REFERENCES:

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Lines, G.C. 1985. The Ground-Water System and Possible Effects of Underground Coal Mining in the Trail Mountain Area, Central Utah. U.S. Geological Survey Water-Supply Paper 2259. Washington, D.C.

Mayo and Associates. 1994. Evaluation of Factors Contributing to the TDS of Mine Discharge Waters from the Skyline Coal Mine. Unpublished consulting report submitted to Utah Fuel Company. Lindon, Utah.

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Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

Rocky Mountain Research Station. 1998. Skyline Mine Subsidence Study, Changes in Stream Channel Characteristics and Hydrualic Paramters Related to Surface Subsidence. Research Work Unit 4301, Forestry Sciences Laboratory, Logan Utah.

Sergent, Hauskins & Beckwith Geotechnical Engineers, Inc. 1986. Supplemental Hydrogeological Study, Soldier Canyon Mine, Carbon County, Utah. Unpublished consulting report submitted to Sunedco Coal Company. Phoenix, Arizona.

U.S. Soil Conservation Service. 1976. Earth Dams and Reservoirs. Technical Release No. 60. U.S. Government Printing Office. Washington, D.C.

Waddell, K.M., P.K. Contrato, C.T. Sumsion, and J.R. Butler. 1981. Hydrologic Reconnaissance of the Wasatch Plateau-Book Cliffs Coal-Fields Area, Utah. U.S. Geological Survey Water-Supply Paper 2068. Washington, D.C.

Waddell, K.M., J.E. Dodge, D.W. Darby, and S.M. Theobald. 1992. Selected Hydrologic Data, Price River Basin, Utah. U.S. Geological Survey Open-File Report 82-916. Salt Lake City, Utah.

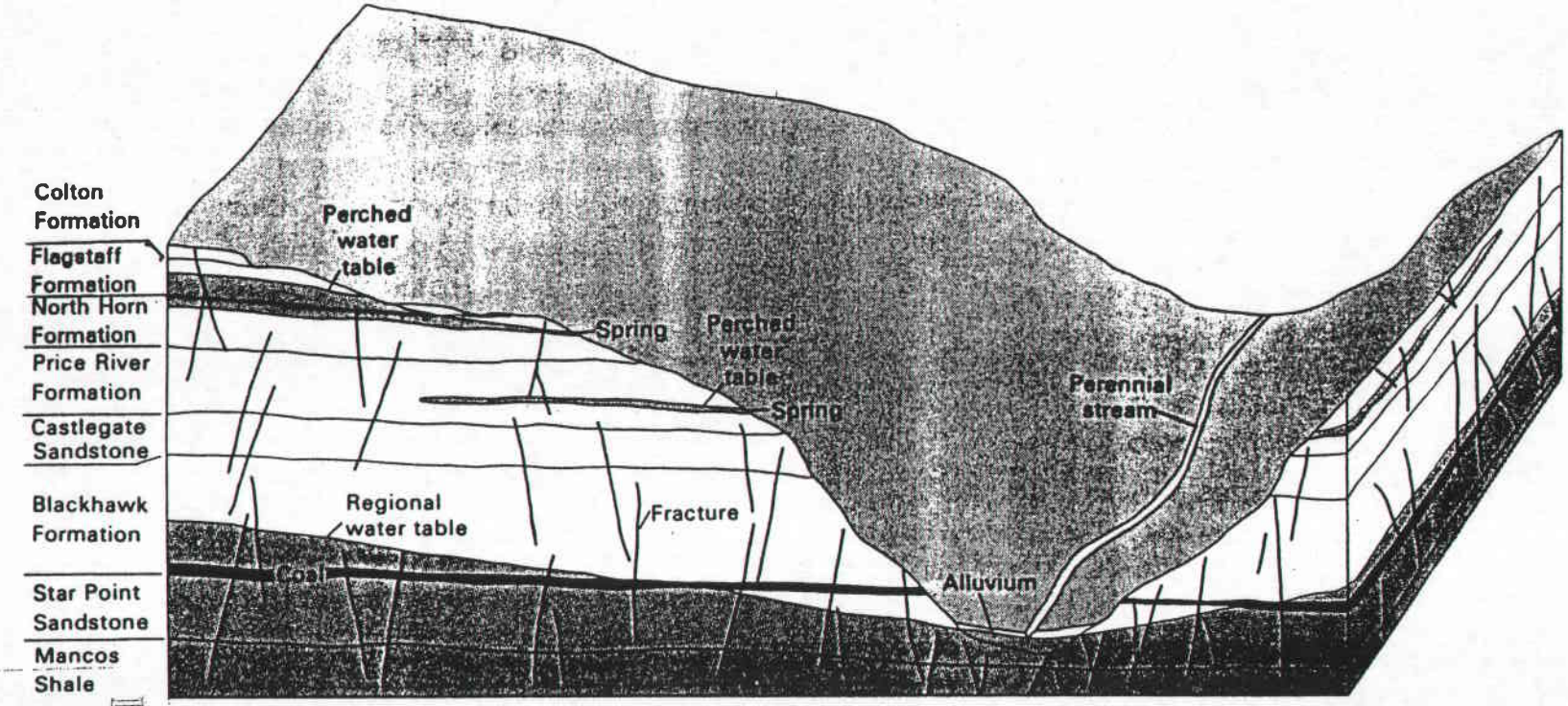
Waddell, K.M., J.E. Dodge, D.W. Darby, and S.M. Theobald. 1986. Hydrology of the Price River Basin, Utah, with Emphasis on Selected Coal-Field Areas. U.S. Geological Survey Water-Supply Paper 2246. Washington, D.C.

Wahler Associates. 1982. Sage Point/Dugout Canyon Basic Hydrogeologic Data Report. Unpublished consulting report submitted to Sunedco Coal Company. Lakewood, Colorado.

REFERENCES (Continued):

Mayo, A.L., Morris, T.H., Peltier, S., Petersen, E.C., Payne, K., Holman, L.S., Tingey, D., Fogel, T., Black, G.J., and Gibbs, T.D., 2003, Active and inactive groundwater flow systems: Evidence from a stratified, mountainous terrain, GSA Bulletin: December 2003: V. 115: no. 12; p. 1456-1472.

Mayo, A.L., and Morris, T.H., 2000, Conceptual model of groundwater flow in stratified mountainous terrain, Utah, USA in Groundwater: Past achievements and future Challenges, Sililo et al. ed: Proceeding XXX IAH Congress on Groundwater, Capetown South Africa, 26 November – 1 December, 2000, p. 225-229.



Modified from Lines (1985)

FIGURE 7-1. GENERAL HYDROSTRATIGRAPHIC CROSS SECTION

INCORPORATED
EFFECTIVE:
OCT 19 1998
UTAH DIVISION OIL, GAS AND MINING

TABLE 7-4
Groundwater Monitoring Program
Field and Laboratory Measurement Protocol

Monitoring Wells	Protocol	Comments
GW-10-2	A, 1	Screened in Castlegate Sandstone
GW-11-2	A, 1	Screened in Price River Formation
GW-24-1	A, 1	Screened in Castlegate Sandstone
Springs		
SP-20 (S-30)	B, 2, 5	Flagstaff
SC-14	B, 2, 5	North Horn
SC-65	B, 2, 5	Colton
SC-100	B, 2, 5	Flagstaff (at North Horn FM. Contact)
SC-116	B, 3, 5	North Horn
200	B, 3, 5	North Horn
203	B, 3, 5	North Horn
227	B, 3, 5	Castlegate Sandstone
259	B, 3, 5	North Horn
259A	B	Colton
260	B, 3, 5	Colton
MD-1	C, 4	Gilson Seam Workings Discharge
321	B,6	Colton
322	B	Colton

Protocols
A Monitoring well: quarterly water level measurement only
B Spring: quarterly flow measurements
C Mine Water Discharge, abandoned Gilson Seam workings: quarterly flow measurements

Water quality
1 Monitoring well: No quality measurements.
2 Spring: quarterly operational groundwater quality parameters for two years beginning 3rd quarter 1999 after which quarterly field measurements only.
3 Spring: quarterly baseline parameters for three years beginning 1st quarter 1999 after which quarterly field measurements only.
4 Mine water discharge: quarterly operational water quality parameters.
5 During wet or dry years (as described in the PHC, Appendix 7-3), flows will be taken weekly between April 1 and August 31 as conditions permit. Also during the first wet or dry year, one operational laboratory sample and one Tritium sample will be obtained at these sites during high and low flow season.
6 Spring: quarterly operational groundwater quality parameters for two years beginning 3rd quarter 2007 after which field measurements only.

Groundwater Quality Parameters

FIELD MEASUREMENTS	REPORTED AS
Water Level or Flow	Feet or gpm or cfs
pH	pH units
Specific Conductivity	μs/cm @ 25°C
Temperature	°C

TABLE 7-4 (continued)
Groundwater Monitoring Program

Laboratory Parameters	Reported As	Operational Monitoring	Baseline Monitoring
Acidity	mg/l		X
Aluminum (Dissolved)	mg/l		X
Ammonia	mg/l		X
Arsenic (Dissolved)	mg/l		X
Boron (Dissolved)	mg/l		X
Bicarbonate	mg/l	X	X
Carbonate	mg/l	X	X
Calcium (Dissolved)	mg/l	X	X
Chloride	mg/l	X	X
Cadmium (Dissolved)	mg/l		X
Copper (Dissolved)	mg/l		X
Iron (Dissolved)	mg/l	X	X
Iron (Total)	mg/l	X	X
Lead (Dissolved)	mg/l		X
Magnesium (Dissolved)	mg/l	X	X
Manganese (Dissolved)	mg/l	X	X
Manganese (Total)	mg/l	X	X
Molybdenum (Dissolved)	mg/l		X
Oil and Grease	mg/l		
Potassium (Dissolved)	mg/l	X	X
Total Alkalinity	mg/l		X
Total Dissolved Solids	mg/l	X	X
Total Hardness (CaCO3)	mg/l		X
Total Suspended Solids	mg/l		
Selenium (Dissolved)	mg/l		X
Sodium (Dissolved)	mg/l	X	X
Sulfate	mg/l	X	X
Zinc (Dissolved)	mg/l		X
Anions	meq/l	X	X
Cations	meq/l	X	X

TABLE 7-5

Surface Water Monitoring Program

Field and Laboratory Measurement Protocol

Streams	Protocol	Comments
DC-1	1	Located on Dugout Creek downstream of mine
DC-2	2	Located on Dugout Creek immediately upstream of mine on left-hand fork
DC-3	2	Located on Dugout Creek immediately upstream of mine on right-hand fork
DC-4	3	Located on Dugout Creek upstream of mine on west fork of left-hand fork
DC-5	3	Located on Dugout Creek upstream of mine on east fork of left-hand fork
PC-1a	2	Located on Pace Creek on the eastern edge of State Coal Lease ML 48435-OBA
PC-2	2	Located on Pace Creek on the western edge of State Coal Lease ML 48435-OBA
PC-3	1	Located on Pace Creek in Section 20, T13S R13E
RC-1	2	Located on Rock Creek on the southern edge of State Coal Lease ML 48435-OBA
FAN	1	Located on Pace Creek above fan facilities
323	1	Located in SE1/4,SW1/4,SE1/4 of Section 8, Township T13S, R13E

Protocols

1 Stream: quarterly operational surface water quality measurements analyzed as per parameters listed below.

2 Stream: quarterly operational surface water quality measurements analyzed as per parameters listed below except during first wet or dry years when weekly flow will be obtained from April 1 through August 31, as conditions permit, in addition to quarterly samples.

3 Stream: weekly flow measurements during first wet or dry year will be obtained from April 1 through August 31 as conditions permit. Also during the first wet or dry year, one operational laboratory sample and one tritium sample will be obtained at these sites during high and low flow season.

Surface Water Quality Parameters

FIELD MEASUREMENTS	REPORTED AS
Flow	gpm or cfs
pH	pH units
Specific Conductivity	μs/cm @ 25°C
Dissolved Oxygen	mg/l
Temperature	°C

Laboratory Parameters	Reported As	Operational Monitoring	Baseline Monitoring
Acidity	mg/l		X
Aluminum (Dissolved)	mg/l		X
Ammonia	mg/l		X
Arsenic (Dissolved)	mg/l		X

TABLE 7-5 (continued)
Surface Water Monitoring Program

Laboratory Parameters	Reported As	Operational Monitoring	Baseline Monitoring
Boron (Dissolved)	mg/l		X
Bicarbonate	mg/l	X	X
Carbonate	mg/l	X	X
Calcium (Dissolved)	mg/l	X	X
Chloride	mg/l	X	X
Cadmium (Dissolved)	mg/l		X
Copper (Dissolved)	mg/l		X
Iron (Dissolved)	mg/l	X	X
Iron (Total)	mg/l	X	X
Lead (Dissolved)	mg/l		X
Magnesium (Dissolved)	mg/l	X	X
Manganese (Dissolved)	mg/l	X	X
Manganese (Total)	mg/l	X	X
Molybdenum (Dissolved)	mg/l		X
Oil and Grease	mg/l	X*	X*
Potassium (Dissolved)	mg/l	X	X
Total Alkalinity	mg/l		X
Total Dissolved Solids	mg/l	X	X
Total Hardness (CaCO3)	mg/l		X
Total Suspended Solids	mg/l	X	X
Selenium (Dissolved)	mg/l		X
Sodium (Dissolved)	mg/l	X	X
Sulfate	mg/l	X	X
Zinc (Dissolved)	mg/l		X
Anions	meq/l	X	X
Cations	meq/l	X	X

* Not sampled at monitoring sites DC-4, DC-5, ~~PG-1A, PG-2,~~ and RC-1. These sites are outside the area that could be influenced by mining related disturbance.

APPENDIX 7-1

Water Rights Data

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007

WATER RIGHT: **90-572** APPLICATION/CLAIM NO.: CERT. NO.:

==========

OWNERSHIP********

==========

NAME: George J. Conover
ADDR: Ferron UT 84532

==========

DATES, ETC.********

==========

LAND OWNED BY APPLICANT? Yes
FILED: |PRIORITY: 00/00/1885|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD Book No. Map: 420
Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

==========

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)**********

==========

FLOW: 0.066 cfs SOURCE: Unnamed Spring
COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located at S 660 ft. E 660 ft. from N4 corner, Sec 15, T13S, R13E, SLBM.
COMMENT: Administratively updated by State Engineer.

==========
==========
USES OF WATER RIGHT
****
==========
==========
SUPPLEMENTAL GROUP NO. 613899. Water Rights Appurtenant to the following use(s):
90-493,494,495,496,497
498,499,500,501,502
517,518,519,520,521
522,523,524,525,526
528,529,530,531,532
533,534,535,536,537
538,539,540,541,542
543,544,545,546,547
548,549,550,551,552
553,554,555,556,557
558,559,560,561,562
563,564,565,566,567
568,569,570,571,**572**
573,574,575,576,577
578,579,580,581,582
583,584,586,587,588
589,590,591,592,593
594,595,596,597,598
599,712,713,714,715
716,717,718,719,720
721,722,723,724,725
726,727,728,729,730
731,732,733,734,735
736,737,738,739,740
741,742,743,744,745
746,747,748,749,750
751,752,753,754,755
756,757,758,759,760
761,762,763,764,765
766,767,768,769,770
771,772,773,774,775
776,777,778,779,780
781,782,783,784,785
786,787,788,789,790
791,792,793,794,795
796,797,798,799,800
801,802,803,804,805
806,807,808,809,810
811,812,813,814,815
816,817,818,819,821
822,823,824,825,826
827,828,829,830,831
832,840,841,842,843
844,845,846,847,848
849,850,851,852,853
854,856,857,858,859
860,861,862,863,864
865,866,867,868,869

870,871

.....
.....
###STOCKWATER: Group Total: 1000.0000 Stock
Div Limit: 28.0 acft. PERIOD OF USE: 01/01 TO 12/31
Sole Supply for Stockwatering for 90-572 in this Group has NOT YET been evaluated
==========
==========
PLACE OF USE for
STOCKWATERING**********
****
==========
==========
NORTH-WEST¼ NORTH-EAST¼
SOUTH-WEST¼ SOUTH-EAST¼
NW NE SW SE NW NE SW SE NW
NE SW SE NW NE SW SE
Sec 15 T 13S R 13E SLBM * : : : * * X: : : * * :
: : * * : : : *
==========
==========
OTHER
COMMENTS**********
****
==========
==========
3/48 Interest
****
****
**********E N D O F D
A T A**********
****
****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007

WATER RIGHT: **91-543** APPLICATION/CLAIM NO.: CERT. NO.:

==========

OWNERSHIP********

==========

NAME: Canyon Fuel Company LLC
ADDR: Attn: Property Administration
CityPlace One Suite 300
St. Louis MO 63141
INTEREST: 100% REMARKS: c/o Ark Land Company

==========

DATES, ETC.********

==========

LAND OWNED BY APPLICANT?
FILED: |PRIORITY: 00/00/1869|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: 09/15/1964|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD Book No. 3 Map: 34
Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

==========

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)**********

==========

FLOW: SOURCE: Soldier Creek
COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:

(1)Stockwatering directly on stream from a point at N 660 ft. E 660 ft. from SW corner, Sec 05, T13S, R12E, SLBM,
to a point at N 660 ft. E 660 ft. from W4 corner, Sec 08, T13S, R12E, SLBM.
COMMENT: Administratively updated by State Engineer.

==========

USES OF WATER RIGHT

****

==========

SUPPLEMENTAL GROUP NO. 615994. Water Rights Appurtenant to the following use(s):
91-522,523,524,525,526
527,528,529,530,531
532,533,534,535,**543**
552,743

.....

###STOCKWATER: Group Total: 300.0000 Stock Div Limit: 8.4 acft. PERIOD OF USE: 01/01 TO 12/31

******Sole Supply for Stockwatering for 91-543 in this Group has NOT YET been evaluated******

==========

PLACE OF USE for STOCKWATERING

****

==========

```
                                NORTH-WEST¼        NORTH-EAST¼
SOUTH-WEST¼        SOUTH-EAST¼
                                NW NE SW SE        NW NE SW SE        NW
NE SW SE        NW NE SW SE
Sec 05 T 13S R 12E SLBM        *  :  :  :  *      *  :  :  :  *      *  :
: X:  *      *  :  :  :  *
Sec 08 T 13S R 12E SLBM        *  :  : X:  *      *  :  :  :  *      *  :
:  :  *      *  :  :  :  *
```

****

****

**********E N D O F D A T A**********

****

****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007

WATER RIGHT: **91-3498** APPLICATION/CLAIM NO.: CERT. NO.:

==========

OWNERSHIP********

==========

NAME: W. Lavon & Marianne W. Day
ADDR: Castle Dale UT
REMARKS: joint tenants

==========

DATES, ETC.********

==========

LAND OWNED BY APPLICANT? Yes
FILED: |PRIORITY: 00/00/1869|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: 03/08/1972|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD Book No. 5 Map: 46
Type of Right: Diligence Claim Source of Info: Proposed Determination Status:

==========

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)**********

==========

FLOW: 0.011 cfs SOURCE: Unnamed Spring
COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION:
(1)Stockwatering directly on spring located at N 660 ft. E 660 ft. from S4 corner, Sec 22, T13S, R13E, SLBM.

COMMENT: Administratively updated by State Engineer.

==========

USES OF WATER RIGHT

SUPPLEMENTAL GROUP NO. 614121. Water Rights Appurtenant to the following use(s):
91-1661,1662,1664,1665,1666
1667,1668,1669,1671,1672
1673,1674,1682,1683,1685
1686,1687,1688,1689,1690
1692,1693,1694,1695,1703
1704,1706,1707,1708,1709
3474,3475,3476,3477,3478
3479,3480,3481,3482,3483
3484,3485,3486,3487,3488
3489,3490,3491,3492,3493
3494,3495,3496,3497,**3498**

.....

###STOCKWATER: Group Total: 1000.0000 Stock Div Limit: 15.0 acft. PERIOD OF USE: 01/01 TO 12/31

******Sole Supply for Stockwatering for 91-3498 in this Group has NOT YET been evaluated******

==========

PLACE OF USE for STOCKWATERING

==========

	NORTH-WEST¼				NORTH-EAST¼							
SOUTH-WEST¼				SOUTH-EAST¼								
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE
Sec 22 T 13S R 13E SLBM	*	:	:	:	*	*	:	:	:	*	*	:
: : * * : : X: *												

==========

OTHER COMMENTS

==========

7/24 Interest.

****

E N D O F D A T A

****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007

WATER RIGHT: **91-4797** APPLICATION/CLAIM NO.: CERT. NO.:

OWNERSHIP

NAME: Ralph Stevenson
ADDR: P.O. Box 52
Wellington UT 84542

NAME: Glen Wells
ADDR: P.O. Box 52
Wellington UT 84542

DATES, ETC.

LAND OWNED BY APPLICANT?
FILED: 04/05/1988|PRIORITY: 00/00/1869|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: 04/05/1988|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD Book No. Map: 57
Type of Right: Diligence Claim Source of Info: Water User's Claim Status: Water User's Claim

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)**

FLOW: SOURCE: Unnamed Stream
COUNTY: Carbon COMMON DESCRIPTION:

POINT OF DIVERSION -- POINT TO POINT:
(1)Stockwatering directly on stream from a point at N 660 ft. E 660 ft. from S4 corner, Sec 34, T13S, R13E, SLBM,
to a point at N 660 ft. W 660 ft. from S4 corner, Sec 34, T13S, R13E, SLBM.
COMMENT: Administratively updated by State Engineer.
SOURCE: Unnamed Stream

==========
==========

USES OF WATER RIGHT
****
==========
==========

SUPPLEMENTAL GROUP NO. 615674. Water Rights Appurtenant to the following use(s):
91-1717,1719,1720,1721,1722
1724,1725,1726,3253,4795
4796,**4797**,4798

.....
.....

###STOCKWATER: Group Total: 120.0000 Stock Div Limit: PERIOD OF USE: 04/15 TO 10/31
******Sole Supply for Stockwatering for 91-4797 in this Group has NOT YET been evaluated******

==========
==========

PLACE OF USE for STOCKWATERING
****
==========
==========

	NORTH-WEST¼				NORTH-EAST¼								
SOUTH-WEST¼				SOUTH-EAST¼									
	NW	NE	SW	SE	NW	NE	SW	SE		NW	NE	SW	SE
Sec 34 T 13S R 13E SLBM	*	:	:	:	*	*	:	:	:	*	*	:	:
: X*	*	:	:	X:	*								

****
****
**********E N D O F D A T A**********
****
****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007

WATER RIGHT: **91-4798** APPLICATION/CLAIM NO.: CERT. NO.:

==========

OWNERSHIP********

==========

NAME: Ralph Stevenson
ADDR: PO Box 52
Wellington, Utah 84542

NAME: Glen Wells
ADDR: PO Box 52
Wellington, Utah 84542

==========

DATES, ETC.********

==========

LAND OWNED BY APPLICANT? Yes
FILED: |PRIORITY: / /1869|PUB BEGAN: |PUB ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: 02/22/1990|LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
PD Book No. Map: 57
Type of Right: Pending Adjudication Claim Source of Info: Water User's Claim Status: Water User's Claim

==========

LOCATION OF WATER RIGHT*(Points of Diversion: Click on Location to access PLAT Program.)**********

==========

FLOW: 0.015 cfs SOURCE: Unnamed Spring
COUNTY: Carbon COMMON DESCRIPTION: 7 miles NNW of Sunnyside

POINT OF SPRING:
(1) S 1980 ft W 660 ft from NE cor, Sec 33, T 13S, R 13E, SLBM
Diverting Works:
Source:

==========
==========

USES OF WATER RIGHT********
****

==========
==========

SUPPLEMENTAL GROUP NO. 615674. Water Rights Appurtenant to the following use(s):
91-1717,1719,1720,1721,1722
1724,1725,1726,3253,4795
4796,4797,**4798**

.....
.....

###STOCKWATER: Group Total: 120.0000 Stock
Div Limit: PERIOD OF USE: 04/15 TO 10/31
******Sole Supply for Stockwatering for 91-4798 in this Group has NOT YET been evaluated******

==========
==========

PLACE OF USE for STOCKWATERING********
****

==========
==========

	NORTH-WEST¼				NORTH-EAST¼				SOUTH-WEST¼				SOUTH-EAST¼			
	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE	NW	NE	SW	SE
Sec 33 T 13S R 13E SLBM	*	:	:	:	*	*	:	:	:	X*	*	:	:	:	*	*

****
****
**********E N D O F D A T A**********
****
****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: a19877 WATER RIGHT: 91-4987 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-4987
RIGHT EVIDENCED BY: 91-23 & 491 (A5039) Cert. No. 1685
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC.
ADDR: 6955 Union Park Center Suite 550
Midvale UT 84047
INTEREST: 100% REMARKS:

FILED: 03/19/1996|PRIORITY: 01/30/1913|ADV BEGAN: 04/25/1996|ADV ENDED: 05/02/1996|NEWSPAPER: Sun Advocate
ProtestEnd:05/22/1996|PROTESTED: [No]|HEARNG HLD: |SE ACTION: [Approved]|ActionDate:07/16/1996|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 03/31/1997|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Terminated**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 4.0 cfs
||FLOW: 500.0 acre-feet |
|----------||----
----------|
|SOURCE: Dugout Canyon Creek
||SOURCE: Dugout Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 11 miles NE of Wellington |
|----------||----
----------|
| ||
This water right will be used to |

provide dust suppression and fire protection

water for both surface and underground

operations at the Dugout Canyon Mine.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1260 ft E 120 ft from SW cor, Sec 03, T 14S, R 12E, SLBM (1) N 3360 ft E 1860 ft from SW cor, Sec 23, T 13S, R 12E, SLBM

Dvrting Wks:

Dvrting Wks: Stilling well in creek with submersible pump

Source:

Source: Dugout Canyon Creek

Stream Alt?: No

PLACE OF USE ------>

CHANGED as follows:

```
                                --NW¼--  --NE¼--  --SW¼--  --SE¼--
--NW¼--  --NE¼--  --SW¼--  --SE¼--
                                N N S S  N N S S  N N S S  N N S S
N N S S  N N S S  N N S S  N N S S
                                W E W E  W E W E  W E W E  W E W E
W E W E  W E W E  W E W E  W E W E
Sec 09 T 14S R 12E SLBM     * : : : ** : : : ** : : : ** :X:X:X*  Sec
09 T 13S R 12E SLBM     * : : : ** : : : ** : : : ** : :X:X*
Sec 10 T 14S R 12E SLBM     *X:X:X: **X: :X: **X:X:X:X** : : : *  Sec
10 T 13S R 12E SLBM     * : : : ** : : : **X:X:X:X**X:X:X:X*
Sec 15 T 14S R 12E SLBM     * :X: :X** : :X: ** :X:X:X**X: :X: *  Sec
11 T 13S R 12E SLBM     * : : : ** : : : **X:X:X:X**X:X:X:X*
Sec 22 T 14S R 12E SLBM     *X:X:X:X** : : : ** : : : ** : : : *  Sec
14 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*
                                                                  Sec
15 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*
                                                                  Sec
16 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*
```

```
|                                                                  ||Sec
17 T 13S R 12E SLBM     * : : : ** : : : ** :X: :X**X:X:X:X*|
|                                                                  ||Sec
20 T 13S R 12E SLBM     * :X:X:X**X:X: : ** : : : ** : : : *|
|                                                                  ||Sec
21 T 13S R 12E SLBM     *X:X: : **X:X:X:X** : : : ** : : : *|
|                                                                  ||Sec
22 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X: : **X:X: : *|
|                                                                  ||Sec
23 T 13S R 12E SLBM     *X:X:X:X**X: :X: ** : : : ** : : : *|
```

```
|NATURE OF USE ------>
||CHANGED as follows:                                              |
|-----------------------------------------------------------------||----
-----------------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                           |
|-----------------------------------------------------------------||----
-----------------------------------------------------------------|
|IRR:    605.7000 acs Sol/Sup:    293.4300 acs USED 04/01 - 09/30||
|
|.................................................................||....
.................................................................|
|STK: 810.0000 Cattle or Equivalent            USED 04/01 - 09/30||
|
|.................................................................||....
.................................................................|
|                                                                  ||MIN:
District: Dugout Canyon                    USED 01/01 - 12/31|
|                                                                  ||
Name:     Dugout Canyon                                     |
|                                                                  ||
Ores:     Coal                                              |
|-----------------------------------------------------------------||----
-----------------------------------------------------------------|
|.................................................................||....
.................................................................|
|                                                                  ||OTH:
OTHER:            Dust suppression and   USED 01/01 - 12/31|
|                                                                  ||
fire protection                                             |
|-----------------------------------------------------------------||----
-----------------------------------------------------------------|
```

```
|RESERVOIR STORAGE -->                                             ||SAME
AS HERETOFORE                                               |
|-----------------------------------------------------------------||----
-----------------------------------------------------------------|
|Storage 03/01 to 07/31, in Clark`s Valley Reservoir               ||
|
```

```
| with a maximum capacity of 460.500 acre-feet, located in:      ||
|
|                              --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
|
|  Height of Dam:          ft |N N S S||N N S S||N N S S||N N S S|||
|
|  Area Inundat            acs|W E W E||W E W E||W E W E||W E W E|||
|
|Sec 10 T 14S R 12E SLBM     * : : : ** : : : ** : : :X** : :X: *||
|
|Sec 15 T 14S R 12E SLBM     * :X: : **X: : : ** : : : ** : : : *||
|
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
 ____________________________________________________________________
_____________________________________________________________________
*-----------------------------------------------------------------------
-----------------------------------------------------------*
EXTENSIONS OF TIME WITHIN WHICH TO FILE
PROOF*********************************************************************
*********************
*-----------------------------------------------------------------------
-----------------------------------------------------------*
FILED:     02/24/2000|PUB BEGAN:            |PUB ENDED:
|NEWSPAPER:
ProtestEnd:           |PROTESTED: [No      ]|HEARNG HLD:          |SE
ACTION: [Approved]|ActionDate:03/23/2000|PROOF DUE:  07/31/2005
-----------------------------------------------------------------------
-----------------------------------------------------------
*********************************************************************
*************************************************************
*************************************************************E N D   O F   D
A T A*********************************************************
*********************************************************************
*************************************************************
```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t22301 WATER RIGHT: 91-23 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-23
RIGHT EVIDENCED BY: 91-23, 491 (A5039) Cert. 1685
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Nielson Construction Company Inc.
ADDR: P.O. Box 620
Huntington UT 84528
REMARKS:

FILED: 06/12/1998|PRIORITY: 06/12/1998|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:06/15/1998|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 06/11/1999|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 19.0 acre-feet
||FLOW: 19.0 acre-feet |
|----------||----
----------|
|SOURCE: Dugout Canyon Creek
||SOURCE: Dugout Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 8 miles N. of Sunnyside Jct. |
|----------||----
----------|
| ||
Water will be used to construct Dugout |

Canyon Road.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1260 ft E 120 ft from SW cor, Sec 03, T 14S, R 12E, SLBM (1)

S 2500 ft E 1230 ft from NW cor, Sec 23, T 13S, R 12E, SLBM

Dvrting Wks:

Dvrting Wks:

Source:

Source:

(2)

S 2300 ft E 2010 ft from NW cor, Sec 34, T 13S, R 12E, SLBM

Dvrting Wks:

Source:

Stream Alt?: No

PLACE OF USE ------>

CHANGED as follows:

	NW¼			NE¼			SW¼			SE¼		
	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S	N N S S
	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E	W E W E
Sec 22 T 13S R 12E SLBM	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X
Sec 23 T 13S R 12E SLBM	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X
Sec 27 T 13S R 12E SLBM	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X
Sec 34 T 13S R 12E SLBM	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X
Sec 13 T 14S R 11E SLBM	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X	X:X:X:X

```
|                                                                    ||Sec
24 T 14S R 11E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                    ||Sec
03 T 14S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                    ||Sec
04 T 14S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                    ||Sec
05 T 14S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                    ||Sec
08 T 14S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                    ||Sec
17 T 14S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                    ||Sec
18 T 14S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
```

```
|NATURE OF USE ------>
||CHANGED as follows:                                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: No
||SUPPLEMENTAL to Other Water Rights: No                             |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|IRR:    605.7000 acs Sol/Sup:    293.4300 acs USED 04/01 - 09/30||
|
|.................................................................||....
.............................................................|
|STK: 810.0000 Cattle or Equivalent            USED 04/01 - 09/30||
|
|.................................................................||....
.............................................................|
|                                                                   ||OTH:
ROAD MAINTENANCE: Road construction and  USED 06/12 - 06/11|
|                                                                   ||
dust suppression.                                            |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
```

```
|RESERVOIR STORAGE -->                                              ||SAME
AS HERETOFORE                                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|Storage 03/01 to 07/31, in Clark`s Valley Reservoir                ||
|
| with a maximum capacity of 460.500 acre-feet, located in:         ||
|
|                              --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
|
|  Height of Dam:          ft |N N S S||N N S S||N N S S||N N S S|||
|
```

```
|  Area Inundat            acs|W E W E||W E W E||W E W E||W E W E|||
|
|Sec 10 T 14S R 12E SLBM     * : : : ** : : : ** : : :X** : :X: *||
|
|Sec 15 T 14S R 12E SLBM     * :X: : **X: : : ** : : : ** : : : *||
|
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
 ____________________________________________________________________
_____________________________________________________________________
**************************************************************************
*************************************************************
*************************************************************E N D   O F   D
A T A*************************************************************
**************************************************************************
*************************************************************
```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t22354 WATER RIGHT: 91-519 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-519
RIGHT EVIDENCED BY: 91-519
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuels Company LLC
ADDR: 6955 Union Park Center, Suite 550
Midvale UT 84047
REMARKS:

FILED: 05/21/1998|PRIORITY: 06/30/1998|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:07/01/1998|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 06/30/1999|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 1.0 cfs OR 224.8 acre-feet
||FLOW: 0.25 cfs OR 84.0 acre-feet |
|----------||----
----------|
|SOURCE: Soldier Creek
||SOURCE: Soldier Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: Soldier Creek Mine |
|----------||----
----------|
| ||
This application is being filed to |

allow the applicant to divert make-up water

from Soldier Creek and pump it into

the mine through a former discharge line

for use as described herein.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1040 ft E 740 ft from SW cor, Sec 19, T 13S, R 12E, SLBM (1) N 30 ft W 1140 ft from SE cor, Sec 07, T 13S, R 12E, SLBM

Dvrting Wks:

Dvrting Wks: Portable pump & pipelines to place of use

Source:

Source: Soldier Creek

Stream Alt?: No

PLACE OF USE ------>

CHANGED as follows:

```
                                --NW¼--  --NE¼--  --SW¼--  --SE¼--
--NW¼--  --NE¼--  --SW¼--  --SE¼--
                                N N S S  N N S S  N N S S  N N S S
N N S S  N N S S  N N S S  N N S S
                                W E W E  W E W E  W E W E  W E W E
W E W E  W E W E  W E W E  W E W E
Sec 25 T 13S R 11E SLBM     * : : : ** : : : ** : : : ** :X: :X*  Sec
07 T 13S R 12E SLBM     * : : : ** : : : ** : : : **X:X:X:X*
Sec 30 T 13S R 12E SLBM     * : : : ** : : : ** : :X: ** : : : *
```

```
|NATURE OF USE ------>
||CHANGED as follows:                                                  |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: No
||SUPPLEMENTAL to Other Water Rights: No                              |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|IRR:     73.1000 acs Sol/Sup:             acs USED 04/01 - 10/31||
|
|.................................................................||....
.............................................................|
|STK: 130.0000 Cattle or Equivalent            USED 01/01 - 12/31||
|
|.................................................................||....
.............................................................|
|                                                                  ||MIN:
District: Soldier Creek                  USED 07/01 - 06/30|
|                                                                  ||
Name:     Soldier Creek                                     |
|                                                                  ||
Ores:     Coal                                              |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|.................................................................||....
.............................................................|
|                                                                  ||OTH:
INDUSTRIAL:       In-mine process water  USED 07/01 - 06/30|
|                                                                  ||
and dust suppression                                        |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
```

****
****
**********E N D O F D
A T A**********
****
****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t22425 WATER RIGHT: 91-519 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-519
RIGHT EVIDENCED BY: 91-519
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: 6955 Union Park Center, Suite 550
Midvale UT 84047
REMARKS:

FILED: 08/03/1998|PRIORITY: 08/03/1998|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:08/03/1998|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 11/30/1998|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 2.0 acre-feet
||FLOW: 2.0 acre-feet |
|----------||----
----------|
|SOURCE: Soldier Creek
||SOURCE: Pine Cyn., Soldier, Fish, & Dugout Creeks |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 12 miles NE of Wellington |
|----------||----
----------|
| ||
The water from this permit will be |

used to drill locations A,B,E, & F in 1998.

See attached sheet.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1040 ft E 740 ft from SW cor, Sec 19, T 13S, R 12E, SLBM (1)

N 2190 ft W 650 ft from SE cor, Sec 04, T 13S, R 12E, SLBM

Dvrting Wks:

Dvrting Wks: Pond

Source:

Source:

N 1680 ft E 460 ft from SW cor, Sec 06, T 13S, R 12E, SLBM (2)

Dvrting Wks:

Source: Soldier Creek

N 310 ft W 860 ft from SE cor, Sec 09, T 13S, R 12E, SLBM (3)

Dvrting Wks: Pond

Source:

S 1100 ft E 1400 ft from NW cor, Sec 15, T 13S, R 12E, SLBM (4)

Dvrting Wks: Pond

Source:

S 150 ft E 710 ft from W4 cor, Sec 23, T 13S, R 12E, SLBM (5)

Dvrting Wks:

Source: Dogout Creek

Stream Alt?: No

```
|PLACE OF USE ------>
||CHANGED as follows:                                                  |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|                                  --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
--NW¼--  --NE¼--  --SW¼--  --SE¼-- |
|                                 |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
|                                 |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
|Sec 25 T 13S R 11E SLBM     * : : : ** : : : ** : : : ** :X: :X*||Sec
15 T 13S R 12E SLBM     * : : : ** : : : ** :X: : ** : : : *|
|Sec 30 T 13S R 12E SLBM     * : : : ** : : : ** : :X: ** : : : *||Sec
16 T 13S R 12E SLBM     * : : : ** : : : ** : : : ** :X: : *|
|                                                                  ||Sec
21 T 13S R 12E SLBM     * : : : ** :X: : ** : : : ** : : : *|
|                                                                  ||Sec
22 T 13S R 12E SLBM     * : : : ** :X: : ** : : : ** : : : *|
```

```
|NATURE OF USE ------>
||CHANGED as follows:                                                  |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: No
||SUPPLEMENTAL to Other Water Rights: No                              |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|IRR:     73.1000 acs Sol/Sup:             acs USED 04/01 - 10/31||
|
|.................................................................||....
.............................................................|
|STK: 130.0000 Cattle or Equivalent            USED 01/01 - 12/31||
|
|.................................................................||....
.............................................................|
|                                                                  ||OTH:
OIL EXPLORATION:  Exploration drilling   USED 08/03 - 11/30|
|                                                                  ||
|
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
```

```
*************************************************************************
*************************************************************
*********************************************************E N D   O F   D
A T A*********************************************************
*************************************************************************
*************************************************************
```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t23594 WATER RIGHT: 91-519 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-519
RIGHT EVIDENCED BY: 91-519
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: 6955 Union Park Center Suite 550
Midvale UT 84047
INTEREST: 100% REMARKS:

FILED: 07/26/1999|PRIORITY: 07/26/1999|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:08/10/1999|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 11/30/1999|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 2.0 acre-feet
||FLOW: 2.0 acre-feet |
|----------||----
----------|
|SOURCE: Soldier Creek
||SOURCE: Trib. to Pine, Soldier, Fish and Dugout Creeks |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 12 miles NE of Wellington |
|----------||----
----------|
| ||
The water from this permit will be |

used to drill locations G, H, I, J, & N-alt

in 1999. See attached sheets.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1040 ft E 740 ft from SW cor, Sec 19, T 13S, R 12E, SLBM (1)

N 2190 ft W 650 ft from SE cor, Sec 04, T 13S, R 12E, SLBM

Dvrting Wks: Earthen ditches

Dvrting Wks: Pond

Source:

Source:

(2)

N 1680 ft E 460 ft from SW cor, Sec 05, T 13S, R 12E, SLBM

Dvrting Wks:

Source: Soldier Creek

(3)

N 2000 ft W 50 ft from SE cor, Sec 09, T 13S, R 12E, SLBM

Dvrting Wks: Pond

Source:

(4)

N 700 ft W 2400 ft from SE cor, Sec 14, T 13S, R 12E, SLBM

Dvrting Wks:

Source: Dugout Creek

(5)

S 1100 ft E 1400 ft from NW cor, Sec 15, T 13S, R 12E, SLBM

Dvrting Wks: Pond

Source:

(6)

S 750 ft W 1400 ft from NE cor, Sec 16, T 13S, R 12E, SLBM

Dvrting Wks:

Source: Fish Creek

(7)

S 150 ft E 710 ft from W4 cor, Sec 23, T 13S, R 12E, SLBM

```
|                                                                    ||
Dvrting Wks:                                                       |
|                                                                    ||
Source:      Dugout Creek                                          |
|                                                                    ||
|
|
||Stream Alt?: No                                                    |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
 ____________________________________________________________________
____________________________________________________________________
 ____________________________________________________________________
____________________________________________________________________
|PLACE OF USE ------>
||CHANGED as follows:                                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|                                --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
--NW¼--  --NE¼--  --SW¼--  --SE¼-- |
|                               |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
|                               |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
|Sec 25 T 13S R 11E SLBM     * : : : ** : : : ** : : : ** :X: :X*||Sec
14 T 13S R 12E SLBM     * : : :X** : : : ** : : : ** :X: : *|
|                                                                   ||Sec
15 T 13S R 12E SLBM     * :X: : ** :X: : ** : : : ** : : : *|
|                                                                   ||Sec
16 T 13S R 12E SLBM     * : : : **X: : : ** :X: : ** : : : *|
 ____________________________________________________________________
____________________________________________________________________
 ____________________________________________________________________
____________________________________________________________________
|NATURE OF USE ------>
||CHANGED as follows:                                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: No
||SUPPLEMENTAL to Other Water Rights: No                             |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|IRR:     73.1000 acs Sol/Sup:             acs USED 04/01 - 10/31||
|
|.................................................................||....
.............................................................|
|STK: 130.0000 Cattle or Equivalent            USED 01/01 - 12/31||
|
|.................................................................||....
.............................................................|
|                                                                   ||OTH:
OTHER:            Exploration Drilling   USED 07/26 - 11/30|
|                                                                   ||
|
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
```

****
****
**********E N D O F D
A T A**********
****
****

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t25914 WATER RIGHT: 91-23 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-23
RIGHT EVIDENCED BY: 91023, 491 (A5039) Cert. #1685
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: P.O. Box 1029
Wellington UT 84542
REMARKS:

FILED: 08/20/2001|PRIORITY: 08/20/2001|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:08/24/2001|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 10/31/2001|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 2.5 acre-feet
||FLOW: 2.5 acre-feet |
|----------||----
----------|
|SOURCE: Dugout Canyon Creek
||SOURCE: Pace Creek |
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 2 mi. North of Clark`s Valley |

|POINT(S) OF DIVERSION ------>
||CHANGED AS FOLLOWS: (Click Location link for WRPLAT) |

|----------||----
----------|
|Point Surface:
||Point Surface: |
|(1) N 1260 ft E 120 ft from SW cor, Sec 03, T 14S, R 12E, SLBM||(1)
N 1150 ft W 950 ft from SE cor, Sec 19, T 13S, R 13E, SLBM|
| Dvrting Wks: ||
Dvrting Wks: |
| Source: ||
Source: |
| ||(2)
N 1150 ft E 1200 ft from SW cor, Sec 20, T 13S, R 13E, SLBM|
| ||
Dvrting Wks: |
| ||
Source: |
| ||(3)
S 150 ft E 1850 ft from NW cor, Sec 30, T 13S, R 13E, SLBM|
| ||
Dvrting Wks: |
| ||
Source: |
| ||
|
|
||Stream Alt?: No |
|----------||----
----------|

|**PLACE OF USE ------>**
||**CHANGED as follows:** |
|----------||----
----------|
| --NW¼-- --NE¼-- --SW¼-- --SE¼-- ||
--NW¼-- --NE¼-- --SW¼-- --SE¼-- |
| |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
| |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
| ||Sec
19 T 13S R 13E SLBM *X: : : ** : : : ** : : : ** : : :X*|
| ||Sec
24 T 13S R 13E SLBM * : : : ** : : : **X: : : ** : : : *|
| ||Sec
30 T 13S R 13E SLBM * :X: : ** : : : ** : : : ** : : : *|

|**NATURE OF USE ------>**
||**CHANGED as follows:** |
|----------||----
----------|

```
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|IRR:    605.7000 acs Sol/Sup:    293.4300 acs USED 04/01 - 09/30||
|
|.................................................................||....
.............................................................|
|STK: 810.0000 Cattle or Equivalent            USED 04/01 - 09/30||
|
|.................................................................||....
.............................................................|
|                                                                  ||OTH:
OIL EXPLORATION:  Exploratory Drilling   USED 08/27 - 10/31|
|                                                                  ||
|
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
 ____________________________________________________________________
 ____________________________________________________________________
 ____________________________________________________________________
 ____________________________________________________________________
|RESERVOIR STORAGE -->                                              ||SAME
AS HERETOFORE                                                 |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|Storage 03/01 to 07/31, in Clark`s Valley Reservoir                ||
|
| with a maximum capacity of 460.500 acre-feet, located in:         ||
|
|                              --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
|
|  Height of Dam:          ft |N N S S||N N S S||N N S S||N N S S|||
|
|  Area Inundat            acs|W E W E||W E W E||W E W E||W E W E|||
|
|Sec 10 T 14S R 12E SLBM     * : : : ** : : : ** : : :X** : :X: *||
|
|Sec 15 T 14S R 12E SLBM     * :X: : **X: : : ** : : : ** : : : *||
|
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
 ____________________________________________________________________
 ____________________________________________________________________
**********************************************************************
**************************************************************
*************************************************************E N D   O F   D
A T A*************************************************************
**********************************************************************
**************************************************************
```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t28162 WATER RIGHT: 91-519 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-519
RIGHT EVIDENCED BY: 91-519
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: 6955 Union Park Center Suite 550
Midvale UT 84047
REMARKS:

FILED: 08/07/2003|PRIORITY: 08/07/2003|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:08/07/2003|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 08/06/2004|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 2.5 acre-feet
||FLOW: 2.5 acre-feet |
|----------||----
----------|
|SOURCE: Soldier Creek
||SOURCE: Dugout Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 12 m. N. Hwy 6 Clark Valley |
|----------||----
----------|
| ||
The water will be used for Dugout |

Canyon Mine exploration drilling and dust suppression.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1040 ft E 740 ft from SW cor, Sec 19, T 13S, R 12E, SLBM (1) N 1600 ft W 1325 ft from SE cor, Sec 13, T 13S, R 12E, SLBM

Dvrting Wks:

Dvrting Wks: Portable pump & tank truck

Source:

Source: Dugout Canyon Creek

(2) N 1850 ft W 1120 ft from SE cor, Sec 13, T 13S, R 12E, SLBM

Dvrting Wks: Portable pump & tank truck

Source: Dugout Canyon Creek

Stream Alt?: No

PLACE OF USE ------>

CHANGED as follows:

```
                                --NW¼--  --NE¼--  --SW¼--  --SE¼--
--NW¼--  --NE¼--  --SW¼--  --SE¼--
                               |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
                               |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
Sec 25 T 13S R 11E SLBM     * : : : ** : : : ** : : : ** :X: :X*||Sec
13 T 13S R 12E SLBM     * : : : ** : : : ** : : : **X:X:X: *|
Sec 30 T 13S R 12E SLBM     * : : : ** : : : ** : :X: ** : : : *||Sec
18 T 13S R 13E SLBM     * : : : ** : : : ** : : : ** : :X: *|
```

```
|NATURE OF USE ------>
||CHANGED as follows:                                                  |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                              |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|IRR:     73.1000 acs Sol/Sup:             acs USED 04/01 - 10/31||
|
|.................................................................||....
.............................................................|
|STK: 130.0000 Cattle or Equivalent            USED 01/01 - 12/31||
|
|.................................................................||....
.............................................................|
|                                                                  ||OTH:
OTHER:            Exploration drilling   USED 08/07 - 08/06|
|                                                                  ||
and dust suppression                                         |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
```

```
*************************************************************************
*************************************************************
*************************************************************E N D   O F   D
A T A*************************************************************
*************************************************************************
*************************************************************
```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: a27255 WATER RIGHT: 91-4987 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-4987
RIGHT EVIDENCED BY: 91-4987
CHANGES: Point of Diversion [X], Place of Use [ ], Nature of Use [ ], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: City Place One Suite 300
St. Louis MO 63141
REMARKS:

FILED: 11/14/2002|PRIORITY: 11/14/2002|ADV BEGAN: 12/05/2002|ADV ENDED: 12/12/2002|NEWSPAPER: Sun Advocate
ProtestEnd:01/01/2003|PROTESTED: [No]|HEARNG HLD: |SE ACTION: [ ]|ActionDate: |PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: |LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
Status: **Terminated**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 250.0 acre-feet
||FLOW: 250.0 acre-feet |
|----------||----
----------|
|SOURCE: Dugout Canyon Creek
||SOURCE: Underground Water Well (Existing) |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: |
|----------||----
----------|
| ||
The purpose of this application is to |

change the point of diversion from

Dugout Canyon Creek to the existing

well covered by water right 91-5024.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

(1) N 3360 ft E 1860 ft from SW cor, Sec 23, T 13S, R 12E, SLBM

Dvrting Wks:

Source:

Point Underground:

UNDERGROUND: (Click Link for PLAT data, Well ID# link for data.)

(1)

S 125 ft E 2307 ft from NW cor, Sec 23, T 13S, R 12E, SLBM

Diameter: 10 ins. Depth: 300 to ft. WELL ID#:

COMMENT: Existing Well

PLACE OF USE ------> **SAME AS HERETOFORE**

```
                          --NW¼--  --NE¼--  --SW¼--  --SE¼--
                         |N N S S||N N S S||N N S S||N N S S|
                         |W E W E||W E W E||W E W E||W E W E|
Sec 09 T 13S R 12E SLBM  * : : : ** : : : ** : : : ** : :X:X*
Sec 10 T 13S R 12E SLBM  * : : : ** : : : **X:X:X:X**X:X:X:X*
Sec 11 T 13S R 12E SLBM  * : : : ** : : : **X:X:X:X**X:X:X:X*
```

```
|Sec 14 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|
|Sec 15 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|
|Sec 16 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*||
|
|Sec 17 T 13S R 12E SLBM     * : : : ** : : : ** :X: :X**X:X:X:X*||
|
|Sec 20 T 13S R 12E SLBM     * :X:X:X**X:X: : ** : : : ** : : : *||
|
|Sec 21 T 13S R 12E SLBM     *X:X: : **X:X:X:X** : : : ** : : : *||
|
|Sec 22 T 13S R 12E SLBM     *X:X:X:X**X:X:X:X**X:X: : **X:X: : *||
|
|Sec 23 T 13S R 12E SLBM     *X:X:X:X**X: :X: ** : : : ** : : : *||
|
 ____________________________________________________________________
 ____________________________________________________________________
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 ____________________________________________________________________
|NATURE OF USE ------>                                              ||SAME
AS HERETOFORE                                                    |
|-------------------------------------------------------------------||----
-------------------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                            |
|...................................................................||....
...................................................................|
|MIN: District: Dugout Canyon                    USED 01/01 - 12/31||
|
|     Name:     Dugout Canyon                                       ||
|
|     Ores:     Coal                                                ||
|
|-------------------------------------------------------------------||----
-------------------------------------------------------------------|
|...................................................................||....
...................................................................|
|OTH: OTHER:            dust suppression and   USED 01/01 - 12/31||
|
|     fire protection                                               ||
|
|-------------------------------------------------------------------||----
-------------------------------------------------------------------|
 ____________________________________________________________________
 ____________________________________________________________________
**********************************************************************
**************************************************************
*************************************************************E N D   O F   D
A T A*************************************************************
**********************************************************************
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```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t29158 WATER RIGHT: 91-409 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-409
RIGHT EVIDENCED BY: 91-409 (A9502) Cert. No. 2207
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company
ADDR: HC 35 Box 380
Helper, Utah 84526
INTEREST: 100% REMARKS:

FILED: 07/01/2004|PRIORITY: 07/01/2004|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:07/02/2004|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 07/01/2005|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 3.0 acre-feet
||FLOW: 3.0 acre-feet |
|----------||----
----------|
|SOURCE: Pace Canyon Creek
||SOURCE: Pace Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 11 mi. No. Hwy 6-Clark Valley |
|----------||----
----------|
| ||
The water will be used for Dugout |

Canyon Mine exploration drilling and dust suppression.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1280 ft W 1200 ft from SE cor, Sec 03, T 14S, R 12E, SLBM (1)

N 1090 ft W 950 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Dvrting Wks: Portable pump and tank truck

Source:

Source: Pace Canyon Creek

(2)

N 1735 ft W 850 ft from NE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks: Portable pump and tank truck

Source: Pace Canyon Creek

(3)

N 1160 ft E 1140 ft from SW cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks: Portable pump and tank truck

Source: Pace Canyon Creek

(4)

N 2320 ft W 2230 ft from SE cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks: Portable pump and tank truck

Source: Pace Canyon Creek

Stream Alt?: No

PLACE OF USE ------>

CHANGED as follows:

```
|                                --NW¼--   --NE¼--   --SW¼--   --SE¼-- ||
--NW¼--   --NE¼--   --SW¼--   --SE¼-- |
|                               |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
|                               |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
|Sec 09 T 14S R 12E SLBM     * : : : ** : : : ** : : :X** :X: :X*||Sec
13 T 13S R 12E SLBM     * : : : ** : : : ** : : : ** : : :X*|
|Sec 10 T 14S R 12E SLBM     * :X:X: **X: :X: **X:X:X:X** : : : *||Sec
24 T 13S R 12E SLBM     * : : : **X: : : ** : : : ** : : : *|
|Sec 15 T 14S R 12E SLBM     * :X:X: ** : :X: ** :X: :X**X: :X: *||Sec
18 T 13S R 13E SLBM     * : : : ** : : : ** : : : **X: : : *|
|Sec 22 T 14S R 12E SLBM     *X:X:X:X** : : : ** : : : ** : : : *||Sec
19 T 13S R 13E SLBM     * : : : ** : : :X** : : : ** : : : *|
|                                                                ||Sec
20 T 13S R 13E SLBM     * : : : ** : : : ** : : : **X: : : *|
 ____________________________________________________________
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|NATURE OF USE ------>
||CHANGED as follows:                                            |
|-----------------------------------------------------------||----
-----------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                        |
|-----------------------------------------------------------||----
-----------------------------------------------------------|
|IRR:    645.8000 acs Sol/Sup:    121.3500 acs USED 04/01 - 10/01||
|
|...........................................................||....
...........................................................|
|STK: 810.0000 Cattle or Equivalent            USED 04/01 - 10/01||
|
|...........................................................||....
...........................................................|
|                                                                ||OTH:
OTHER:            Exploration drilling   USED 07/02 - 07/01|
|                                                                ||
and dust suppression                                      |
|-----------------------------------------------------------||----
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 ____________________________________________________________
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**********************************************************************
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*****************************************************E N D   O F   D
A T A*************************************************************
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```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t30602 WATER RIGHT: 91-409 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-409
RIGHT EVIDENCED BY: 91-409(A9502) Cert. No. 227
Prior approved Temporary Change Applications for this right: t27967; t28160; t29158
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [X].

NAME: Canyon Fuel Company LLC
ADDR: Attn: Property Administration
CityPlace One Suite 300
St. Louis MO 63141
INTEREST: 100% REMARKS: c/o Ark Land Company

FILED: 08/31/2005|PRIORITY: 08/31/2005|ADV BEGAN: |ADV ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE ACTION: [Approved]|ActionDate:08/31/2005|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 08/30/2006|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE: [ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 5.0 acre-feet
||FLOW: 5.0 acre-feet |
|----------||----
----------|
|SOURCE: Pace Canyon Creek
||SOURCE: Pace Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 15 Miles NE of Wellington |

Pine Canyon Quad

POD - DIVERTING WORKS: Portable pump and tank truck

The water will be used for Dugout Canyon Mine exploration drilling and dust suppression.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1280 ft W 1200 ft from SE cor, Sec 03, T 14S, R 12E, SLBM (1) N 3475 ft W 845 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Dvrting Wks:

Source:

Source:

(2) N 2280 ft W 1300 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(3) N 1050 ft W 890 ft from SE cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

```
|                                                                    ||(4)
N 1075 ft E 2560 ft from SW cor, Sec 20, T 13S, R 13E, SLBM|
|                                                                    ||
Dvrting Wks:                                                       |
|                                                                    ||
Source:                                                            |
|                                                                    ||
|
|
||Stream Alt?: No                                                    |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
 ____________________________________________________________________
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|PLACE OF USE ------>
||CHANGED as follows:                                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|                                --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
--NW¼--  --NE¼--  --SW¼--  --SE¼-- |
|                               |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
|                               |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
|Sec 09 T 14S R 12E SLBM     * : : : ** : : : ** : : : ** :X:X:X*||Sec
17 T 13S R 13E SLBM     * : : : ** : : : ** : : : ** : :X: *|
|Sec 10 T 14S R 12E SLBM     * :X:X: **X: :X: **X:X:X:X** : : : *||Sec
18 T 13S R 13E SLBM     * : : : ** : : : ** : : : ** : : :X*|
|Sec 15 T 14S R 12E SLBM     * :X: :X** : :X: ** :X:X:X**X: :X: *||Sec
19 T 13S R 13E SLBM     * : : : ** : : : ** : : : ** :X: : *|
|Sec 22 T 14S R 12E SLBM     *X:X:X:X** : : : ** : : : ** : : : *||Sec
20 T 13S R 13E SLBM     * : : : ** : : : **X: : :X** :X: : *|
|                                                                    ||Sec
21 T 13S R 13E SLBM     * : : : ** : : : **X: : : ** : : : *|
 ____________________________________________________________________
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|NATURE OF USE ------>
||CHANGED as follows:                                                |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                             |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|IRR:    645.8000 acs Sol/Sup:    121.3500 acs USED 04/01 - 10/01||
|
|.................................................................||....
.............................................................|
|STK: 810.0000 Cattle or Equivalent            USED 04/01 - 10/01||
|
|.................................................................||....
.............................................................|
```

```
|                                                                    ||OTH:
OTHER:            Exploration drilling   USED 08/16 - 08/15|
|                                                                    ||
and dust supression                                          |
|-----------------------------------------------------------------||----
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A T A*************************************************************
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Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t31206 WATER RIGHT: 91-409 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-409
RIGHT EVIDENCED BY: 91-409(A9502) Cert. No. 2207
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: Attn: Property Administration
CityPlace One Suite 300
St. Louis MO 63141
INTEREST: 100% REMARKS: c/o Ark Land Company

FILED: 03/20/2006|PRIORITY: 03/20/2006|ADV BEGAN: |ADV
ENDED: |NEWSPAPER:
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:03/23/2006|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 03/31/2007|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: **Lapsed**

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 9.0 acre-feet
||FLOW: 9.0 acre-feet |
|----------||----
----------|
|SOURCE: Pace Canyon Creek
||SOURCE: Pace Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 11 Miles NW of Sunnyside |
|----------||----
----------|

The water will be used for Dugout Canyon Mine exploration drilling and dust suppression.

Diverting Works: Portable pump & tank trucks.

POINT(S) OF DIVERSION ------>

CHANGED AS FOLLOWS: (Click Location link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1280 ft W 1200 ft from SE cor, Sec 03, T 14S, R 12E, SLBM (1) N 1070 ft W 1100 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Dvrting Wks:

Source:

Source:

(2) N 3500 ft W 850 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(3) N 1325 ft E 1400 ft from SW cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(4) N 1060 ft E 2590 ft from SW cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(5) N 1070 ft W 900 ft from SE cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(6) N 700 ft E 1970 ft from SW cor, Sec 21, T 13S, R 13E, SLBM

```
|                                                                  ||
Dvrting Wks:                                                      |
|                                                                  ||
Source:                                                           |
|                                                                  ||(7)
N 1400 ft W  960 ft from SE cor, Sec 21, T 13S, R 13E, SLBM|
|                                                                  ||
Dvrting Wks:                                                      |
|                                                                  ||
Source:                                                           |
|                                                                  ||
|
|
||Stream Alt?: No                                                  |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
 ____________________________________________________________________
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|PLACE OF USE ------>
||CHANGED as follows:                                              |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|                                --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
--NW¼--  --NE¼--  --SW¼--  --SE¼-- |
|                                |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
|                                |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
|Sec 09 T 14S R 12E SLBM     * : : : ** : : : ** : : :X** :X: :X*||Sec
17 T 13S R 13E SLBM     * : : : ** : : : ** : : : ** : :X: *|
|Sec 10 T 14S R 12E SLBM     * :X:X: **X: :X: **X:X:X:X** : : : *||Sec
19 T 13S R 13E SLBM     * : : : ** : : : ** : : : ** :X: : *|
|Sec 15 T 14S R 12E SLBM     * :X:X: ** : :X: ** :X: :X**X: :X: *||Sec
20 T 13S R 13E SLBM     * : : : ** : : : **X: : :X** :X: : *|
|Sec 22 T 14S R 12E SLBM     *X:X:X:X** : : : ** : : : ** : : : *||Sec
21 T 13S R 13E SLBM     * : : : ** : : : **X: : : ** : : : *|
 ____________________________________________________________________
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____________________________________________________________________
|NATURE OF USE ------>
||CHANGED as follows:                                              |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                           |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|IRR:    645.8000 acs Sol/Sup:    121.3500 acs USED 04/01 - 10/01||
|
|.................................................................||....
.............................................................|
|STK: 810.0000 Cattle or Equivalent            USED 04/01 - 10/01||
|
```

```
|.............................................................||....
.............................................................|
|                                                              ||OTH:
OTHER:              Exploration drilling   USED 04/01 - 04/01|
|                                                              ||
and dust supression                                          |
|-------------------------------------------------------------||----
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 ____________________________________________________________
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*************************************************************************
*************************************************************
*************************************************************E N D   O F   D
A T A*************************************************************
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```

Select Related Information

(WARNING: Water Rights makes NO claims as to the accuracy of this data.) RUN DATE: 10/08/2007 Page 1

CHANGE: t32919 WATER RIGHT: 91-409 CERT. NO.:
AMENDATORY? No
BASE WATER RIGHTS: 91-409
RIGHT EVIDENCED BY: 91-409(A9502)
CHANGES: Point of Diversion [X], Place of Use [X], Nature of Use [X], Reservoir Storage [ ].

NAME: Canyon Fuel Company LLC
ADDR: Attn: Property Administration
CityPlace One Suite 300
St. Louis MO 63141
INTEREST: 100% REMARKS: c/o Ark Land Company

FILED: 04/26/2007|PRIORITY: 04/26/2007|ADV BEGAN: |ADV
ENDED: |NEWSPAPER: No Adv Required
ProtestEnd: |PROTESTED: [No]|HEARNG HLD: |SE
ACTION: [Approved]|ActionDate:05/01/2007|PROOF DUE:
EXTENSION: |ELEC/PROOF:[ ]|ELEC/PROOF:
|CERT/WUC: |LAP, ETC: 05/01/2008|LAPS LETTER:
RUSH LETTR: |RENOVATE: |RECON REQ: |TYPE:
[ ]
Status: Approved

****
****
**********H E R E T O F O R E**********
**********H E R E A F T E R**********
****
****

|FLOW: 12.0 acre-feet
||FLOW: 12.0 acre-feet |
|----------||----
----------|
|SOURCE: Pace Canyon Creek
||SOURCE: Pace Canyon Creek |
|----------||----
----------|
|COUNTY: Carbon
||COUNTY: Carbon COM DESC: 11 Miles NE of Wellington |
|----------||----
----------|

Additional Place of Use:

Sections 16, 17, 18, 19, 20, 21, and

30 of T13S, R13E, SLB&M.

In addition to normal mining

activities, the applicant seeks to use water for

a drilling program incidental to coal

mining including dust suppression, fire

protection, and coal processing.

POINT(S) OF DIVERSION ------> SAME AS HERETOFORE, AND IN ADDITION TO: (Click link for WRPLAT)

Point Surface:

Point Surface:

(1) N 1280 ft W 1200 ft from SE cor, Sec 03, T 14S, R 12E, SLBM (1) N 1070 ft W 1100 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Dvrting Wks:

Source:

Source:

(2) N 3500 ft W 850 ft from SE cor, Sec 19, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(3) N 1325 ft E 1400 ft from SW cor, Sec 20, T 13S, R 13E, SLBM

Dvrting Wks:

Source:

(4) N 1070 ft W 900 ft from SE cor, Sec 20, T 13S, R 13E, SLBM

```
|                                                                  ||
Dvrting Wks:                                                     |
|                                                                  ||
Source:                                                          |
|                                                                  ||(5)
N 1060 ft E 2590 ft from SW cor, Sec 20, T 13S, R 13E, SLBM|
|                                                                  ||
Dvrting Wks:                                                     |
|                                                                  ||
Source:                                                          |
|                                                                  ||(6)
N 1400 ft W  960 ft from SE cor, Sec 21, T 13S, R 13E, SLBM|
|                                                                  ||
Dvrting Wks:                                                     |
|                                                                  ||
Source:                                                          |
|                                                                  ||(7)
S 1011 ft E 1322 ft from NW cor, Sec 30, T 13S, R 13E, SLBM|
|                                                                  ||
Dvrting Wks:                                                     |
|                                                                  ||
Source:                                                          |
|                                                                  ||
|
|
||Stream Alt?: No                                                  |
|-----------------------------------------------------------------||----
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 ____________________________________________________________________
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|PLACE OF USE ------>                                              ||SAME
AS HERETOFORE, AND IN ADDITION TO:                              |
|-----------------------------------------------------------------||----
-------------------------------------------------------------|
|                              --NW¼--  --NE¼--  --SW¼--  --SE¼-- ||
--NW¼--  --NE¼--  --SW¼--  --SE¼-- |
|                             |N N S S||N N S S||N N S S||N N S S|||
|N N S S||N N S S||N N S S||N N S S||
|                             |W E W E||W E W E||W E W E||W E W E|||
|W E W E||W E W E||W E W E||W E W E||
|                                                                  ||Sec
17 T 13S R 13E SLBM     * : : : ** : : : **X:X:X:X** : : : *|
|                                                                  ||Sec
18 T 13S R 13E SLBM     * : : : ** : : : ** : : : **X:X:X:X*|
|                                                                  ||Sec
19 T 13S R 13E SLBM     * : : : **X:X:X:X** : : : **X:X:X:X*|
|                                                                  ||Sec
20 T 13S R 13E SLBM     *X:X:X:X**X:X:X:X**X:X:X:X**X:X:X:X*|
|                                                                  ||Sec
21 T 13S R 13E SLBM     *X:X:X:X** : : : **X:X:X:X** : : : *|
 ____________________________________________________________________
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```

```
|NATURE OF USE ------>                                                  ||SAME
AS HERETOFORE, AND IN ADDITION TO:                                |
|-----------------------------------------------------------------||----
-----------------------------------------------------------|
|SUPPLEMENTAL to Other Water Rights: Yes
||SUPPLEMENTAL to Other Water Rights: No                              |
|.................................................................||....
.............................................................|
|                                                                    ||OTH:
INDUSTRIAL:       Dust Suppression,      USED 05/15 - 10/31|
|                                                                    ||
Fire protection, & coal processing.                               |
|-----------------------------------------------------------------||----
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*************************************************************************
*************************************************************
*************************************************************E N D   O F   D
A T A*************************************************************
*************************************************************************
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```

APPENDIX 7-2

Groundwater Monitoring Data

Appendix 7-2

SPRINGS
321 and 322

"321" Monitoring Data 2007

Date	Time	pH	Cond.	Temp.	Flow (gpm)	Comments
3/15/07	1220				NOA	Snow/Ice
5/18/07	1420	8.08	406	4	1.5	
6/21/07	1114	8.11	410	7.6	1.3	
7/24/07	834	7.38	469	8.5	0.75	
8/30/07	1205	7.42	471	8	0.7	

"322" Monitoring Data 2007

Date	Time	pH	Cond.	Temp.	Flow (gpm)	Comments
3/15/07	1220				NOA	Snow/Ice
6/21/07	905	7.84	704	7	18	
7/24/07	916	7.91	698	9	0.2	Livestock
8/30/07	1130	7.91	663	11	0.1	Livestock

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 321

ACZ Sample ID: ***L63413-01***
Date Sampled: *06/21/07 00:00*
Date Received: *06/25/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							06/27/07 19:18	erf

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	77.5			mg/L	0.2	1	07/03/07 13:37	msh
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	07/03/07 13:37	msh
Iron, total	M200.7 ICP	1.59		*	mg/L	0.02	0.05	07/05/07 22:24	djt
Magnesium, dissolved	M200.7 ICP	22.5			mg/L	0.2	1	07/03/07 13:37	msh
Manganese, dissolved	M200.7 ICP		U		mg/L	0.005	0.03	07/03/07 13:37	msh
Manganese, total	M200.7 ICP	0.024	B		mg/L	0.005	0.03	07/05/07 22:24	djt
Potassium, dissolved	M200.7 ICP	1.0	B		mg/L	0.3	2	07/03/07 13:37	msh
Sodium, dissolved	M200.7 ICP	9.2			mg/L	0.3	2	07/03/07 13:37	msh

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		270			mg/L	2	20	06/26/07 0:00	lcp/jlf
Carbonate as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Hydroxide as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Total Alkalinity		270			mg/L	2	20	06/26/07 0:00	lcp/jlf
Cation-Anion Balance	Calculation								
Cation-Anion Balance		6.1			%			07/10/07 15:15	calc
Sum of Anions		5.4			meq/L	0.1	0.5	07/10/07 15:15	calc
Sum of Cations		6.1			meq/L	0.1	0.5	07/10/07 15:15	calc
Chloride	325.2 / SM4500Cl-E	3	B	*	mg/L	1	5	07/02/07 15:00	aml/jag
Residue, Filterable (TDS) @180C	160.1 / SM2540C	290			mg/L	10	20	06/28/07 15:50	jlf
Sulfate	SM4500 SO4-D		U	*	mg/L	10	50	07/03/07 9:20	aeh
TDS (calculated)	Calculation	275			mg/L	10	50	07/10/07 15:15	calc
TDS (ratio - measured/calculated)	Calculation	1.05						07/10/07 15:15	calc

** Please refer to Qualifier Reports for detail.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 321

ACZ Sample ID: ***L64797-01***
Date Sampled: *08/30/07 12:05*
Date Received: *09/04/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							09/05/07 14:15	bjl

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	75.9			mg/L	0.2	1	09/06/07 3:00	djt
Iron, dissolved	M200.7 ICP	0.03	B		mg/L	0.02	0.05	09/06/07 3:00	djt
Iron, total	M200.7 ICP	0.24			mg/L	0.02	0.05	09/06/07 20:31	erf
Magnesium, dissolved	M200.7 ICP	22.1			mg/L	0.2	1	09/06/07 3:00	djt
Manganese, dissolved	M200.7 ICP	0.014	B		mg/L	0.005	0.03	09/06/07 3:00	djt
Manganese, total	M200.7 ICP	0.007	B		mg/L	0.005	0.03	09/06/07 20:31	erf
Potassium, dissolved	M200.7 ICP	1.1	B		mg/L	0.3	2	09/06/07 3:00	djt
Sodium, dissolved	M200.7 ICP	10.0			mg/L	0.3	2	09/06/07 3:00	djt

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		274			mg/L	2	20	09/06/07 0:00	lcp
Carbonate as CaCO3			U		mg/L	2	20	09/06/07 0:00	lcp
Hydroxide as CaCO3			U		mg/L	2	20	09/06/07 0:00	lcp
Total Alkalinity		274			mg/L	2	20	09/06/07 0:00	lcp
Cation-Anion Balance	Calculation								
Cation-Anion Balance		4.3			%			09/17/07 0:00	calc
Sum of Anions		5.5			meq/L	0.1	0.5	09/17/07 0:00	calc
Sum of Cations		6.0			meq/L	0.1	0.5	09/17/07 0:00	calc
Chloride	325.2 / SM4500Cl-E	2	B	*	mg/L	1	5	09/10/07 12:59	mls
Residue, Filterable (TDS) @180C	160.1 / SM2540C	290			mg/L	10	20	09/04/07 16:22	lcp
Sulfate	SM4500 SO4-D		U		mg/L	10	50	09/05/07 9:14	aeh
TDS (calculated)	Calculation	276			mg/L	10	50	09/17/07 0:00	calc
TDS (ratio - measured/calculated)	Calculation	1.05						09/17/07 0:00	calc

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 322

ACZ Sample ID: ***L64797-02***
Date Sampled: *08/30/07 11:30*
Date Received: *09/04/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							09/05/07 15:10	bjl

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	91.6			mg/L	0.2	1	09/06/07 3:04	djt
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	09/06/07 3:04	djt
Iron, total	M200.7 ICP	8.27			mg/L	0.02	0.05	09/06/07 20:35	erf
Magnesium, dissolved	M200.7 ICP	41.3			mg/L	0.2	1	09/06/07 3:04	djt
Manganese, dissolved	M200.7 ICP	0.014	B		mg/L	0.005	0.03	09/06/07 3:04	djt
Manganese, total	M200.7 ICP	0.512			mg/L	0.005	0.03	09/06/07 20:35	erf
Potassium, dissolved	M200.7 ICP	1.5	B		mg/L	0.3	2	09/06/07 3:04	djt
Sodium, dissolved	M200.7 ICP	25.7			mg/L	0.3	2	09/06/07 3:04	djt

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		390			mg/L	2	20	09/06/07 0:00	lcp
Carbonate as CaCO3		6	B		mg/L	2	20	09/06/07 0:00	lcp
Hydroxide as CaCO3			U		mg/L	2	20	09/06/07 0:00	lcp
Total Alkalinity		396			mg/L	2	20	09/06/07 0:00	lcp
Cation-Anion Balance	Calculation								
Cation-Anion Balance		2.8			%			09/17/07 0:00	calc
Sum of Anions		8.6			meq/L	0.1	0.5	09/17/07 0:00	calc
Sum of Cations		9.1			meq/L	0.1	0.5	09/17/07 0:00	calc
Chloride	325.2 / SM4500Cl-E	2	B	*	mg/L	1	5	09/10/07 13:01	mls
Residue, Filterable (TDS) @180C	160.1 / SM2540C	430			mg/L	10	20	09/04/07 16:23	lcp
Sulfate	SM4500 SO4-D	30	B		mg/L	10	50	09/05/07 9:19	aeh
TDS (calculated)	Calculation	432			mg/L	10	50	09/17/07 0:00	calc
TDS (ratio - measured/calculated)	Calculation	1.00						09/17/07 0:00	calc

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 322

ACZ Sample ID: ***L63413-02***
Date Sampled: *06/21/07 00:00*
Date Received: *06/25/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							06/27/07 19:30	erf

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	91.4			mg/L	0.2	1	07/03/07 13:40	msh
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	07/03/07 13:40	msh
Iron, total	M200.7 ICP	0.69		*	mg/L	0.02	0.05	07/05/07 22:28	djt
Magnesium, dissolved	M200.7 ICP	43.8			mg/L	0.2	1	07/03/07 13:40	msh
Manganese, dissolved	M200.7 ICP	0.018	B		mg/L	0.005	0.03	07/03/07 13:40	msh
Manganese, total	M200.7 ICP	0.040			mg/L	0.005	0.03	07/05/07 22:28	djt
Potassium, dissolved	M200.7 ICP	1.5	B		mg/L	0.3	2	07/03/07 13:40	msh
Sodium, dissolved	M200.7 ICP	24.5			mg/L	0.3	2	07/03/07 13:40	msh

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		380			mg/L	2	20	06/26/07 0:00	lcp/jlf
Carbonate as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Hydroxide as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Total Alkalinity		380			mg/L	2	20	06/26/07 0:00	lcp/jlf
Cation-Anion Balance	Calculation								
Cation-Anion Balance		5.1			%			07/10/07 15:15	calc
Sum of Anions		8.3			meq/L	0.1	0.5	07/10/07 15:15	calc
Sum of Cations		9.2			meq/L	0.1	0.5	07/10/07 15:15	calc
Chloride	325.2 / SM4500Cl-E	3	B	*	mg/L	1	5	07/02/07 15:02	aml/jag
Residue, Filterable (TDS) @180C	160.1 / SM2540C	420			mg/L	10	20	06/28/07 15:52	jlf
Sulfate	SM4500 SO4-D	30	B	*	mg/L	10	50	07/03/07 9:23	aeh
TDS (calculated)	Calculation	422			mg/L	10	50	07/10/07 15:15	calc
TDS (ratio - measured/calculated)	Calculation	1.00						07/10/07 15:15	calc

** Please refer to Qualifier Reports for detail.*

APPENDIX 7-3

Mayo and Associates Report

UPDATE TO THE PROBABLE HYDROLOGIC CONSEQUENCES OF COAL MINING AT THE DUGOUT CANYON MINE

OCTOBER 2007

PROBABLE HYDROLOGIC CONSEQUENCES ADDENDUM

OCTOBER 2007
Revised April 2008
Revised July 2008

Table of Contents

1.0 Introduction

2.0 Analysis of surface and groundwater systems
- 2.1 Study area
- 2.2 Methods of investigation
- 2.3 Description of data
- 2.4 Explanation of chemical reporting units and terms
- 2.5 Overview of mine operations
  - 2.5.1 History of mine ownership and operation
  - 2.5.2 Mining techniques and locations
    - 2.5.2.1 Rock dusting
    - 2.5.2.2 Water management and discharge to Dugout Creek
- 2.6 Geologic setting
  - 2.6.1 Geology
  - 2.6.2 Bedrock formations
  - 2.6.3 Geologic structure
  - 2.6.4 Physiography
- 2.7 Hydrology
  - 2.7.1 Climate
  - 2.7.2 Hydrology
- 2.8 Hydrogeology
  - 2.8.1 Chemical evolution of ground waters
  - 2.8.2 Description of ground-water systems
    - 2.8.2.1 Colton ground-water system
    - 2.8.2.2 Flagstaff ground-water system
    - 2.8.2.3 North Horn ground-water system
    - 2.8.2.4 Price River ground-water system
    - 2.8.2.5 Blackhawk ground-water system
      - 2.8.2.5.1 Springs
      - 2.8.2.5.2 Blackhawk Formation wells
    - 2.8.2.6 Star Point Sandstone ground-water system
    - 2.8.2.7 Mancos Shale ground-water system

3.0 Probable hydrologic consequences
- 3.1 Potential adverse impacts to the hydrologic balance
  - 3.1.1 Potential for decreasing creek flows and spring discharges
  - 3.1.2 Potential for increasing creek flows and spring discharges
  - 3.1.3 Potential for increasing the groundwater recharge to the overlying ground water systems
- 3.2 Impacts of proposed coal mining and reclamation operations
  - 3.2.1 Whether acid-forming or toxic-forming materials are present that could result in the contamination of surface or ground-water supplies
  - 3.2.2 Impact on acidity, total suspended and dissolved solids and other important water quality parameters of local impact

Table of Contents (Continued)

3.2.3 Impact on ground-water and surface-water availability

4.0 Conclusions

5.0 Recommendations
5.1 Soldier Canyon Mine
5.1.1 Monitoring wells
5.1.2 Streams
5.1.3 Springs
5.2 Dugout Canyon Mine
5.2.1 Monitoring wells
5.2.2 Streams
5.2.3 Springs

6.0 References Cited

LIST OF FIGURES

Figure X Annotated photograph showing fluvial channel and encasing lower-permeability fine-grained rocks in a road cut in the Colton Formation near Colton, Utah.

Figure Y Annotated photograph showing surface erosional exposure of fluvial channels and encasing lower-permeability fine-grained rocks in the Colton Formation near Colton, Utah.

ATTACHMENTS

Attachment 1

PHC Figure 1
PHC Figure 2
Table 1 Baseline Spring Field Data
Baseline Water Quality Data for Springs 321, 322 and 323

Attachment 2

Palmer Hydrologic Drought Index, Region 6 and 7, 1991-2006
Spring Flow Graphs for Dugout Canyon Mine Sites

Attachment 3

Palmer Hydrologic Drought Index, Region 6 and 7, 1991-2006
Well Water Level Graphs for Dugout Canyon Mine

Attachment 4

Palmer Hydrologic Drought Index, Region 6 and 7, 1991-2006
Surface Water Flow Graphs for Dugout Canyon Mine Sites

1.0 INTRODUCTION

This addition to the Dugout Canyon Mine (Dugout) PHC is being prepared in conjunction with expansion of the mine permit area to include approximately 240 additional acres to the northeastern portion of the permit area. This addition includes updates to the surface and ground water monitoring plan, updated flow and water quality information for selected monitoring sites, additional monitoring sites, and the probable hydrologic impacts of mining to the approximate 240 acres of added permit area. This addition to the PHC does not address all sections of the existing PHC, rather only those sections that either need updating with current information and are pertinent to the Dugout Mine or sections that include new data. While all sections of the existing PHC are listed in the text of this addition, the sections not changed are indicated by the text "No Changes Made".

2.0 ANALYSIS OF SURFACE AND GROUNDWATER SYSTEMS

2.1 STUDY AREA

Section 12 of T13S R12E and Sections 16, 17, 18, and 21 of T13S R13E have been added to the study area as a result of permit area expansion. Portions of the drainage areas that intersect these sections have also been added to the study area (PHC Update Figure 1). The addition to the study area includes portions of the headwaters of Pace and Dugout Canyons as well as a small portion of the headwaters of unnamed tributary (Section 17) to Cow Canyon, a tributary to Nine Mile Canyon. The expanded area lies almost exclusively within the exposed Tertiary-age Colton Formation.

2.2 METHODS OF INVESTIGATION

Methods similar to the initial PHC investigation have been employed to determine possible hydrologic consequences due to proposed mining of the 240 acre expansion and in the updating of the existing Dugout Mine portion of the PHC. Also, measured flow and selected chemistry parameters have been reviewed for existing Dugout Mine monitoring sites to determine what, if any, impacts have occurred to surface and ground water resources. Baseline field data have been collected from surface and ground water sites in the expansion area and new monitoring sites have been selected to be added to the permit water monitoring schedule. Water quality samples have been obtained and analyzed for these selected sites.

2.3 DESCRIPTION OF DATA

The 240 acre expansion sample locations are identified on Plate 7-1 and tables listing the measured field parameters are listed in PHC Update Table 1 and included in Attachment 1. Laboratory analysis results for the selected water monitoring sites in the expansion area are also included in Attachment 1. Graphs supporting the discussion regarding mining impacts to existing monitoring sites are included in Attachments 2, 3 and 4 of this document.

2.4 EXPLANATION OF CHEMICAL REPORTING UNITS AND TERMS

No Changes Made

2.5 OVERVIEW OF MINE OPERATIONS

2.5.1 HISTORY OF MINE OWNERSHIP AND OPERATION

In this PHC update, this section pertains to the operation of Dugout Canyon Mine. The Soldier Canyon Mine was idled in 1998 and has not been actively mined since that date. Future mine plans potentially include reopening the mine once the reserves at the Dugout Canyon Mine are depleted. Monitoring of the majority of the water monitoring sites associated with the Soldier

Canyon Mine was suspended in 2003.

As an update to the history of the mine ownership, a brief discussion of the ownership of the Solder Canyon and Dugout Mine properties is presented herein. Arco Coal purchased the Soldier Canyon and Dugout Mine properties from Coastal Corporation in 1996 and combined this property with the Sufco and Skyline mines to form Canyon Fuel Company, LLC. Itochu purchased from Arco a portion of Canyon Fuel Company, LLC. Arco sold its interest in Canyon Fuel Company, LLC to Arch Coal, LLC in 1998. Itochu sold its interest in the Canyon Fuel properties in 2004 to Arch Coal.

Dugout Canyon Mine was opened in 1998 when mining activities began in the Rock Canyon seam. Longwall mining moved from the Rock Canyon seam to the Gilson seam in February 2004 and has continued through 2007. It is anticipated mining will continue to occur in either the Rock Canyon or Gilson seams at this mine through at least 2013.

2.5.2 MINING TECHNIQUES AND LOCATIONS

Since the Dugout Mine was opened, the primary method of coal extraction has been using longwall techniques supported by development mining using continuous mining equipment. Initial mining within the Rock Canyon seam began with typical two- or three-entry systems for the headgates and tailgates. However, difficulties in roof control and depth of cover forced the mine to develop longwall panels that were and currently are separated by thick coal barrier pillars. Most of the future panels will be separated by barrier pillars. Improved roof control has been obtained by using the barrier pillar technique and subsidence over those panels separated by the barriers is notably less than those panels lacking the barrier pillars.

2.5.2.1 Rock Dusting

No Changes Made

2.5.2.2 Water management and discharge to Dugout and Pace Creeks

Water is collected in the Dugout Mine from numerous roof drips, fractures and faults. The water is managed through as series of sumps that include flooded gob and abandoned workings. Discharge rates and total volumes have changed throughout the years since the mine opened in 1998. Overall, between 1998 and September 2007, the average discharge rate from the mine to Dugout Creek has increased from a few gallons per minute to a rate of about 1200 gpm, though recent (July 2007) discharges rates have occasionally been higher due to power failures and interception of additional ground water. Discharge to Pace Creek from the Pace Canyon Fan portals can also average as much as 700 gpm. Both discharge rates vary according to the volume of intercepted water, holding capacities within the sumps and gobs, and power availability.

Water discharged from the mine to both Dugout Creek and Pace Creek must be compliant with the limits of the mines UPDES permit. The mine has a limit of one ton per day of Total Dissolved Solids (TDS) as part of its UPDES permit. Dugout frequently cannot meet this limit and has

entered into an agreement with the Utah Division of Water Quality to participate in a salinity reduction program within the Price River drainage. The agreement allows the mine to discharge additional tons of TDS provided the mine continues to participate in the salinity reduction program. The program was initiated in 2005 and will continue through at least 2013. Tons of TDS discharged from the mine has averaged between approximately one and nine tons per day.

2.5.2.2 Methane Extraction

Certain areas of the Dugout Mine contain methane gas. The gas is typically encountered at the mining face during both development and longwall mining. Methane gas is also released in the gob. To help reduce the volume of methane within the ventilation system of the mine, numerous methane drainage wells have been drilled and completed from the surface to above the coal seam in the developed longwall panels. The wells typically drain methane after the longwall has passed the well location. The methane drainage wells are operated until the methane concentration drops to a minimal level. The wells are then often shut in or abandoned.

Mining operations also have encountered hydrogen sulfide gases but not in the concentrations that methane gas has been encountered. Both the methane and hydrogen sulfide gasses appear to increase in volume as the depth of cover over the mined seam increases.

2.6 GEOLOGIC SETTING

2.6.1 GEOLOGY

The geologic setting of the Dugout Canyon Mine is discussed in some detail in Chapter 6 of the M&RP. The original PHC briefly describes the geologic setting of the Soldier Canyon. Other than the description of the physical location of that mine, the general description can be applied to some extent to the Dugout Canyon Mine.

2.6.2 BEDROCK FORMATIONS

No Changes Made

2.6.3 GEOLOGIC STRUCTURE

Bedrock in the Dugout Canyon Mine generally dips to the north-northeast at an average of 8 degrees. Normal faults do occur in the mine area but typically have throws measured in feet and not tens of feet. Most faults encountered underground have little or no obvious surface expression. A few faults encountered underground have produced water from the floor and roof. Typically, the flow from the roof will diminish significantly over a short period of time while flow from the roof will also diminish but may persist for several months or even years.

Fractures are also encountered during the mining process and some can produce water similar to the faults. The majority of both the fault and fracture systems trend northwest to southeast. A few

fractures and faults trend east west in the Pace Canyon area.

2.6.4 PHYSIOGRAPHY

The description contained in the original PHC is adequate for the Dugout Canyon Mine. The same elements exist both at the Soldier Canyon and Dugout Canyon Mines.

2.7 HYDROLOGY

2.7.1 CLIMATE

This section of the original PHC is adequate to describe the general climate of the Dugout Canyon Mine area.

2.7.2 HYDROLOGY

As described in the original PHC, Dugout Canyon Mine is located within the Price River Drainage. It currently operates with in the Dugout Canyon, Pace Creek, Fish Creek, and Pine Creek drainages that are tributary to the Price River drainage. The 240 acre expansion will result in the mine operating within small portions of the unnamed tributary (Section 17) of Cow Canyon a tributary to Nine Mile Canyon. Both the Price River and Nine Mile drainages are tributary to the Green River.

The general description of the function and water chemistry of the ephemeral, intermittent, and perennial streams in this section of the original PHC is adequate to describe the conditions within the existing permit area. While the 240 acre expansion includes a small portion of the Cow Canyon drainage, the mining and related minor amounts of subsidence will not occur under or near perennial streams. The segments of drainages that will be undermined are ephemeral in nature. No significant surface disturbance that would impact the drainage are planned, except a pad for the drilling of a methane drainage well(s). Ground water samples have been obtained from a few springs within the drainage and are described in Section 2.8.2 of this addendum.

2.8 HYDROGEOLOGY

No Changes Made

2.8.1 CHEMICAL EVOLUTION OF GROUND WATERS

No Changes Made

2.8.2 DESCRIPTION OF GROUND WATER SYSTEMS

This update to the PHC will concentrate on the physical characteristics of the spring locations and the flow volumes discharging from the springs associated with the Dugout Mine area. Since most

of the monitored springs are currently located outside of the mining area, flow rates where chosen to be the parameter that would most likely be impacted by mining activities. The general water chemistry of the monitored springs has not significantly changed since monitoring began.

Perched Groundwater Systems

A general discussion of perched groundwater systems in the Colton, Flagstaff, North Horn, Price River, and the Castlegate Sandstone formations, follows.

The nature and occurrence of groundwater systems in the Wasatch Plateau and Book Cliffs coal fields are described in a Geological Society of America Bulletin publication (Mayo et al., 2003). The Dugout Canyon Mine permit and adjacent area is included in the study area for this publication. This publication describes active and inactive groundwater flow systems in stratified mountainous terrains. Mayo et al. describe groundwater systems in the Dugout Canyon Mine area as occurring in one of two fundamental groundwater flow regimes. These include "active" groundwater flow systems, and "inactive" groundwater flow systems. Active zone groundwater flow paths are continuous, and responsive to annual recharge and climatic variability. Active zone groundwater systems support springs discharging at the surface in the area. Inactive zone groundwater systems have extremely limited or no communication with annual recharge. Inactive zone groundwater systems may be partitioned, occur as discrete bodies, and may occur in hydraulically isolated regions that do not have hydraulic communication with each other (Mayo et al, 2003; See also Mayo and Morris, 2000).

In the vicinity of the Dugout Canyon Mine, discharge of groundwater from geologic formations overlying mining areas occurs primarily from localized perched groundwater systems (See Appendix 7-3 for further information on shallow groundwater systems). Perched groundwater systems in the near-surface bedrock formations overlying the Dugout Canyon Mine (including the region near the permit expansion area) were noted by Waddell et al. (1986). It is noteworthy that Waddell reports perched groundwater systems encountered in some drill holes, while perched groundwater systems were not encountered in some other nearby drill holes (See Figure 19 in Waddell et al., 1986). This condition demonstrates the lack of lateral continuity in the local perched groundwater systems present in the area and also highlights the fact that meaningful potentiometric surface maps cannot be constructed for these isolated perched groundwater systems.

The presence of local perched groundwater systems overlying unsaturated strata and the hydraulic disconnect between the shallow perched groundwaters and the deep Blackhawk Formation groundwater systems encountered during mining operations is fundamentally the result of the heterogeneity of the rock sequence in the region (Mayo et al, 2003). The flow of bedrock groundwater in quantities sufficient to support discharge to springs occurs primarily within permeable sandstone strata. Groundwater flow along fault planes, bedding planes, and through rocks with fracture-enhanced permeability also occurs locally. In the rock sequence overlying the Dugout Canyon Mine area, the permeable sandstone units commonly exist as discontinuous sandstone paleochannels. Annotated photographs showing sandstone fluvial channels in the Colton Formation near Colton, Utah are presented in Figures X and Y. Also shown on Figures X

and Y are the fine-grained sediments with lower hydraulic conductivities that encase the more permeable sandstone rocks in the fluvial channels. Because of the depositional environments in which these rocks were formed, the fluvial sandstone paleochannels are commonly encased both vertically and horizontally by low-permeability rocks (shales, mudstones, and claystones; Mayo et al., 2003). Although the permeability of individual sandstone bodies may be of aquifer quality, the overall ability of these rocks to transmit water horizontally over great distances is low because of the discontinuous nature of the sandstones (Mayo et al., 2003). The surrounding low-permeability rocks impede the outward migration of groundwater from permeable strata both vertically and horizontally. The abundant presence of low-permeability strata in the rock sequence, and the discontinuous character of permeable strata prevent the appreciable downward migration of groundwater from the perched systems into deeper horizons (or into the underground mine environment; Mayo et al., 2003). As indicated in Appendix 7-3 and based on drilling data (Appendix 6-1 and 7-4), large portions of the rock sequence overlying mining areas in the Dugout Canyon Mine area do not appear to be fully saturated in the vicinity of the Dugout Canyon Mine.

Unlike the Colton, Flagstaff, North Horn, and Price River formations, which consist largely of low-permeability rocks with interbedded sandstone strata, the Castlegate Sandstone in composed primarily of sandstone rocks. However, for several reasons, large aquifers do not form in the Castlegate Sandstone. The Castlegate Sandstone is not a uniform sand deposit. Rather, interbedded with the lenticular fluvial braided sandstone horizons are repeating sequences of mudstone drapes or depositional bounding surfaces (Mayo et al., 2003). The permeabilities of the mudstone drapes are typically many times lower than that of the surrounding sandstone. Consequently, although portions of the Castlegate Sandstone are sufficiently permeable to facilitate groundwater flow, the interbedded mudstones drapes partition and isolate these sandstone units such that the overall ability of the formation to transmit water both laterally and vertically over significant distances is poor (Mayo et al., 2003). Where Castlegate Sandstone discharge is present, it is most commonly associated with the presence of fracturing or jointing. Additionally, the potential for recharge to the Castlegate Sandstone is low. The pervasiveness of low-permeability strata in the geologic formations overlying the Castlegate prevents appreciable recharge to the formation from vertical leakage from the overlying formations. Additionally, because of the limited surface exposure of the Castlegate Sandstone in the area, the potential for groundwater recharge directly onto the Castlegate is low. As discussed above, the observation that the Castlegate Sandstone does not support many springs in the region and that much of the formation was dry when drilled supports these conclusions (See drilling data in Appendix 6-1 and Appendix 7-4). Because geologic and hydrogeologic conditions in the Castlegate Sandstone in the proposed expansion area are believed to be very similar to those in surrounding areas in the Book Cliffs coal field, it is considered probable that the hydrogeologic behavior of Castlegate Sandstone groundwater systems in the proposed expansion area will be consistent with the Castlegate Sandstone groundwater flow conditions described regionally by Mayo (2003).

It should be noted that although there appear to be large areas of unsaturated low-permeability rock surrounding the perched groundwater systems, saturated low-permeability strata are likely also present locally in the rock sequence. However, the rate of movement of water in the low permeability strata is commonly several orders of magnitude less than that in the permeable

sandstone horizons (Mayo et al., 2003; Waddell, 1986). Consequently, groundwater in these horizons likely exists mostly under relatively stagnant conditions and is not of much consequence to the hydrologic balance.

The shallow, perched groundwater systems in the Dugout Canyon Mine area are likely recharged where the up-dip ends of the sandstone beds or fractured bedrock strata are exposed at the land surface in wet areas, or where the beds are directly overlain by water-bearing alluvial or colluvial sediments. Recharge to the sandstones from overlying saturated shallow fractured bedrock may also occur. Recharge to the sandstone strata via direct vertical leakage from overlying, competent, low-permeability strata is probably low (Waddell, 1986).

Discharge rates from shallow, perched groundwater systems overlying mining areas in the Dugout Canyon Mine generally exhibit both seasonal and climatic variability (see Appendix 7-3 and flow information submitted to the Division's online hydrology database). Most springs discharging from perched systems respond rapidly to the annual snowmelt recharge event, followed by a rapid waning of discharge rates later in the year. These conditions are indicative of shallow groundwater systems that are in good hydraulic communication with shallow, active recharge sources (i.e., active zone groundwater systems). These conditions are not commonly observed in springs discharging from large aquifers with large storage volumes (Waddell, 1986).

Groundwater flow directions in the perched groundwater systems are constrained largely by the geometry of the permeable sandstone strata through which the groundwater is conveyed. In the general sense, it may be stated that perched groundwaters flow from up-dip recharge areas to topographically lower discharge areas. However, because the sinuous geometries and subsurface locations of individual three-dimensional sandstone paleochannels (or other fractured or permeable strata) are difficult to delineate in the subsurface, the determination of concise groundwater flow directions within these bodies is problematic.

Discharge from the perched groundwater systems commonly occurs where the down-dip ends of the permeable sandstones or bedrock fractures or bedding planes intersect the land surface (Waddell, 1986; Mayo et al., 2003). In some localities, the presence of bedrock fracturing or jointing within sandstone channels enhances the hydraulic conductivity locally. It is not uncommon for the spring discharge locations from perched groundwater systems to coincide with the occurrence of local bedrock fracturing (Mayo et al., 2003). Where fracturing of the bedrock is present at groundwater discharge locations, spring discharge locations are commonly focused into discrete spring locations rather than as diffuse seepage through porous rock.

Potentiometric Surface Maps

A fundamental assumption underlying the construction of a potentiometric surface contour map is that there is a continuously saturated, interconnected aquifer that is present over a substantial aerial extent. Because there are no identified aerially extensive groundwater regimes in the strata overlying coal mining areas in the Dugout Canyon Mine area (See Appendix 7-3), and the probable lack of connection between the individual small perched groundwater systems, it is not possible or

scientifically correct to draw potentiometric surface contour maps for these groundwater systems at a reasonable scale. While potentiometric surface contour maps of individual small, perched groundwater systems could conceivably be created at a local scale, it would be impractical and of limited value to do so. Consequently, potentiometric surface contour maps depicting groundwater conditions cannot be presented here.

Delineation of Likely Recharge Areas for Springs in the Expansion Area

While it is not possible to precisely delineate the recharge areas for individual springs using the existing hydrogeologic data, a determination of the most probable recharge area is possible using existing geologic, hydrogeologic, and topographic information. A discussion of the most probable recharge areas for springs in the expansion area is presented below.

Two springs (260 and 260A) have been identified within the boundaries of the expansion area that has the possibility of being impacted by subsidence. The Division of Water Rights (DWRi) has indicated two other springs are located in the eastern portion of Section 17, T 13 S R 13 E and within the permit expansion area. However, these springs were not found in the original seep and spring survey or subsequent surveys. Dugout has committed to take the water right owners to the DWRi mapped locations to verify whether or not these springs do indeed exist.

A few other springs, 261, 262, 262A, 263, 263A, have been identified in the nearby surrounding areas outside the permit area. These springs are outside the area where subsidence would potentially occur and are separated from the underlying coal seams by more than 2,000 feet of cover. Mining impacts to the recharge area of these springs will only occur in a very small portion of the recharge area and will likely be similar to spring 260. Because of this, the impacts to the springs outside the permit and subsidence area have not been considered individually. The potential for impacting these springs is considered negligible.

Spring 260 is part of the mine's water monitoring program and thus has several years of data that can be analyzed. Spring 260A is not part of the water monitoring program. Both springs appear to discharge from the same shallow groundwater system as they are in close proximity to one another and discharge at similar elevations. Therefore, it is assumed that mining induced impacts to these two springs would be similar in nature.

Spring 260 discharges from the east side of the canyon wall near the bottom of the local surface-water drainage. The spring discharges from the Colton Formation at an elevation of about 8600 feet above sea level. Because groundwater must recharge in an area topographically higher than the spring discharge location in order to provide driving hydraulic head, the recharge area for the spring must lie at an elevation greater than 8600 feet. As shown in Figure 2 and Plate 7-1, areas higher than 8600 feet in elevation that could potentially be recharge areas for spring 260 are present in the region to the southeast of the spring and also in the region to the northwest of the spring. Both of these areas are situated along the crest of the Book Cliffs escarpment and are truncated on both the north and south by incised drainages and escarpments.

Because of the considerable discharge from spring 260, which averaged 20.0 gpm between 2000 and 2007, it seems unlikely that sufficient recharge to support the spring could occur on the small surface area situated on the very steep slopes of the south-facing Book Cliffs escarpment above an elevation of 8600 feet immediately south of the spring area (Figure 2). Rather, it seems more likely that the relatively flat and broad high-elevation plateau surfaces above 8600 feet as depicted on Figure 2 and Plate 7-1 could provide recharge in sufficient quantities to support the observed discharge at the spring.

The sedimentary rocks in the vicinity of the Dugout Canyon Mine area dip at about 8 degrees to the north-northeast (Appendix 7-3). The strike of the rock formations in the area is approximately coincident with the trend of the Book Cliffs escarpment. Similarly, most minor fracture orientations in the coal seams and in the adjacent rock formations trend in roughly the same direction as the strike of the Book Cliffs escarpment (Appendix 7-3). Assuming a primarily northerly component to the bedrock dip in the area, the high- elevation area situated to the southeast of the spring seems more likely to be the recharge area for spring 260 than the high-elevation area to the northwest. This conclusion is based on the assumption that most of the northwest area would be stratigraphically down-dip of the spring area. The observation that spring 260 emanates from the east side of the canyon seems to support this conclusion. Consequently, the area to the southeast of spring 260 at an elevation above 8600 feet and stratigraphically up-dip of the spring location is considered the most likely recharge area for the spring (Figure 2). While the maximum lateral extent of the recharge area from the spring discharge location is not known, an arbitrary (and likely conservative) estimate of about 1.6 miles is delineated on Plate 7-1 and on Figure 2.

It is interesting to note that the maximum possible depth of circulation for the groundwater system that supports spring 260 is less than about 350 feet (maximum topographic elevation in the probable recharge area minus the spring discharge elevation). This observation supports the conclusion that spring 260 originates from a shallow, perched groundwater system and not from a large aquifer of regional extent.

It should be noted that although the spring discharges from the east side of the canyon, it is possible that the sandstone channel or fracture network that focuses discharge to the spring is continuous on both the east and west sides of the canyon near spring 260. Consequently, it is possible that the groundwater recharge area could also include portions of the high-elevation region to the northwest of the spring depicted on Figure 2, although this is considered a less likely scenario.

Spring 261 discharges from near the bottom of the canyon a short distance north of the expansion area boundary. As discussed above, the potential for impact to this spring is considered negligible and consequently a delineation of a most probable recharge area for this spring has not been performed. However, it is likely that this spring, as well as other similar nearby springs, recharge by mechanisms similar to that at spring 260. Like spring 260, the springs further north in the unnamed tributary of Cow Canyon (springs 261, 262 and 262A, Section 17) are likely not recharged from infiltration on the steep slopes of the north facing slopes of the Book Cliffs escarpment. Again, similar to spring 260, these springs probably receive recharge from broad upland areas to

the east-southeast.

Surface runoff from the majority of the land surface in the expansion area drains to the Cow Canyon drainage. Discharges from the localized perched Colton Formation groundwater systems in the vicinity contribute baseflow discharge to streams in the expansion area and sustain discharges in portions of the drainage during the summer and fall months and during wet years. During the spring snowmelt event and in response to torrential precipitation events, streamflow in the drainages are augmented by surface runoff. After the spring runoff season is complete, there is typically not a sufficient contribution of groundwater to the surface water systems and many reaches of the stream drainages in the expansion area are dry. There is no discharge from a regional type aquifer system to the stream drainages in the expansion area. Consequently, because impacts to the localized perched Colton Formation groundwater systems are not anticipated, detrimental impacts to baseflow in the stream drainages are likewise not anticipated.

As shown on Plate 5-7 in Chapter 5 of the M&RP, the projected magnitude of subsidence in the area of the unnamed tributary to Cow Canyon Drainage in T13S, R13E, Section 17 is small (<1 foot). The thickness of the overburden above the coal seam to be mined in the vicinity of the drainage exceeds 2,000 feet. Because of the minimal projected subsidence and the thick overburden, the potential for large subsidence cracks to form at the surface is considered low. While subsidence cracking can occur along escarpment margins where confining pressures are low, the potential for large aperture subsidence cracks to form in the bottom of the stream channel is considered very low because of the confining pressures of the surrounding rock strata. Consequently, the potential for diminution of stream flow in the unnamed tributary of Cow Canyon due to direct interception of stream water into open subsidence cracks in the channel bottom is considered low.

Additionally, based on "rule-of-thumb" estimates for the height of upward propagation of fracturing above longwall mined areas commonly utilized in Utah coal mining areas, it is likely that a thick sequence of unfractured rock strata will persist above longwall mined areas after subsidence in the area is complete. As a conservative estimate, assuming a mining height of 10 feet and a 50:1 upward fracture propagation height to mining height ratio, it is estimated using these assumptions that the fractures overlying longwall mined areas would extend upward about 500 feet. Above this interval, rock strata (particularly the fine-grained shaley strata) tend to deform ductilly (i.e., the rocks tend to bend rather than fracture). Based on visual inspection, it is commonly assumed that surface tension cracks that sometimes form at the land surface overlying longwall panels extend for only a few tens of feet below the land surface. Thus, it is estimated that there would likely be many hundreds of feet of in-tact rock strata overlying longwall mined areas with relatively uncompromised hydraulic properties which would minimize the potential for downward migration of fluids. Consequently, the potential for the loss of stream water in the unnamed tributary to the Cow Canyon drainage to deep strata or into the mine workings is considered remote.

As described above, the potential for significantly diminished discharge rates from the perched groundwater systems that support springs and provide baseflow to the unnamed Cow Canyon tributary in the proposed expansion area as a result of coal mining in the Dugout Canyon Mine is

considered low. This is primarily because of the large thickness of overburden and the small projected subsidence magnitude in the area. Additionally, the abundant presence of low-permeability strata in the geologic sequence of the overburden minimizes the potential for downward migration of surface-waters or groundwaters into deeper horizons. Accordingly, the potential for impacts to baseflow in the unnamed Cow Canyon tributary as a result of mining activities is considered low.

2.8.2.1 Colton Ground Water System

The Colton Formation forms the plateau within the expansion area and contains the additional springs to be monitored as part of the expansion. The original text discusses two springs that have been evaluated in the Soldier Canyon area, G96 and #45. Two springs have been included in the Dugout Canyon Mine water monitoring plan and are designated as Springs SC-65 and 260. Figures contained in Attachment 2 illustrate the history of the flow monitored at springs SC-65 and 260. Spring SC-65 has been monitored since October 1995 while Spring 260 has been monitored since June 2000. Both springs and their recharge areas are located north and outside the areas that have been undermined and subsided by Dugout Mine. Both springs demonstrate seasonal flows. The variability of the flow from SC-65 appears to follow the pattern of drought and wet cycles as illustrated on the Palmer Hydrologic Drought Index figure included in Attachment 2. Flow from Spring 260 somewhat follows the cycle of drought and wet but not quite as clearly as SC-65.

Two new Colton springs have been added to the water monitoring plan for Dugout Mine. These two springs are 321 and 322. Spring 321 is located in the NE1/4 of Section 18 T13S R13E and Spring 322 is located in the NW1/4 of Section 22 T13S R13E. Both springs are located outside the area that is planned to be mined and subsided. Flows from these two springs were first gathered in May 2007 followed by measurements obtained in June, July, August, and October. Graphs of these flows are contained in Attachment 2. Measured flows appear to drop from a high following spring runoff to baseline conditions by August.

2.8.2.2 Flagstaff Ground Water Systems

The Flagstaff Formation is present in the Dugout Canyon area and in the 600 acre expansion. However, the formation thins to the east and eventually pinches out near the eastern portion of the mine permit area. Currently, the mine monitors two springs in the Flagstaff Formation, SC-100 and SP-20. Spring SP-20 was monitored briefly between June 1976 and October 1979. Monitoring of the spring was resumed in August 1997 and has continued through the present (October 2007). Spring SC-100 has been monitored since 1995 and continues to the present.

The graph of measured flow for SP-20 clearly demonstrates seasonal flows that are impacted significantly by drought and wet cycles. This spring is located outside the area that has been undermined by Dugout Mine. The recharge area for this spring is also likely to be outside the area affected by current Dugout mining operations.

Spring SC-100 is located upstream of the mine operations in the Dugout Creek drainage. It issues from the side of a stream bank near the bottom of the channel. According to water monitoring personnel, flows monitored between 1997 and 2002 may have included portions of the adjacent creek. Changes in the stream channel and spring discharge have allowed the flow of the spring to be monitored separately from the stream flow. The spring is located at least three fourths of a mile north of the current mine workings and is unlikely to have been impacted by mining operations.

No new monitoring sites are proposed for the Flagstaff Formation as part of the 240 acre expansion.

2.8.2.3 North Horn Ground Water Systems

Dugout Mine currently monitors five springs discharging from the North Horn ground water system. These springs are SC-14, SC-116, SC-200, SC-203, 259, and spring 259A. Graphs illustrating the flow of the springs are located in Attachment 2. SC-14 was monitored briefly between 1976 and 1979. Dugout mine started monitoring the flows again in 1995 and the monitoring has continued through at least October 2007. Flows from the spring appear be influenced by seasonal and climatic variations in precipitation. This spring is located north and west of the current Dugout Mine workings and flow data obtained from this spring does not indicate impacts due to mining.

Spring SC-116 flow was first monitored at this site in October 1995 with regular monitoring initiated in November 1998. This spring is located in a tributary to Pace Creek and overlies a longwall panel Dugout Mine is likely to mine in 2008-2009. Historical flows indicate ground water discharge volume from the spring is related to cycles of drought and wet. Between June 2001 and November 2004, flow volumes were less than 2 gpm. Through the wetter cycle of 2005, flows increased. Then in the drier period of 2006, the flows once again diminished.

Spring SC-200 is located in a tributary to Rock Creek and is located southeast of current mine workings. This spring typically has no flow or flows less than 1 gpm. The recharge area for this spring is likely located south and east of the current mine plan and is unlikely to be impacted by planned future mining. Lack of flow at this site makes it difficult to determine how it is impacted by changes in climatic cycles. This site is important, however, since it appears to be the only accessible and reliable source of ground water discharge in this drainage.

Spring SC-203 is located in Pace Canyon and is east and outside of current and future mine workings. It is a developed spring that is used to water cattle. The flow graph of the spring illustrates flows typically between 2.5 and 5 gpm with occasional flows slightly less or greater. Flow was measured in the spring of 2003 at more than 20 gpm but that rate appears to be anomalous to other recorded flows. Spring flows do not appear to typically be impacted by climatic changes.

Spring 259 is associated with a slump in a side drainage of Pace Canyon. In 2002, the monitored discharge location moved as a result of renewed slumping. Monitoring of the original discharge point was continued even though groundwater no longer discharged from this location. The ground water currently discharges from a point a few hundred feet downstream of the original monitoring

point. The slump was probably reactivated as a result of saturation from natural causes. Ground water continues to flow from the as reported through field observations noted by personnel monitoring the original site. A new monitoring point, 259A, was added to the monitoring program in July of 2007. This spring has been developed by the landowner for livestock watering and is located upstream of 259 and outside the slump area. Previous measurements of the discharge rates obtained in 2006 indicate the flow in early spring was about 1 gpm. The spring flows decrease by fall to approximately 0.25 gpm. In the 2007, the spring flows gradually deceased through the summer and by September, the flow essentially ceased. This spring and its recharge area have not been subsided to date. However, the area may be subsided in 2008.

2.8.2.4 Price River Ground Water System

The text of the original PHC includes the Castlegate Sandstone within the Price River Formation. For purposes of this text, the Castlegate Sandstone will continue to be included as part of the Price River Formation.

During early baseline studies of the Dugout Mine area two springs were reported to discharge from the Price River Formation, springs SC-80 and 227. Spring SC-80 was initially intended to be included in the mine ground water monitoring plan. However, subsequent visits to the site resulted in no spring being found. Therefore, the site was not added to the plan. Spring 227 has been monitored since 2000 but no flow has yet to be observed discharging at this location. The lack of flow is not surprising based on the data and observations presented in the original PHC.

2.8.2.5 Blackhawk Ground Water Systems

2.8.2.5.1 Springs

No Changes Made

2.8.2.5.2 Blackhawk Formation Wells

The format of the original PHC included most of the ground water wells in the Soldier Canyon Mine and Dugout Mine area within this section. However, several of the wells are completed in formations other than the Blackhawk. Two ground water wells in the immediate area of the mine are included in the Dugout Mine water monitoring plan. These two wells, GW-10-2 and GW-11-2, are located north and down dip of the current Dugout Mine workings.

The water level in GW-10-2, which is completed in the Castlegate Sandstone, has been monitored since June of 1987 as reported in the original PHC. Depth to water was initially 716.0 feet. Water level data presented in the original PHC indicate the level in the well more or less was dropping between June 1987 and May 1995. The last reading obtained in 1985 indicated a water level 726.5 feet below top of casing. Dugout Mine began reporting water levels in March 1998 when the water level was measured at 732.0 feet below top of casing. Data collected by the mine indicates the water level has continued its general decline to a low of 745.0 feet below top of casing in May 2007

(See graph in Attachment 3).

As discussed in the original PHC, the cause for the decline in water level is unknown. The relatively steady rate of decline of the water level in the well does not appear to be relatable to the timing of underground mining and subsidence at the Dugout Canyon Mine. The rate of decline before mining appears to have continued after mining at Dugout commenced.

The water level in GW-11-2, a well completed in the Price River Formation, has been measured by Dugout Mine since August 1997. An earlier measurement, November 4, 1982, presented in the original PHC indicates the water level in the well to be 1127.39 feet below the top of casing. Dugout Mine's first reported water level on August 27, 1997 indicates the water level was 1120.90 feet below top of casing. By June 30, 1998 the water level had dropped to1128.5 feet below top of casing. It remained within a few feet of that level until June 15, 2006 when the water level was measured at 1116.17 feet below top of casing. The cause of the fluctuations in the water level of about 12 feet is unknown.

Soldier Canyon Mine

The Soldier Canyon Mine was idled in 1998. The portals were temporarily backfilled with soil and mine water discharge ceased. No water has discharged from the mine since the portals were sealed.

Dugout Canyon Mine

Water is collected in the Dugout Mine from numerous roof drips, fractures and faults. Currently, the highest volume of water entering the mine appears to discharge from intercepted fractures and faults with minor offset. The majority of the water discharging to the mine from the fractures and faults flows up through the floor. Overall rates of inflow of ground water to the mine also increase, independently of the fracture flow, as longwall panels are mined. Often longwall mining will intercept isolated aquifers above the roof of the mine that discharge water at a few tens to a few hundred gallons per minute after the coal has been removed. The flows associated with these isolated aquifers typically are short lived and either cease flowing altogether or significantly diminish in rate. Inflows from faults or fractures also diminish over time but at a much slower rate.

The ground water entering the mine is managed through as series of sumps that include flooded gob and abandoned workings. Discharge rates have changed throughout the years since the mine opened in 1998. From 1998, all of the water discharged from the mine was directed into Dugout Creek. Overall, between 1998 and September 2007, the average discharge rate from the mine to Dugout Creek has increased from a few gpm to over 1200 gpm. Beginning in July of 2007, a portion of the mine water has been discharged to Pace Creek through the Pace Canyon Portals. Discharge to Pace Creek from the Pace Canyon Fan portals can also average 700 gpm or more. Both discharge rates vary according to the volume of intercepted water, holding capacities within the sumps and gobs, and power availability.

It is important to note that before the construction of the Dugout Canyon Mine, two abandoned mine workings within the Gilson Seam were flooded to near the mouth of their old portals. In fact, the old Gilson workings on the east side of the canyon actually discharged water at the surface at a few gallons per minute to Dugout Creek. These workings were eventually drained by the mine for use as a sump. The flooded old Gilson seam workings on the west side of the canyon has also been used as a sump by the Dugout Canyon Mine.

2.8.2.6 Star Point Sandstone Ground Water System

As was observed and reported in the original PHC, no springs had been found discharging from the Star Point Sandstone in the Soldier Canyon and Dugout Canyon Mine areas. However, subsequent field studies found one spring, SC-64, that may be related to the Star Point Sandstone. This spring, however, is not part of the monitoring plan. Two samples were obtained from the site and field parameters were measured. The samples indicate the water has a slightly alkaline pH (7.5) and relatively high specific conductance (1011 -1112 mmho)

2.8.2.7 Mancos Shale Ground Water System

No Mancos Shale ground water discharge has been observed in the Dugout Mine permit area. As noted in the original PHC, typical TDS concentrations of water associated with the Mancos Shale are about 10,000 mg/L. Water this brackish has not been found within the mine therefore suggesting water sources discharging to the mine are unlikely to include the Mancos Shale.

3.0 PROBABLE HYDROLOGIC CONSEQUENCES

This section contains a description of the probable hydrologic consequences of operating the Dugout Canyon since 1997 and the additional 240 acres to be added to the mine area in 2008. The consequences are based on the observations and conclusions of the original PHC, observed reactions of surface and ground water to mining at Dugout Canyon Mine since 1997, and projected future potential impacts to these water systems due to mining.

3.1 POTENTIAL ADVERSE IMPACTS TO THE HYDROLOGIC BALANCE (728.310)

Coal mining has the potential to impact the hydrologic balance by:

1. Decreasing creek flows and spring discharges by capturing surface or other ground waters,
2. Increasing creek flows and spring discharges by increasing discharge rate of ground water from the Blackhawk ground water system, and
3. increasing ground water recharge rates to overlying ground water systems.

3.1.1 Potential for Decreasing Creek Flows and Spring Discharges

Coal mining has the potential to decrease creek flows and spring discharges by capturing water

from these sources as a result of mine related subsidence, bedrock fracturing, and aquifer dewatering.

Decreasing Creek Flows

Generally, since subsidence began at the Dugout Canyon Mine, surface tension cracks have been noted in limited locations, typically on canyon rims that have been undermined. On the surface of the plateau overlying the mine and at the base of the drainages that bifurcate the plateau, cracks have been noted in the soils and alluvium covering bedrock. However, these cracks soon naturally heal and are no longer obvious. Surface runoff continuously entering subsidence cracks has not been observed in this area. Graphs illustrating the monitored flow volumes of the surface drainages in the Dugout Creek Mine area are included in Attachment 4.

Four surface water monitoring points have been established to record, on a quarterly basis, the flows in the Dugout, Pace, and Rock Canyon Creeks. DC-1 is located in the main stem of Dugout Creek below the mine site. DC-2 is located in the Left Fork just upstream of the mine site. DC-3 is located in the Right Fork just upstream of the mine site. Additionally, DC-4 and DC-5 have been established in the Left Fork of Dugout Creek and are monitored on a five year basis at permit renewal. Site PC-1A is located on Pace Creek upstream of currently planned mining activity and at the eastern permit boundary. PC-2 is located on Pace Creek downstream of planned mining activities and near the permit boundary. PC-3 is located in Pace Creek just downstream of the confluence of Pace Creek and an unnamed tributary in the south half of Section 20, Township 13 South, Range 13 East. This site was established in September 2007. RC-1 is located on Rock Creek downstream of any planned mining activities and near the southeastern boundary of the permit area (Plate 7.1 of the MRP).

The monitored flows within the Dugout Creek drainage system will be discussed first followed by Pace Creek and then Rock Canyon Creek flows. Dugout Canyon Mine has subsided minor portions of the Right Fork of Dugout Creek with single seam mining in the Gilson seam. As stated earlier, DC-3 was established to monitor flows in the Right Fork. A graph of the monitored flows at DC-3 between August 1997 and May 2007 is included in Attachment 4. The peaks that occur in 1998 and 2001 appear to be flows measured during spring runoff. A short segment of the Right Fork of Dugout Creek was subsided when coal was extracted from the Gil 2 panel in April 2005. Flows in the stream appear to be impacted more from natural wet and drought cycles than by mining subsidence. No extra ordinary decreases in flow in the Right Fork were noted after mining and subsidence occurred.

The Left Fork of Dugout Creek has not been subsided. Flows measured at DC-2 appear to follow the drought-wet cycles noted in the Palmer Hydrologic Drought Index for this area.

The graph of Dugout Creek at site DC-1, which is located downstream of the mine, also does not show an abrupt change in flow volume at the time of subsidence in the Right Fork. However, it is important to note, the flow volume of Dugout Creek downstream of the mine is impacted by discharge from the mine to the creek at a point upstream of DC-1. Discharge from the mine began

in March 2002.

Flows in Pace Creek have monitored on a quarterly basis at PC-1A and PC-2 since September 1999 and June 2000, respectively. Flow data was also collected at PC-2 from April 1978 to October 1979. Mining has not occurred upstream of PC-1A and no flow impacts from mining subsidence are anticipated. Flow measured at PC-2 also does not appear to have decreased as a result of mining and subsidence in the area. Mining and subsidence did not occur in the area upstream of this monitoring point until May 2005. Flows in Pace Creek at PC-2 currently appear to be controlled by the cycles of wet and drought. PC-3 was established at the time of the writing of this update and data will be collected at this site beginning in 1st quarter of 2007.

The flows in Rock Canyon Creek are monitored at site RC-1. The graph of the flows at site RC-1 illustrates the creek seldom contains water at this point. In fact, flows are typically seen in the creek bed at this site during significant snow melt runoff or after heavy precipitation events. No portions of the creek are currently planned to be subsided.

Surface runoff from the majority of the land surface in the expansion area drains to the Cow Canyon drainage. Discharges from the localized perched Colton Formation groundwater systems in the vicinity contribute baseflow discharge to streams in the expansion area and sustain discharges in portions of the drainage during the summer and fall months and during wet years. During the spring snowmelt event and in response to torrential precipitation events, streamflow in the drainages are augmented by surface runoff. After the spring runoff season is complete, there is typically not a sufficient contribution of groundwater to the surface water systems and many reaches of the stream drainages in the expansion area are dry. There is no discharge from a regional type aquifer system to the stream drainages in the expansion area. Consequently, because impacts to the localized perched Colton Formation groundwater systems are not anticipated, detrimental impacts to baseflow in the stream drainages are likewise not anticipated.

As shown on Plate 5-7 in Chapter 5 of the M&RP, the projected magnitude of subsidence in the area of the unnamed tributary to Cow Canyon Drainage in T13S, R13E, Section 17 is small (<1 foot). The thickness of the overburden above the coal seam to be mined in the vicinity of the drainage exceeds 2,000 feet. Because of the minimal projected subsidence and the thick overburden, the potential for large subsidence cracks to form at the surface is considered low. While subsidence cracking can occur along escarpment margins where confining pressures are low, the potential for large aperture subsidence cracks to form in the bottom of the stream channel is considered very low because of the confining pressures of the surrounding rock strata. Consequently, the potential for diminution of stream flow in the unnamed tributary of Cow Canyon due to direct interception of stream water into open subsidence cracks in the channel bottom is considered low.

Additionally, based on "rule-of-thumb" estimates for the height of upward propagation of fracturing above longwall mined areas commonly utilized in Utah coal mining areas, it is likely that a thick sequence of unfractured rock strata will persist above longwall mined areas after subsidence in the area is complete. As a conservative estimate, assuming a mining height of 10 feet and a 50:1

upward fracture propagation height to mining height ratio, it is estimated using these assumptions that the fractures overlying longwall mined areas would extend upward about 500 feet. Above this interval, rock strata (particularly the fine-grained shaley strata) tend to deform ductilly (i.e., the rocks tend to bend rather than fracture). Based on visual inspection, it is commonly assumed that surface tension cracks that sometimes form at the land surface overlying longwall panels extend for only a few tens of feet below the land surface. Thus, it is estimated that there would likely be many hundreds of feet of in-tact rock strata overlying longwall mined areas with relatively uncompromised hydraulic properties which would minimize the potential for downward migration of fluids. Consequently, the potential for the loss of stream water in the unnamed tributary to the Cow Canyon drainage to deep strata or into the mine workings is considered remote.

As described above, the potential for significantly diminished discharge rates from the perched groundwater systems that support springs and provide baseflow to the unnamed Cow Canyon tributary in the proposed expansion area as a result of coal mining in the Dugout Canyon Mine is considered low. This is primarily because of the large thickness of overburden and the small projected subsidence magnitude in the area. Additionally, the abundant presence of low-permeability strata in the geologic sequence of the overburden minimizes the potential for downward migration of surface-waters or groundwaters into deeper horizons. Accordingly, the potential for impacts to baseflow in the unnamed Cow Canyon tributary as a result of mining activities is considered low.

As described in the original PHC, the water intercepted underground during mining is likely moving north toward the Uinta Basin and eventually toward the Green River. The mine is currently removing only a small portion of the ground water contained in the overall regional system that would discharge to the Green River. Once mining is complete, it is likely the mine workings will flood to an elevation at or slightly below the mine portals, similar to the flooding of the old Gilson workings located in Dugout Canyon. Ground water in the Dugout Mine area will continue to migrate north and down dip toward the Uinta Basin.

Decreasing Spring Flows

As described in preceding sections of this PHC Update, flows in monitored springs do not appear to have been measurably decreased by mining activities. Two spring monitoring sites have recorded changes in flows: spring SC-100 as erosion has moved the stream channel away from the ground water discharge point allowing more accurate flow measurements and spring SC-259 as a result of reactivated movement of the slump from which is discharges. Neither of these two springs have been subsided nor has their likely recharge areas. Spring 227 was undermined in April 2007 but flow records of this spring indicate it is typically dry.

Mining will include subsiding springs in the Pace Canyon, Dugout Canyon, and Cow Canyon drainages (Plate 7.1 of the PHC). The majority of these springs are located in the same drainages as monitored springs. The potential exists that flow from these springs may be decreased for a short period of time or their discharge points moved. The springs generally discharge from the North Horn, Flagstaff or Colton Formation. The depth of cover between the spring discharge

locations and their recharge area and the mine workings themselves exceed at least 1000 feet. While subsidence fracturing associated with mining at these depths does occur at the surface, it typically has not resulted in creating pathways from the surface to the mine workings. Typically, surface cracks only extend a few tens of feet into the bedrock before attenuating. Below that depth, the bedrock will typically react more plastically and bend, rather than break, as the ground over the mine longwall panels subside. The North Horn, Flagstaff, and Colton Formations contain significant beds of fine grained material, such as shale, siltstone, and claystone that will tend to heal if fractured. This healing process would likely stop or restrict rapid downward migration of water either from the surface or from aquifers.

Subsidence of a portion of the aquifers that feed these springs may cause recharge to temporarily "pool" in the subsided portion, thus temporarily decreasing discharge. Surface cracking of the aquifer may also result in the discharge point of the spring moving either laterally or vertically downward a few feet. While this phenomenon has not been noted in this area, it has been observed at other mine sites within the Book Cliffs area and the Wasatch Plateau. However, it is not anticipated there will be a loss of water to the Pace Canyon drainage system.

Springs within the Dugout Canyon drainage that may be undermined discharge from either the North Horn or Flagstaff Formations. As with the springs located in the Pace Canyon drainage, decreased flow or changes in discharge locations are possible. However as discussed in the preceding paragraphs, permanent decreases in flow volumes are unlikely and over all discharge of ground water volumes in the drainage are unlikely.

Several springs discharge from the Colton Formation north and east of the current permit area and the 240 acre expansion area within the Cow Canyon drainage. Spring 260 is currently part of the Dugout Canyon Mine water monitoring program. The monitored flows are included in graphic form in Attachment 2 of this document. Discharges of this flow show a strong relationship to seasonal variations in precipitation. The springs in the Cow Canyon drainages appear to be stratigraphically controlled. That is, they appear to discharge at the down dip end of an exposed stratigraphic unit within the Colton Formation. Because the Colton Formation contains interbedded sandstones, siltstones, and shales, it is likely these springs discharge at the base of a sandstone overlying a less permeable unit such as shale or siltstone. This observation is generally supported by the topography of the spring areas. The springs appear to discharge at a break in topography where there is change from a relatively steep slope to a more gentle slope. There is also a potential for some of the springs to be both stratigraphically and structurally controlled. In other words, the springs discharge from a fracture within a permeable layer overlying a less permeable layer. Unfortunately, the thick soil mantle in the area precludes observation of structure near the discharge location.

Mining in the northeastern most portion of the permit area and within the 240 acre expansion area could decrease flows at or alter the discharge location for spring 260 and 260A. It appears the recharge area for these springs is to the south/southeast and overlies a small portion of one panel. However, interruption of spring flow volume would likely be short-lived. Where Dugout Mine has designed longwall panels separated by thick barrier pillars, surface expressions of subsidence have

been much less than where barrier pillars are not left in place. Projected surface subsidence at the spring locations is likely to be less than one feet. The recharge area is more than 2000 feet above the projected mine workings. Any interruption of flow would likely be temporary as the subsidence created low areas within the aquifer itself filled with recharge. Because of the fine-grained nature of the bedrock units, diversion of water from the aquifer into underlying bedrock units is unlikely. If the spring discharges are also structurally controlled, new surface fractures related to subsidence may move the springs a few tens of feet either laterally or vertically. Overall, continued flow from the springs will continue to enter the Cow Canyon drainage.

Two new springs will be added to the Dugout water monitoring plan, 321 and 322 (Plate 7.1 of the MRP). Spring 321 is located north east of 260 in a small tributary to Cow Canyon. Spring 322 is located southeast of 260 and 321 in a tributary drainage of Cow Canyon. Tributary containing 322 runs roughly parallel to the tributary that contains 260 and 321. Some development work has been performed at spring 321. Both springs are outside of the area to be subsided. Since all of the springs, with the exception of 260 and 260A, within the Cow Canyon drainage lie outside of the area to be mined and subsided, and the limited portions of the recharge area for the majority of the springs will be subsided, it seems unlikely a decrease in ground water discharge will occur. Also, it is unlikely discharge points will move for these springs as a result of mining.

3.1.2 Potential for Increasing Creek Flows and Spring Discharges

Increasing Creek Flows

Dugout Canyon Mine discharges mine water to both Dugout Creek and Pace Creek at permitted UPDES discharge points. Increases in stream flows are likely to be limited to Dugout Creek and Pace Creek, the mine has no other discharge points planned at this time. In the original PHC, Mayo and Associates estimated the maximum ground water discharge rate from Dugout Canyon Mine would be approximately 800 gpm. That estimate was based on the assumption that Dugout Canyon Mine would produce about 1.0 million tons of coal per year. However, the mine has produced and currently is planned to produce between three and four million tons per year. That is three to four times the initial rate of production described in the original PHC.

In the summer of 2007, the Dugout Canyon Mine has discharged at a rate between1900 and 2800 gpm through its UPDES discharge points. The rate at which the mine discharges water is based upon the volume of water intercepted, water contained in the sumps and old workings, and the reliability of electrical power delivered to the mine. Early in the mining of the Rock Canyon and Gilson seams, ground water generally discharged from perched aquifers encountered in the Blackhawk Formation. As mining has progressed down dip, water discharging from fractures encountered in the mine floor, and to a lesser degree the mine roof, have become more prominent. It is estimated that more than half the total inflow to the mine is currently associated with flows moving through fractures or faults.

For the next several years as mining progresses north and down dip in the coal seams and deeper into the potentiometric surface of the underlying aquifers that discharge through the floor of the

mine, inflow rates are likely to increase. However, as mining is then shifted to the southeast portion of the permit area (between Pace and Rock Canyons) and up dip in the coal seams, inflow rates from sources below the mine will likely be much less. Inflows to the mine at that time will be more likely dominated by inflows from isolated perched aquifers in the overlying Blackhawk Formation.

Increasing Spring Flows

Temporary increases of spring flows may be noted as the aquifers are compressed during subsidence. This is typically a transient phenomenon that ceases once the compressive and tensional forces within the subsided bedrock become static. In a few cases, spring flows may experience more long term increases if fracturing in the aquifer allows additional stored ground water to discharge at the spring location.

3.1.3 Potential for Increasing the Ground Water Recharge to Overlying Ground Water Systems

No Changes Made

3.2 IMPACTS OF PROPOSED COAL MINING AND RECLAMATION OPERATION (728.330)

3.2.1 Whether Acid-forming or Toxic Forming Materials Are Present that Could Result in the Contamination of Surface or Ground Water Supplies (728.331)

The original PHC did not anticipate the construction, operation, reclamation of the Dugout Wasterock Site. However, subsequent revisions to the permit addressed the probable hydrologic consequences of creating the wasterock site. This issue is addressed in the document attached to the MRP titled "Refuse Pile Amendment, February 2003".

The remainder of this section has not been changed.

3.2.2 Impact on Acidity, Total Suspended and Dissolved Solids and Other Important Water Quality Parameters of Local Impact (728.332)

Mining in the Dugout Mine area should not affect the water quality of adjacent ground waters or springs since the ground water system in the mine layers is locally compartmentalized both vertically and horizontally.

Total Suspended Solids (TSS) above background concentration may increase in areas where road building or facilities construction may occur. Additionally, where subsidence occurs, down cutting may result and increase sediment load in the stream flow. It is also likely that subsidence will result in low areas where deposition of sediments will occur. TSS measured in the mine water discharge is typically at or near background levels.

Water discharged from the mine to Dugout Creek, and recently to Pace Creek, has contained total

dissolved solid (TDS) concentrations ranging between 830 and 2440 mg/L. The concentration of TDS in the mine water is dependant upon the quality of the ground water encountered and residence time within the sumps and abandoned. It is apparent that the longer water is held underground in sumps and old workings, the higher the TDS values rise. Therefore, the mine has tried to balance the need for storage time to allow for the settlement of suspended solids while limiting the amount of time water stays in contact with the coal and overburden in the gob or abandoned flooded workings. Total iron concentrations in the water can either increase or decrease with the amount of oxygenation the mine water is subjected to or contact time the water has with exposed coal.

Initially in 2002 when mine water discharge began, Dugout mine discharged water with TDS concentrations between 1300 and 1500 mg/l at rates between 40 and 250 gpm with occasional higher spikes. Over time, the TDS concentration increased until the end of 2006. Since that time, discharge rates have nearly tripled but the TDS concentration has dropped to less than 1000 mg/l. The drop in TDS concentration is related in part to an increase in mine inflows and a reduction in residence time of the water.

The TDS level of the water discharged from the mine is currently about twice what the concentration in Dugout Creek was prior to mine water being discharged. However, it is important to note, prior to mine discharge, it was not uncommon for the creek to quit flowing within a few miles downstream of the mine location by mid to late summer. The water that was available was diverted a few miles downstream of the mine site east into the Pace Canyon drainage and used to grow alfalfa crops. The remaining water left the cultivated fields and flowed downstream across the Mancos Shale before eventually discharging to Grassy Trail Creek and then to the Price River. TDS concentrations in the stream, as it flowed downstream, continued to increase. Dugout Creek did not and currently does not contain a known fishery. Water in the stream is still used for cultivation of alfalfa. Wildlife and cattle also use the stream as a source of drinking water. The current TDS concentration of the water discharged from the mine is within the range established by the Utah Division of Water Quality for use by livestock.

Dugout Mine began discharging water to Pace Creek in the area of the mine's Pace Canyon Fan Portal. This water has been similar in quality to the mine water discharged at Dugout Creek. The water, when discharged from the mine, enters Pace Creek and eventually is diverted to water the same alfalfa fields as Dugout Creek waters. At this time, it is unknown if the mine will increase, decrease, or maintain the current discharge rates at the two locations.

To mitigate discharging into Dugout and Pace Creeks increased TDS volumes greater than one ton per day allowed by its UPDES permit, tributaries to the Colorado River System, the mine has participated in a salinity reduction program. To allow the mine to participate in the program, a cost per removal of a ton of TDS from the Price River Basin was determined by the appropriate State and Federal agencies. The mine determined the total projected life of the mine, the average tons of TDS per month over that period, and multiplied the total tons by the cost per ton of removal. That amount was then paid in three equal annual installments to the Utah Division of Water Quality. The money was then made available to pay for projects that would remove tons of TDS from the Price River equivalent to the tons of TDS the mine discharged in excess of one ton per day. To the best of the mine's knowledge, this program overall has been successful in reducing the TDS

concentration in the upper Colorado River Basin.

Total iron concentrations with the mine discharge waters have on occasion been measured at levels higher than background numbers obtained from Dugout and Pace Creek. However, under normal operating conditions total iron concentrations in the mine water is less than 1 mg/l, the UPDES limit for the mine water discharge.

3.2.3 Impact on Ground Water and Surface Water Availability (728.334)

As described in Sections 3.1 and 3.2, it is anticipated that continued mining in the Dugout Canyon Mine and the 240 acre expansion will not affect the availability of ground water. However, mining will increase the baseflow of both Dugout Creek and Pace Creek. There should be no sustained increase of the surface water flows in Cow Canyon.

4.0 CONCLUSIONS

No significant changes are proposed for this section since the basic conclusions reached in the original PHC, only an addition of text. Monitoring of springs and surface waters in the Dugout Canyon Mine area since1998 has indicated there is no hydraulic connection between the mine and surface waters. Also, except for increasing the baseflow in Dugout and Pace Creeks, the effects of coal mining in the Dugout Canyon Mine within the Blackhawk Formation on overlying springs and surface water is and should continue to be negligible.

5.0 RECOMMENDATIONS

5.1 SOLDIER CANYON MINE

No Changes Made

5.2 DUGOUT CANYON MINE

5.2.1 Monitoring Wells

No new monitoring wells are proposed for the Dugout Canyon Mine at this time. It is recommended the wells included in the monitoring plan continue to be measured.

5.2.2 Streams

A new stream monitoring point, 323, associated with the 240 acre expansion area is proposed in Section 18, T13S R 13E for the Dugout Canyon Mine. It is recommended the stream be monitored as per the surface water monitoring plan contained in Chapter 7 of the MRP.

5.2.3 Springs

Two new spring monitoring points are proposed for the Dugout area. The springs are located adjacent to the 240 acre expansion in the northeast portion of the permit area and within the Cow Canyon drainage. The springs are designated as sites 321 and 322. It is recommended these springs be monitored as per the ground water monitoring plan contained in Chapter 7 of the MRP.

6.0 REFERENCES CITED

~~No Changes Made~~

Mayo, A.L., Morris, T.H., Peltier, S., Petersen, E.C., Payne, K., Holman, L.S., Tingey, D., Fogel, T., Black, G.J., and Gibbs, T.D., 2003, Active and inactive groundwater flow systems: Evidence from a stratified, mountainous terrain, GSA Bulletin: December 2003: V. 115: no. 12; p. 1456-1472.

Mayo, A.L., and Morris, T.H., 2000, Conceptual model of groundwater flow in stratified mountainous terrain, Utah, USA in Groundwater: Past achievements and future Challenges, Sililo et al. ed: Proceeding XXX IAH Congress on Groundwater, Capetown South Africa, 26 November – 1 December, 2000, p. 225-229.

Waddell, K.M., Dodge, J.E., Darby, D.W., and Theobald, S.M., 1986, Hydrology of the Price River Basin, Utah with emphasis of selected coal-field areas, U.S. Geological Survey Water-Supply Paper 2246.

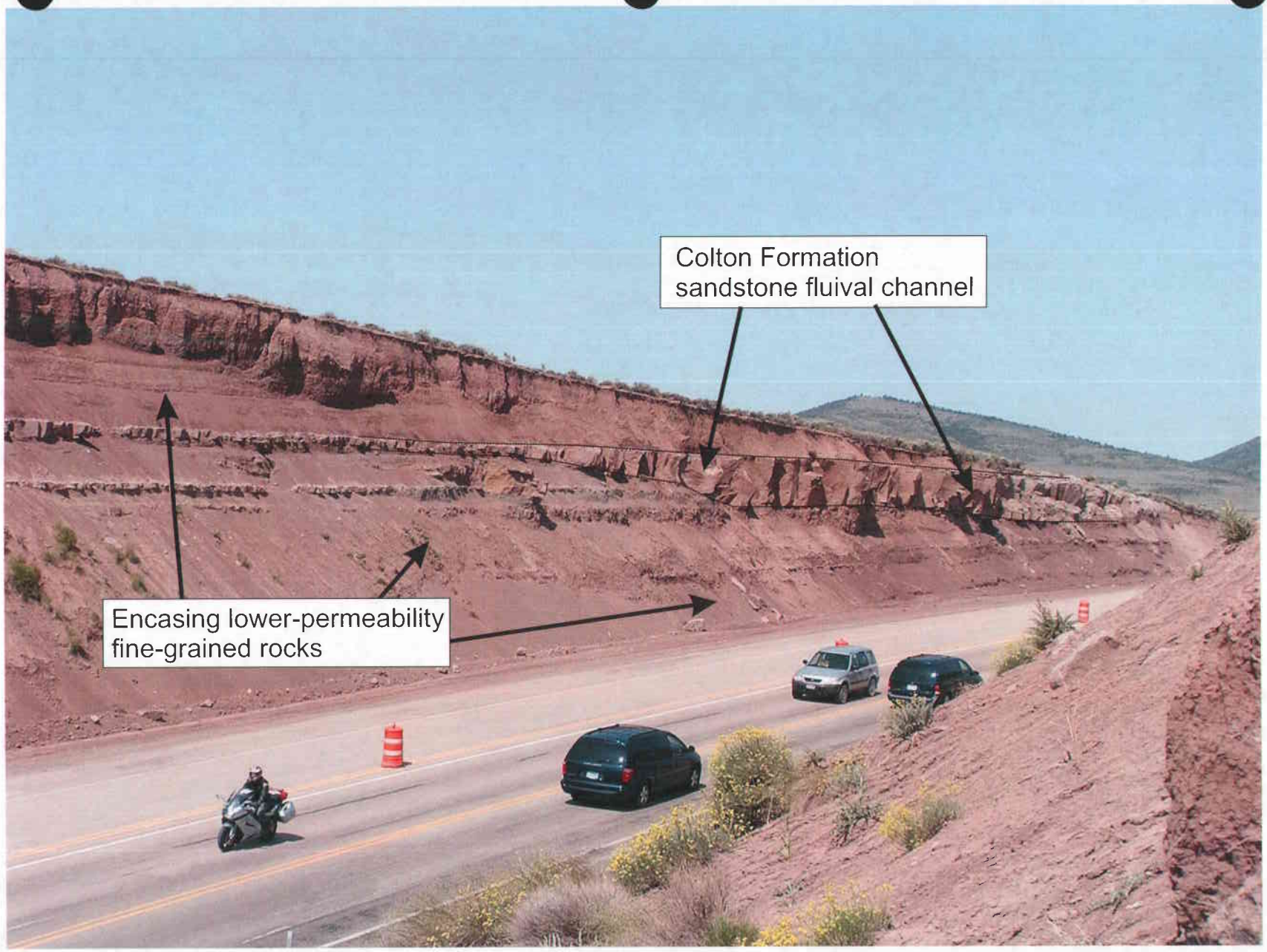


Figure X Annotated photograph showing fluvial channel and encasing lower-permeability fine-grained rocks in a road cut in the Colton Formation near Colton, Utah.

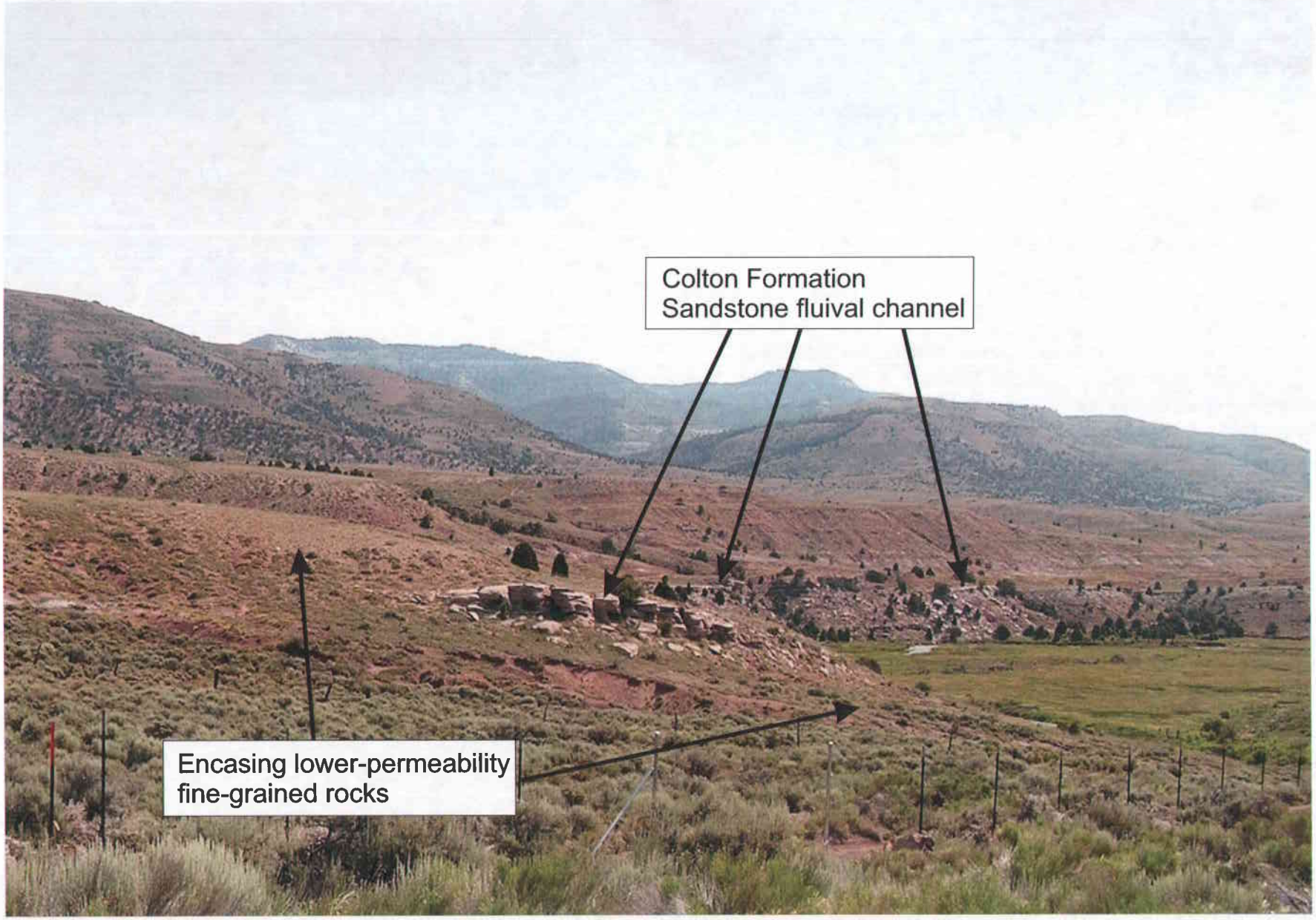
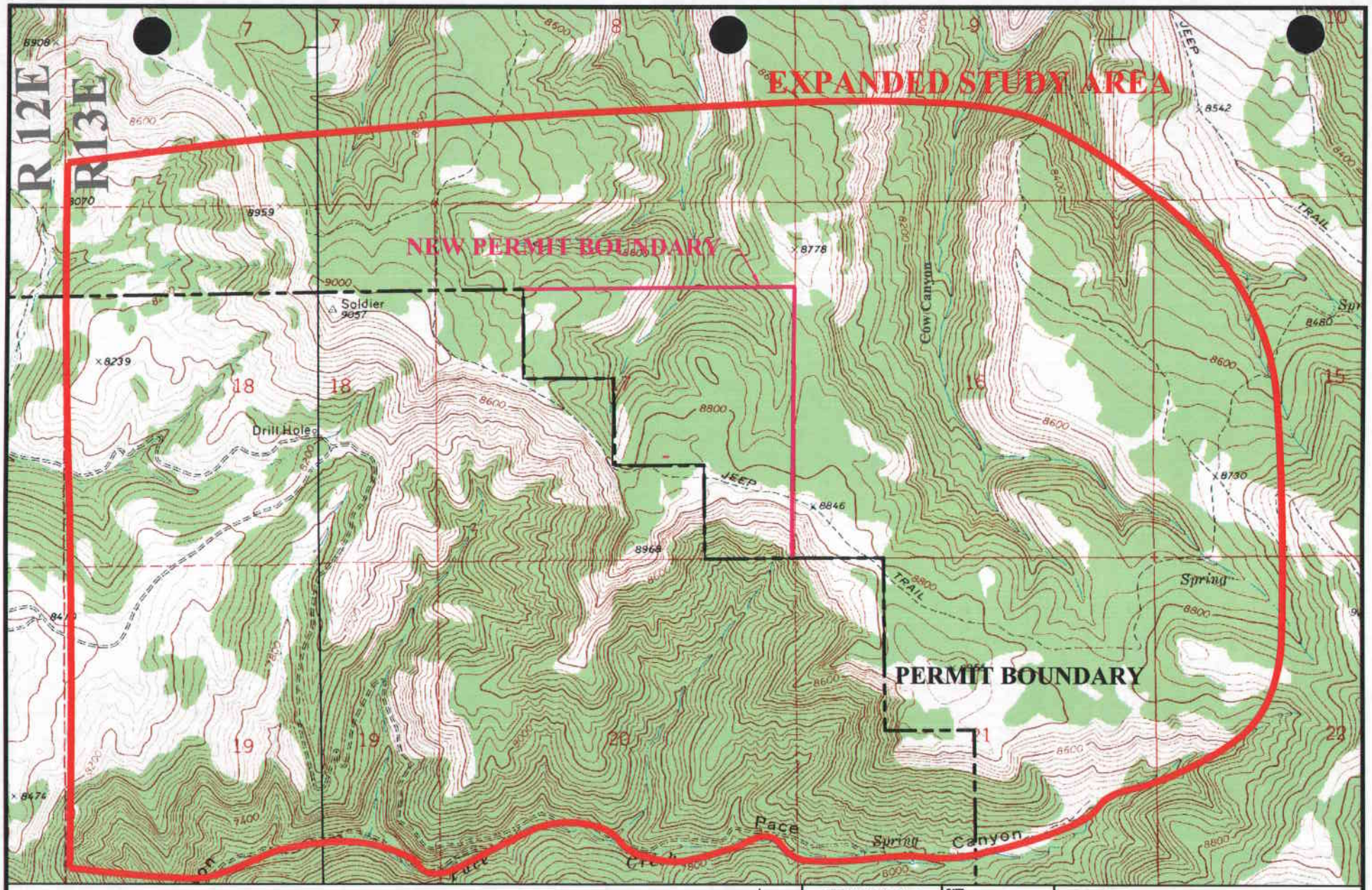


Figure Y Annotated photograph showing surface erosional exposure of fluvial channels and encasing lower-permeability fine-grained rocks in the Colton Formation near Colton, Utah.

ATTACHMENT 1

PHC Update Figure 1
Recharge Area Figure 2
Table 1 600 Acre Baseline Spring Field Data
Baseline Water Quality Data for Springs 321, 322 and 323



T 13S R 13E

PERMIT BOUNDARY

REVISIONS OR UP-DATES			DATE: 4-15-08
NO.	DATE	BY	DESIGNED BY:
			DRAWN BY: SC/VSM
			CHECKED BY:
			SCALE: 1"=2000'

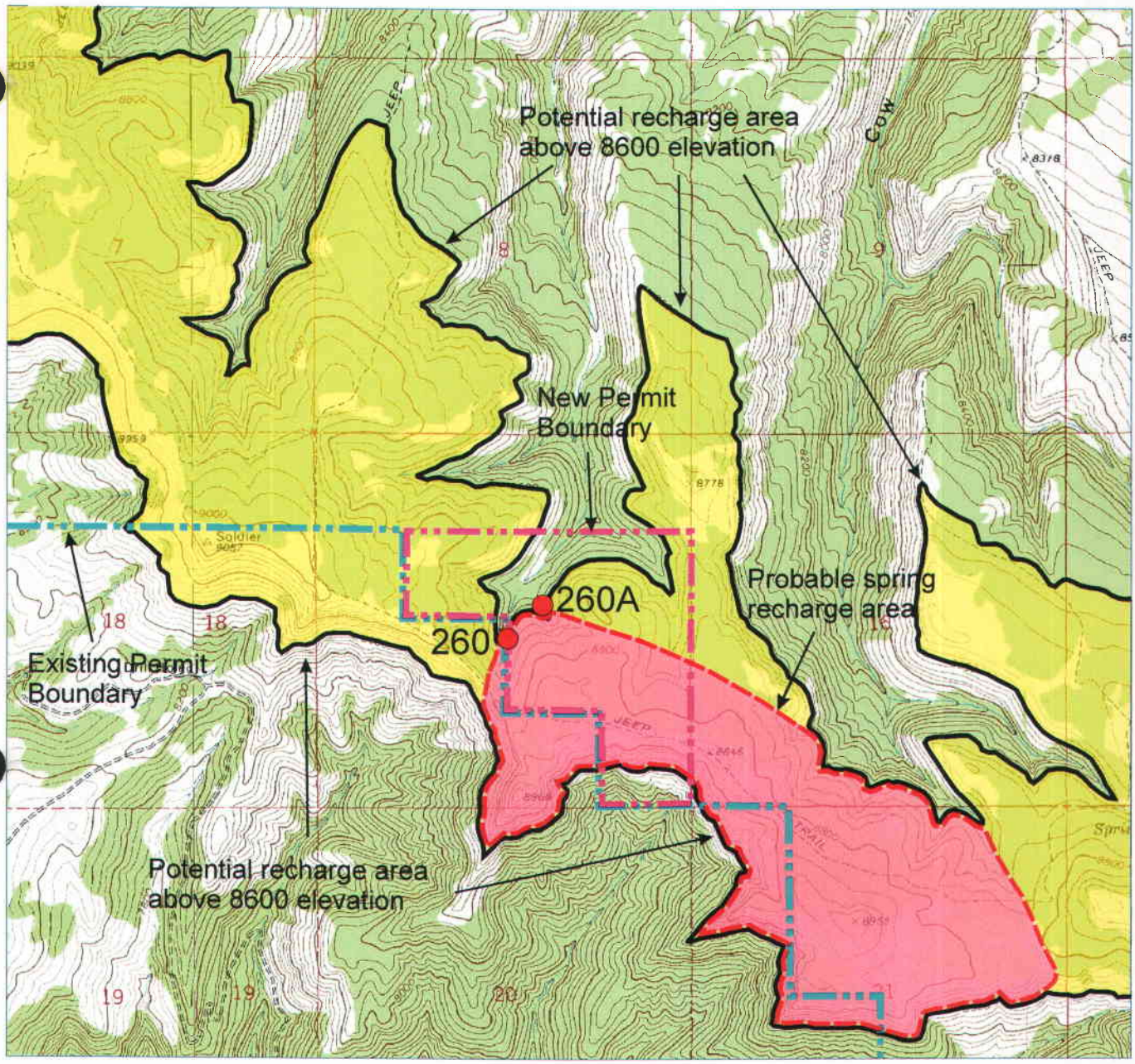
FILENAME: PHC FIGURE 1.DWG

Canyon Fuel Company, LLC
Dugout Canyon Mine

PHC FIGURE 1

P.O BOX 1029
WELLINGTON, UTAH 84542

DRAWING OR MAP NUMBER



PETERSEN HYDROLOGIC, LLC
recharge.cdr 11 April 2008

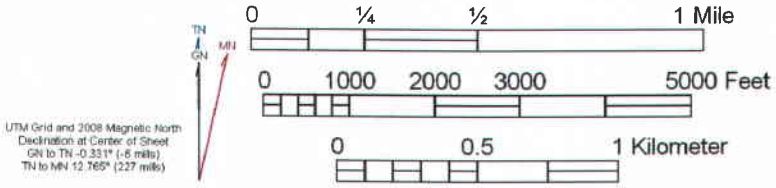


Figure 2 Probable recharge area for springs 260 and 260A.

"321" Monitoring Data 2007

Date	Time	pH	Cond.	Temp.	Flow (gpm)	Comments
3/15/07	1220				NOA	Snow/Ice
5/18/07	1420	8.08	406	4	1.5	
6/21/07	1114	8.11	410	7.6	1.3	
7/24/07	834	7.38	469	8.5	0.75	
8/30/07	1205	7.42	471	8	0.7	

"322" Monitoring Data 2007

Date	Time	pH	Cond.	Temp.	Flow (gpm)	Comments
3/15/07	1220				NOA	Snow/Ice
6/21/07	905	7.84	704	7	18	
7/24/07	916	7.91	698	9	0.2	Livestock
8/30/07	1130	7.91	663	11	0.1	Livestock

"323 (Junction)" Monitoring Data 2007

Date	Time	pH	Cond.	Temp.	Flow (gpm)	Comments
3/15/07	1220				NOA	Snow/Ice
5/18/07	1340	7.80	591	11	17	
6/21/07	1220	7.9	621	12.5	20.5	
8/30/07	1345	8.4	675	14	13	Livestock Use

SPRING 211				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/11/2007	693	8.01	3	1.5
6/15/2007	653	7.8	7.6	0.62

SPRING 211A				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/11/2007	527	7.63	2	2.5
6/15/2007	538	7.73	9.3	0.48

SPRING 213				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/11/2007	499	7.55	10	SEEP
6/15/2007				NO FLOW

SPRING 214				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/11/2007	561	7.34	5	0.5
6/15/2007				NO FLOW

SPRING 262				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/18/2007	411	7.98	5	7
6/21/2007	359	8.04	8.1	7
8/30/2007	422	8.18	11	7

SPRING 262A				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
6/21/2007	401	7.82	7.8	10.5
8/30/2007	413	7.9	8	6

SPRING 263				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/18/2007	390	7.17	4	1.5
6/21/2007	408	7.69	11.7	0.75
8/30/2007	-	-	-	NO FLOW

SPRING 263A				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
6/21/2007	403	7.91	8.1	0.6
8/30/2007	-	-	-	NO FLOW

SPRING 300				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/11/2007	496	7.92	10	0.25
6/15/2007	449	8.23	11.2	0.22

SPRING 301				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/11/2007	469	7.48	5	0.5
6/15/2007				NO FLOW

SURFACE WATER 320				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/18/2007	550	7.7	12	10

SPRING 260A				
Date	Conductivity mmhos	pH	Temperature C	Flow gpm
5/18/2007	369	7.64	5	6
6/21/2007	358	8.09	8.6	2.5
8/30/2007	400	8.1	8	0.8

MEMORANDUM
COALGEO, LLC

Date: January 5, 2008

Subject: Fracture Control of Springs in the central part of Section 17, T13S, R13E

To: Vicky Miller (Dugout Canyon Mine)

From: Alex Papp (Coalgeo, LLC)

Based upon review of available geologic information and mining experience at Dugout Canyon Mine, it is my opinion that the groundwater flowing at the springs located in the central part of Section 17, T13S, R13E originate from faults and/or major fractures. The geographical location of the springs, the significant amount of flow, the apparent thin alluvium/colluvium, the small restricted catchment area, and documented faults and/or major fractures within the vicinity leads me to this conclusion.

The major fracture orientation within this area of the Dugout Canyon Mine averages N65^{o}W (295°) and is based on a substantial database of underground and surface measurements (See Attachment, Structural Framework). IntraSearch, Inc. produced a photogeologic map in 2005 that depicts faults and/or major fractures within the vicinity of the drainage where the springs are located (See Attachment; IntraSearch Photogeologic Map). The orientations are consistent with that measured at the Dugout Canyon Mine. Other geologic investigations also support the orientation and occurrence of faulting specific to the drainage where the springs are located (See Attachment: Doelling, H.H., 1970; Central Utah Coalfields). Faults and fractures commonly serve as conduits for groundwater flow and are well documented at the Dugout Canyon Mine.

LICENSED PROFESSIONAL GEOLOGIST
ALEXANDER R. PAPP
5218643-2250
1-5-08
STATE OF UTAH

Structural Framework
Current Longwall Area (Gil 5 – Gil 8)

- **Strike of coal seam – N57°W (303°); Dip – 6.9° (12%)**

- **Low to moderate fault frequency**

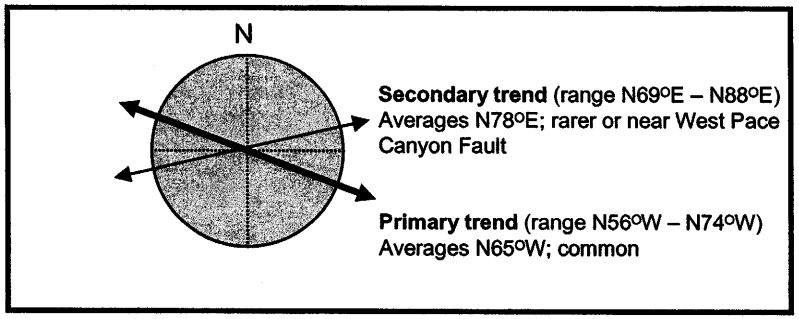
  West Pace Canyon Fault; orientation N79°E (079°); downthrown on North; maximum displacement 22'; normal; delineated by underground drilling

  East Pace Canyon Fault orientation N74°W (286°); downthrown on South: Maximum displacement 12.5'; normal; evidence of lateral movement; intercepted in mine

- **Primary joint and major cleat orientation averages N65°W (295°)**

  High cleat frequency, parallels joint trend
  Joints difficult to distinguish in mine roof; spacing not well defined
  Joints/faults appear to be important conduits/reservoir for gas and groundwater

Fracture Trends



R 13 E

T 13 S

T 13 S

R 13 E

STRATIGRAPHIC LEGEND

PHOTOGEOLOGIC MAP OF AN AREA IN CARBON COUNTY, UTAH

GEOLOGIC SYMBOLS

Prepared by
IntraSearch
Denver, Colorado

Scale: 1:12,000

REVISIONS OR UP-DATES			DATE: Jan. 5, 2006	
NO.	DATE	BY	DESIGNED BY:	
			DRAWN BY:	A. Papp
			CHECKED BY:	
			SCALE:	As shown
FILENAME: ####				

Canyon Fuel Company, LLC
Dugout Canyon Mine

Photogeologic Map by IntraSearch, Inc.
Dugout Canyon Mine Area

P.O BOX 1029
WELLINGTON, UTAH 84542

DRAWING OR MAP NUMBER

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 320

ACZ Sample ID: ***L62749-02***
Date Sampled: *05/18/07 12:55*
Date Received: *05/22/07*
Sample Matrix: *Surface Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							05/29/07 12:24	erf

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	58.4			mg/L	0.2	1	06/01/07 7:37	djt
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	06/01/07 7:37	djt
Iron, total	M200.7 ICP	1.08			mg/L	0.02	0.05	06/01/07 20:02	msh
Magnesium, dissolved	M200.7 ICP	28.4			mg/L	0.2	1	06/01/07 7:37	djt
Manganese, dissolved	M200.7 ICP		U		mg/L	0.005	0.03	06/01/07 7:37	djt
Manganese, total	M200.7 ICP	0.025	B		mg/L	0.005	0.03	06/01/07 20:02	msh
Potassium, dissolved	M200.7 ICP	1.0	B		mg/L	0.3	2	06/01/07 7:37	djt
Sodium, dissolved	M200.7 ICP	14.5			mg/L	0.3	2	06/01/07 7:37	djt

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		227			mg/L	2	20	05/31/07 0:00	cas
Carbonate as CaCO3		16	B		mg/L	2	20	05/31/07 0:00	cas
Hydroxide as CaCO3			U		mg/L	2	20	05/31/07 0:00	cas
Total Alkalinity		243		*	mg/L	2	20	05/31/07 0:00	cas
Cation-Anion Balance	Calculation								
Cation-Anion Balance		5.4			%			06/07/07 0:00	calc
Sum of Anions		5.3			meq/L	0.1	0.5	06/07/07 0:00	calc
Sum of Cations		5.9			meq/L	0.1	0.5	06/07/07 0:00	calc
Chloride	325.2 / SM4500Cl-E	3	B		mg/L	1	5	05/30/07 14:05	jlf
Residue, Filterable (TDS) @180C	160.1 / SM2540C	290			mg/L	10	20	05/24/07 8:56	lcp
Residue, Non-Filterable (TSS) @105C	160.1 / SM2540C		U	*	mg/L	5	20	05/25/07 15:00	cas
Sulfate	SM4500 SO4-D	20	B	*	mg/L	10	50	05/30/07 9:52	seb
TDS (calculated)	Calculation	278			mg/L	10	50	06/07/07 0:00	calc
TDS (ratio - measured/calculated)	Calculation	1.04						06/07/07 0:00	calc

** Please refer to Qualifier Reports for detail.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Organic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 320

ACZ Sample ID: ***L62749-02***
Date Sampled: *05/18/07 12:55*
Date Received: *05/22/07*
Sample Matrix: *Surface Water*

Oil & Grease, Total Recoverable

Analysis Method: **1664A - Gravimetric**
Extract Method:

Workgroup: WG225514
Analyst: tam
Extract Date:
Analysis Date: 05/29/07 13:40

Compound	CAS	Result	QUAL	Dilution	XQ	Units	MDL	PQL
Oil and Grease			U	1.031		mg/L	2	10

** Please refer to Qualifier Reports for detail.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 321

ACZ Sample ID: ***L63413-01***
Date Sampled: *06/21/07 00:00*
Date Received: *06/25/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							06/27/07 19:18	erf

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	77.5			mg/L	0.2	1	07/03/07 13:37	msh
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	07/03/07 13:37	msh
Iron, total	M200.7 ICP	1.59		*	mg/L	0.02	0.05	07/05/07 22:24	djt
Magnesium, dissolved	M200.7 ICP	22.5			mg/L	0.2	1	07/03/07 13:37	msh
Manganese, dissolved	M200.7 ICP		U		mg/L	0.005	0.03	07/03/07 13:37	msh
Manganese, total	M200.7 ICP	0.024	B		mg/L	0.005	0.03	07/05/07 22:24	djt
Potassium, dissolved	M200.7 ICP	1.0	B		mg/L	0.3	2	07/03/07 13:37	msh
Sodium, dissolved	M200.7 ICP	9.2			mg/L	0.3	2	07/03/07 13:37	msh

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		270			mg/L	2	20	06/26/07 0:00	lcp/jlf
Carbonate as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Hydroxide as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Total Alkalinity		270			mg/L	2	20	06/26/07 0:00	lcp/jlf
Cation-Anion Balance	Calculation								
Cation-Anion Balance		6.1			%			07/10/07 15:15	calc
Sum of Anions		5.4			meq/L	0.1	0.5	07/10/07 15:15	calc
Sum of Cations		6.1			meq/L	0.1	0.5	07/10/07 15:15	calc
Chloride	325.2 / SM4500Cl-E	3	B	*	mg/L	1	5	07/02/07 15:00	aml/jag
Residue, Filterable (TDS) @180C	160.1 / SM2540C	290			mg/L	10	20	06/28/07 15:50	jlf
Sulfate	SM4500 SO4-D		U	*	mg/L	10	50	07/03/07 9:20	aeh
TDS (calculated)	Calculation	275			mg/L	10	50	07/10/07 15:15	calc
TDS (ratio - measured/calculated)	Calculation	1.05						07/10/07 15:15	calc

** Please refer to Qualifier Reports for detail.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 321

ACZ Sample ID: ***L64797-01***
Date Sampled: *08/30/07 12:05*
Date Received: *09/04/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							09/05/07 14:15	bjl

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	75.9			mg/L	0.2	1	09/06/07 3:00	djt
Iron, dissolved	M200.7 ICP	0.03	B		mg/L	0.02	0.05	09/06/07 3:00	djt
Iron, total	M200.7 ICP	0.24			mg/L	0.02	0.05	09/06/07 20:31	erf
Magnesium, dissolved	M200.7 ICP	22.1			mg/L	0.2	1	09/06/07 3:00	djt
Manganese, dissolved	M200.7 ICP	0.014	B		mg/L	0.005	0.03	09/06/07 3:00	djt
Manganese, total	M200.7 ICP	0.007	B		mg/L	0.005	0.03	09/06/07 20:31	erf
Potassium, dissolved	M200.7 ICP	1.1	B		mg/L	0.3	2	09/06/07 3:00	djt
Sodium, dissolved	M200.7 ICP	10.0			mg/L	0.3	2	09/06/07 3:00	djt

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		274			mg/L	2	20	09/06/07 0:00	lcp
Carbonate as CaCO3			U		mg/L	2	20	09/06/07 0:00	lcp
Hydroxide as CaCO3			U		mg/L	2	20	09/06/07 0:00	lcp
Total Alkalinity		274			mg/L	2	20	09/06/07 0:00	lcp
Cation-Anion Balance	Calculation								
Cation-Anion Balance		4.3			%			09/17/07 0:00	calc
Sum of Anions		5.5			meq/L	0.1	0.5	09/17/07 0:00	calc
Sum of Cations		6.0			meq/L	0.1	0.5	09/17/07 0:00	calc
Chloride	325.2 / SM4500Cl-E	2	B	*	mg/L	1	5	09/10/07 12:59	mls
Residue, Filterable (TDS) @180C	160.1 / SM2540C	290			mg/L	10	20	09/04/07 16:22	lcp
Sulfate	SM4500 SO4-D		U		mg/L	10	50	09/05/07 9:14	aeh
TDS (calculated)	Calculation	276			mg/L	10	50	09/17/07 0:00	calc
TDS (ratio - measured/calculated)	Calculation	1.05						09/17/07 0:00	calc

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 322

ACZ Sample ID: ***L64797-02***
Date Sampled: *08/30/07 11:30*
Date Received: *09/04/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							09/05/07 15:10	bjl

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	91.6			mg/L	0.2	1	09/06/07 3:04	djt
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	09/06/07 3:04	djt
Iron, total	M200.7 ICP	8.27			mg/L	0.02	0.05	09/06/07 20:35	erf
Magnesium, dissolved	M200.7 ICP	41.3			mg/L	0.2	1	09/06/07 3:04	djt
Manganese, dissolved	M200.7 ICP	0.014	B		mg/L	0.005	0.03	09/06/07 3:04	djt
Manganese, total	M200.7 ICP	0.512			mg/L	0.005	0.03	09/06/07 20:35	erf
Potassium, dissolved	M200.7 ICP	1.5	B		mg/L	0.3	2	09/06/07 3:04	djt
Sodium, dissolved	M200.7 ICP	25.7			mg/L	0.3	2	09/06/07 3:04	djt

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		390			mg/L	2	20	09/06/07 0:00	lcp
Carbonate as CaCO3		6	B		mg/L	2	20	09/06/07 0:00	lcp
Hydroxide as CaCO3			U		mg/L	2	20	09/06/07 0:00	lcp
Total Alkalinity		396			mg/L	2	20	09/06/07 0:00	lcp
Cation-Anion Balance	Calculation								
Cation-Anion Balance		2.8			%			09/17/07 0:00	calc
Sum of Anions		8.6			meq/L	0.1	0.5	09/17/07 0:00	calc
Sum of Cations		9.1			meq/L	0.1	0.5	09/17/07 0:00	calc
Chloride	325.2 / SM4500Cl-E	2	B	*	mg/L	1	5	09/10/07 13:01	mls
Residue, Filterable (TDS) @180C	160.1 / SM2540C	430			mg/L	10	20	09/04/07 16:23	lcp
Sulfate	SM4500 SO4-D	30	B		mg/L	10	50	09/05/07 9:19	aeh
TDS (calculated)	Calculation	432			mg/L	10	50	09/17/07 0:00	calc
TDS (ratio - measured/calculated)	Calculation	1.00						09/17/07 0:00	calc

** Please refer to Qualifier Reports for details.*

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Soldier Creek Coal Company
Project ID:
Sample ID: 322

ACZ Sample ID: ***L63413-02***
Date Sampled: *06/21/07 00:00*
Date Received: *06/25/07*
Sample Matrix: *Ground Water*

Inorganic Prep

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Total Hot Plate Digestion	M200.2 ICP							06/27/07 19:30	erf

Metals Analysis

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Calcium, dissolved	M200.7 ICP	91.4			mg/L	0.2	1	07/03/07 13:40	msh
Iron, dissolved	M200.7 ICP		U		mg/L	0.02	0.05	07/03/07 13:40	msh
Iron, total	M200.7 ICP	0.69		*	mg/L	0.02	0.05	07/05/07 22:28	djt
Magnesium, dissolved	M200.7 ICP	43.8			mg/L	0.2	1	07/03/07 13:40	msh
Manganese, dissolved	M200.7 ICP	0.018	B		mg/L	0.005	0.03	07/03/07 13:40	msh
Manganese, total	M200.7 ICP	0.040			mg/L	0.005	0.03	07/05/07 22:28	djt
Potassium, dissolved	M200.7 ICP	1.5	B		mg/L	0.3	2	07/03/07 13:40	msh
Sodium, dissolved	M200.7 ICP	24.5			mg/L	0.3	2	07/03/07 13:40	msh

Wet Chemistry

Parameter	EPA Method	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration								
Bicarbonate as CaCO3		380			mg/L	2	20	06/26/07 0:00	lcp/jlf
Carbonate as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Hydroxide as CaCO3			U		mg/L	2	20	06/26/07 0:00	lcp/jlf
Total Alkalinity		380			mg/L	2	20	06/26/07 0:00	lcp/jlf
Cation-Anion Balance	Calculation								
Cation-Anion Balance		5.1			%			07/10/07 15:15	calc
Sum of Anions		8.3			meq/L	0.1	0.5	07/10/07 15:15	calc
Sum of Cations		9.2			meq/L	0.1	0.5	07/10/07 15:15	calc
Chloride	325.2 / SM4500Cl-E	3	B	*	mg/L	1	5	07/02/07 15:02	aml/jag
Residue, Filterable (TDS) @180C	160.1 / SM2540C	420			mg/L	10	20	06/28/07 15:52	jlf
Sulfate	SM4500 SO4-D	30	B	*	mg/L	10	50	07/03/07 9:23	aeh
TDS (calculated)	Calculation	422			mg/L	10	50	07/10/07 15:15	calc
TDS (ratio - measured/calculated)	Calculation	1.00						07/10/07 15:15	calc

** Please refer to Qualifier Reports for detail.*

SOLDIER / DUGOUT CANYON MINES

OPERATIONAL WATER MONITORING PROGRAM

Sample Identification		321	322	0F001							
Sample Date		7/24/2007	7/24/2007	7/24/2007							
Laboratory Protocol		2	2								
Time		834	916	1104							
Laboratory Analyses											
Total Dissolved Solids	mg/l	X	X	X	-	-	-	-	-	-	-
Total Suspended Solids	mg/l	-	-	X	-	-	-	-	-	-	-
Oil and Grease	mg/l	-	-		-	-	-	-	-	-	-
Bicarbonate	mg/l	X	X	-	-	-	-	-	-	-	-
Carbonate	mg/l	X	X	-	-	-	-	-	-	-	-
Calcium (Dissolved)	mg/l	X	X	-	-	-	-	-	-	-	-
Chloride	mg/l	X	X	-	-	-	-	-	-	-	-
Iron (Dissolved)	mg/l	X	X	X	-	-	-	-	-	-	-
Iron (Total)	mg/l	X	X	X	-	-	-	-	-	-	-
Magnesium (Dissolved)	mg/l	X	X	-	-	-	-	-	-	-	-
Manganese (Dissolved)	mg/l	X	X	-	-	-	-	-	-	-	-
Manganese (Total)	mg/l	X	X	-	-	-	-	-	-	-	-
Potassium (Dissolved)	mg/l	X	X	-	-	-	-	-	-	-	-
Sodium (Dissolved)	mg/l	X	X	-	-	-	-	-	-	-	-
Sulfate	mg/l	X	X	-	-	-	-	-	-	-	-
Cations	meq/l	X	X	-	-	-	-	-	-	-	-
Anions	meq/l	X	X	-	-	-	-	-	-	-	-
Total Hardness (CaCO3)	mg/l	-	-	-	-	-	-	-	-	-	-

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME

Sampled by Amanda Richard - 4 bottles enclosed for each sample

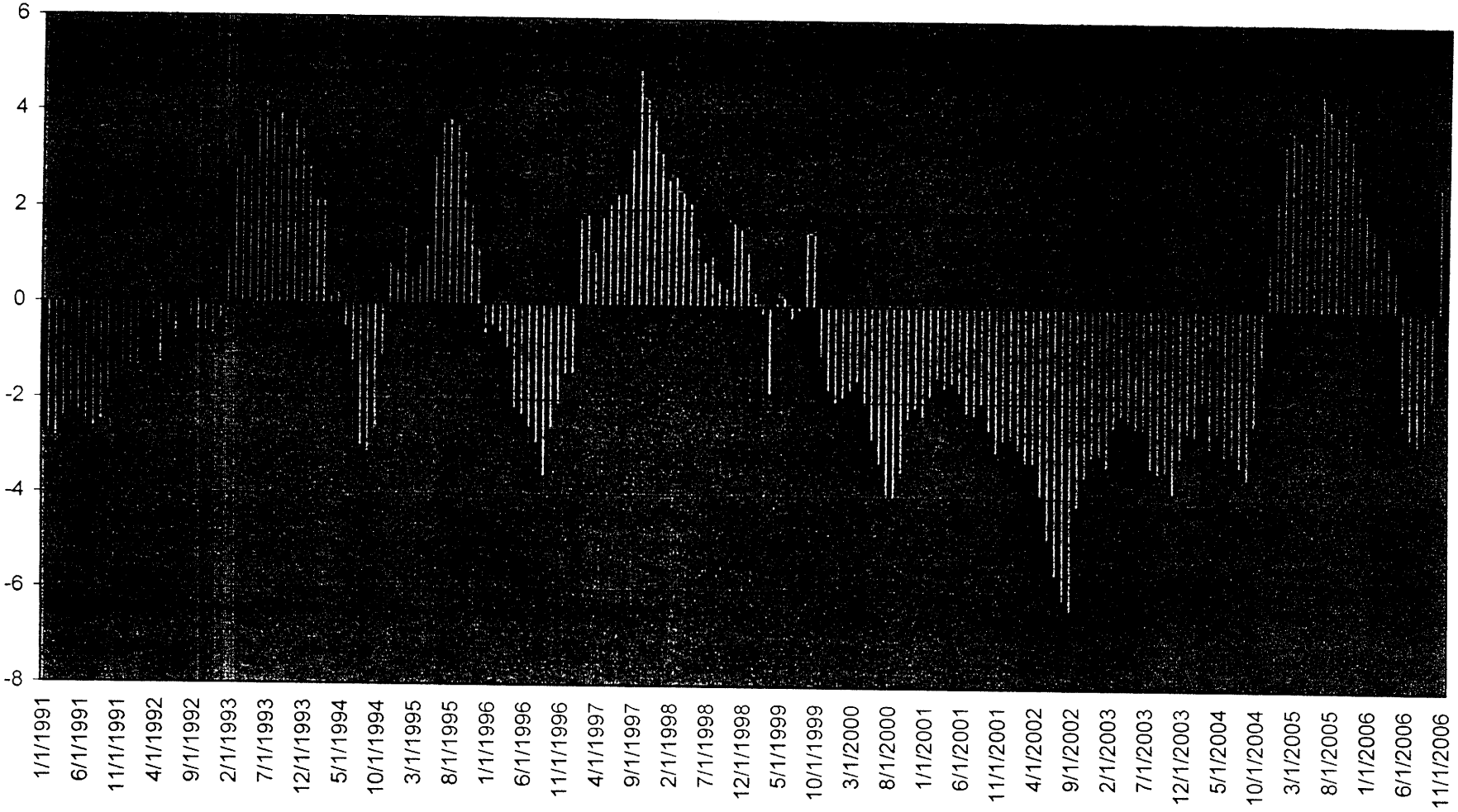
Protocol Identification -

1 - Dugout Canyon Mine (Surface Water)	Bottles - U, W, G, R, O
2 - Dugout Canyon Mine (Ground Water)	Bottles - U, W, G, R
3 - Soldier Canyon Mine (Surface Water) - 1st, 2nd & 4th Quarters	Bottles - U, W, G, O
4 - Soldier Canyon Mine (Surface Water) - 3rd Quarter Only	Bottles - U, W, G, R & O
5 - Soldier Canyon Mine (Ground Water) - 1st, 2nd & 4th Quarters	Bottles - U, W, G
6 - Soldier Canyon Mine (Ground Water) - 3rd Quarter Only	Bottles - U, W, G, R
7 - Banning Loadout (Ground Water)	Bottles - U, W, G, R

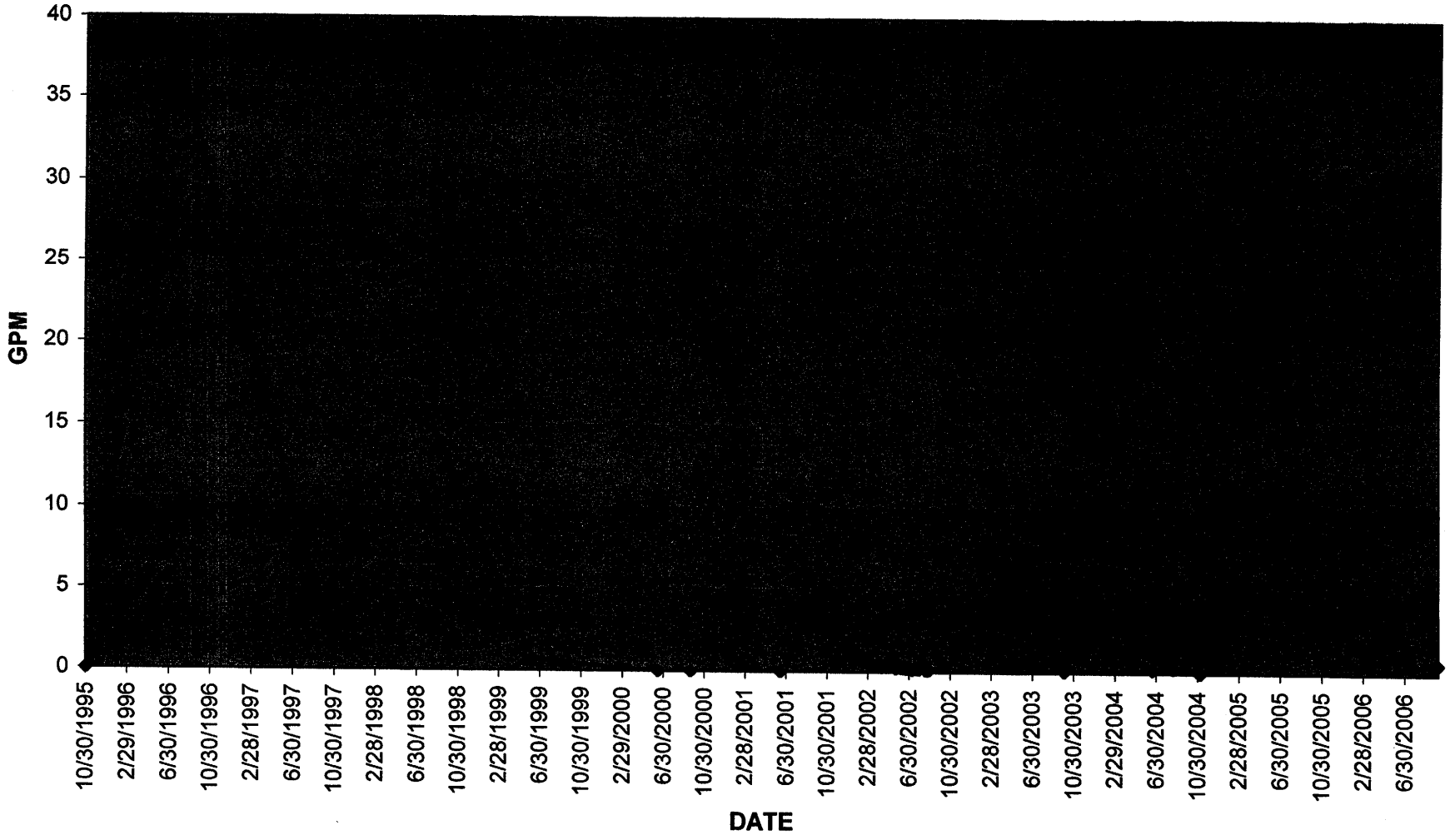
ATTACHMENT 2

Palmer Hydrologic Drought Index, Region 6 and 7, 1991-2006
Spring Flow Graphs for Dugout Canyon Mine Sites

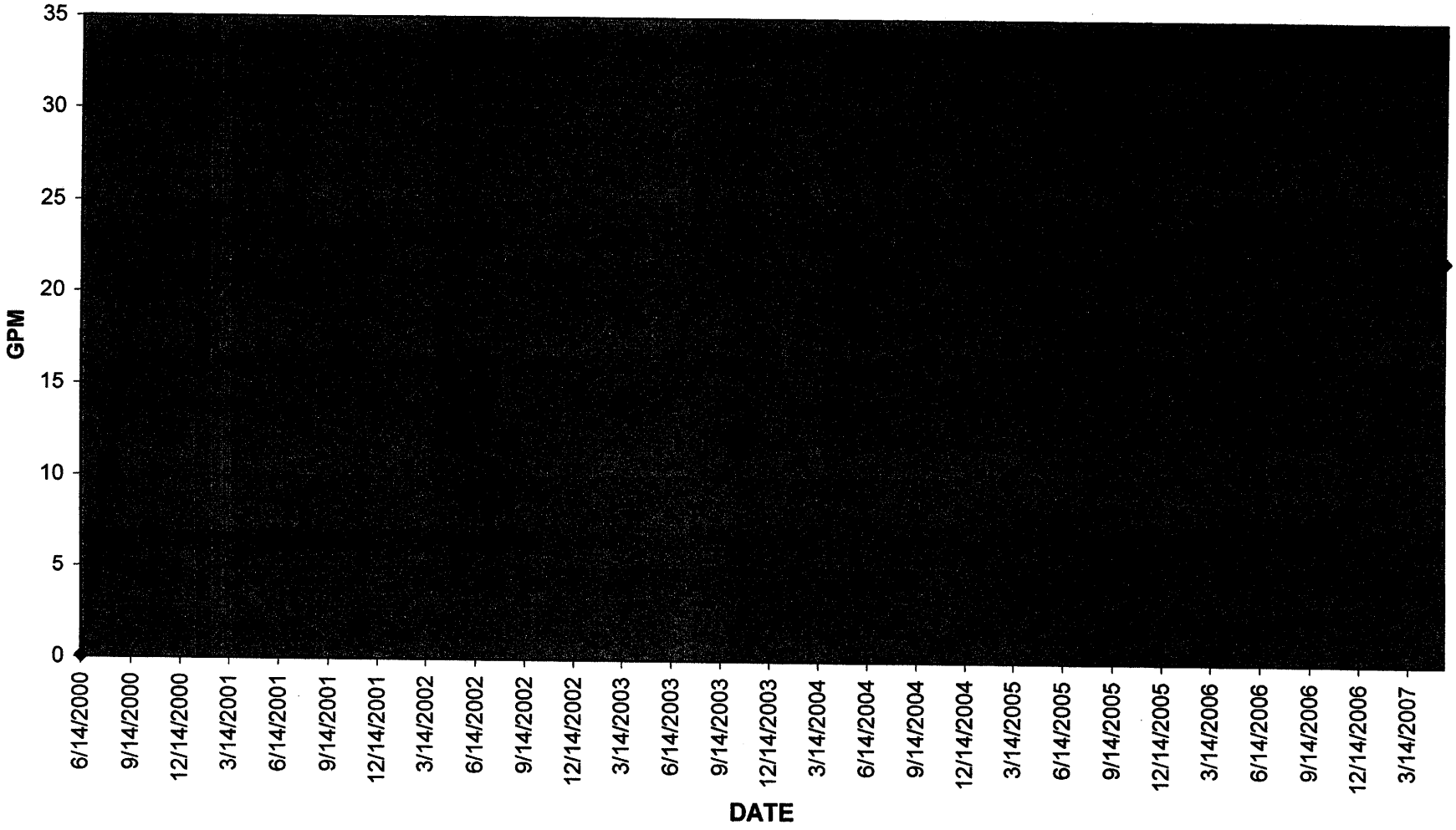
PALMER HYDROLOGIC DROUGHT INDEX
REGION 6 AND 7
1991 - 2006



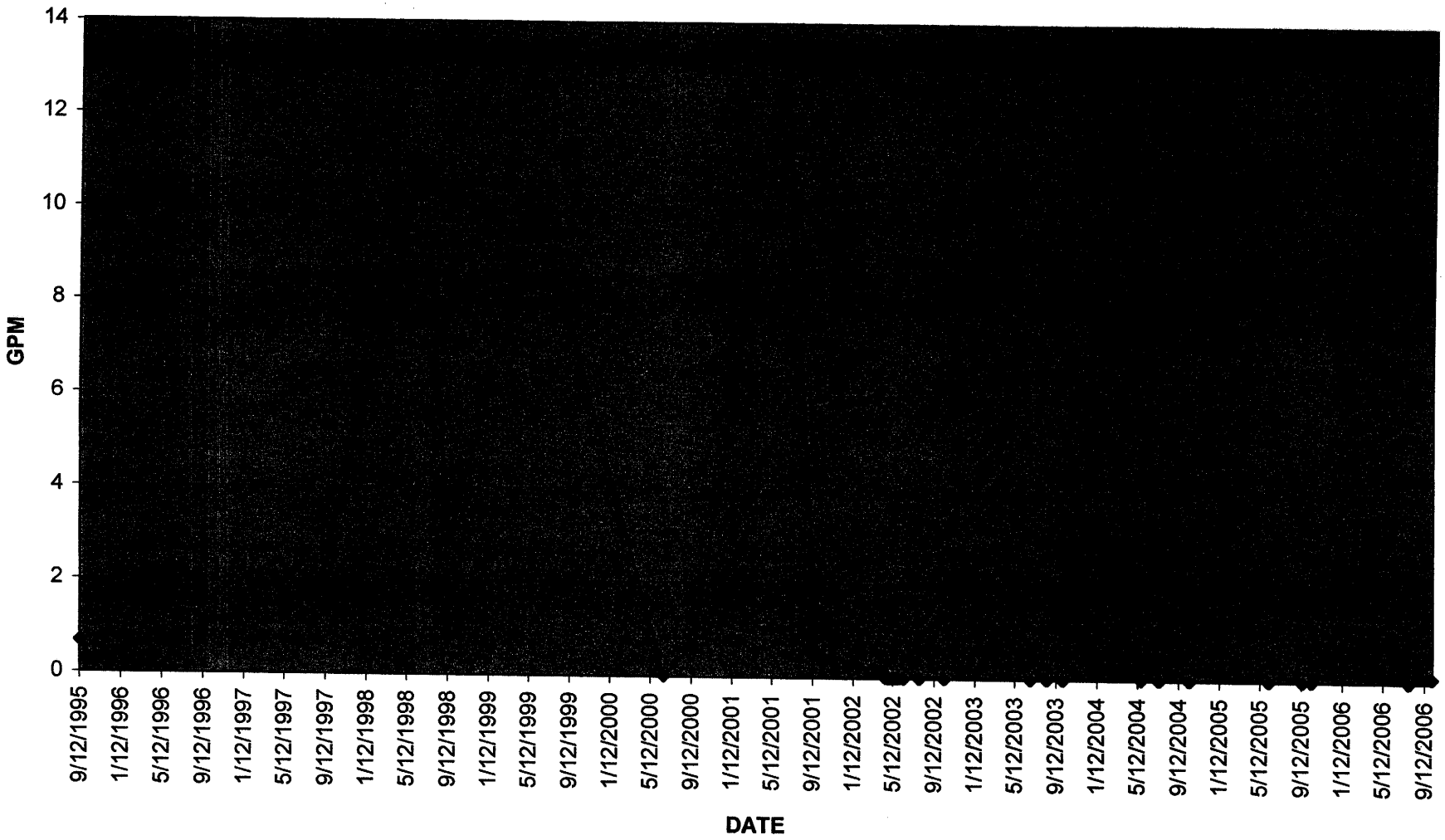
Spring SC-65
Flow



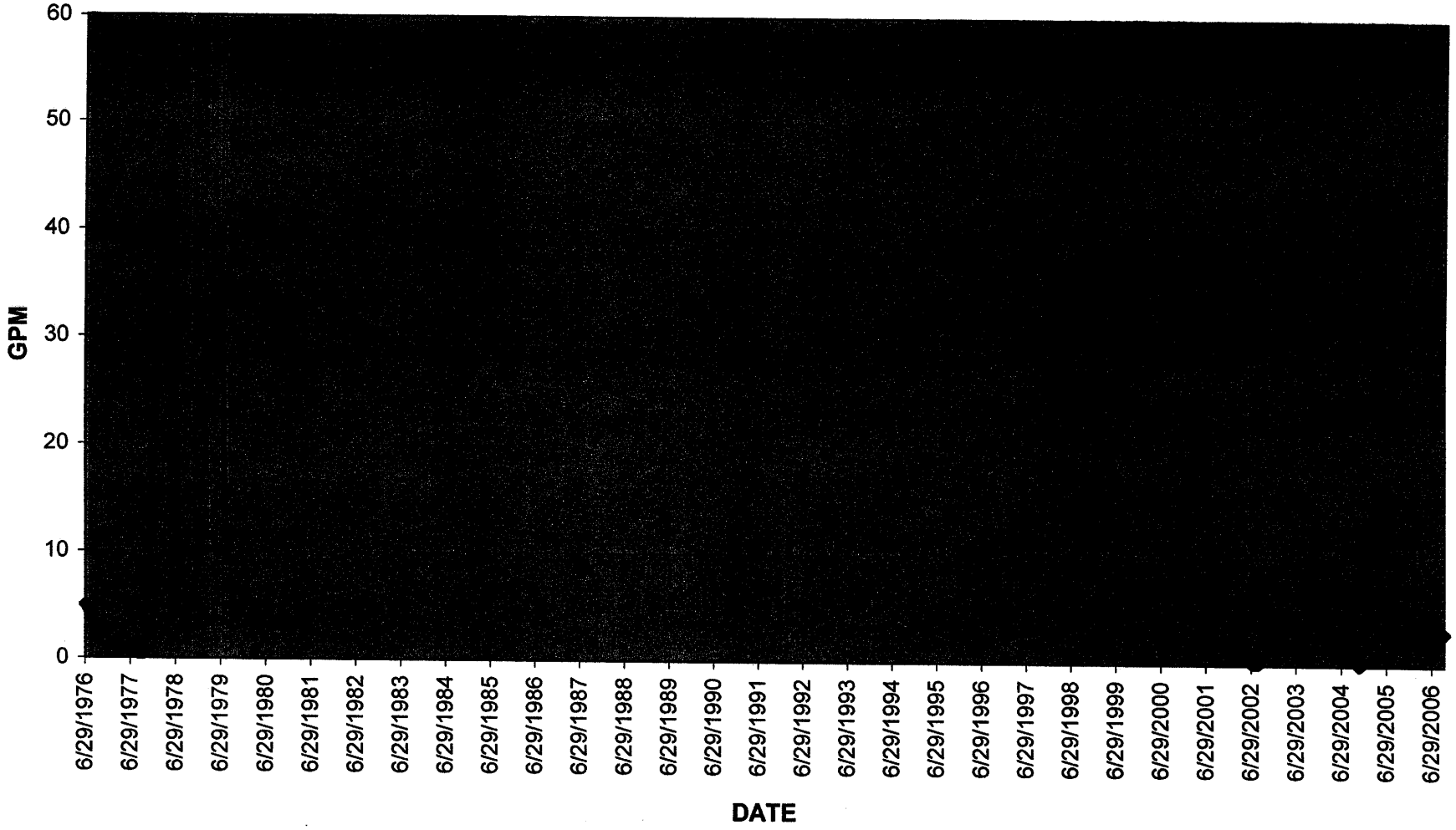
Spring 260
Flow



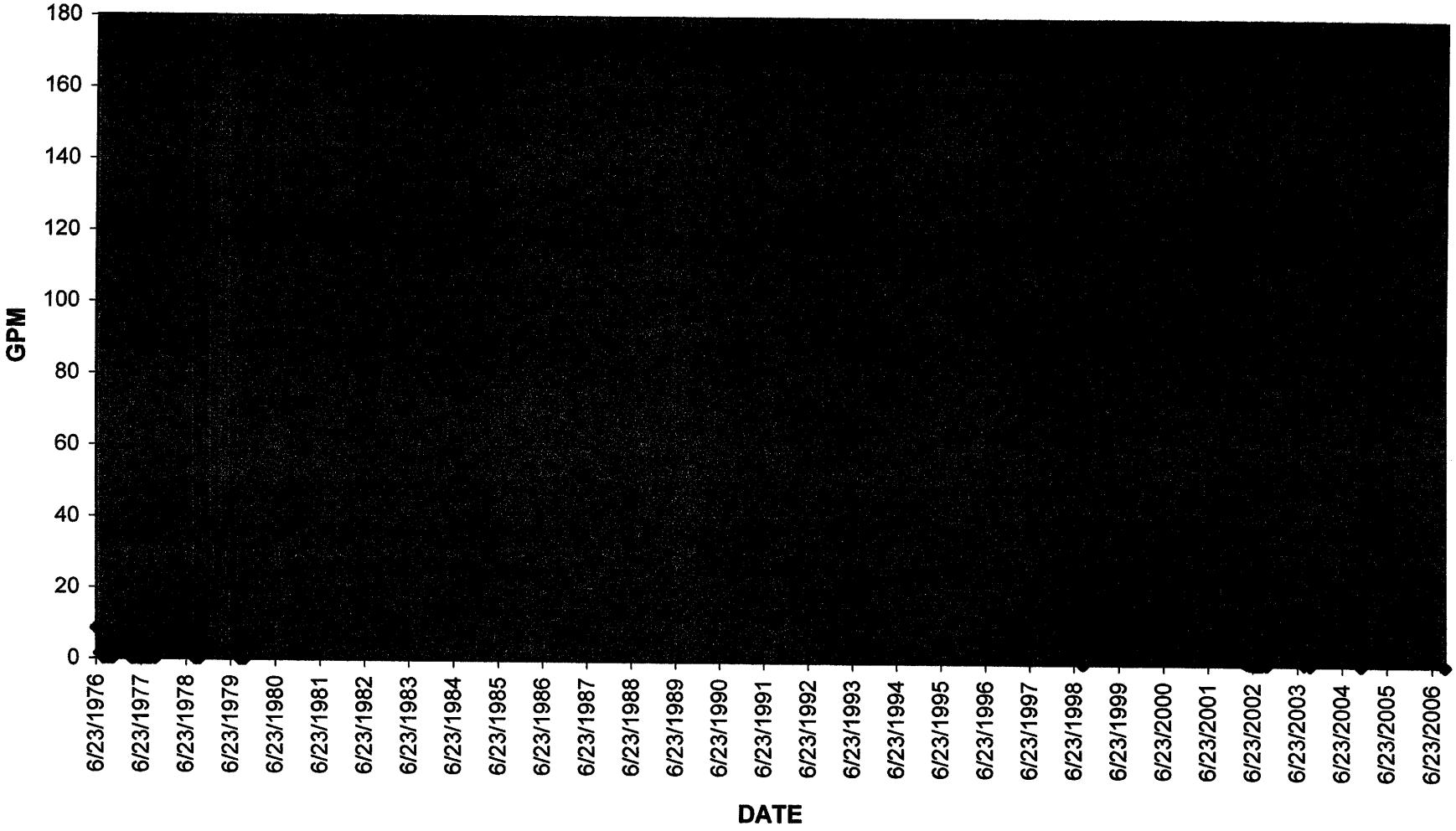
Spring SC-100
Flow



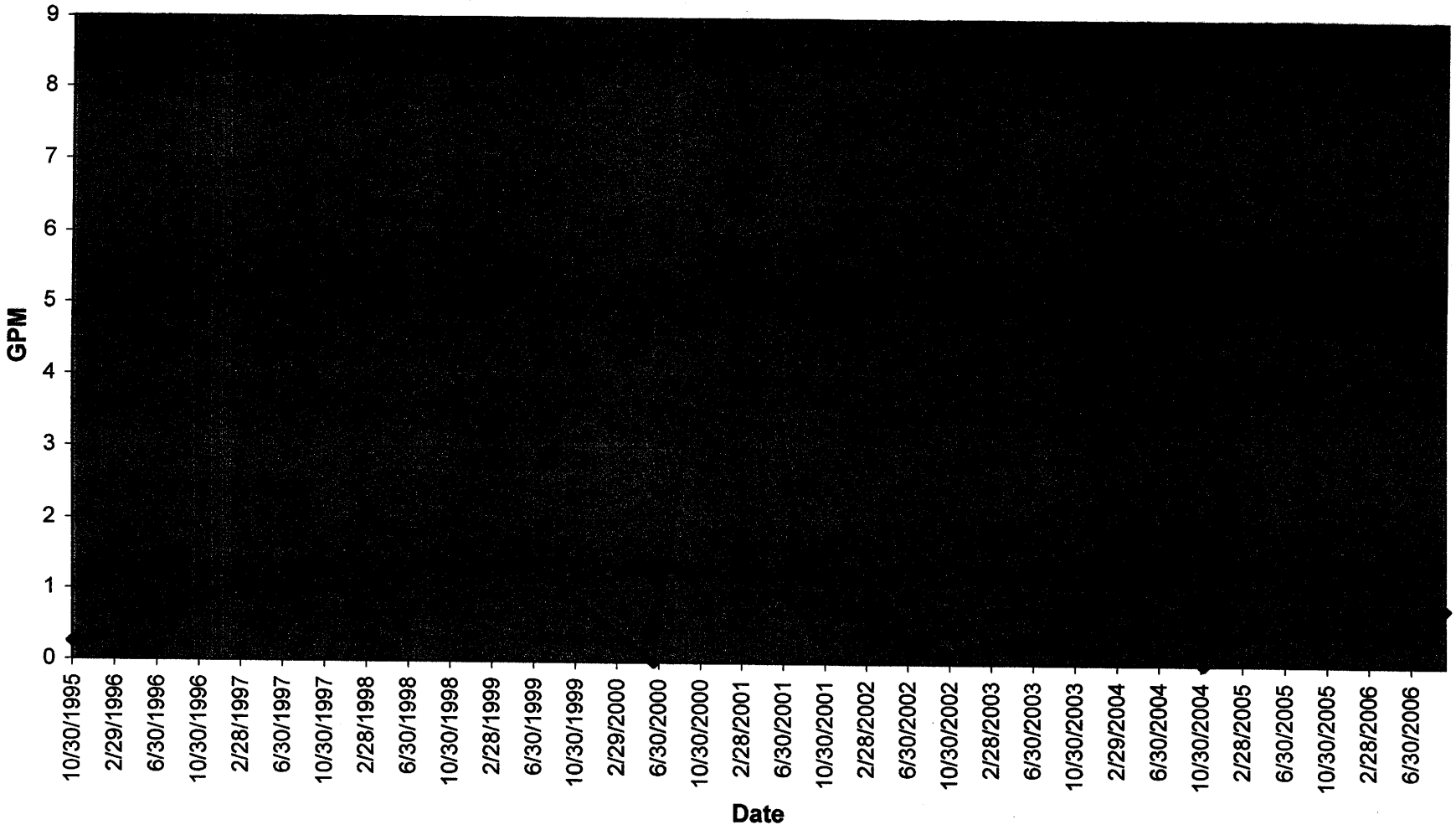
Spring SP-20
Flow



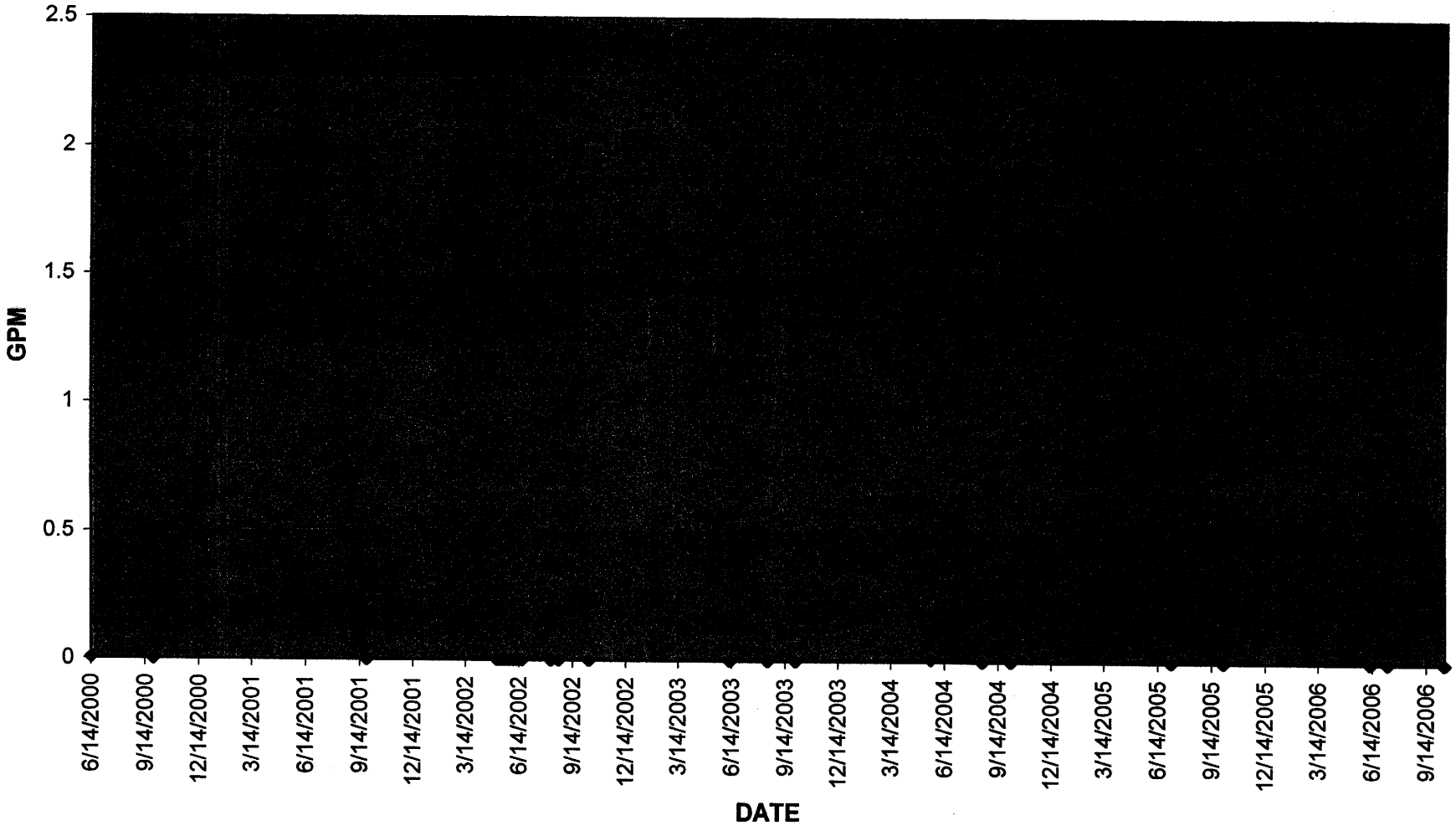
Spring SC-14
Flow



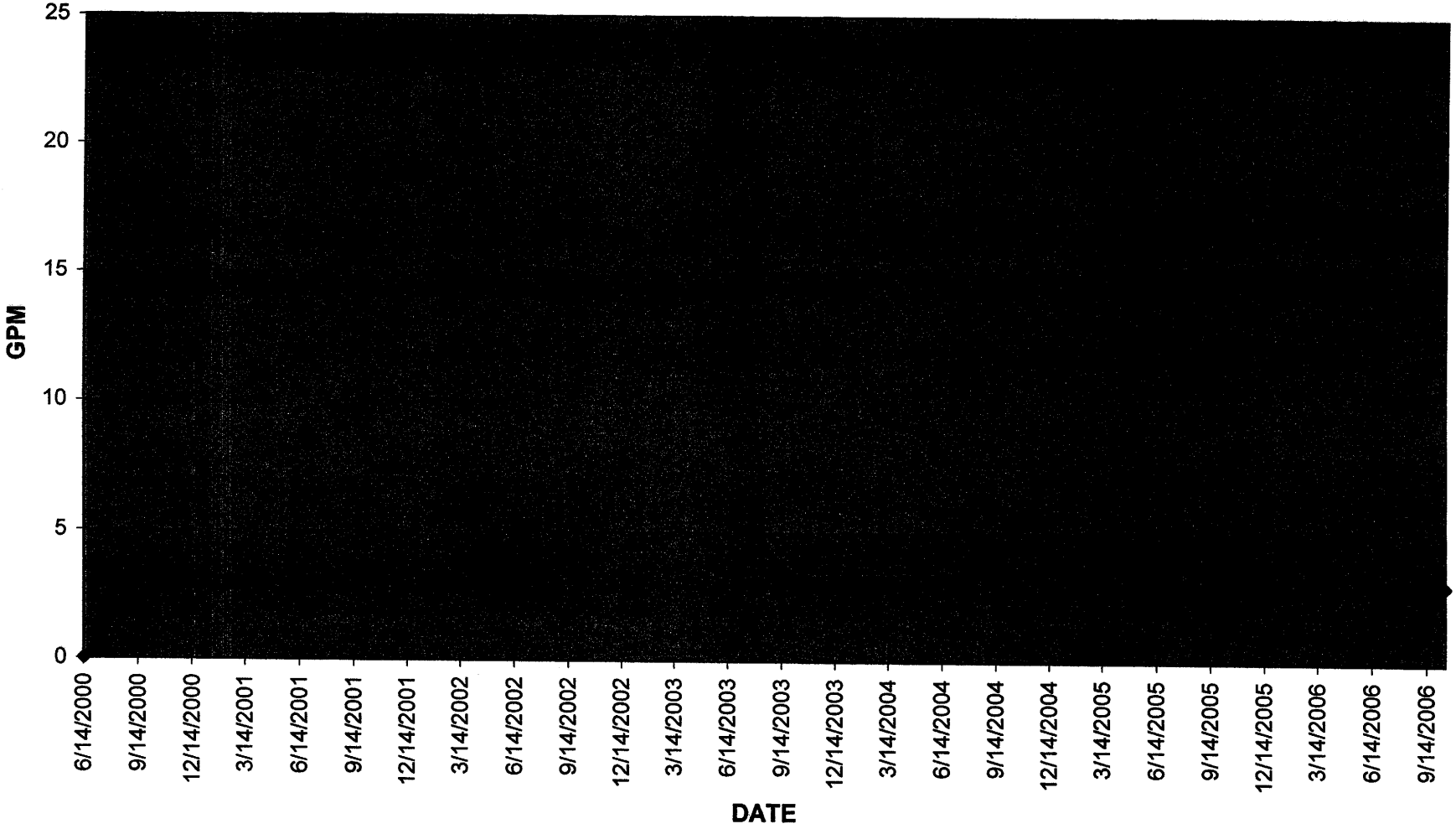
Spring SC-116
Flow



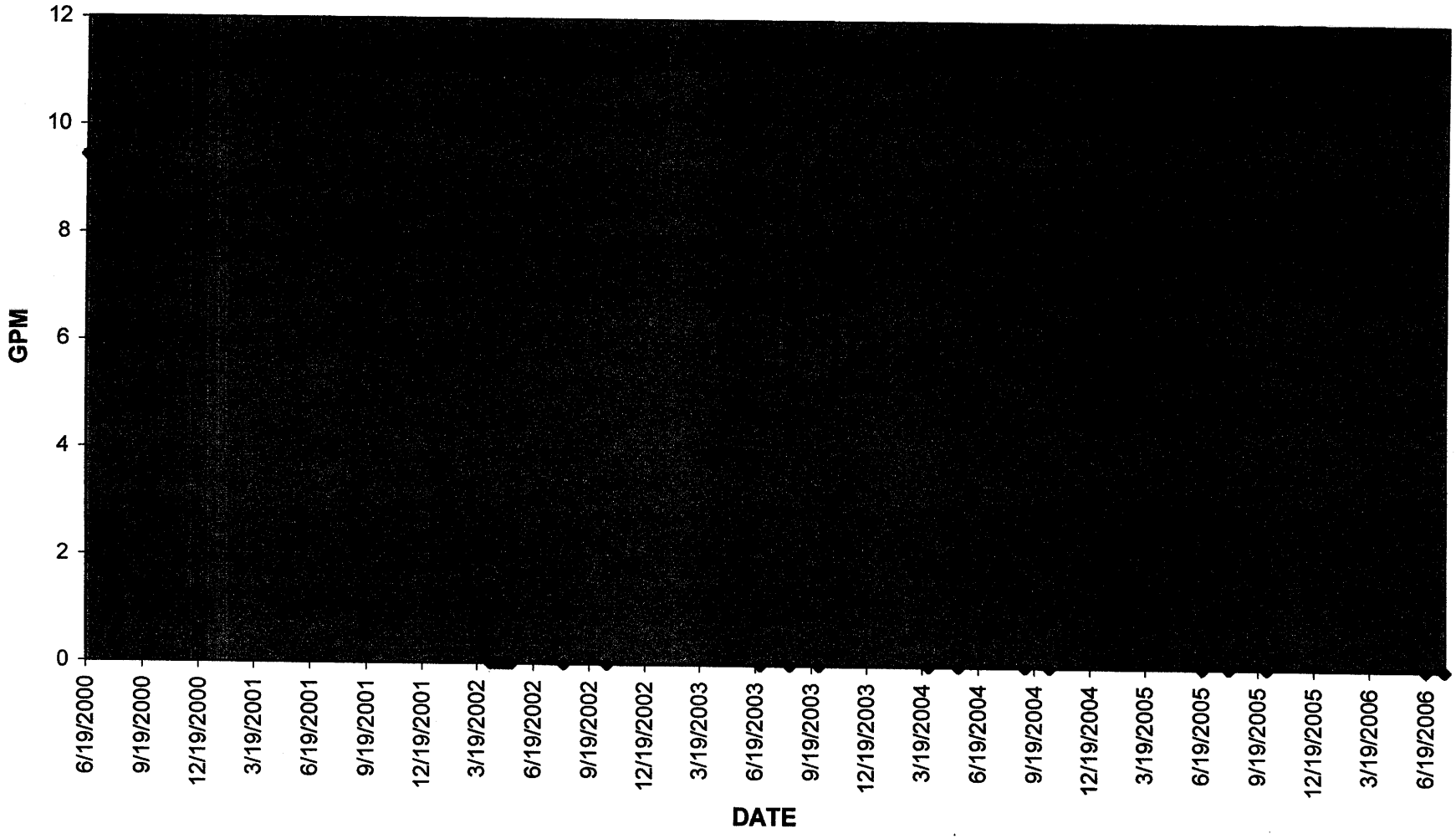
Spring SC-200
Flow



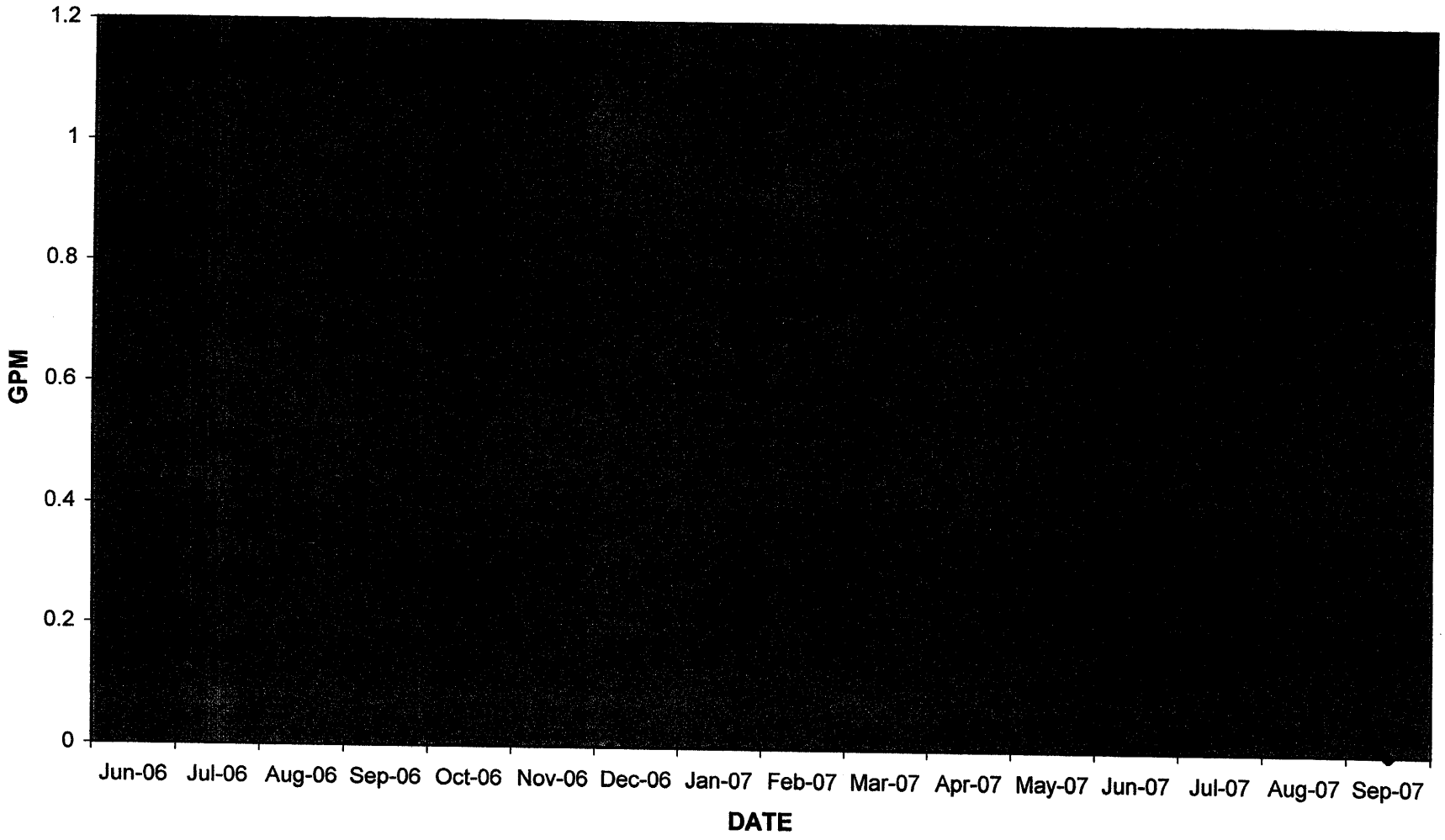
Spring 203
Flow



Spring 259
Flow



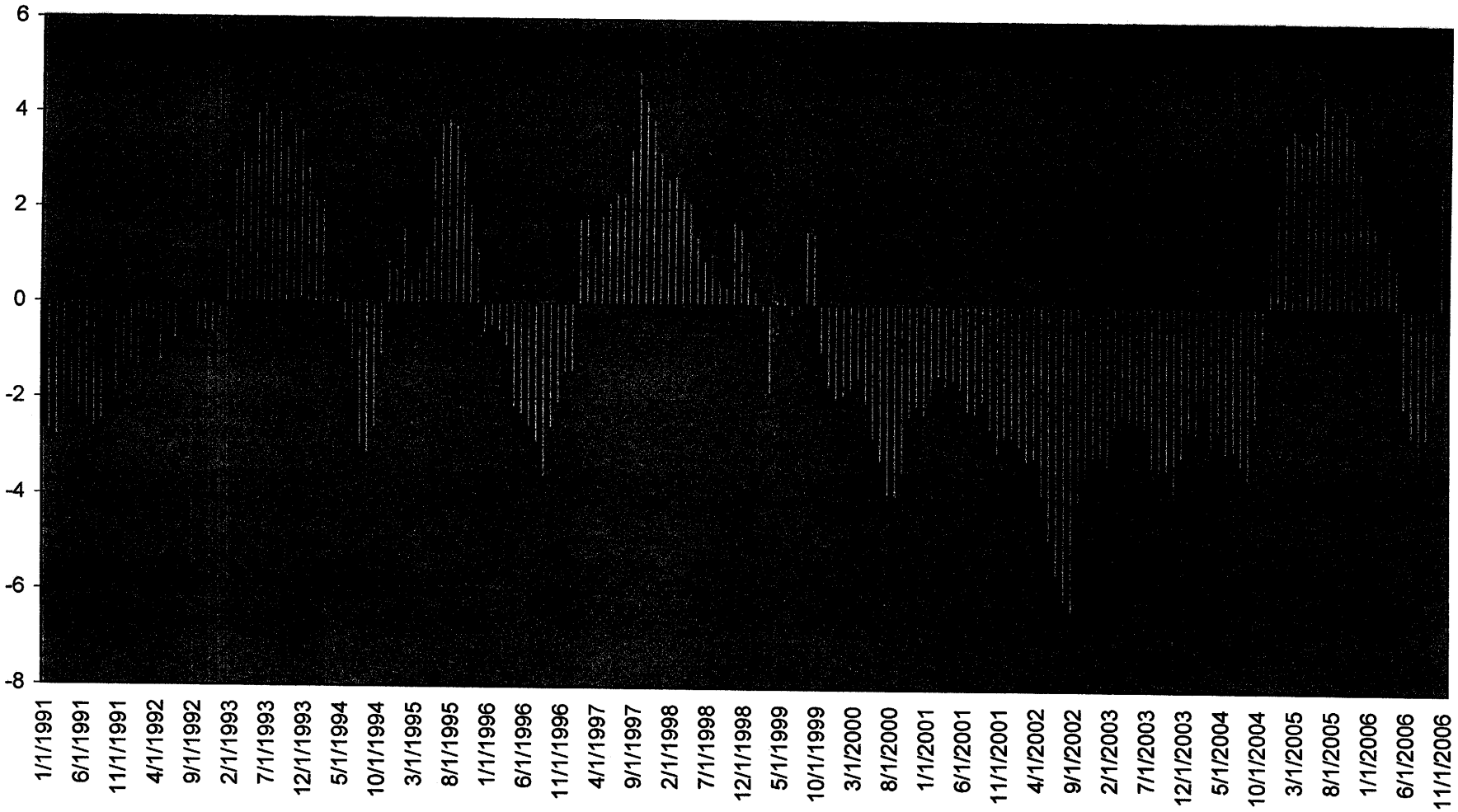
Spring 259A
Flow



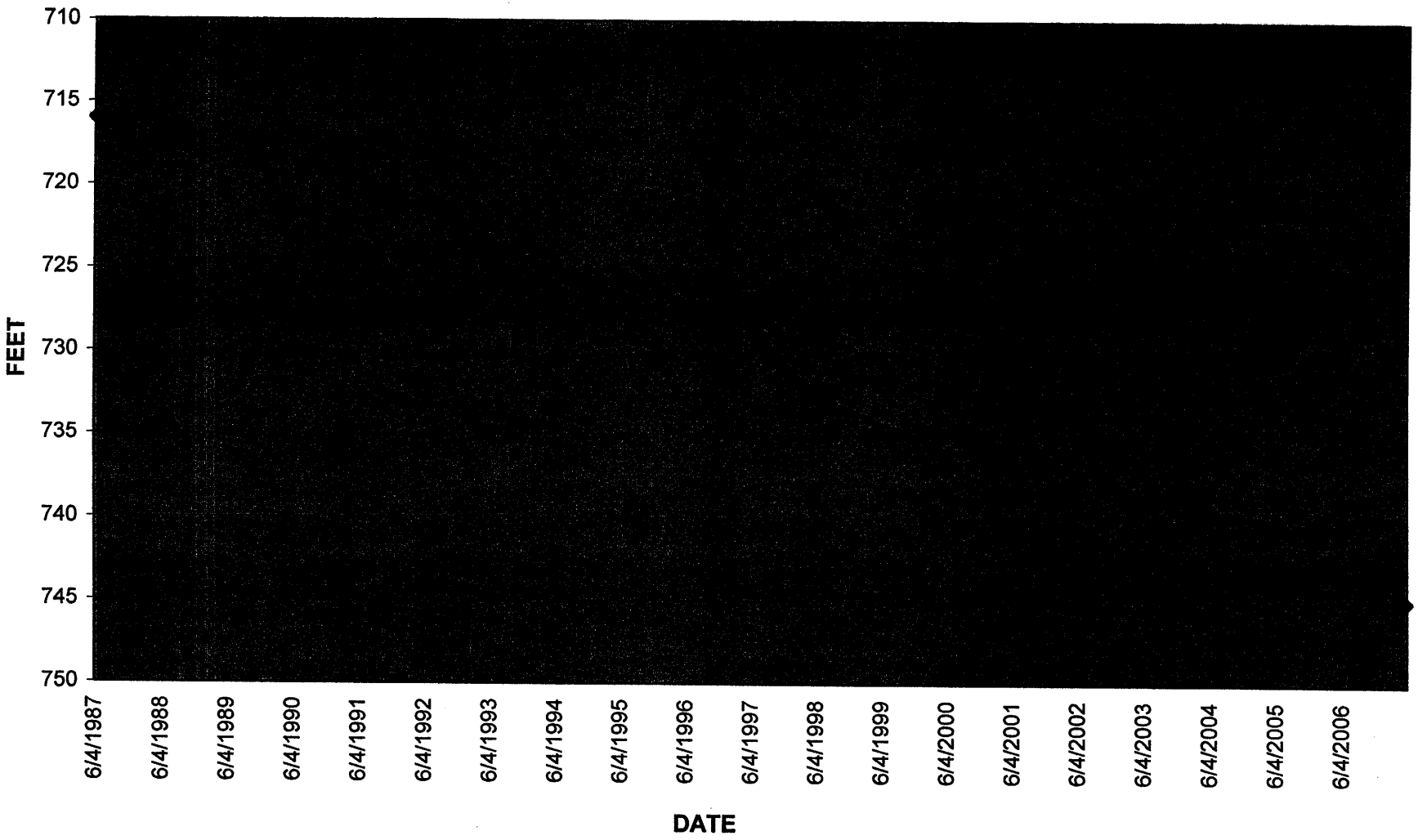
ATTACHMENT 3

Palmer Hydrologic Drought Index, Region 6 and 7, 1991-2006
Well Water Level Graphs for Dugout Canyon Mine

PALMER HYDROLOGIC DROUGHT INDEX
REGION 6 AND 7
1991 - 2006



Well GW-10-2


710
715
720
725
730
735
740
745
750
FEET
6/4/1987
6/4/1988
6/4/1989
6/4/1990
6/4/1991
6/4/1992
6/4/1993
6/4/1994
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6/4/1996
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6/4/2001
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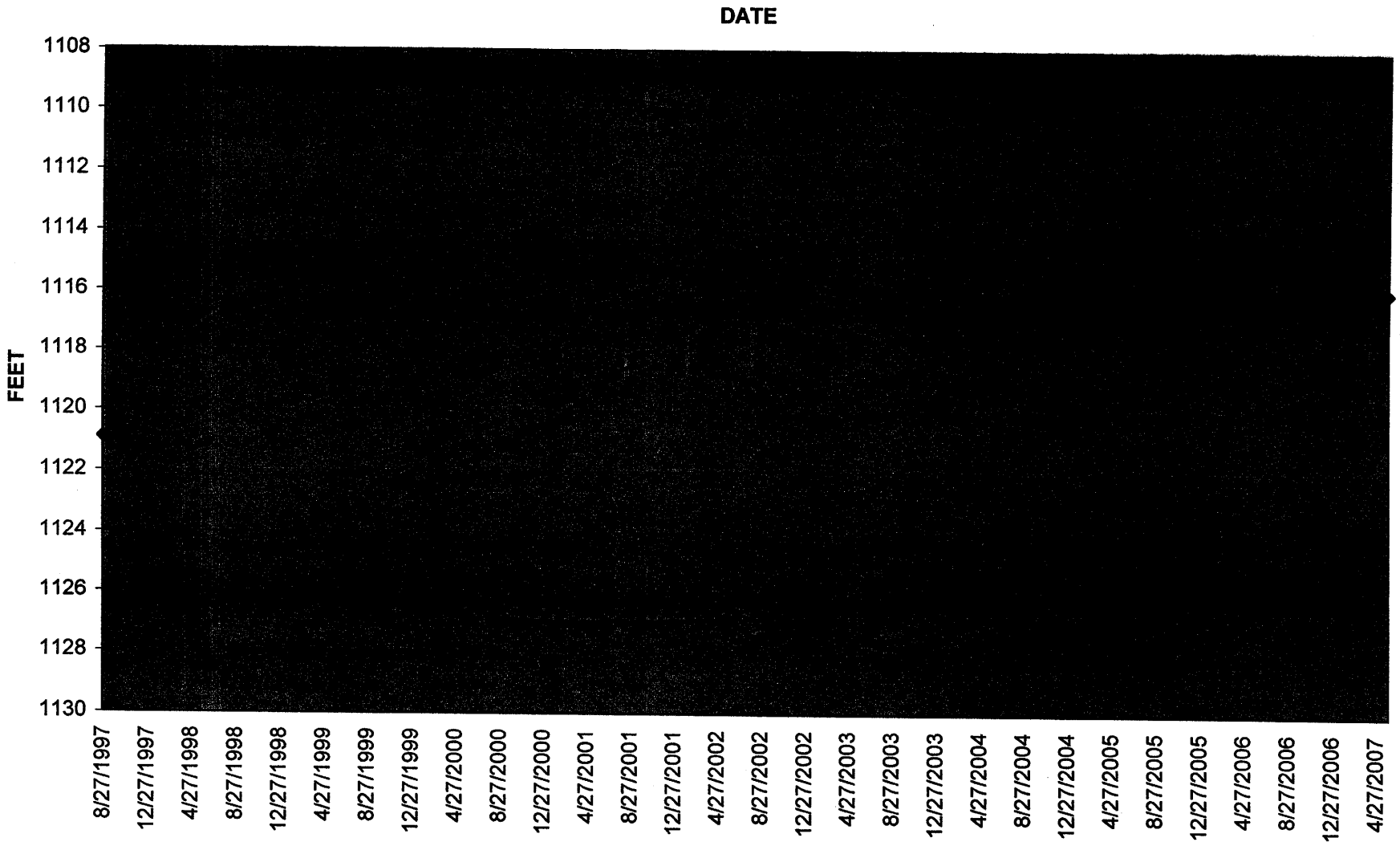
6/4/2003
6/4/2004
6/4/2005
6/4/2006
DATE

Well GW-11-2


DATE
FEET
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1110
1112
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1128
1130
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12/27/1997
4/27/1998
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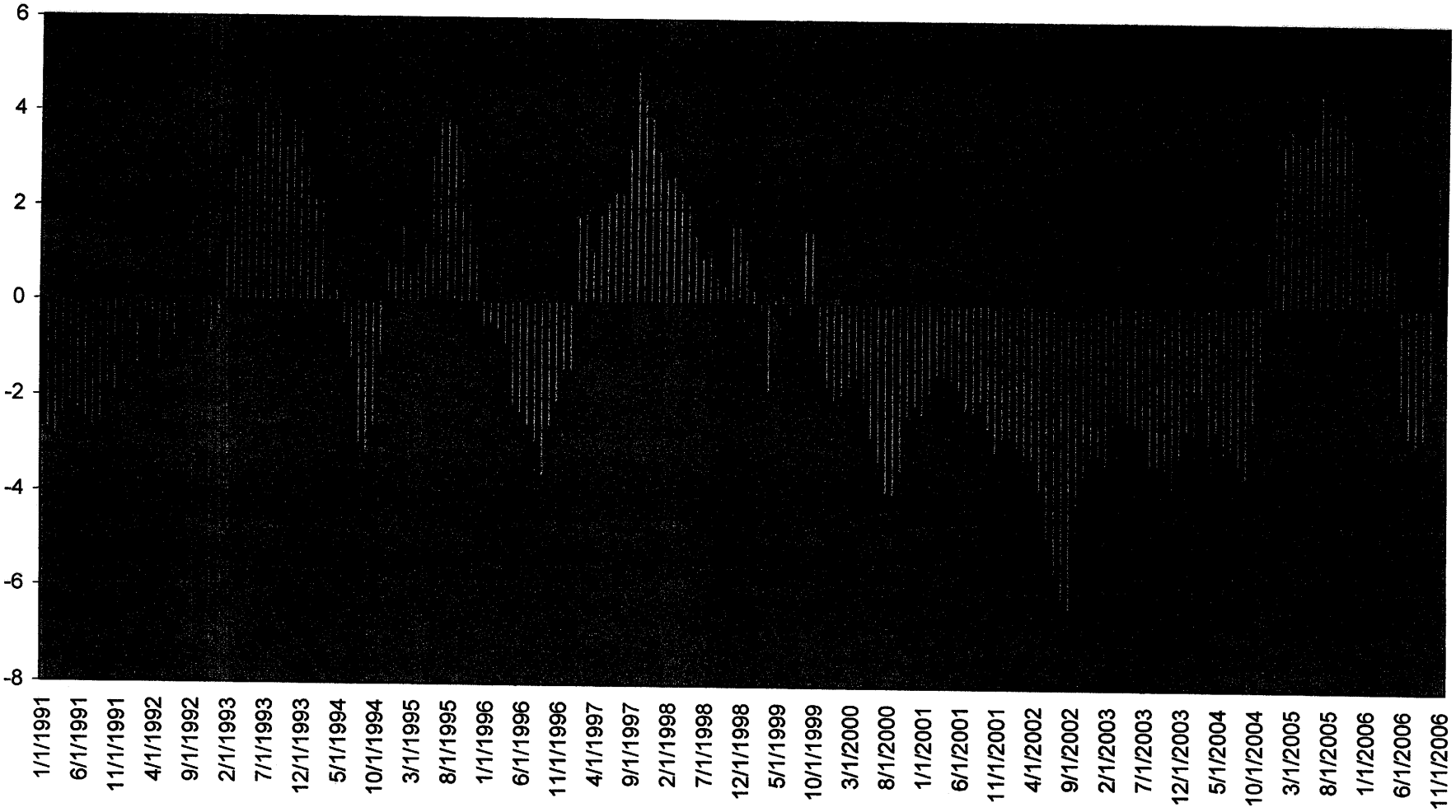
8/27/2006
12/27/2006
4/27/2007

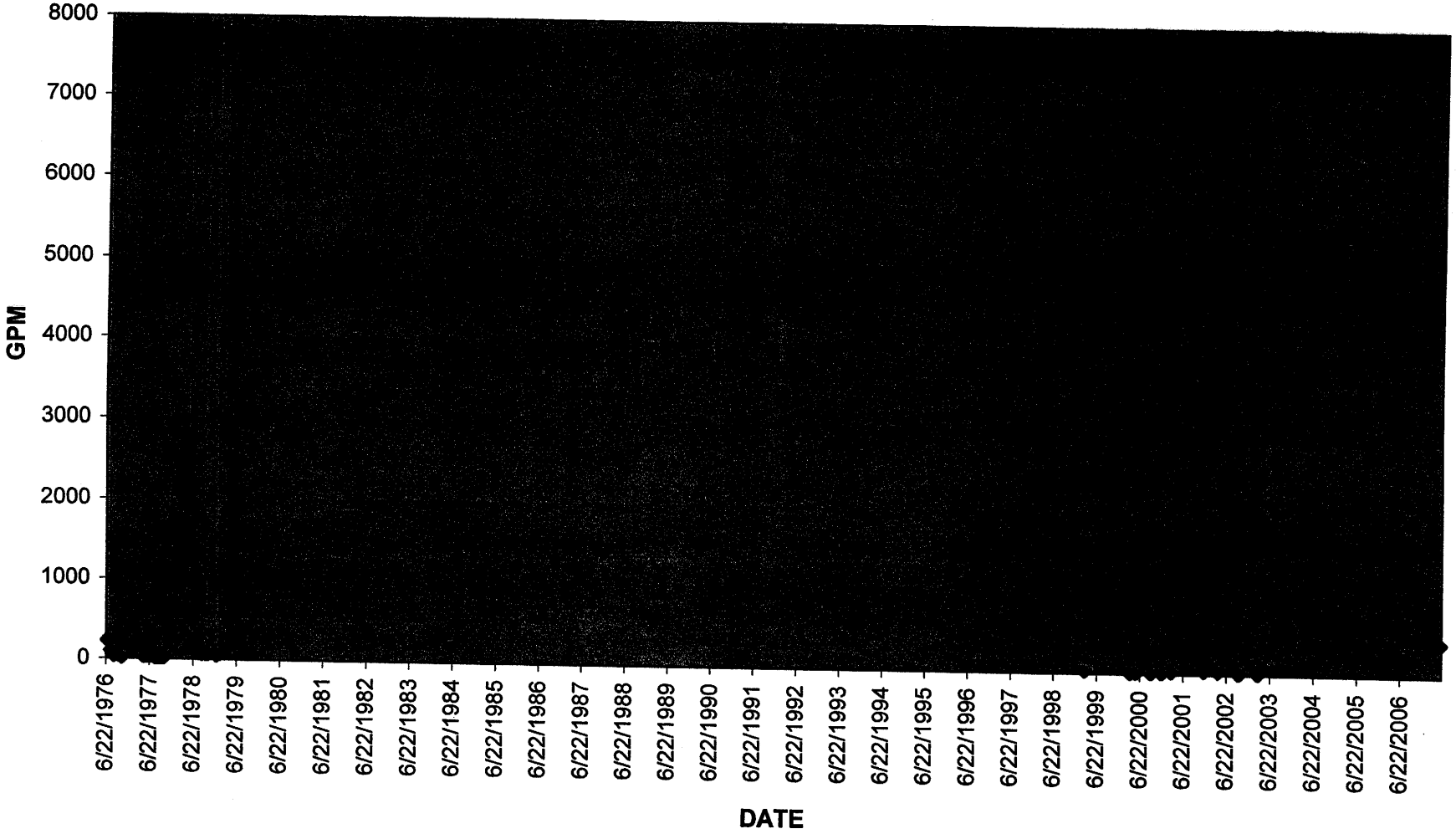
ATTACHMENT 4

Palmer Hydrologic Drought Index, Region 6 and 7, 1991-2006
Surface Water Flow Graphs for Dugout Canyon Mine Sites

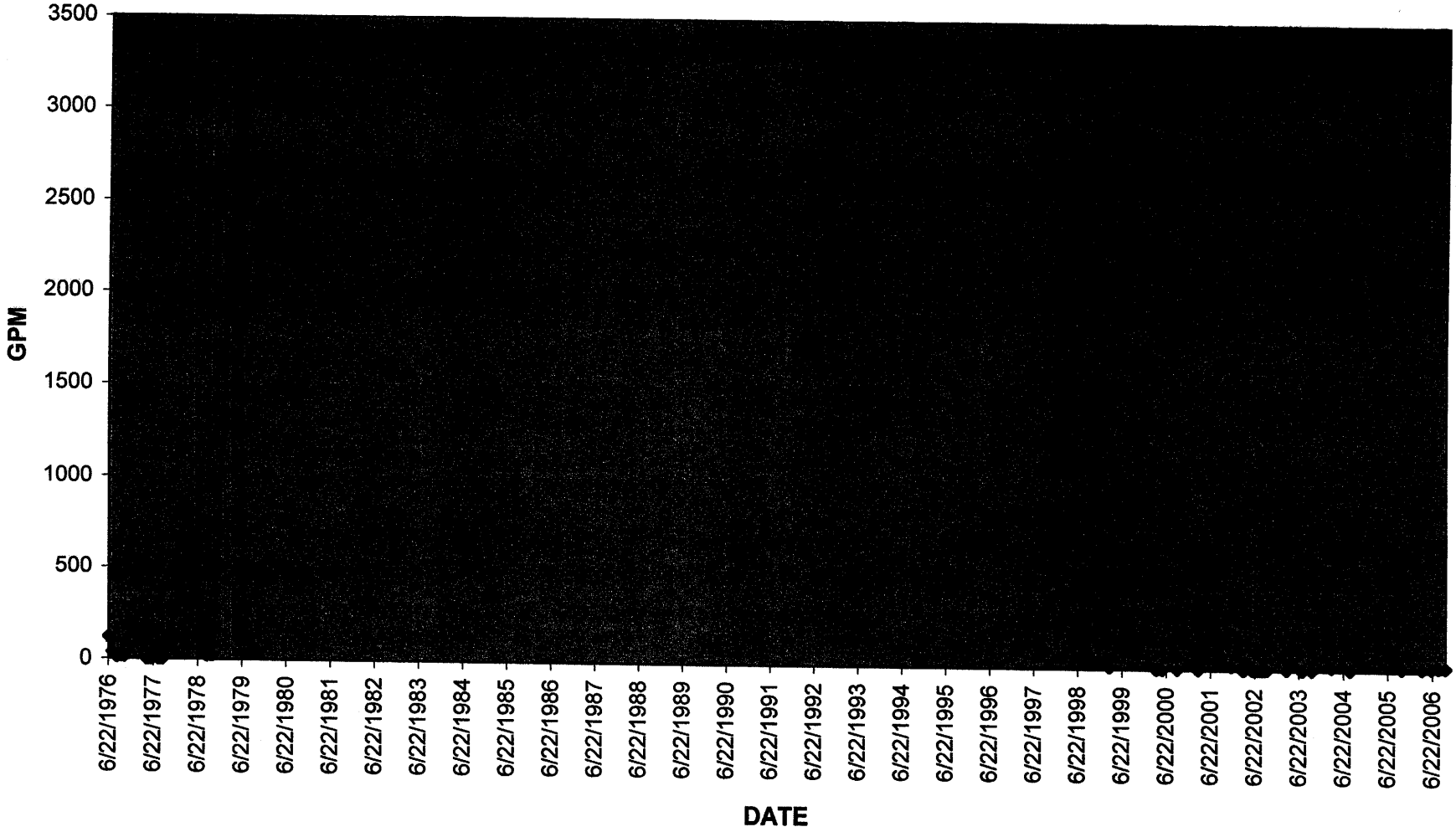
PALMER HYDROLOGIC DROUGHT INDEX
REGION 6 AND 7
1991 - 2006



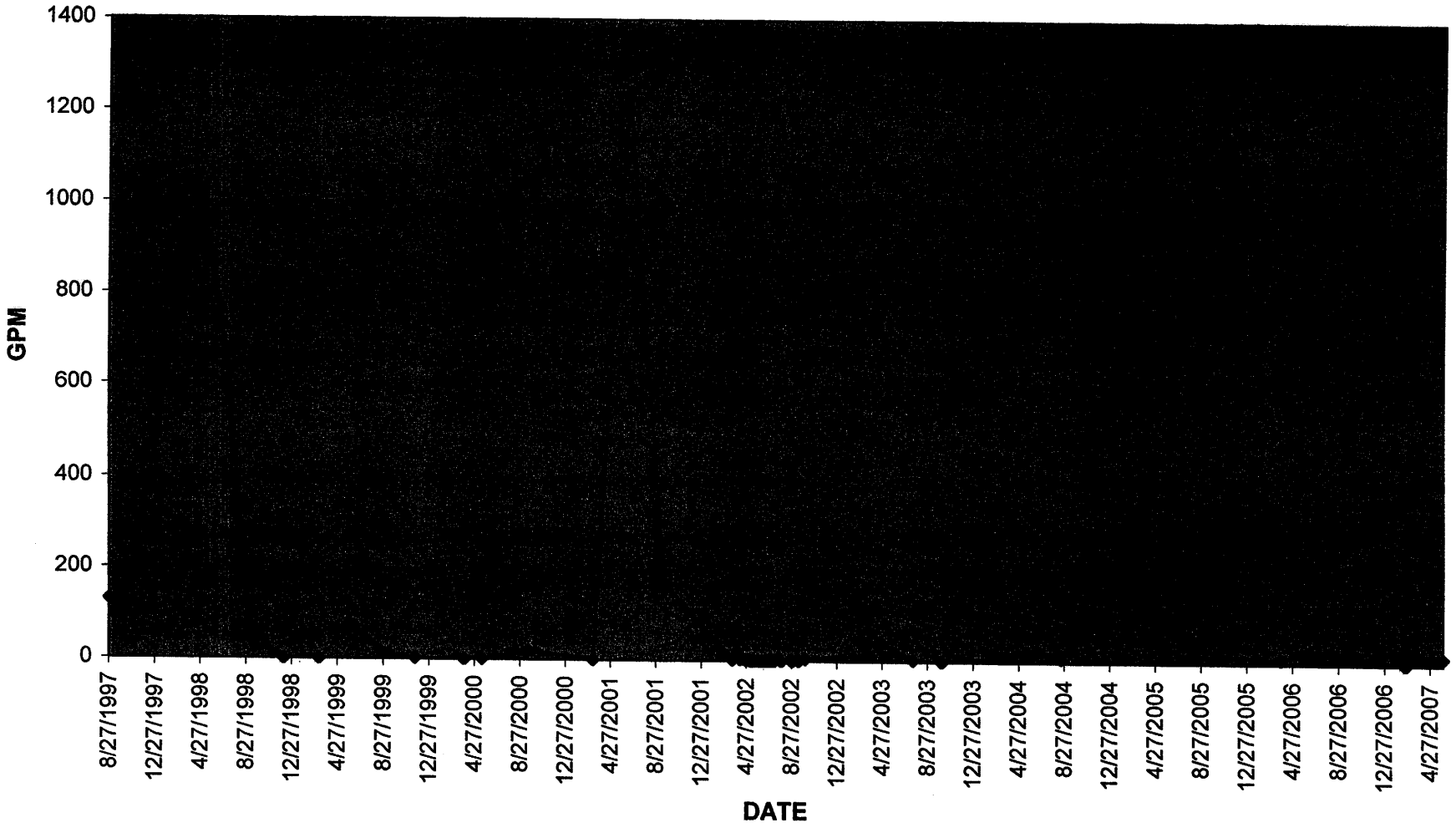
Dugout Creek Flow
DC-1



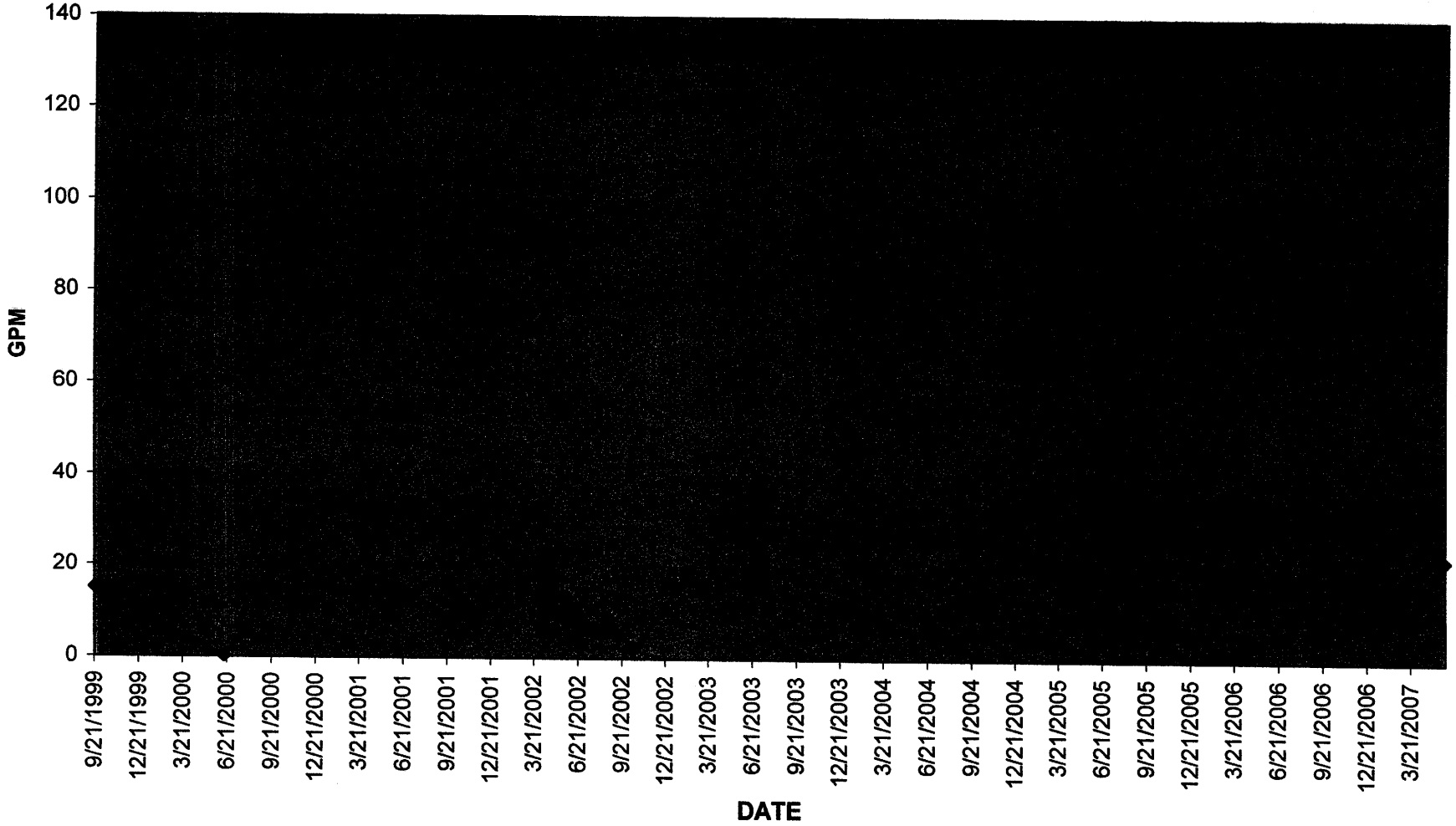
Dugout Creek Flow - Left Fork
DC-2



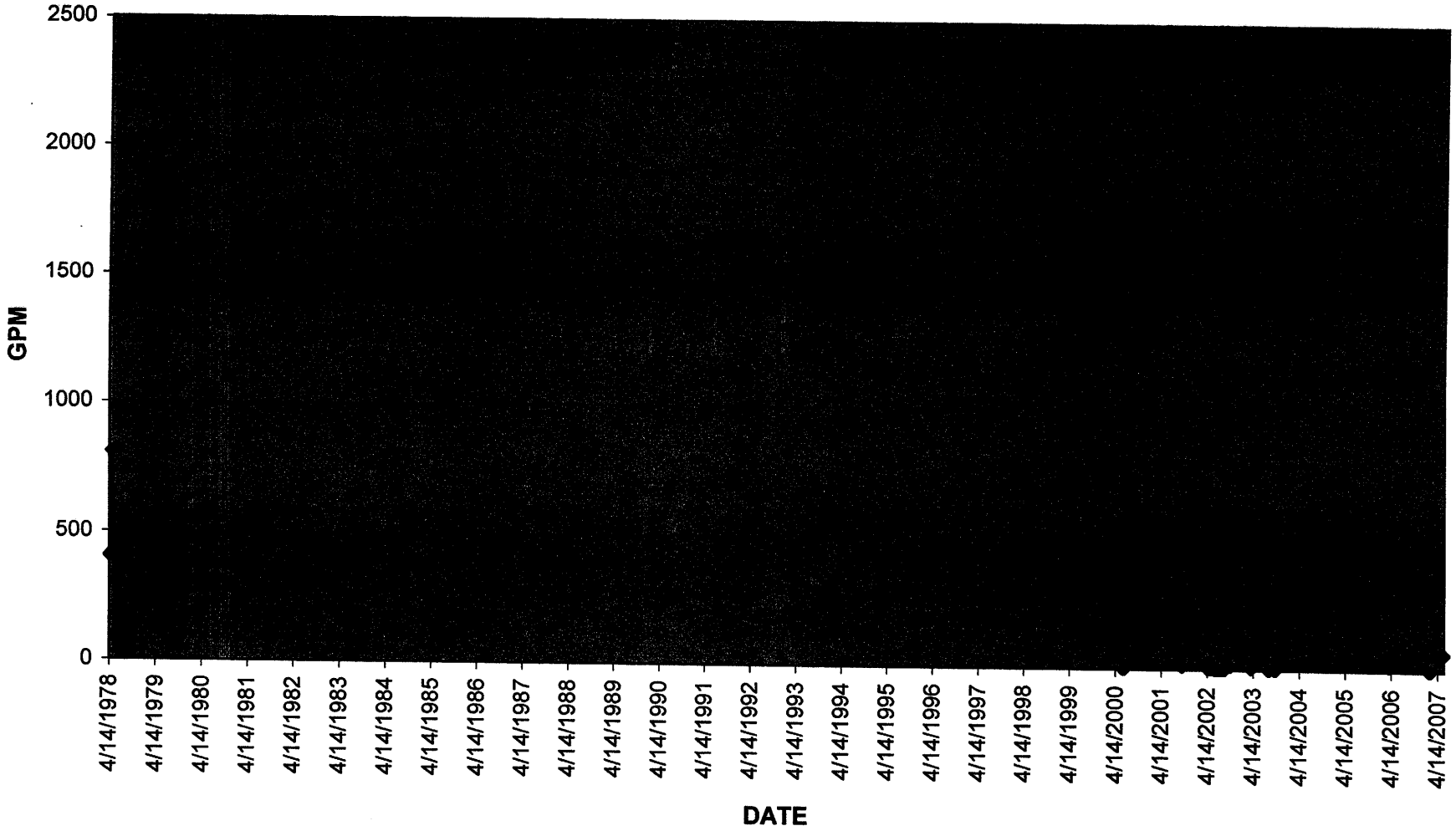
Dugout Creek Flow - Right Fork
DC-3



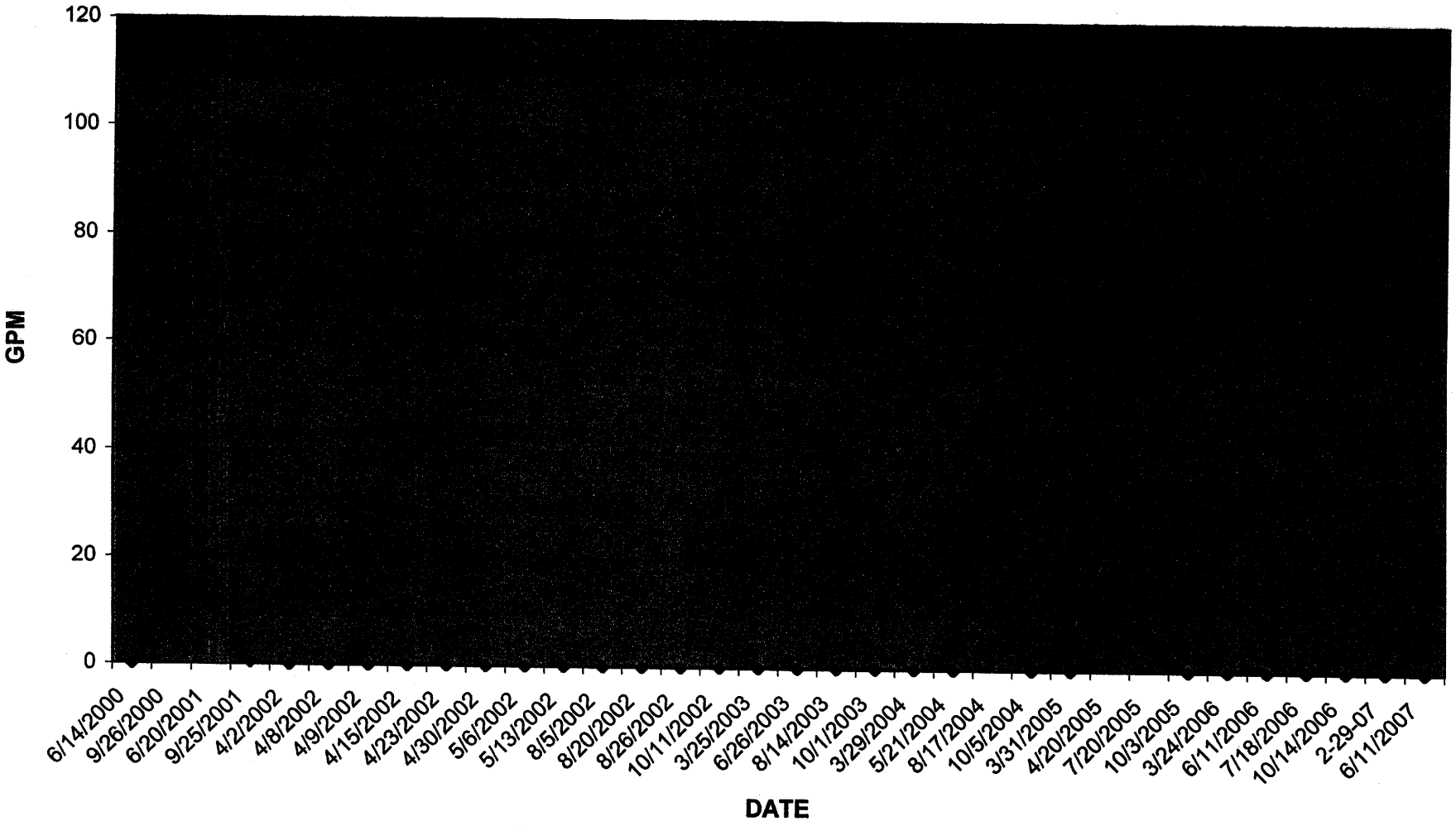
Pace Creek Flow
PC-1A



Pace Creek Flow
PC-2



Rock Creek Flow
RC-1



APPENDIX 7-4

Monitoring Well Water-Level Data
and Well Logs

SAGEPOINT/DUGOUT CANYON
BASIC HYDROGEOLOGIC DATA REPORT

Prepared for:

SUNEDCO COAL COMPANY
7401 W. MANSFIELD AVENUE
LAKEWOOD, COLORADO 80235

WAHLER ASSOCIATES
12477 W. CEDAR DRIVE, SUITE 206
LAKEWOOD, COLORADO 80228

December 15, 1982

Wahler Associates

Geotechnical and Water Resources Engineering

December 15, 1982
SED102

Mr. Charles W. Durrett
Environmental Coordinator
Sunedco Coal Company
7401 W. Mansfield Ave.
Lakewood, Colorado 80235

Dear Mr. Durrett:

Wahler Associates (WA) is pleased to submit with this letter a summary of work performed at Sunoco Energy Development Co.'s (Sunedco) Sage Point/Dugout Canyon property in Carbon County, Utah. The work performed is to be used in support of Sunedco's application (ACT/007/007) entitled Sage Point/Dugout Canyon Project, SMCRA Permit Application Chapter IV-B, Hydrology. The scope of work included the performance of static water levels, falling head tests, preparation and presentation of test results, and the preparation of a ground water potentiometric map for each of the aquifers on the property. Soldier Canyon Mine, which is adjacent to Sunedco's property, ground water data were also evaluated.

PROJECT OVERVIEW

The field work was directed by Mr. Joel Siegel, WA staff water resources engineer. The field work was initiated November 1, 1982. Water data were collected from five monitoring well locations (Figure 1) described below:

Well Number	Latitude	Longitude	Top of Casing Elevation In Feet Above Sea Level
5-1	394315	1103548	7186
10-2	384254	1103333	6626
11-2	394221	1103205	8204
19-1	394112	1103022	8254
24-1	394046	1103055	8416

The wells were established by Eureka Energy Co. (Eureka), the prior property owner, between 1976 and 1979. These wells are further described in Sunedco's application noted above.

Water level data were collected from all five wells. Only well 19-1 was found dry (Table 1). These data were used in conjunction with data previously collected by Eureka (Table 1) in developing the potentiometric level map (Figure 1) for the property.

Falling head tests were performed at three of the five wells. Wells 19-1 and 24-1 were not accessible owing to poor weather and road conditions.

TEST PROCEDURES

A 2000 gallon clean water truck, provided by Western Exploration, was used to carry water to each of the monitoring wells. Static water levels were taken at the wells, after which an additional head was applied to the aquifer. This was done via the injection of water into the wells from the water truck. Water level measurements were taken prior to and during all tests using an Olympic well probe. The levels were measured frequently during the early stages of the test, and several hours apart after a few hours had passed.

Because the representative value of elapsed time from which transmissivity values were calculated from the data is on the order of 1000 minutes, the significance of early time data is less than what was anticipated at the time of testng.

Wells 10-2 and 11-2 were filled to within 100 feet of the ground surface. Well 5-1 was filled to approximately 20 feet below ground surface. Time was allowed for each well to settle, which generally occurred 5 to 10 minutes after filling. Response of the Price River formation aquifer was slow at both test locations (wells 10-2 and 11-2).

Well 5-1 displayed a very slow decline in head. Therefore, the time between measurements was increased from minutes to hours after test initiation. This test was in the coal members of the Blackhawk formation.

DATA ANALYSIS

The basic equation for the residual head in a well, to which an initial excess is applied, was modified in order to determine the transmissivity of the Price River formation. Assumptions implicit in the analysis are that water levels in the formation are affected by the recharge only in the immediate vicinity of the well, and that the storativity is small. These assumptions are applicable for the Price River formation. This type of analysis does not allow for the determination of aquifer storativity.

Attachment I includes all data in tabular form for each of the 3 tests, and time-residual head plots for the Price River formation (wells 10-2 and 11-2). A simplified analysis for determining Blackhawk formation coal (well 5-1) transmissivity is included in Attachment I, as well as a description of the graphical procedures applied to the data from the Price River formation. All field test data is given in Attachment II.

RESULTS

The transmissivity of the Price River formation aquifer at the locations tested on the Sage Point/Dugout Canyon property is 1 gallon per day per foot (gpd/ft). This value is a reliable order of magnitude estimate. The transmissivity of the formation apparently decreased with time during falling head tests at wells 10-2 and 11-2. The stated confidence in the results is well within the normally expected range for falling head tests.

A simple analytical procedure for determining the coupled transmissivity of the Sunnyside and Rock Canyon coal members of the Blackhawk formation is described in Attachment I-C. The conclusion that can be drawn from well 5-1 data is that the coals of the Blackhawk formation are near-impermeable. The transmissivity is 0.009 gpd/ft.

The results of the aquifer tests indicate that the strata of the Price River formation and the coal seams of the Blackhawk formation have limited aquifer potential. The calculated transmissivities of the strata are so low that water development would be uneconomical,

even for domestic or stock-watering uses. Therefore, the strata of the Price River and Blackhawk formations should not be considered aquifers.

POTENTIAL HEAD DATA AND MAP

Table 2 summarizes potential head data with reference to both ground elevation and mean sea level for all wells monitored by WA during the time period November 1-5, 1982. Figure 1 is a potentiometric map for the Price River formation, and was based upon data from Table 2.

WA is confident that the content of this report, inclusive of data and backup calculations, is sufficient for presentation to the Office of Surface Mining and Utah Division of Oil, Gas and Mining as a baseline hydrologic report for the Sage Point/Dugout Canyon property. Please call if we can be of any further assistance.

Sincerely,

WAHLER ASSOCIATES

John Reiss, Jr.
General Manager
Rocky Mountain Region

JR:br

TABLE 1

WATER LEVEL DATA COLLECTED BY EUREKA ENERGY CO.*

DATA	MONITORING WELLS				
	5-1	10-2	11-2	19-1	24-1
Formation Perforated	Sunnyside & Rock Canyon Coal	Middle Castlegate Sandstone	Price River	North Horn	Lower Castle gate Sandstone (PR)
Collar Altitude (FT MSL)	7186.38	7727.39	8203.79	8254	8416
Dates Sampled (ft below land surface)					
November, 1979					
16				--	--
23		--			
24			--		
26	139.90				
27		348.44		304.78	759.75
December, 1979					
12	159.91	640.62	1119.65	312.26	895.72
January, 1980					
10		709.03	1123.51		
19	180.77				
24				311.40	
February, 1980					
14			1123.32		
15	197.72	711.86			
March, 1980					
17	208.29	710.60			
18			1121.25	296.95	1019.92
April, 1980					
9	215.15	710.46	1121.15	228.29	1024.41
April, 1981					
1	275.92	711.23	1119.17		

*Data provided by Sunoco Energy Development Co.

TABLE 2

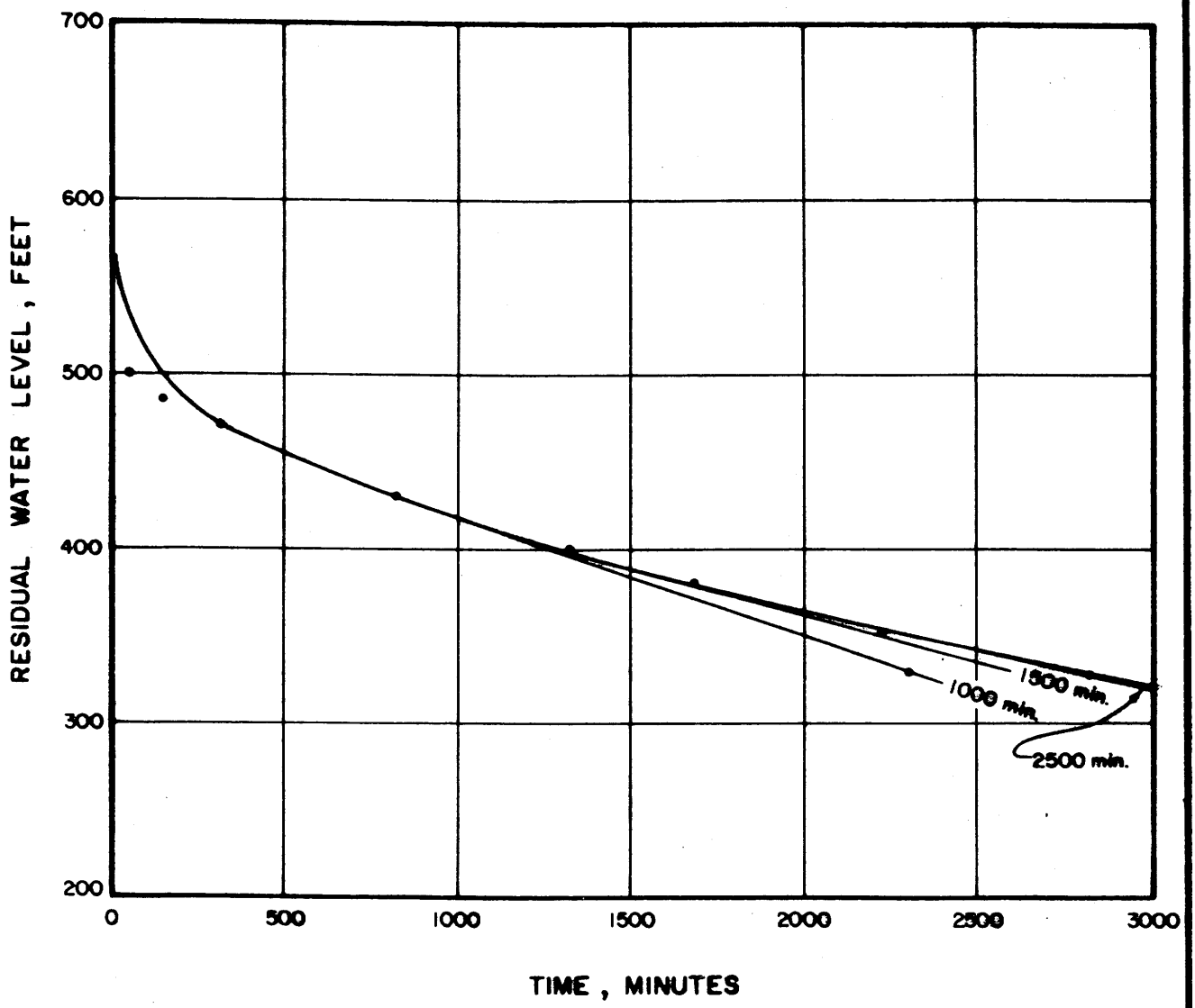
WATER LEVEL SUMMARY

SAGE POINT/DUGOUT CANYON PROPERTY

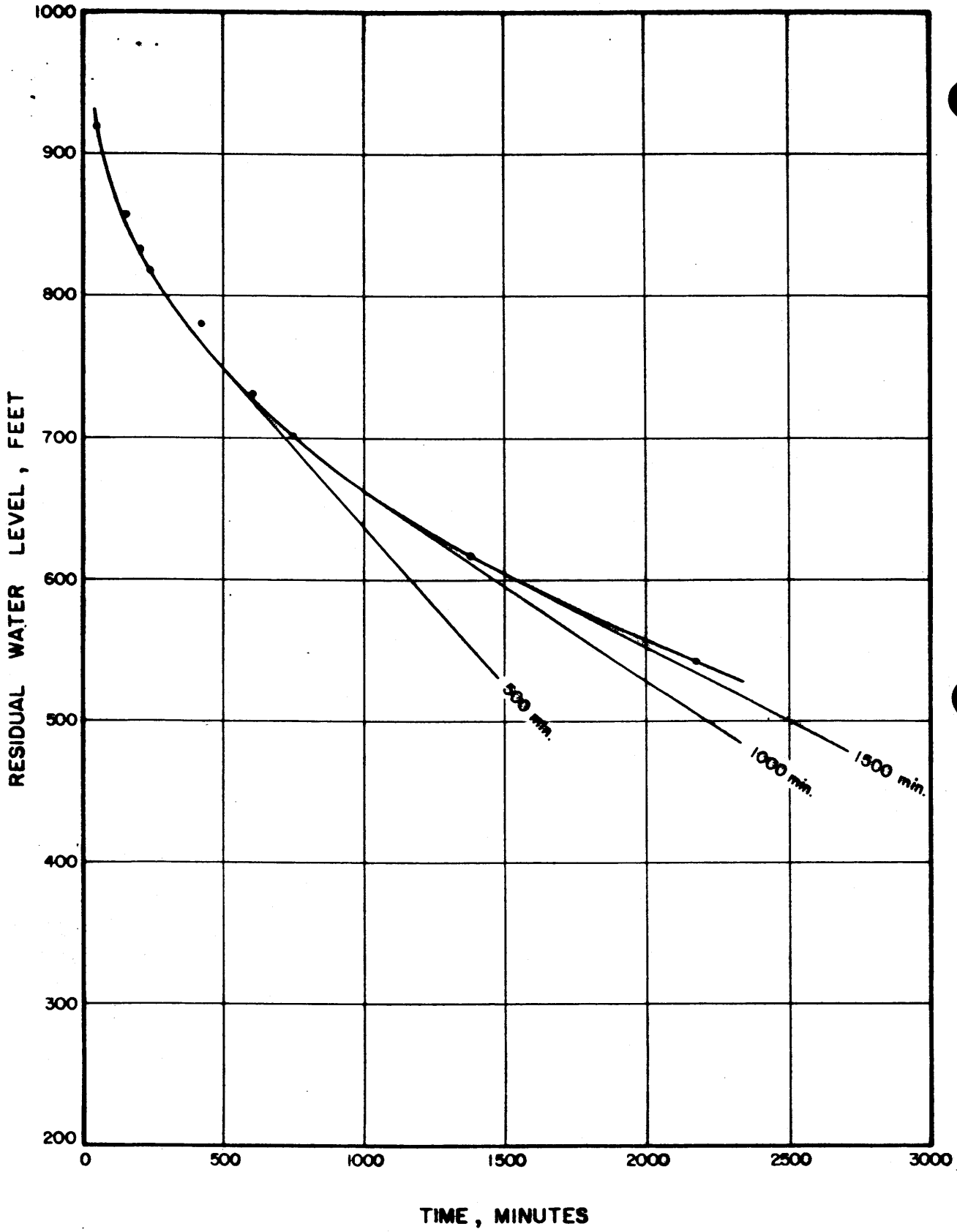
NOVEMBER, 1982

WELL NUMBER	GEOLOGIC FORMATION	TOP OF CASING ELEVATION IN FEET ABOVE MEAN SEA LEVEL	STATIC WATER LEVEL BELOW TOP OF CASING IN FEET	STATIC WATER LEVEL IN FEET ABOVE MEAN SEA LEVEL	DATE OF MEASUREMENT
5-1	Sunnyside and Rock Canyon Coals	7186	304.9	6881.1	11-4-82
10-2	Price River Formation	7727	715.8	7011.2	11-3-82
11-2	Price River Formation	8204	1127.6	7076.4	11-4-82
19-1	North Horn Formation	8254	Dry[1]	———	11-2-82
24-1	Price River Formation	8416	1020	7396	11-2-82

[1]Used two probes to depths of 750 feet; both verified as working; well has no water.



Wahler Associates	SUNEDCO COAL COMPANY	RESIDUAL HEAD VS. TIME, WELL 10-2		
		PROJECT NO.	DATE	FIGURE NO.
	PALO ALTO • NEWPORT BEACH • DENVER	SED-102A	NOVEMBER 1982	1-1



Wahler Associates	SUNEDCO COAL COMPANY	RESIDUAL HEAD VS. TIME, WELL 11-2		
PALO ALTO • NEWPORT BEACH • DENVER		PROJECT NO.	DATE	FIGURE NO.
		SED-102A	NOVEMBER 1982	1-2

ATTACHMENT I
GENERAL EQUATIONS

ATTACHMENT I

A. General Equation for the Residual Head in a Well

Theis (1935) presented the equation for the drawdown in an instantaneous vertical line source.[1] The equation provides a useful method for estimating the transmissivity of a formation in the vicinity of a well, which is a physical approximation of the theoretical vertical line source. Ideally, a "slug" of water is injected into a fully developed well at time t=0. The well theoretically penetrates the full length of the aquifer in question, a condition met by each well, 10-2 and 11-2. The equation for the residual head is then written as:

$$s = \frac{Q \exp(-r^2S/4Tt)}{4\pi Tt} \qquad [1]$$

where

- s = residual water level after injection of the water, measured with respect to the original water table.
- r = distance from the injection well to an observation point
- t = time since injection of the slug
- Q = volume of the slug
- T = aquifer transmissivity
- S = aquifer storativity

Generally, only a small volume of water is injected into a well. For this reason, the reaction to the injected slug usually is not measurable in the aquifer beyond the immediate vicinity of the well. Therefore, the water-level measurements are made only in the injection well; the distance is then the radius of the well. For values of r as small as the well radius, especially where S is small (as for artesian aquifers), the argument of the exponential in equation 1 approaches zero as t becomes large and the value of the exponential terms approaches unity. Then, for a consistent set of units, transmissivity can be represented as:

$$T = \frac{Q}{4\pi st} \qquad [2]$$

A plot of s versus 1/t should be a straight line which passes through the origin. Any coordinate of the line should thus yield a value for T.

B. Specific Technique for Transmissivity Determination from test Data of Wells 11-2 and 10-2

Observed data for wells 11-2 and 10-2 did not plot on a straight line, nor was there a trend for any of the locally straight segments on either plot to pass through the origin. This may be attributed

[1]Theis, C.V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: Amer. Geophys. Union Trans., 16th Ann. Mtg., pt.2, p. 519-524

to poor well construction techniques. The water levels in both wells were asymptotic not to the original static level, but to levels more than 200 feet higher. WA has speculated that all of the additional excess head was indeed necessary to force water into the formation and to overcome head loss associated with the perforations in the casing. At later time, the residual excess head in the well was not great enough to overcome severe head loss, through the perforations, thus causing a relatively slow decline in the water level and a correspondingly low apparent transmissivity.

Assuming that the water levels were displaced by some constant value due to well inefficiency during the tests, WA has employed a differential form of equation 2 to determine transmissivity from the graphs of Figures I-1 and I-2, which represent time-residual head data for wells 10-2 and 11-2 respectively. The key to the analysis is that T is determined from the predicted rate of fall of the water level rather than its actual position at various times during the test. Consequences of the analysis is that the apparent transmissivity of the formation is found at various points in time, with the gradual decrease being attributed more and more to poor well completion. In addition, the trend for the water table not to return to static is removed from the analysis.

Equation 2 is rearranged as:

$$T = \frac{-Q}{4\pi(ds/dt)t^2} \qquad [3],$$

and the slope of the time-residual head curve (always negative) is measured at various values of time, t. Table 1 summarizes the values of transmissivity for the Price River formation as obtained by equation 3. Using 1000 as a time during the test for which T is representative, the transmissivity of the Price River formation aquifer is approximately 1 gpd/ft.

C. Coal Transmissivities as Derived from Well 5-1 Data

An estimate of the transmissivity of the coal members of the Blackhawk formation is possible by applying Darcy's law to the observed data for well 5-1. This is done by calculating the volume of water lost to the formation from the well over a given time, and dividing it by the average gradient in the immediate vicinity of the well during the time period. As water is not likely to have penetrated too far radially into the formation, the assumption that the formation gradient is equal to the average excess head during the time period of interest is reasonable. Therefore,

$$T = Q/i\Delta t\pi d \qquad [4],$$

where:

Q = volume of water lost to formation during time Δt
i = average excess head during time Δt
πd = the "width" of well screen, if unfolded, normal to the flow.

For well 5-1, use i = 280.2 ft/ft between times of 2 and 1922 minutes. Then Δt = 1.33 days, and Q = 4.5 feet (7.48 gallons/ft^3) ($\pi d^2/4$), or 4.6 gallons. Then:

$$T = 4.6 \text{ gallons}/(280.2)(1.33 \text{ days})\ \pi(.417 \text{ ft})$$
$$T = 0.009 \text{ gpd/ft}$$

TABLE I-1

SUMMARY OF TRANSMISSIVITY VALUES FROM

PRICE RIVER FORMATION AQUIFER TESTS

A. Well 10-2*

time t (min)	slope ds/dt (ft/min)	transmissivity T (gpd/ft)***
1000	90/1300	1.04
1500	30/550	0.59
2500	42/1000	0.27

B. Well 11-2**

time t (min)	slope ds/dt (ft/min)	transmissivity T (gpd/ft)***
500	110/500	2.19
1000	40/300	0.91
1500	30/300	0.54

*Volume of slug = Q = $(\pi d^2/4)$(initial excess head)(7.48 gal/ft^3)

= 627 gallons

**Volume of slug = Q = $(\pi d^2/4)$(initial excess head)(7.48 gal/ft^3)

= 1053 gallons

***$T = 114.6Q/(ds/dt)t^2$, for units used.

ATTACHMENT II

FIELD TEST DATA

FIELD PERMEABILITY TEST

FALLING HEAD

PROJECT SAGE POINT / DUBOUT CANYON TESTED BY JOEL SIEGEL DATE 11-4-82
PROJECT NO. SED102A CALCULATED BY Joel Siegel DATE 11-9-82
BORING NO. 5-1 CHECKED BY _____ DATE _____

DIAMETER OF BORING N/A
DIAMETER OF CASING 5 INCH PERMEABILITY, K _____
HEIGHT OF CASING (REF. LEVEL)
ABOVE GROUND SURFACE 2.6 FT. PUMPING FROM: _____ TO _____
PERFORATED CASING FROM: _____ TO _____
TYPE OF PERFORATION: _____
DEPTH TO GROUND WATER
FROM TOP OF CASING (STATIC) 304.9 FT. PUMPING RATE: _____ gp

	DATE AND TIME	ELAPSED TIME (MIN)	DEPTH TO WATER (ft)	S.W.L.-DEPTH TO WATER(ft) H	H/H₀**	INVERSE TIME (MIN⁻¹)
11-4-82	13:41	0	304.9 *	—	—	—
	13:51	0	11.9	293.0	—	—
	13:53	2	22.5	282.4	1	50×10^{-2}
	13:53:30	2.5	23.5	281.4	0.99	40×10^{-2}
	13:55	4	23.7	281.2	0.99	25×10^{-2}
	13:58	7	23.8	281.1	0.99	14.3×10^{-2}
	14:02	11	23.9	281.0	0.99	9.1×10^{-2}
	14:17	26	24.0	280.9	0.99	3.85×10^{-2}
	14:41	50	24.0	280.9	0.99	2.00×10^{-2}
	21:53	482	24.9	280.0	0.99	0.21×10^{-2}
11-5-82	08:24	1113	25.9	279.0	0.99	0.09×10^{-2}
	21:53	1922	27.0	277.9	0.98	0.05×10^{-2}
			END	OF TEST.		

COMMENTS: * STATIC LEVEL

FIELD PERMEABILITY TEST

FALLING HEAD

PROJECT SAGE POINT/DUGOUT CANYON
PROJECT NO. SED102A
BORING NO. 10-2

TESTED BY JOEL SIEGEL DATE 11-3-8
CALCULATED BY Joel Siegel DATE 11-9-8
CHECKED BY _____ DATE _____

DIAMETER OF BORING N/A
DIAMETER OF CASING 5 INCH
HEIGHT OF CASING (REF. LEVEL)
ABOVE GROUND SURFACE 2.3 FT.
PERFORATED CASING FROM: _____ TO _____
TYPE OF PERFORATION: _____
DEPTH TO GROUND WATER
FROM TOP OF CASING (STATIC) 715.8 FT

PERMEABILITY, K _____
PUMPING FROM: _____ TO _____
PUMPING RATE: _____ g

	DATE AND TIME	ELAPSED TIME (MIN)	DEPTH TO WATER (ft)	S.W.L.-DEPTH TO WATER(ft) H	H/Ho	INVERSE TIME (MIN^{-1})
11-3-82	8:31	0	715.8 *	—	—	—
	9:06	0	101.0	614.8	1	—
	9:09	3	125.4	590.4	.96	33.3×10^{-2}
	9:11	5	139.6	576.2	.94	20.0×10^{-2}
	9:13	7	146.5	569.3	.93	14.3×10^{-2}
	9:15	9	149.7	566.1	.92	11.1×10^{-2}
	9:18	12	150.8	565.0	.92	8.33×10^{-2}
	9:23	17	182.5	533.2	.87	5.88×10^{-2}
	9:27	21	195.3	520.5	.85	4.76×10^{-2}
	9:39	33	212.4	503.4	.82	3.03×10^{-2}
	9:47	41	213.8	502.0	.82	2.44×10^{-2}
	10:00	54	215.8	500.0	.81	1.85×10^{-2}
	10:34	88	220.6	495.2	.81	1.14×10^{-2}
	11:12	126	225.2	490.6	.80	0.79×10^{-2}
	11:39	153	229.5	486.3	.79	0.65×10^{-2}
	12:03	177	231.1	484.7	.79	0.56×10^{-2}
	12:41	215	235.0	480.8	.78	0.46×10^{-2}
	13:19	253	238.8	477.0	.78	0.39×10^{-2}
	14:26	320	245.1	470.7	.77	0.31×10^{-2}
	15:18	372	249.8	466.0	.76	0.27×10^{-2}
	20:13	667	273.2	442.6	.72	0.15×10^{-2}
	22:49	823	284.1	431.7	.70	0.12×10^{-2}
11-4-82	07:14	1328	315.6	400.2	.65	0.075×10^{-2}
	13:12	1686	335.0	380.8	.62	0.059×10^{-2}

COMMENTS: * STATIC LEVEL

FIELD PERMEABILITY TEST

FALLING HEAD

PROJECT SAGE POINT/DUGOUT CANYON
PROJECT NO. SED102A
BORING NO. 10-2

TESTED BY JOEL SIEGEL DATE 11-3-
CALCULATED BY Joel Siegel DATE 11-9
CHECKED BY _____ DATE _____

DIAMETER OF BORING N/A
DIAMETER OF CASING 5 INCH
HEIGHT OF CASING (REF. LEVEL)
ABOVE GROUND SURFACE 2.3 FT.
PERFORATED CASING FROM: _____ TO _____
TYPE OF PERFORATION: _____
DEPTH TO GROUND WATER
FROM TOP OF CASING _____

PERMEABILITY, K _____
PUMPING FROM: _____ TO _____
PUMPING RATE: _____

	DATE AND TIME	ELAPSED TIME (MIN)	DEPTH TO WATER (ft)	S.W.L.-DEPTH TO WATER(ft) H	H/Ho	INVERSE TIME (MIN^{-1})
11-4-82	22:10	2224	361.0	354.8	.58	0.045×10^{-2}
11-5-82	08:11	2825	386.9	328.9	.53	$0.035 \times$ [illegible]
	21:36	3630	417.0	298.8	.49	0.027×10^{-2}
			END OF	TEST		

COMMENTS:

FIELD PERMEABILITY TEST

FALLING HEAD

PROJECT SAGE POINT/DUGOUT CANYON
PROJECT NO. SED102A
BORING NO. 11-2

TESTED BY JOEL SIEGEL DATE 11-4-8
CALCULATED BY Joel Siegel DATE 11-9-8
CHECKED BY DATE

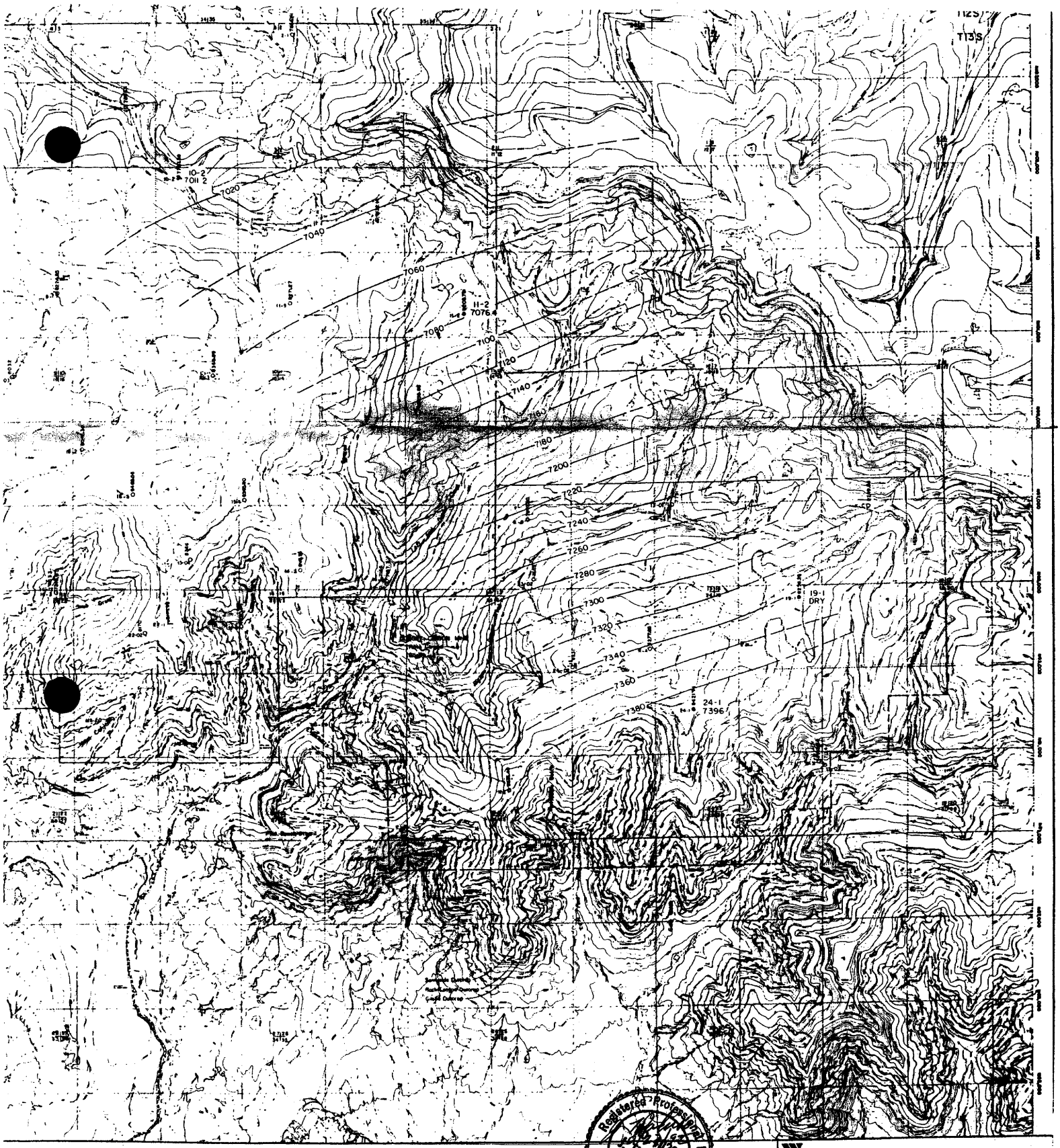
DIAMETER OF BORING N/A
DIAMETER OF CASING 5 INCH
HEIGHT OF CASING (REF. LEVEL) ABOVE GROUND SURFACE 2.4 FT.
PERFORATED CASING FROM: TO
TYPE OF PERFORATION:
DEPTH TO GROUND WATER FROM TOP OF CASING (STATIC) 1127.6 FT

PERMEABILITY, K
PUMPING FROM: TO
PUMPING RATE: g

	DATE AND TIME	ELAPSED TIME (MIN)	DEPTH TO WATER (ft)	S.W.L.-DEPTH TO WATER(ft) H	H/Ho	INVERSE TIME (MIN^{-1})
11-4-82	7:40	0	1127.6 *	—	—	—
	8:53	0	95.3	1032.3	1	—
	8:56	3	119.2	1008.4	.98	33.3×10^{-2}
	9:01	8	130.0	997.6	.97	12.5×10^{-2}
	9:02	9	143.4	984.2	.95	11.1×10^{-2}
	9:06	13	172.1	955.5	.93	7.69×10^{-2}
	9:09	16	184.1	943.5	.91	6.25×10^{-2}
	9:15	22	187.9	939.7	.91	4.55×10^{-2}
	9:21	28	193.7	933.9	.90	3.57×10^{-2}
	9:28	35	198.9	928.7	.90	2.86×10^{-2}
	9:41	48	208.0	919.6	.89	2.08×10^{-2}
	10:00	67	221.3	906.3	.88	1.49×10^{-2}
	10:22	89	234.0	893.6	.87	1.12×10^{-2}
	10:45	112	247.9	879.7	.85	0.89×10^{-2}
	11:25	152	270.6	857.0	.83	0.66×10^{-2}
	11:48	175	281.3	846.3	.82	0.57×10^{-2}
	12:16	203	294.2	833.4	.81	0.49×10^{-2}
	12:40	227	303.5	824.1	.80	0.44×10^{-2}
	12:58	245	309.7	817.9	.79	0.41×10^{-2}
	15:00	427	348.3	779.3	.75	0.23×10^{-2}
	16:53	480	372.1	755.5	.73	0.21×10^{-2}
	18:52	599	397.1	730.5	.71	0.17×10^{-2}
	21:23	750	425.5	702.1	.68	0.13×10^{-2}
11-5-82	07:53	1380	512.3	615.3	.60	0.072×10^{-2}
	21:08	2175	584.6	543.0	.53	0.046×10^{-2}

COMMENTS: * STATIC LEVEL.

END OF TEST



LEGEND

- Outline of Sunedco
- Measured Section of Outcrop
- Mined Out Areas
- Outcrop
- Proposed Road
- Proposed Railroad
- Oil & Gas Test Well
- 11-2 / 7076.4 — Drill Hole Number / Static Water Level Elevation
- Surface Elevation
- 7100 — Price River Formation Equal Potential Contour in Feet Above Mean Sea Level (Dashed Where Inferred)

I, being a professional engineer hereby certify that this map was prepared by me or under my direct supervision and that all information contained thereon is true and correct to the best of my knowledge and information.

Registered Professional Engineer — THOMAS PALUSO — State of Utah

REVISED
SEP 08 1992

0 1000 2000
SCALE

Wahler Associates
PALO ALTO • NEWPORT BEACH • DENVER

SUNEDCO COAL COMPANY
SAGE PT.-DUGOUT CANYON PROJECT

GENERALIZED PRICE RIVER FORMATION
POTENTIOMETRIC LEVEL MAP

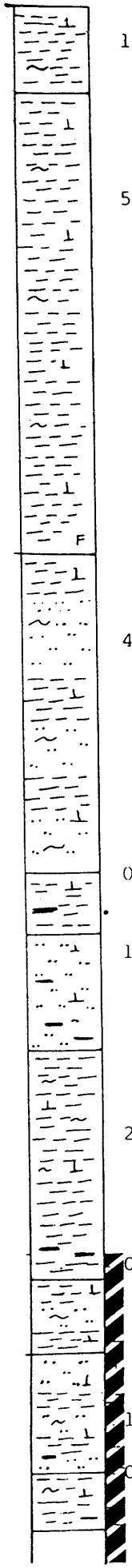
PROJECT NO SED-102	FIGURE NO 1
SCALE: 1" = 2000	DATE NOVEMBER 1982

GEOLOGIC lOGS
WATER LEVEL MONITORING WELLS

WELL 5-1

Core: D.H. 5-1
Scale: 1"=2'

1540'



1.1' mudstone, sl. silty & dr. gray to black, calc., med. to sl. carb., plant frag.; bedding is v. thin & irreg. ox-ov; no fract.

5.9' mudstone, black, mod. carb.; abundant plant frag.; sl. calc.; occasional mollusc fossils (gast.); upper 1.0' contains some mottling of unit above; from 3.3' to 4.3' are brown globs (1/16" to 3/8") of calc. mudst; no fract.

1547'
Core in 1.6' to 0.8' sections

4.1' interbedded, mixed & mottled mudst., dr. gray to black, sl. silty & sandy siltst.; lt. gray to gray, v. calc.; v.f.g.; ratio is 2:3; unit is calc.; mod. carb.; bedding is thin & convoluted; some of the mottling is due to bioturbation; basal 0.2' have a few v. thin coal streaks; no fract. ox-ov.

0.8' carb. mudst., sl. calc.; a few resin pods & coal streaks; sandy & silty in upper 0.2'; contact gradational; lower contact is sharp but irreg.; abund. plant frag.; no fract.

1.5' siltstone, lt. gray to gray, calc., contains thin irreg. laminae of darker muddy carb. material; a few thin coal streaks; rooted in upper 2/3 sharp irreg. lower contact.

2.95' carb. mudst., sl. calc. in upper 1.0' and also only sl. carb.; from 1.1' to 1.5' unit is coaly & resinous; lower portion contains a few thin coal streaks; vert. fract. from 0.1' to 0.9' & from 1.1' to 1.5'; closed & hairlike

0.95' interbedded mudst., dr. gray to gray & siltstone, lt. gray; ratio is 3:1; unit is calc.; sl. carb.; a few plant frags.; mod. bioturbation; bedding is thin to laminae & mostly horiz. w/some irreg. beds; siltst. shows some small syndepositional faulting (¼" displacements); no fract.

1557.3'
Core in 4.4' to 1.0' sections

1.55' same as above; lower 1.0' contains numerous thin coal streaks & trace of resin; no fract.

0.7' mudstone, sl. silty; mod. carb.; sl. calc.; a few thin coal streaks; sharp irreg. lower contact; no fract.

WATER MONITORING ZONE - SUNNYSIDE SEAM

Core: D.H. 5-1
Scale: 1"=2'

0.35' carb. mudstone; thin, numerous coal streaks; sl. resinous; no fract.

0.4' bone coal; sl. resinous; hard; vert. fract. throughout; closed; numerous coal streaks

0.5' carb. mudstone, sl. resinous; numerous thin coal streaks; no fract.

0.55' coal, hard, shiny; resinous; gassy, vert. fract. throughout; close

0.25' bone coal; resinous w/coal streaks; vert. fract. throughout; closed, gassy

0.35' high-ash coal, resinous; small vert. fract. throughout; closed

5.75' coal, hard, shiny; sl. resinous; gassy, small vert. & oblique closed fract. (cleat); 0.05' pyrite streak at 0.0'; Sunnyside coal seam

WATER MONITORING ZONE - SUNNYSIDE SEAM

1567.7' Core in 3.9' to 1.1' sections

3.85' coal, as above; thin, closed cleat; fract. throughout, open vert. fract. from 1.5' to 3.7'; Sunnyside, sharp lower contact

0.3' carb. mudstone, sl. resinous; numerous v. thin coal streaks & plant frag.; sl. sandy; no fract.

1.45' sandstone, lt. gray to gray, v.f.g.; sub-rounded, mod. to well sorted; sl. calc.; mod. cementing; semi-porous; gassy; contains a few thin irreg. laminations of carb. mat. & a rare thin coal streak; lower contact is break in core-sharp; vert. fract. from 0.25' to end; closed; calcite filled

1.2' sandy siltst., lt. gray, sl. calc., ss. is v.f.g. as above; unit fines toward base; contains a few thin discont. lenses of dr. carb. mudst., thin coal streak at base; tr. pyrite; vert. fract. throughout; closed & calcite filled

2.35' interbedded sandy siltst.; sandstone of two units above & mudst., dr. gray to carb.; ratio is 3:3:2; sl. calc.; unit is v. thinly & mostly reg. horiz. bedded; finest units from 1.0' to 1.6'; upper 1.0' and lower 0.45' are semi-porous & gassy; unit is sl. bioturbated horiz. & vert.; vert. fract. from 0.0' to 0.4'; closed & calcite filled

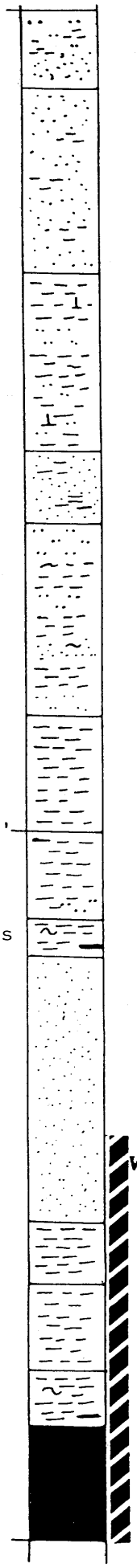
0.35' mudstone, black. sl. carb.; w/thin lentils of lt. gray siltst; vert. fract. from 0.1' to end-open

1578.05' Core in 2.4' to 0.2' sections

0.85' Plugged to next core pt. interbedded, mixed & mottled, sandstone, v.f.g. to f.g.; sub-angular to sub-rounded; poorly sorted; "salt & pepper"; mod. cem. semi-porous & mudst. gray to black; occasionally sl. carb.; ratio is 3:2; bedding is thin & irreg.; mottling is caused by intense bioturbation (horiz. & vert.); washover R.M.; vert. fract. 0.0' to 0.3', open.

Core: D.H. 5-1
Scale: 1"=2'

1687'



1.0' siltstone, dr. gray, muddy w/a few thin silty ss. beds in lower 0.3'; unit is intensely bioturbated (Chondrites, some ophiomorpha);ratio siltst. to ss. is 3:1; gradational lower contact; no fract.

2.3' ss., lt. gray, v.f.g.; sl. silty, mod. cemented; low-angle x-bedding & thin, horiz. laminae w/a few thin beds to laminae of dr. gray mudst.; large ophiomorpha burrows in upper 0.6'; sharp lower contact.

2.3' silty mudst. to siltst.; ratio is 4:1; thinly to med. bedded; sl. calc.; intensely bioturbated (mostly Chondrites); gradational lower contact; no fract.

0.95' muddy ss., dr. gray, v.f.g. to f.g.; poorly sorted, sub-rounded to sub-angular; mod. bioturbated; some plural curing tubes? no bedding; no fract.

2.4' interbedded siltst.; gray to dr. gray, mudst., black & silty ss.; ratio is 3:3:1; sl. carb. w a few v. thin coal streaks; bedding is thin to v. thin; mostly even w/some irreg. beds in upper portion; upper 1.0' is bioturbated by large mostly vert. burrows that are filled w/ss. of the overlying unit (R.M.?); some beds are mildly bioturbated; no fract.

1.5' mudstone, black; some hairlike streaks of lt. mudst.; no fract. Restricted Marine

1697.45'
Core in 5.5' to 0.5' sections

1.1' mudstone of above; sl. silty near base; no fract.

0.5' carb. mudstone w/numerous coal streaks (¼"); sl. resinous; sl. gassy; irreg. lower contact; no fract.

3.4' mixed & mottled muddy to sandy siltstone; black to gray, intensely bioturbated; mostly horiz. & oblique; some rooting; most bedding destroyed; some irreg. horiz. beds; numerous thin laminae of carb. material; sharp irreg. bioturbated lower contact; no fract. R.M.

WATER MONITORING ZONE - ROCK CANYON SEAM

0.8' mudstone, black w/numerous v. thin lenses of gray siltst.; ratio is 15:1; med. carb. w/a few v. thin coal streaks in basal 0.1'; sl. bioturbation; irreg. lower contact; no fract.; R.M

1.1' same unit as the one just above the overlying mudstone; no fract.; R.M.

0.7' mudstone, black, mod. carb. w/numerous thin lenses & pods of gray siltst.; mod. bioturbation; a few thin coal streaks in basal 0.05'; lower contact is sharp & sl. irreg.; bedding is thin & horiz. w/irreg. caused by bioturbation; no fract.

1.15' coal, hard, shiny, banded, pyritic lense at 0.2' which is 3/8" thick; vert. fract. throughout; open; gassy

1706.2'

Core: D.H. 5-1
Scale: 1"=2'

1706.2'
Core in
3.6' to
broken
sections

10.0' coal, hard, shiny, a rare thin streak of resin; vert. open fract. from 0.0' to 1.0'; 1.3' to 1.9'; 3.3' to end; (50% lost from 8.7' to 10.0')coal is broken in this zone and sl. pyritic; gassy

WATER MONITORING ZONE - ROCK CANYON SEAM

1716.2'
Core in
5.4' to
broken
sections

1.7' coal, as above; sl. pyritic; banded; gradational lower contact; vert. open fract. throughout & broken; exact thickness is in question; gassy

0.65' bone coal; hard, banded, numerous coal streaks; sl. resinous; sl. pyritic; vert. open fract. from 0.0' to 0.3'

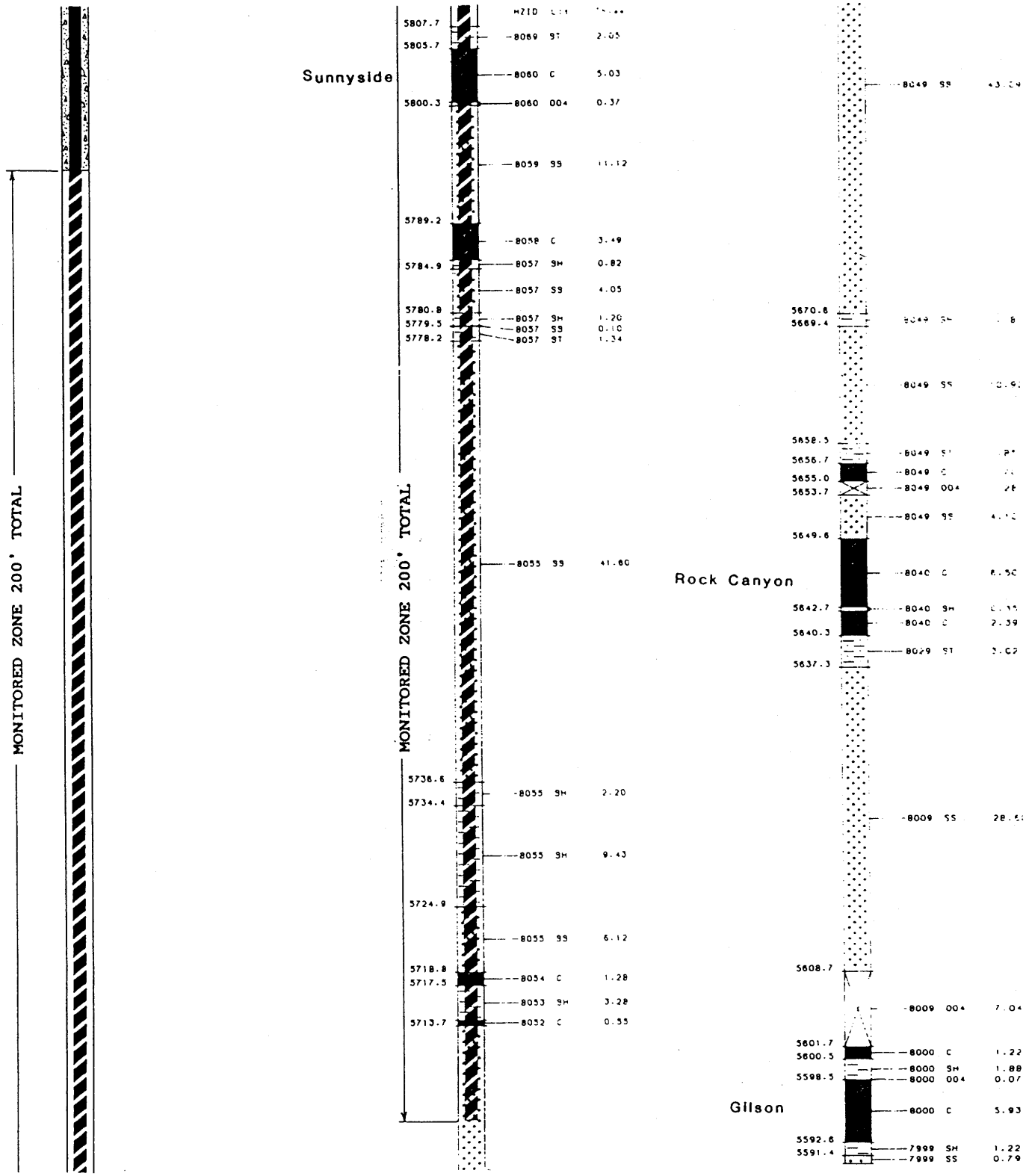
0.5' mudstone, carb. silty, black, a few v. thin coal streaks; irreg. grad. lower contact; no fract.

6.0' interbedded, mixed & mottled, sandy siltst.; lt. gray v.f.g.; silty to carb. mudstone; ratio is 1:1; bedding is mostly convoluted w/some thin horiz. bedding w/carb. laminae; sharp erosional contacts on sandy beds at 2.3' & at base of unit; some mottling caused by mod. bioturbation; lowest section contains some small clay intraclasts; unit is calc. below 3.0'; ve: fract.(open) from 0.5' to end; two major sets running through the core; polished break at 1.8' & 4.0'

1.95' ss., gray, v.f.g., mod. sorting, sub-rounded to sub-angular; friable, calc.; semi to non-porous; upper ½ is x-bedded; lower portion is mostly horiz.; bedding planes contain (cont. next page)

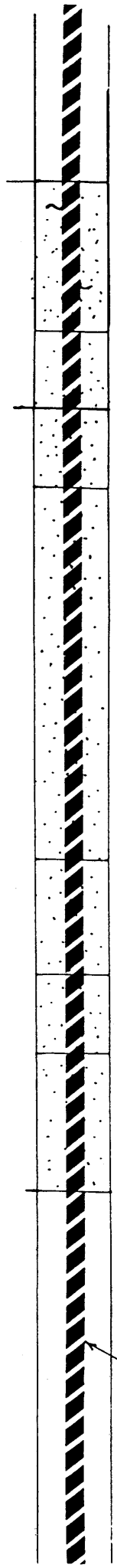
WELL 6-1

DRILL HOLE 6-1-89



WELL 10-2

Core: D.H. 10-2
Scale: 1"=2'
Castlegate Sandstone



1483'

Core #1 1483'-1486'; rec. 3'

2' ss., gray, v.f.g.; well sorted; sub-rounded; numerous interbedded laminations of carb. material

1' same as above w/o carb. material.

1486'

Core #2 1486'-1495.5'; rec. 5.5'

1' ss., med. gray, med. grained; subangular to subrounded; well sorted w/common carb. laminae, esp. heavy at 86.5'; lt. to dr. banded 1" (lam. perpendicular to core indicating flat bedding).

1487'-1492'

5' ss, med. gray; subang. to subrounded; well sorted; fair porosity w/occ. streaks black carb. lam. at 10° to 30° to core indicating x-lam.; core parting on 30° thin carb. lam. at 1489'; at 1488.5' top of vert. fract. running to 92.3'; fract. is partly healed in top with druzy white, crystalline quartz open voids ¼" to ½"; core badly broken along vert. fract. at 90' to 92'; ss. is mod. friable

1486-1489' solid core; no breaks

1489-1492' badly fract; vert. fracts. partly open w/ subhedral quartz lining.

1492-1496.5' solid core; no breaks

1492'-1493.5'

1.5' ss., med. gray, med. grained; well sorted subang.; tr. muscovite; w/scattered black, rounded granules of carbon (check out under binocs) massive or indistinctly lam.

1493.5'-1494.5'

1.0' ss, as above; being faintly to distinctly lam. w/ carb. partings at 80° to 85° to core (est. 5-10° from horiz.) in irreg. small-scale x-lam. trough sets.

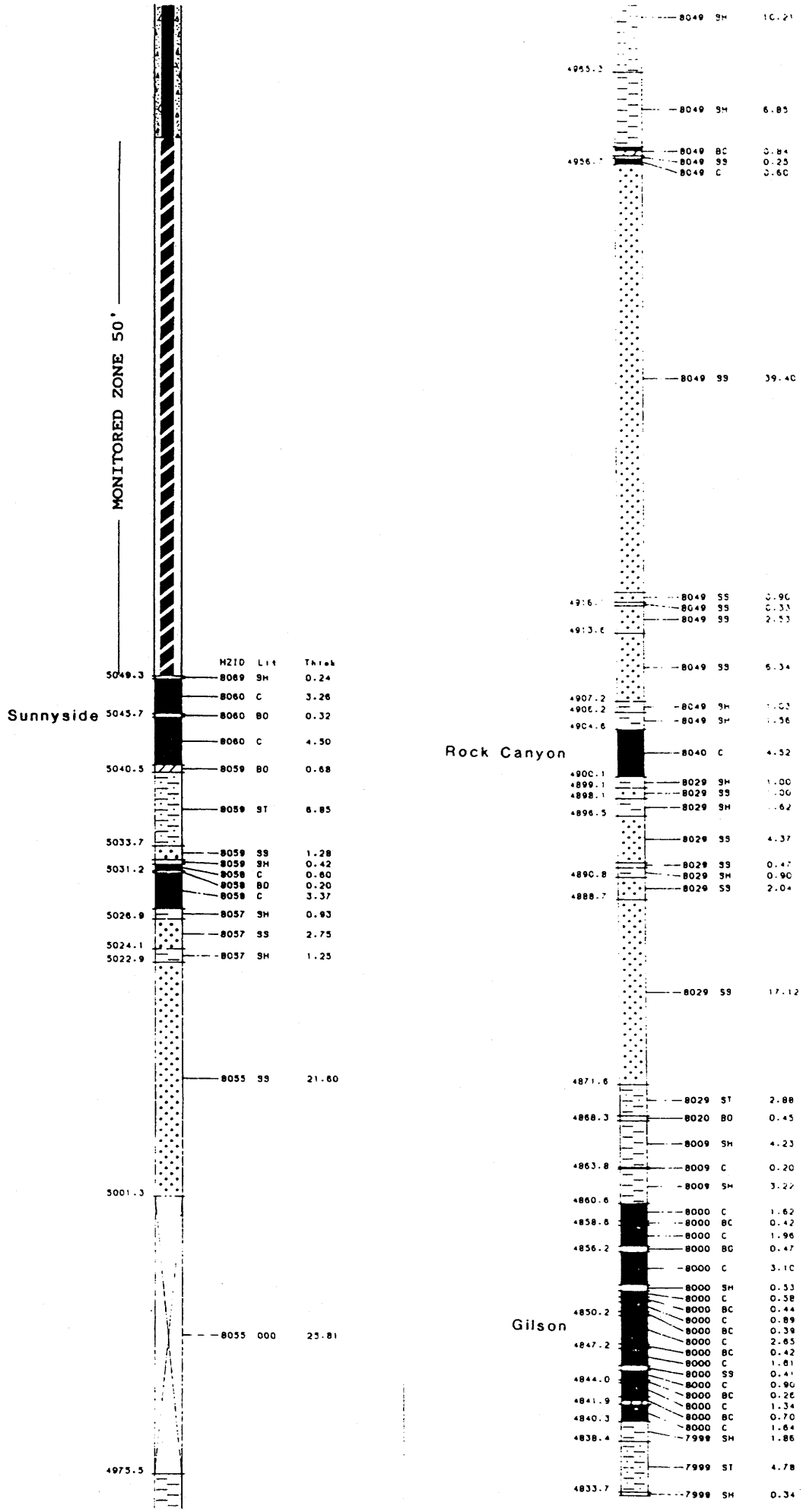
2.0' ss., as above; being slightly coarser grained to est. .3 to .4 mm (maximum) w/tr. angular chert or stained quartz, micas as above; sl. carb. w/faint lam. perpendicular to core; tr. white cherty infilling; fair to good porosity; faint sulfur odor on fresh break.

1496.5'

WATER MONITORING ZONE - 1400' TO 1650'

WELL 32-1

DRILL HOLE 32-1-90



DUGOUT CANYON MINE
MDW G18A

COLLAR START POINT
X=93320.1
Y=86414.3
ELEV.=8354'

14" CASING CEMENTED WITH 4 SUPER SACKS PORTLAND CEMENT AND 4 - 50# SACKS OF CALCIUM CHLORIDE

19" SURFACE HOLE TO 60'

14" SURFACE CASING SET AT 59.6'

9⅝" CASING CEMENTED WITH 14 SUPER SACKS OF PORTLAND CEMENT THRU THE TREMMIE AND 6 SUPER SACKS OF PORTLAND DOWN THE ANNULUS. 3-50# SACKS OF CALCIUM CHLORIDE WERE MIXED WITH THE ANNULUS SLURRY.
48-50# SACKS OF HOLE PLUG WAS POURED DOWN THE ANNULUS.

WATER ENCOUNTERED AT 1830'

7" BLANK CASING SET FROM _____ TO _____

9⅝" CASING SET AT 1956.55'

12¼" HOLE DRILLED TO 1987'

7" SLOTTED CASING SET FROM _____ TO 2245'

END OF HOLE
X=93105.1
Y=86387.7
ELV.=6127.2'
TVD= 2226.75'

8.875" HOLE DRILLED TO 2246'

NOTE: NOT TO SCALE

~25 TO GILSON SEAM

GILSON SEAM

DUGOUT CANYON MINE
MDW G31A

COLLAR START POINT
X=84681.1
Y=92982.8
ELEV.=8168.2'

14" CASING CEMENTED WITH 1 SUPER SACK PORTLAND CEMENT AND 1 50# SACK OF CALCIUM CHLORIDE

19" SURFACE HOLE TO 20'

14" SURFACE CASING SET AT 20'

9⅝" CASING CEMENTED WITH 15 SUPER SACKS OF PORTLAND CEMENT THRU THE TREMMIE AND 5 SUPER SACKS OF PORTLAND DOWN THE ANNULUS. 4-50# SACKS OF CALCIUM CHLORIDE WERE MIXED WITH THE ANNULUS SLURRY.
52-50# SACKS OF HOLE PLUG WAS POURED DOWN THE ANNULUS.

WATER ENCOUNTERED 1044'

7" BLANK CASING SET FROM 1665.38' TO 1709.97'

9⅝" CASING SET AT 1719.9'

12¼" HOLE DRILLED TO 1727'

7" SLOTTED CASING SET FROM 1709.97' TO 1954'

END OF HOLE
X=84867.1
Y=93068.8
ELV.=6239.0'

8.875" HOLE DRILLED TO 1954'

NOTE: NOT TO SCALE

~25' TO GILSON SEAM

GILSON SEAM

Hydrology of the Price River Basin, Utah with emphasis on Selected Coal-Field Areas

By K. M. Waddell, J. E. Dodge, D. W. Darby, *and* S. M. Theobald

Prepared in cooperation with the
U.S. Bureau of Land Management

Portions only of paper

U.S. GEOLOGICAL SURVEY WATER-SUPPLY PAPER 2246

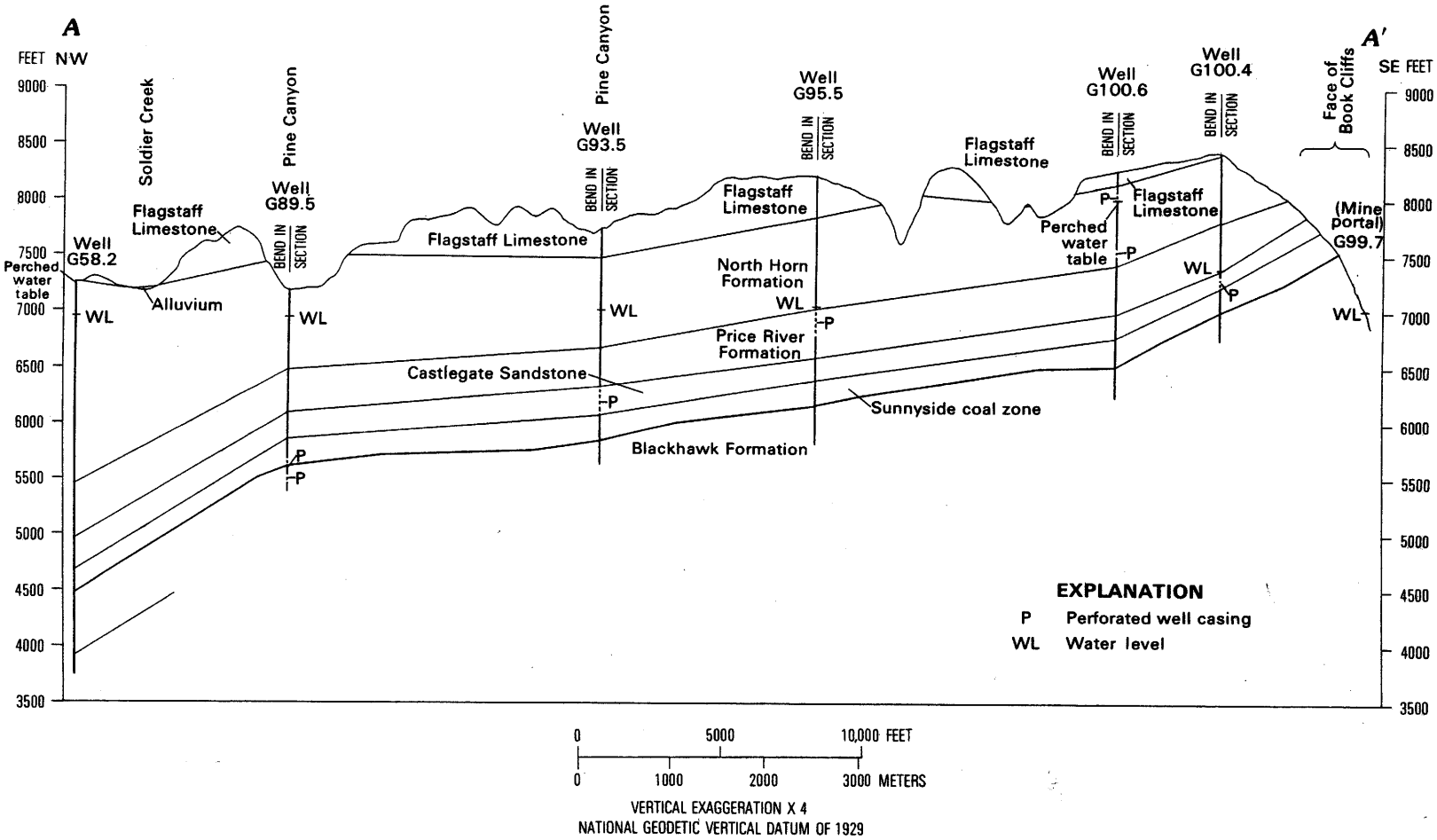


Figure 19. Generalized geologic section showing water levels in wells and a mine in the Soldier Creek area in the Book Cliffs, 1980. See plate 1 for line of section.

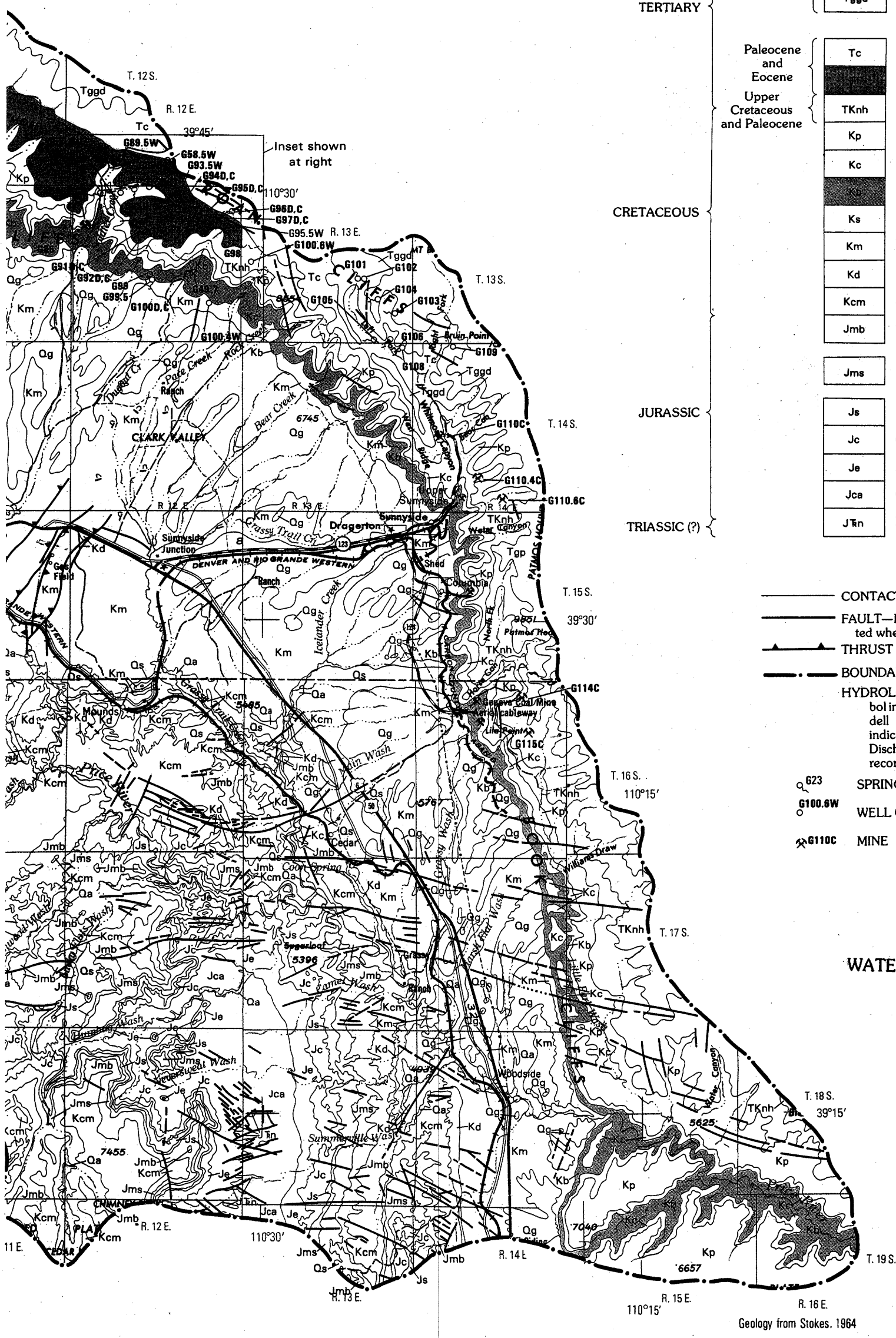
Wells G95.5, G100.6 and G100.4 shown on this drawing (Figure 19) are located within the 2008 permit boundary of the Dugout Canyon Mine. Refer to "Map Showing Geology and Data-Collection Sites for Ground Water, 1979 - 80 and Insert Showing Geology, Water Quality, and Hydrology Data-Collection Sites in a Part of the Soldier Creek Area, which follow this drawing.

MAP SHOWING GEOLOGY AND DATA-COLLECTION SITES FOR GROUND WATER, 1979-80

SCALE 1:250 000

5 0 5 10 MILES

5 0 5 10 KILOMETERS



EXPLANATION

QUATERNARY	Of the same age	Qa	ALLUVIAL DEPOSITS—Chiefly along active streams
		Qg	GRAVEL SURFACES—Mainly on pediments and terraces
		Qs	COVERING DEPOSITS—Chiefly wind-blown silts lacking dune form, includes some alluvium
TERTIARY	Eocene	Tgp	LOWER UNIT OF PARACHUTE CREEK MEMBER OF GREEN RIVER FORMATION
		Tggd	GARDEN GULCH AND DOUGLAS CREEK MEMBERS OF THE GREEN RIVER FORMATION
	Paleocene and Eocene	Tc	COLTON FORMATION
			FLAGSTAFF LIMESTONE
	Upper Cretaceous and Paleocene	TKnh	NORTH HORN FORMATION
CRETACEOUS	Mesa Verde group	Kp	PRICE RIVER FORMATION
		Kc	CASTLEGATE SANDSTONE
		Kb	BLACKHAWK FORMATION
		Ks	STAR POINT SANDSTONE
		Km	MANCOS SHALE
		Kd	DAKOTA SANDSTONE
		Kcm	CEDAR MOUNTAIN FORMATION
		Jmb	BRUSHY BASIN MEMBER OF MORRISON FORMATION
		Jms	SALT WASH SANDSTONE MEMBER OF MORRISON FORMATION
JURASSIC		Js	SUMMERVILLE FORMATION
		Jc	CURTIS FORMATION
		Je	ENTRADA SANDSTONE
		Jca	CARMEL FORMATION
TRIASSIC (?)		JTn	NAVAJO SANDSTONE

CONTACT

FAULT—Dashed where approximately located; dotted where concealed

THRUST FAULT—Barbs on side of thrust plate

BOUNDARY OF PRICE RIVER DRAINAGE BASIN

HYDROLOGIC DATA SITES—Number by symbol indicates site number in data tables in Waddell and others (1982). Letter by symbol indicates type of data: C, Chemical analysis; D, Discharge measurement; W, Water level and records of wells and test holes.

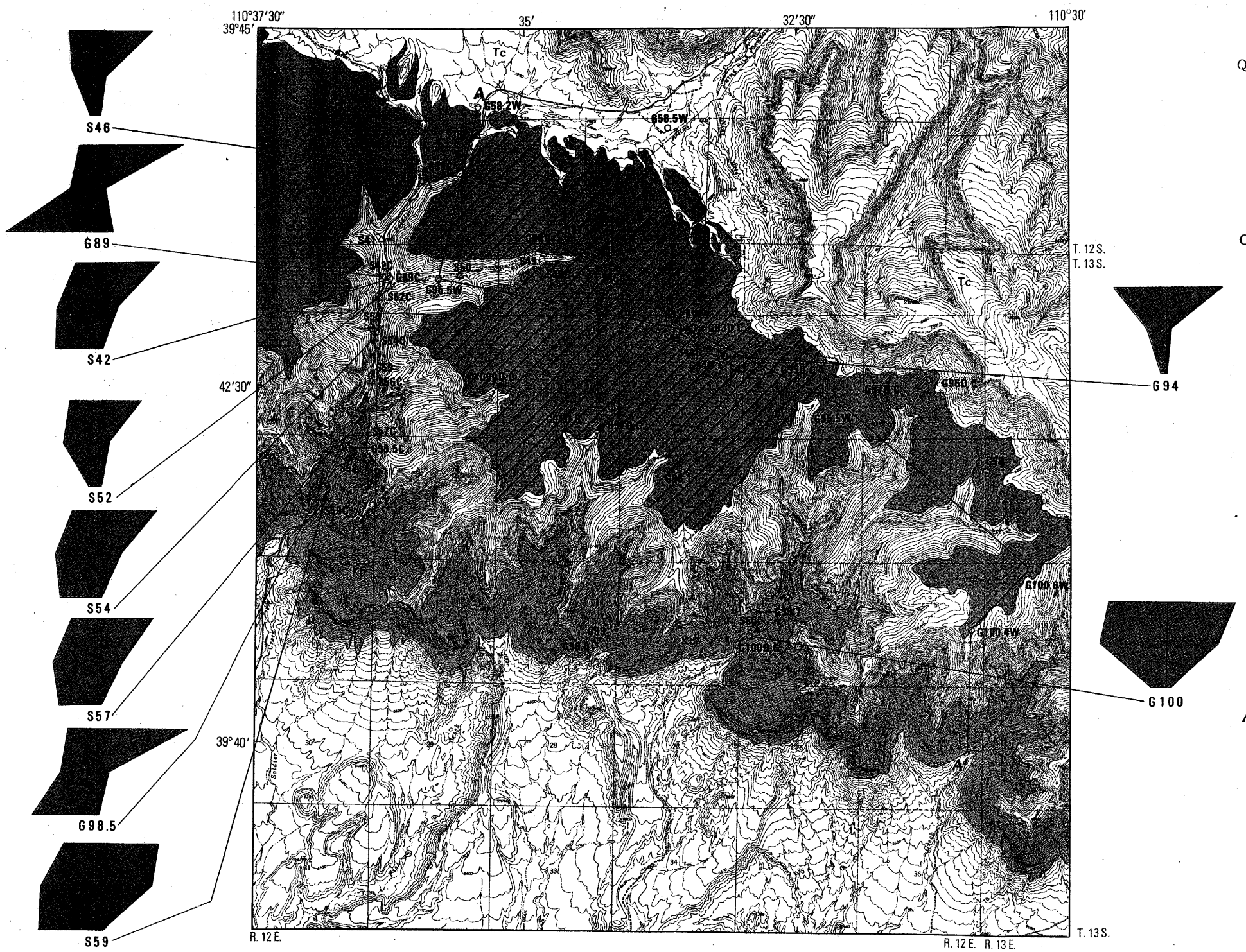
G23 SPRING

G100.6W WELL OR TEST HOLE

G110C MINE

WATER-SUPPLY PAPER 2246
PLATE 1

INSET SHOWING GEOLOGY, WATER QUALITY, AND HYDROLOGIC DATA-COLLECTION SITES IN A PART OF THE SOLDIER CREEK AREA



Base from U.S. Geological Survey
Scofield, 1:24,000, 1979

SCALE 1:50 000

1 ½ 0 1 2 3 MILES

1 .5 0 1 2 3 KILOMETERS

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION

QUATERNARY	Qa	ALLUVIUM
TERTIARY	Tc	COLTON FORMATION
	Tf	FLAGSTAFF LIMESTONE
	TKnh	NORTH HORN FORMATION
CRETACEOUS	Kp	PRICE RIVER FORMATION
	Kc	CASTLEGATE SANDSTONE
	Kb	BLACKHAWK FORMATION

CONTACT

AREA USED FOR ESTIMATING RECHARGE TO FLAGSTAFF LIMESTONE

HYDROLOGIC DATA SITE AND NUMBER—G preceding number indicates a ground water site; S preceding number indiactes a surface-water site; C, chemical analysis; D, discharge measurment; W, water level and records of wells and test holes

G99.7 MINE

G97D,C SPRING

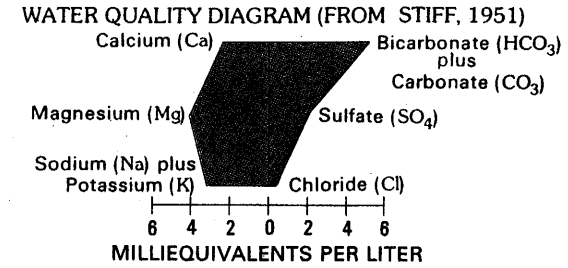
G95.5W WELL

S60 GAGING STATION

S55 SEEPAGE-STUDY SITE

A——A′ TRACE OF SECTION SHOWN IN FIGURE 19

WATER QUALITY DIAGRAM (FROM STIFF, 1951)



APPENDIX 7-7

Surface-Water Monitoring Data

Appendix 7-7

SURFACE WATER MONITORING LOCATION 323

"323 (Junction)" Monitoring Data 2007

Date	Time	pH	Cond.	Temp.	Flow (gpm)	Comments
3/15/07	1220				NOA	Snow/Ice
5/18/07	1340	7.80	591	11	17	
6/21/07	1220	7.9	621	12.5	20.5	
8/30/07	1345	8.4	675	14	13	Livestock Use