ENERGY WEST Mining Co.
PO Box 310
Huntington, Utah 84528

PACIFICORP

DEER CREEK
NORTH RILDA AREA
ACT/015/018/018-97-1

RESPONSE TO DEFICIENCIES
REDLINE COPY FOR REVIEW PURPOSES
(TEXT SECTIONS ONLY)
DOGM COPY
May 14, 1997

Huntington Office:
(801) 687-9821
Fax (801) 687-2695
Purchasing Fax (801) 687-9092

Deer Creek Mine:
(801) 381-2317
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Cottonwood Mine:
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Fax (801) 748-2380

RECEIVED
MAY 14 1997
DIV. OF OIL, GAS & MINING

PacifiCorp
Deer Creek
North Rilda Lease
ACT/015/018-97-1

Technical Analysis
Summary of Deficiencies

Regulation Cited	Deficiency - Bold Response - Redlined*
	* page numbers refer to the redline copies submitted for review, numbering of the non-redline copies may vary slightly due to strikeout removal.
R645-301-731.710	**Text on page 97 that states there are no water supply intakes within the permit or adjacent areas must be revised.**
	This section has been revised and now appears on page 103 of the Hydrology section of Volume 11.
R645-301-322	**current raptor monitoring information within the North Rilda Lease area must be included in the application or MRP.**
	Current(1996) raptor monitoring information, including a map are included in the Biology section appendix of the application.
R645-301-322	**a bat survey must be conducted within areas of potential cliff subsidence and the results included in the application.**
	A bat survey will be conducted within the areas of potential cliff subsidence. The survey will be scheduled for the summer of 1997. A statement to this effect appears on page 4 of the Biology section of Volume 11.
R645-301-332	**an angle-of-draw projection or other suitable subsidence projection showing anticipated impacts of longwall mining induced subsidence on the Rilda Canyon riparian areas, or showing why mining induced subsidence and related impacts are not anticipated to reach those riparian areas.**
	This deficiency is addressed on page 2 of the Biology section of Volume 11.

PacifiCorp
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Technical Analysis
Summary of Deficiencies

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R645-301-333

a commitment to conduct annual raptor monitoring in the North Rilda area. The commitment must also include a provision for either submitting the monitoring information to the Division, or providing the Division with the information immediately, upon request.

The North Rilda Lease Area will be included in the annual raptor survey that Energy West conducts in conjunction with UDWR. The results of the survey will be available upon request. A statement appears on page 3 of the Biology section of Volume 11.

R645-300-122

the permittee must correct, to the satisfaction of USFS, the deficiencies set forth in the March 7, 1997 letter from the USFS to the Division.

Forest Service Deficiencies

1. a. Describe how the North Fork of Rilda Creek .....

This deficiency is addressed on pages 9-10 and 645-301-500: Appendix 1 in the Engineering section of Volume 11.

1. b. Describe how the protection zone along the alluvial system.....

This deficiency is addressed on pages 9-10 and 645-301-500: Appendix 1 in the Engineering section of Volume 11.

PacifiCorp
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North Rilda Lease
ACT/015/018-97-1

Technical Analysis
Summary of Deficiencies

Regulation Cited | **Deficiency - Bold** **Response - Redlined***

* page numbers refer to the redline copies submitted for review, numbering of the non-redline copies may vary slightly due to strikeout removal.

2. a. Disclose how much escarpment could .....

This deficiency is addressed on pages 9-10, 30-31 and 645-301-500: Appendix 1 in the Engineering section of Volume 11.

2. b. Disclose what resources would be affected by escarpment failure .....

This deficiency is addressed on pages 9-10, 30-31 and 645-301-500: Appendix 1 in the Engineering section of Volume 11.

115. ***Status of Unsuitability Clamis, page 6.***

Addressed on Page 6 of the General section of Volume 11.

525. ***Subsidence, general comments***

This deficiency is addressed on pages 24-36 and 645-301-500: Appendix 1 in the Engineering section of Volume 11.

525. ***Subsidence, page 19, last sentence of second paragraph***

Revision is located on page 32-33 of the Engineering section of Volume 11.

525. ***Subsidence, Aerial Photogrammetry, pages 22-23***

This deficiency is addressed on page 29 of the Engineering section of Volume 11.

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Technical Analysis
Summary of Deficiencies

Regulation Cited	Deficiency - Bold Response - Redlined*
	* page numbers refer to the redline copies submitted for review, numbering of the non-redline copies may vary slightly due to strikeout removal.
525.	***Subsidence, South Castlegate Escarpment - North Rilda Canyon Area, second paragraph, page 24.***
	Revision appears on pages 30-31 of the Engineering section of Volume 11.
525.	***Subsidence, Mitigation of Subsidence Damage Effects, first paragraph on page 25.***
	Revision appears on pages 32-33 of the Engineering section of Volume 11.
525.	***Subsidence, Subsidence Control, first paragraph, page 25.***
	Revision appears on page 34 of the Engineering section of Volume 11.
700.	***Hydrology, general comments.***
	Revision appears on pages 87-88 of the Hydrologic section of Volume 11
700.	***Hydrology, Alluvial Aquifers, page 13***
	Revision appears on pages 14-15 of the Engineering section of Volume 11
700.	***Hydrology, 4. Springs and seeps, page 16, last paragraph***
	Revision appears on pages 12-13 of the Hydrologic section of Volume 11
700.	***Hydrology, 6. Mine Dewatering, pages 19-20.***
	Revision appears on page 21 of the Hydrology section of Volume 11.

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Technical Analysis
Summary of Deficiencies

Regulation Cited	Deficiency - Bold Response - Redlined*
	* page numbers refer to the redline copies submitted for review, numbering of the non-redline copies may vary slightly due to strikeout removal.
728.	***Probable Hydrologic Consequences Determination, General Comments.***
	This deficiency is addressed on page 73 of the Hydrology section of Volume 11 and Appendix 1 of Volume 9 - Hydrologic Section of the Deer Creek MRP (a copy is included to assist in the review process).
728.	***Probable Hydrologic Consequences Determination, Hydrologic Balance - Surface Water System, page 66, first paragraph.***
	Revision appears on pages 65-67 of the Hydrology section of Volume 11.
728.	***Probable Hydrologic Consequences Determination, Hydroloic Balance - Groundwater, page 71.***
	This deficiency is addressed on page 87-88 of the Hydrology section of Volume 11.
728.	***Include a sampling plan for the two springs included within the North Rilda permit area.***
	This deficiency is addressed on page 73 of the Hydrology section of Volume 11 and Appendix 1 of Volume 9 - Hydrologic Section of the Deer Creek MRP (a copy is included to assist in the review process)..
728.	***Probable Hydrologic Consequences Determination, GroundWater Systems, Page 73***
	This deficiency is addressed on page 99 of the Hydrology section of Volume 11.

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Technical Analysis
Summary of Deficiencies

Regulation Cited	**Deficiency - Bold** **Response - Redlined*** * page numbers refer to the redline copies submitted for review, numbering of the non-redline copies may vary slightly due to strikeout removal.
728.	***Probable Hydrologic Consequences Determination, B. Mining in the Rilda Canyon Area - NEWUA Springs, third paragraph, page 73.*** *This deficiency is addressed on pages 50-52 and 100-101 of the Hydrology section of Volume 11.*
728.	***Probable Hydrologic Consequences Determination, C. Interception of Groundwater by Mine Working, Post Mining, page 91-92*** *This deficiency is addressed on pages 94-95 of the Hydrology section of Volume 11.*
R645-731-200	***Water Monitoring, Groundwater, B. In-Mine, page 95.*** *This deficiency is addressed on pages 98-100 of the Hydrology section of Volume 11.*
R645-731-600	***Stream Buffer Zones, page 97.*** *This deficiency is addressed on pages 102-103 of the Hydrology section of Volume 11.*
R645-731-600	***Water Rights and Replacement, pages 97-98.*** *This deficiency is addressed on pages 104-105 of the Hydrology section of Volume 11.*

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Technical Analysis
Summary of Deficiencies

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R645-301-631	**The North Rilda Area amendment or current MRP must be revised to clarify how the operator has and will in the future manage exploration bore-holes to prevent acid or other toxic drainage from entering ground and surface waters; to minimize disturbance to the prevailing hydrologic balance and to ensure the safety of people, livestock, fish and wildlife, and machinery in the permit and adjacent areas.** This deficiency is addressed on page 1 of the R645-301-600 Geology section of Volume 11.
R645-301-731.212	**The North Rilda Are amendment or current MRP must be revised to clarify that the operator will promptly notify of the Division when analysis of any ground-water sample indicates noncompliance with the permit conditions, that the operator will immediately provide for any accelerated or additional monitoring necessary to determine the nature and extent of noncompliance and the results of the noncompliance, and that plans and hydrologic information to evaluate and mitigate the noncompliance situation and information relevant to the PHC will be submitted to the Division as required.** This deficiency is addressed on page 98 of the Hydrology section of Volume 11.

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Technical Analysis
Summary of Deficiencies

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R645-301-731.215	**The North Rilda Area amendment or current MRP must be revised to clarify how equipment, structures, and other devices used by the operator, onsite and offsite, in conjunction with monitoring quality and quantity of surface water will be properly installed, maintained, and operated and will be removed by then operator when no longer needed.** This deficiency is addressed on page 98 of the Hydrology section of Volume 11.
R645-301-731-215	**The North Rilda Area amendment or current MRP must be updated to incorporate the Utah Safe Drinking Water Committee's current, finalized rules for implementing the Federal Safe Drinking Water Act.** This deficiency is addressed on page 80 of the Hydrology section of Volume 11
R645-301-731.214	**The North Rilda Area amendment or current MRP must be revised to clarify the extent of ground-water monitoring that will be done in the North Rilda Area during reclamation or before bond release.** This deficiency is addressed on page 98 of the Hydrology section of Volume 11.

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ACT/015/018-97-1

Technical Analysis
Summary of Deficiencies

Regulation Cited	Deficiency - Bold Response - Redlined*
	* page numbers refer to the redline copies submitted for review, numbering of the non-redline copies may vary slightly due to strikeout removal.
R645-301-731.215	**The North Rilda Area amendment or current MRP must be revised to clarify how and when the piezometers in the North Rilda Area will be removed.**
	This deficiency is addressed on page 98 of the Hydrology section of Volume 11.
R645-301-731.225	**The North Rilda Area amendment or current MRP must be revised to clarify how and when the flumes will be removed from surface-water monitoring sites.**
	This deficiency is addressed on page 100 of the Hydrology section of Volume 11.
R645-301-731.214	**The North Rilda Area amendment or current MRP must be revised to clarify the location of ground-water monitoring stations, if any, that will be used to gather data on water quality and quantity to demonstrate reclamation success in the North Rilda Area.**
	This deficiency is addressed on pages 98-100 of the Hydrology section of Volume 11.

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NORTH RILDA AREA
ACT/015/018

100 GENERAL (R645-301-100)

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DEER CREEK
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100 GENERAL (R645-301-100)

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100. GENERAL CONTENTS (R645-301-100)

112. IDENTIFICATION OF INTERESTS (R645-301-112)

Pertinent names, addresses, and telephone numbers have been addressed previously in Vol. 1, Part 1 of the Mining & Reclamation Plan (MRP).

113. VIOLATION INFORMATION (R645-301-113)

Violation information of the applicant has also been addressed previously in Vol. 1, Part 1 of the MRP.

114. Right-of-Entry Information (R645-301-114)

The following is the legal description of the North Rilda Area.

Refer to Figure R645-301-100a

T16S, R7E, SLM	
SE1/4	Section 19
S1/2, S1/2NE1/4	Section 20
S1/2NW1/4, S1/2NE1/4, SW1/4, SE1/4	Section 21
SW1/4NW1/4, SW1/4	Section 22
NE1/4	Section 30
N1/2	Section 29
NW1/4, N1/2NE1/4	Section 28

The following federal and nonfederal coal leases address the right to perform coal mining in the North Rilda Area of the Deer Creek Mine for the areas in the legal description above.

Lease No. U-06039

Lease issued effective May 1, 1953 to Ferdinand F. Hintze

T16S, R7E, SLM, Utah
Sec. 19, SE;
Sec. 20, S2;
Sec. 29, N2;
Sec. 30, NE.

960.00 acres

Insert figure R645-301-100a

Lease No. U-24317

Lease issued effective May 1, 1958 to Huntington Corp.

T16S, R7E, SLM, Utah
Sec. 20, S2NE;
Sec. 21, S2NW, S2NE, SW.

400.00 acres

Lease No. U-2810

Lease issued effective October 1, 1967 to John Helco

T16S, R7E, SLM, Utah
Sec. 28, E2NW.

80.00 acres

Lease No. SL-051221

Lease issued effective November 5, 1934 to Rulon W. Jeppson.

T16S, R7E, SLM, Utah
Sec. 28, W2NW.

80.00 acres

Patent No. 523194*

Granted April 5, 1916 to Harvey G. Fisher

T16S, R7E, SLM, Utah
Sec. 22, SWNW.

40.00 acres

Patent No. 523192*

Granted April 5, 1916 to Rilla Snyder.

T16S, R7E, SLM, Utah
Sec. 22, SW.

160.00 acres

Patent No. 523204*

Granted April 5, 1916 to Ernest Bowman.

T16S, R7E, SLM, Utah
Sec. 28, N2NE

80.00 acres

Patent No. 523201*

Granted April 5, 1916 to Carrie Levy.

T16S, R7E, SLM, Utah
Sec. 21, SE

160.00 acres

* Peabody Coal Company transferred all right, title and interest to Utah Power & Light Company of these tracts on April 27, 1978.

115. STATUS OF UNSUITABILITY CLAIMS (R645-301-115)

No information is on record to suggest the North Rilda Area has been designated unsuitable for mining and reclamation activities.

The proposed area will not be mined within 300 feet of an occupied public dwelling or within 100 feet of a public road.

There are no known dwellings or roads within the North Rilda area. Buffer zones established for protection of riparian areas are addressed in the Engineering Section of Volume 11.

116. PERMIT TERM (R645-301-116)

116.100. Mining in the North Rilda Permit Area will take place from the years 2000 through 2005. Mining will begin in the Blind Canyon seam in 2000 and will end in 2003. Hiawatha seam mining will begin in 2003 and will end in 2005. These time periods are consistent with the R_2P_2. Blind Canyon seam mining will affect approximately 912 acres. Mining in the Hiawatha seam will affect an additional 73 acres outside the Blind Canyon affected area. A total of approximately 985 acres will be affected by mining in the North Rilda Permit Area.

117. INSURANCE (R645-301-117)

117.100. The MRP for the Deer Creek Coal Mine contains a certificate of liability insurance in Vol. 1, Part 1.

117.200. A copy of the newspaper advertisements (or proof of publication of the advertisements) of the significant revision will be filed with DOGM and will be made a part of the application not later than 4 weeks after the last date of publication as required by R645-300-121.100.

118. FILING FEE (R645-301-118)

The filing fee to mine coal has previously been paid for by PacifiCorp.

120. PERMIT APPLICATION FORMAT AND CONTENTS (R645-301-120)

Format and contents are in accordance with requirements of the State of Utah, Department of Natural Resources, Division of Oil, Gas & Mining (DOGM).

130. TECHNICAL INFORMATION (R645-301-130)

This document has been prepared by *PACIFICORP* and *MT. NEBO SCIENTIFIC, INC.* Attempts have been made to provide the names of persons or organizations that collected and analyzed all technical data submitted in the permit application including dates of the collection, analysis of the data, and descriptions of the methodology used to collect and analyze the data.

Technical analyses have been planned by or performed under the direction of a professional qualified in the subject to be analyzed.

140. MAPS AND PLANS (R645-301-140)

Maps submitted with permit applications have been presented in a consolidated format and include all the types of information that are set forth on U.S. Geological Survey maps of the 1:24,000 scale series. Maps of the permit area have been included at a scale of 1:6,000 or larger. Maps of the adjacent area clearly show the lands and waters within those areas.

All maps and plans submitted with the permit application distinguish among each of the phases during which coal mining and reclamation operations were or will be conducted at any place within the life of operations. At a minimum, distinctions have been clearly shown among those portions of the life of operations in which coal mining and reclamation operations occurred.

150. COMPLETENESS (R645-301-150)

Attempts have been made for the application to be complete and include, at a minimum, information required under R645-301 of the State Rules.

PACIFICORP

DEER CREEK
NORTH RILDA AREA
ACT/015/018

300 BIOLOGY (R645-301-300)

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NORTH RILDA AREA
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300 BIOLOGY (R645-301-300)

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300. BIOLOGY (R645-301-300)

VEGETATION

Vegetation studies have been conducted within the Deer Creek Mine permit area. The vegetation mapping that was previously done for the mine area includes the North Rilda Area, [formerly called the "Future Permit Area" (Vol. 4, Map 2-14)]. The principal plant communities of the North Rilda Area are Mixed Conifer and Pinyon-Juniper. Vegetation studies were conducted for the permit area by J.R. Barker in 1982. Quantitative and qualitative data of the major plant communities provided in the 1982 study are also relevant to the North Rilda Area.

The most common plant species of the Mixed Conifer community were: Douglas fir (*Pseudotsuga menziesii*), Saskatoon serviceberry (*Amalanchier alnifolia*), corymbed eriogonum (*Eriogonum corymbosum*) and bluebunch wheatgrass (*Elymus spicatus*). Common plant species of the Pinyon-Juniper community are: Utah juniper (*Juniperus osteosperma*), pinyon pine (*Pinus edulis*), Cutler ephedra (*Ephedra cutleri*), corymbed eriogonum, and bluebunch wheatgrass.

Quantitative data of these communities sampled within the approved permit area and reference areas have been presented previously in the Deer Creek MRP (Vol. 1, Part 2).

No surface disturbance has been proposed in the North Rilda Area, therefore no disturbance will be conducted to the plant communities (including potential sensitive, threatened

or endangered species) that exist within its boundaries.

Second mining, ie. longwall extraction, room & pillar, of the North Rilda area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur beneath the stream channels of these canyons. First mining, ie. mainline, gateroad development, will occur below the Right Fork of Rilda Canyon. For a complete analysis of the proposed "no subsidence" design of the 4th North Mains development within the Right Fork of Rilda and the long-term stability analysis refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the Right Fork of Rilda Canyon a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the Hiawatha Seam, the lowest seam to be mined. The riparian zone within the Right Fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial fill with the canyon's side slopes. The angle of draw was calculated from the Hiawatha Seam horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. The referenced 15 degree angle of draw is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full extraction mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above (refer to Annual Subsidence Reports of the Deer Creek MPR).

FISH & WILDLIFE

Wildlife studies have been conducted within the Deer Creek Mine permit areas and those areas adjacent to it. The wildlife habitats of the North Rilda Area include Mixed Conifer and Pinyon-Juniper and probably some riparian communities. Descriptions of these and other habitats that exist within the permit boundaries have been given in previous wildlife sections of the MRP. "Species of Special Significance", threatened, endangered, and "Special Status Species" have been described previously. Table 1 of Vol. 1, Part 2 of the MRP lists Vertebrate Species of the Wasatch Plateau of which the Deer Creek Mine permit area and the North Rilda Area are part. The tables include the species status (common, rare, threatened, etc.), the habitats in which they occur, and the likelihood of their occurrence within the boundaries of the lease area.

Mule deer habitats have been mapped for the permit and adjacent areas, part of which are within the North Rilda Area boundaries (Vol. 4, Map 2-19). Neither "Critical Deer Winter Range", nor "High Priority Deer Winter Range" exist in the North Rilda Area. Instead, the area is mapped as "High Priority Summer Habitat" (Vol. 4, Map 2-19).

Raptor nesting studies and nest mapping have been conducted in the North Rilda Area. Much of the area is raptor nesting habitat. Specific nests have been numbered and mapped in the area (see Biology Section Appendix). The status of these nests have also been included (see Biology Section Appendix). Nest information and locations are based on results from the 1996 annual raptor survey conducted by Energy West Mining Co., in conjunction with the Utah Department

of Wildlife Resources. Energy West Mining Co. will conduct annual raptor surveys in the area. The results of those surveys will be available upon request.

Due to the potential for Townsends Big-eared bats and Spotted bats to occur along the cliff escarpment in Rilda Canyon, a bat survey of the areas of potential failure will be conducted to determine the presence of these mammals. The bat survey will occur during the summer of 1997.

No surface disturbance has been proposed to the wildlife habitats in the North Rilda Area, therefore little or no influence on the proposed new permit area is expected.

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DEER CREEK
NORTH RILDA AREA
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500 ENGINEERING (R645-301-500)

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500 ENGINEERING (R645-301-500)

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510. INTRODUCTION (R645-301-510)

Coal mining has occurred since 1946 in Deer Creek Canyon, a tributary of Huntington Canyon in Emery County, Utah. Utah Power & Light Company (now PacifiCorp) purchased the operations and coal leases from Peabody Coal Company in 1977. The Deer Creek Mine portal, mine personnel, and its coal handling facilities are located in Deer Creek Canyon.

Mining in the North Rilda Area will continue in the Blind Canyon and Hiawatha coal seams. Approximately 23 million tons of minable coal is anticipated to be mined from the North Rilda Area during life-of-mine production.

A variety of engineering principles and techniques are applied in the Deer Creek Mine operation. Principles of engineering employed are those associated with standard prudent mine engineering practices. More detail about the methodologies used to plan the coal mining activities for long-range goals at the Deer Creek Mine and the use of computer assisted models can be found in Vol. 2, Part 3 of the MRP.

511. GENERAL REQUIREMENTS (R645-301-511)

This document will include the general requirements to meet the State of Utah's regulatory requirements to mine coal in the North Rilda Area as part of the Deer Creek Mine. The proposed new mining plan will include new information or reference the existing mine plan when appropriate. The potential impact to the environment will also be addressed. As reflected by its format, much of the current Deer Creek MRP was written prior to the State's R645- Rules. This amendment to the plan attempts to follow the Rules general format, yet allow it to also be consistent with the existing MRP.

512. CERTIFICATION (R645-301-512)

Applicable cross sections and maps have been included or referenced within this document. They have been prepared by, or under the direction of, and certified by a qualified, registered, professional engineer or land surveyor, with assistance from experts in related fields such as hydrology, geology and biology.

513. COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS (R645-301-513)

Because the area is a permitted coal mine, existing coal processing waste dams, embankments, impoundments, sediment ponds, and refuse piles comply with all MSHA regulations governing them. No additional structures are proposed for mining in the North Rilda Area.

Underground development waste, coal processing waste and excess spoil will continue to be disposed of in accordance with plans approved by DOGM and MSHA. There are no plans to return coal processing wastes to the underground workings at Deer Creek Mine.

514. INSPECTIONS (R645-301-514)

All appropriate engineering inspections and reports will be conducted by a qualified registered professional engineer or other qualified professional specialist under the direction of the professional engineer.

515. EMERGENCY PROCEDURES (R645-301-515)

In the event any potential hazard exists, develops, or occurs in association with slides and/or impoundment structures which may have an adverse effect on the public, health, safety, property, and environment, DOGM will be promptly notified and the operator commits to comply with any remedial measures required to protect and ensure the health and safety of the public.

The Deer Creek Mine facility conducts routine inspections on a weekly basis. Should a hazard exist or occur, personnel have been instructed to notify the Mine Manager, who will coordinate and implement any emergency procedures and remedial measures to be taken.

Where temporary cessation of operations is necessary for a period beyond 30 days, the applicant will submit the proper notification and information required of R645-301-515.300 to DOGM.

520. OPERATION PLAN (R645-301-520)

521. INTRODUCTION (R645-301-521)

The plan for the mining in the North Rilda Area includes or references maps, cross sections, narratives, descriptions, and calculations indicating how the relevant requirements are met. The plan describes and identifies the lands subject to coal mining and reclamation operations over the estimated life of the operations and the size, sequence, and timing of the subareas for which it is anticipated that individual permits for mining will be sought.

Previously Mined Areas

Areas previously mined at the Deer Creek Mine are shown in Vol. 4, Map 1-3.

Support Facilities

Surface facilities of the Deer Creek Mine include the following: sediment pond, embankment fills, coal surge bin, transfer tower, breaker station, crusher station, coal weigh bin, truck load-out, facility conveyors, overland conveyor, parking lot, parking garage, office-bathhouse, warehouse-shop, materials storage area, access and service roads, mine ventilation fan, power supply and substations, water treatment system, high pressure pumphouse, sewer treatment system, and drainage system (see Vol. 5, Maps 3-9 and 3-9A).

Another support facility of the mine is located in Rilda Canyon. This facility includes an access road and a pad area which supports two portals, a substation, power line, fan, water storage tank, and pumphouse. Topsoil removed prior to construction of the site is also stored within the permit area of the Rilda Canyon facilities. Additional information about this facility is provided in Vol. 2, Part 3 and Vol. 5, Map 3-9A.

An off-site support facility of the mine is the Deer Creek Waste Rock Storage Facility located northeast of the mine site, near State Highway 31. See Vol. 10 of the MRP for more details of the Deer Creek Waste Rock Site. Additional information about all support facilities at the Deer Creek Mine is included in Section 526 of this document.

522. COAL RECOVERY (R645-301-522)

This section includes a description of the mine plan and measures to be used to maximize the use and conservation of the coal resource. The description attempts to show that coal mining and reclamation operations are conducted to maximize the utilization and conservation of the coal, while utilizing the best technology currently available to maintain environmental integrity. This decreases the likelihood of re-affecting the land in the future through coal mining and reclamation operations.

Mine Plan: Access to the to North Rilda reserves will be achieved with the use of 5-entry set of mains referred to as 4th North Mains. The 4th North Mains are projected to be developed northwest (approximately 3000 feet) from the 4th North / 10th West Mains intersection. The 4th North Mains development then changes course to a northeast bearing, with development proceeding under the Right Fork area of Rilda Canyon. The proposed location and layout of the 4th North #1 / 4th North #2 intersection are currently **only** a projection. Preliminary mine plan sequence and layout provide for the current 4th North Mains to continue as a 5-entry development system to a point just south of the proposed 4th North #1 / 4th North #2 intersection. At this point the development is planned to be reduced to a 2-entry "exploration" section continuing on the original northwest bearing to delineate the western margin of the Blind Canyon coal seam or to intersect the projected Mill Fork Fault Graben.

Based on the information gained from this proposed 2-entry "exploration" development, a

detailed plan will be developed to position the 4th North #1 / 4th North #2 intersection to optimize the "no-subsidence" design of the 4th North #2 / Rilda Canyon Right Fork crossing route and rock slope access into the lower Hiawatha Seam as well as maximizing overall reserve recovery within the area.

From the 4th North #2 intersection, mainline development will proceed to the northern boundary of Federal Coal Lease U-024317. Longwall gateroad development sections will be driven due east from the 4th North Mains to the extent of mineable reserves. The sequence of longwall extraction will be from the northern portion of Federal Coal Lease U-024317 to the south (Federal coal leases U-06039, SL-051221, U-2810 and PacifiCorp patent fee claims). Six longwall panels are projected in each seam.

Based on the current layout, the two northern and two southern panels of each seam are projected to extend below the Castlegate Sandstone escarpment. As specified in the lease stipulations, "except at specifically approved locations, the Castlegate escarpment must be protected from mining induced failure". Where escarpment failure is proposed or anticipated, an environmental analysis will be needed to assess the following:

a. How much escarpment could fail based on analytical methods, observation of similar areas, geologic/topographic conditions, and panel orientation.

extraction) mining on the stability of the Castlegate escarpment, i.e., Cottonwood Newberry Canyon/Corncob Wash and Trail Mountain 5th East/Cottonwood Canyon Test Areas, development of a predictive escarpment/mining model is in progress. The model developed from these studies will be used to forecast anticipated effects of proposed mining under the escarpment within the southern portion of the North Rilda Area, ie. The two (2) most southern longwall panels proposed in the Blind Canyon and Hiawatha Seams - North Rilda Area, refer to R645-301-500: Appendix 1 for complete description of the Geotechnical Study.

Coal Recovery: The maximum amount of economically recoverable coal will be extracted from the North Rilda Area of the Deer Creek Mine with the exception of protective coal barriers which must be left in place to ensure the integrity of the mine entries associated with the active underground workings and to protect environmentally sensitive surface resources within the Rilda Canyon Fork Area [See R_2P_2 Mine Plan Map(Vol. 5, Map 3-6 & 3-7)]. These protective coal barriers can be broken into five (5) separate categories:

(1) **Property Boundary Barriers:** All external property boundary lines are protected by a 50 foot (minimum) solid coal "buffer" barrier.

(2) **Protective Main Entry Barriers:** Protective main entry barriers are designed to protect long term mine entries from excessive abutment pressures of the retreating longwall. Design of these barriers are based on (i) intended duration of use, (ii) depth of

cover in the area, (iii) geologic conditions present, and (iv) historical performance of similar sized barriers in similar conditions.

(3) **Bleeder Entry Barriers:** Bleeder entry barriers are designed to insure the long term stability of the longwall panel bleeder system. Design of these barriers is based on (i) intended duration of use, (ii) depth of cover in the area, (iii) geologic conditions present, and (iv) historical performance of similar sized barriers in similar conditions. Evaluation of localized conditions at the time of development, in conjunction with the preceding design parameters, will be on-going to determine final barrier sizing so that bleeder entry stability and coal recovery may be optimized.

(4) **Surface and Sub-Surface Resource Protective Barriers:** In-place coal will be left within the Rilda Canyon fork area to insure the long-term stability and integrity of environmentally sensitive surface and sub-surface resources.

(5) **Mining Below the Right Fork of Rilda Canyon:** A portion of the right fork of Rilda Canyon lies within the proposed North Rilda Area Permit Application of the Deer Creek Mine. Due to the environmental sensitivity of the Right Fork area (specifically the sub-surface hydrologic alluvial system and associated surface riparian vegetation zone), a complete analysis of a proposed "no-subsidence" design of the 4th North Mains development within the area of the right fork of Rilda Canyon has been prepared addressing the long term ground stability and subsidence protection of the area with

regards to proposed mining. All pre-mining and post-mining conditions have been evaluated based on the best geologic and engineering information currently available (refer to R645-301-500 Engineering Section: Appendix 1).

The 4th North Mains, as projected, consists of a 5-entry development section, bearing northwest from the Deer Creek 10th West Mains. Initial location of the 10th West/4th North intersection was based on the following:

(1) Existing Blind Canyon seam conditions encountered in 10th West Mains development.

(2) Proximity to the projection of the Mill Fork Fault Graben.

(3) Most practical access route to the North Rilda - Blind Canyon and Hiawatha coal reserves, across the North Rilda Canyon Forks area.

A complete analysis of the location and long term ground stability of the 4th North / 10th West Mains and the left fork of Rilda Canyon was prepared and submitted by PacifiCorp to the BLM on November 15, 1996. Approval to proceed with relocation and development of the 4th North Mains was given by the BLM (per letter) February 13, 1997.

With regard to PacifiCorp's North Rilda Area Permit Application, the 4th North Mains are projected to be developed northwest (approximately 3000 feet), from the 4th North / 10th West Mains intersection. The 4th North Mains development then changes course to

a northeast bearing, with development proceeding across the right fork area of Rilda Canyon. The proposed location and layout of the 4th North #1 / 4th North #2 intersection are currently **only** projections. Preliminary mine plan sequence and layout provides for the current 4th North Mains to continue as a 5-entry development system to a point just south of the proposed 4th North #1/4th North #2 intersection. At this point, the development is planned to be reduced to a 2-entry "exploration" section, continuing on the original northwest bearing to delineate the western margin of the Blind Canyon coal seam or to intersect the projected Mill Fork Fault Graben. Based on the information gained from this proposed 2-entry "exploration" development, a detailed plan will be developed to position the 4th North #1/4th North #2 intersection to optimize the "no-subsidence" design of long term entry stability for the 4th North #2 / Rilda Canyon Right Fork crossing route and rock slope access into the lower Hiawatha Seam as well as maximizing overall reserve recovery within the area.

It is expected that recovery rates of 85% can be obtained within the proposed longwall panel areas. The overall minable reserve recovery for the North Rilda Canyon area of the Deer Creek Mine is estimated at approximately 65%.

The Deer Creek mining plan is based on the geologic information of the area obtained from outcrops, drilling, and previous mining by the operator. For geologic information of this area, refer to Vol. 8 of the MRP.

523. MINING METHODS (R645-301-523)

The following is a description of the mining operation proposed to be conducted during the life of the mine within the North Rilda Canyon Area, including the methods of coal mining, engineering techniques, and anticipated annual and total production of coal.

Continuous Mining Units (Main Entry and Longwall Section Gateroad Development):

The principal purpose of the continuous mining units within the North Rilda Area of the Deer Creek Mine is underground mine development (i.e. section development of mainline entries, longwall section gateroad development, and longwall section setup/bleeder entry development; along with development of mine water holding sumps, rock storage rooms, etc.).

Figure R645-301-500a (attached) illustrates the basic configuration of a typical five-entry mains, consisting of (nominal) 20 feet wide entries and crosscuts driven on standard 80 feet x 100 feet pillar centers. The pillars created measure a (nominal) 60 feet wide x 80 feet long; a size which has been developed for sufficient support of the main entries and overlying strata.

A variation to this typical configuration is proposed for the main entries underlying the crossing of the Rilda Canyon Fork Area. These five-entry mains will consist of (nominal) 20 feet wide entries and crosscuts driven on 80 feet x 130 feet pillar centers. Depending on site-specific ground conditions, crosscut locations may be staggered. The pillars created measure a (nominal)

60 feet wide x 110 feet long; a size which is proposed for long term main entry stability and overlying strata stability through an area of hydrologic and surface resource concern.

Figure R645-301-500a also illustrates the basic configuration of a typical two-entry longwall panel development, consisting of (nominal) 20 feet wide entries and crosscuts driven on (nominal) 50 feet x 100 feet pillar centers. With the retreating longwall mining system, all panel development work is accomplished by continuous mining units prior to longwall installation.

Longwall Mining System:

The predominant mining method to be used in the North Rilda Area of the Deer Creek Mine will be *Longwall Retreat Mining*. This method, as practiced by PacifiCorp, presents the safest and most efficient underground resource recovery mining method available.

As referenced above, the two-entry gateroad system is developed with (nominal) 20 feet wide entries and crosscuts driven on (nominal) 50 feet x 100 feet pillar centers. This type of "yield pillar" configuration is designed so that the gateroad support pillar will gradually yield as longwall retreat proceeds from panel to panel. The purpose of this design is to prevent the buildup of unrelieved stresses within the pillar.

Figure R645-301-500b illustrates the basic configuration of a retreating longwall

(Insert Figure R645-301-500a here)

(Insert Figure R645-301-500b here)

system. After gateroad entries are driven to the extent of the longwall panel length, on both sides of the longwall face, setup and bleeder entries are driven to connect the gateroads. A solid coal barrier is left between the setup and bleeder entries, size based on; (1) intended duration of use, (2) depth of cover in the area, (3) geologic conditions present, and (4) historical performance of similar sized barriers in similar conditions.

Longwall face width, depending on the geologic parameters of the coal deposit, varies from 500 feet to 1000 feet wide. Standard face width is 750 feet center to center (from center-line of head-gate belt entry to center-line of tailgate entry), or 730 feet coal block width. Once installed in the setup entry, the longwall begins retreat mining (from the setup entry "outby" toward the main line entries). A protective barrier is left between the mined out longwall panel (extraction face) and the main line entries that is sized to insure long term main line entry stability.

Panels are designed within the mining area, bounded by natural and imposed limits, with varying degrees of confidence as to final location and extent. Faults may vary somewhat from currently assumed locations. Geologic limitations such as seam splits, channel scours, spars, stratigraphic thinning, etc. may affect the mining limits by varying hundreds of feet as information becomes available and as mining recovery economics and practicality are further refined. Underground burned areas are difficult to define prior to mining. Regulatory mining restrictions, such as escarpment protection barriers and perennial stream buffer zones further confine mining extent.

The anticipated production will be obtained by utilizing two to three continuous mining units and one longwall mining system. The Deer Creek Mine presently operates three continuous mining units and one longwall mining system.

The North Rilda Area of the Deer Creek Mine will be developed with mains and sub-mains which support a series of longwall mining panels. This system is very effective in extracting and maximizing coal recovery. Approximately 75% of the Deer Creek minable coal reserve will be extracted by longwall mining systems, 25% will be extracted by continuous miner development.

The extracted coal is sized in the Deer Creek coal handling facility and conveyed to the PacifiCorp - Huntington Power Plant, approximately two miles away. A portion of the coal is also transferred to the Cottonwood Mine loading facilities via underground conveyor belts and transfer shaft.

The interburden in the minable area where the two seams overlap averages about 80 feet. Mining will commence in interburden thickness of 30 feet or greater when extracting both seams.

The mine layout of the Deer Creek mine is illustrated in Vol. 5, Maps 3-6 and 3-7. The drawings show an arrangement of longwall panels and development sections interconnected by systems of main and sub-main entries. This arrangement is predicated on geographical dedication of reserves, regulatory mining restrictions, available coal quality, and geologic information.
The planned mine development sequence accommodates longwall panels as the primary means of efficiently extracting the reserves. This will ensure the best possible means of maximizing

reserve recovery while maintaining consistent coal quality and ground control. Vol. 5, Map 3-6 and Map 3-7 shows the North Rilda Area. Table 3 (Vol 2, Part 3) provides the approximate number of acres affected by mining in five-year increments for the Deer Creek Mine.

Mine Production

It is expected that an average production rate of 1,150 tons/machine shift for continuous miners and 9,000 tons/machine shift for longwalls will be the production rate in the North Rilda Area. Table 4 (Vol. 2, Part 3) of the MRP lists the anticipated annual and total production of coal at the Deer Creek Mine.

As noted above, a mining productivity of 1,150 tons/ continuous miner shift and 9,000 tons/longwall shift is attainable. This translates into two miner sections and one longwall section operating 2 shifts/day, 190 days/year in order to achieve the required coal output at full production.

All in-mine coal haulage is by belt conveyor. Of the total entries in the main entry system, at least one entry is dedicated specifically to the belt conveyor. All mine personnel and materials are transported underground by diesel equipment. Table 5 (Vol. 2, Part 3) lists the major ancillary equipment used in Deer Creek Mine.

524. BLASTING AND EXPLOSIVES (R645-301-524)

The Deer Creek Mine is a developed and producing underground mine and there is no anticipated need for any blasting activities incident to the underground mining activities. However, if circumstances develop that require surface blasting activities, a plan will be initiated in accordance with DOGM regulations in R645-301-524.

525. SUBSIDENCE (R645-301-525)

This section describes in detail the operator's plan to ensure minimal environmental impacts from mine-induced subsidence. The Operation Plan (Vol. 2, Part 3) plus the Geology Section (Vol. 8) present the detailed data on which the analytical approach for the subsidence control plan is based. The following subsections describe the principal factors involved in controlling subsidence impacts resulting from the proposed mining operations.

Subsidence Damage Probability Survey

A survey has been conducted on that portion of East Mountain surface which could possibly be affected by the mining of coal from the North Rilda Area. It has been determined that there are renewable resources present in the area in the forms of springs, water seeps, grazing land, timber, and wildlife. There are no springs and seeps located above the projected mining activities in the North Rilda Area. The occurrence of the springs is discussed in the hydrology section of this document (Section 700) . Only two springs are located within the North Rilda permit area, 80-50 located in Section 29 and the Rilda Canyon Springs located in Section 28 (refer to HM-9 included with this submittal for the location of the springs and Vol. 9 - Hydrologic Section of the Deer Creek MRP. Appendix A for sampling sites and monitoring schedule). ~~and no further discussion will take place here, however, data collected suggests that the springs on the surface will not be affected by the subsidence.~~ Most of the streams within the permit area are ephemeral and/or intermittent. Only the lower portion of Rilda Canyon Creek below the forks is considered perennial. The streams are fed by springs that emanate primarily in the North Horn Formation west of the permit boundary. Second mining, ie. longwall

extraction, room & pillar, of the North Rilda area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur beneath the stream channels of these canyons. First mining, ie. mainline, gateroad development, will occur below the Right Fork of Rilda Canyon. For a complete analysis of the proposed "no subsidence / long term stability" design of the 4th North Mains development within the Right Fork of Rilda and the long-term stability analysis refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the Right Fork of Rilda Canyon a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the Hiawatha Seam, the lowest seam to be mined. The riparian zone within the Right Fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial fill with the canyon's side slopes. The angle of draw was calculated from the Hiawatha Seam horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. The referenced 15 degree angle of draw is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full extraction mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above (refer to Annual Subsidence Reports of the Deer Creek MPR).

The angle of draw of subsidence produced by full-extraction mining can be influenced by many factors. These include the size of the area mined, number of seams mined, fractures or faults in the overburden, adjacent mine workings, and adjacent areas of burned coal and clinker. If mine workings extend to an area of burned coal, experience has shown that the overburden stresses above the mined area can be transferred to the adjacent burned coal and clinkers which can cause

the clinkered areas to fail. In this case, the angle of draw may appear to be very shallow, when the crushing of the clinkered areas are the source of subsidence outside the normal area of influence.

Faults can also influence the angle of draw. If mining occurs adjacent to an existing fault, the area of subsidence will follow the natural plane of weakness formed by the fault. In this case, the angle of draw will be the same as the dip of the fault.

Based on data collected by the U.S. Bureau of Mines and eighteen years of subsidence data collection on East and Trail mountains, the angle of draw is found to be between 0 and 15 degrees from vertical. In some limited areas, the angle of draw is greater than 15 degrees, but in every case, the angle is greater due to the influence of one of the other factors mentioned above.

For planning purposes, any barrier of protection left in the mine to protect surface features should use a 15 degree angle of draw unless one of the factors mentioned above is known to exist in the immediate area.

No structures such as cabins, fencing, water troughs, and stock ponds currently exist within the boundaries of the North Rilda Area. Moreover, there are no oil, gas or water wells located within the East Mountain property, nor are there any gas or oil pipelines.

Mining Methods and Subsidence

The operator intends to minimize surface effects of subsidence by adopting, wherever practical, the longwall mining method and mining the coal deposits as completely as possible. The areas within the mine limits not mined by the longwall method will be mined by continuous miner in development for the longwall system. Approximately seventy-five percent (75%) of the coal reserve will be mined by the longwall method, the remaining area will utilize a continuous miner.

The longwall mining method allows almost total extraction of the mineral and induces caving of the immediate and upper roof strata. As the coal seam is extracted, the overlying strata caves rapidly. The caving process has been shown to propagate to within 100 feet of the surface in less than two weeks after mining. This was determined by a cooperative study conducted by the U.S. Bureau of Mines using Time Domain Reflectometry (TDR). In this study, a coaxial cable was cemented within a drill hole positioned near the center of the 14th West longwall panel in the Cottonwood Mine. As the caving of the strata occurred, the cable would shear or be stretched. The depth of the shears or stretches could be identified with instruments on the surface. The data collected from this study is contained in Vol. 3, Appendix IV of the MRP. Surface subsidence has been observed within two months of the coal extraction. In most areas, the subsidence will stabilize within 2 years of undermining.

It is the operator's intent to mine areas as wide and long as present mining technology or equipment allows in order to minimize the area which would be on the sloping edge of the subsidence trough. The pillars of support for the longwall gate roads have been designed on the

yielding pillar principle so that they will yield to destruction. This has been proven in practice in the mines and therefore will not affect the subsidence trough.

The size of the normal coal pillars used in mine planning for both the Blind Canyon and Hiawatha seams to ensure stability has been determined by basic calculation for the deepest expected cover (from prior mining practice in the area) and USBM study. Experience has also shown that, in multi-seam mining circumstance, columnizing main development pillars in both seams is essential for main stability.

Full extraction areas, by definition, are planned and can control subsidence in areas. It is anticipated that the planned subsidence will minimize impacts and result in a generally uniform lowering of the surface lands in broad areas, thereby limiting the extent of material damage to those lands and causing no appreciable change to present land uses and renewable resources. Subsidence prediction work has shown that the expected maximum planned and controlled subsidence will vary from zero to fifteen (0-15) feet, assuming that the total cumulative extraction from the two minable seams will not exceed twenty (20) feet.

Subsidence Monitoring Plan

The operator initially adopted a twofold approach to subsidence monitoring:

1) aerial photogrammetry,
2) on-the-ground monumentation.

After seven years of comparing the two types of surveys it was determined that both methods

effectively document the amount of subsidence which has occurred; however, the aerial photogrammetry method has the advantage of showing more detail because more data points can be monitored with less effort. Therefore in 1987, with the concurrence of the State of Utah, Division of Oil, Gas & Mining (DOGM), the operator discontinued on-the-ground monumentation and now collects subsidence data solely by aerial photogrammetry.

The subsidence monitoring program, conducted since 1980, has produced data which not only document the amount of subsidence that has occurred but also allows the operator to predict the amount of subsidence that is likely to occur when mining in new areas. The detail of the data collected in years past is not included herein. If the reader desires to investigate past data, it can be found in the annual subsidence reports available in the offices of DOGM.

Aerial Photogrammetry

PacifiCorp's subsidence monitoring program is primarily based on aerial photogrammetry. A baseline photogrammetric survey was conducted in 1980 which includes over 12,000 elevations measured on a 200-foot spacing grid. These elevations are then compard to elevations measured from the photographs taken annually in August. This method has proven to be the best way to collect subsidence data on East Mountain. In flat areas with limited vegetation, the elevations can be read from the photographs with a precision of one-half foot. In steeper areas where cliffs are present, the resolution becomes less reliable, and inaccuracies of greater than ten feet can occur. In steeper areas, photogrammetric monitoring can, and has been, augmented by conventional survey data. The applicant will maintain survey control aerial targets within the permit boundary necessary to allow the interpretation of coordinates on photos within ±1 foot.

Following this procedure the operator shall conduct annually an aerial photo survey of all areas which have been undermined. ~~Elevations of control points within the photos will be determined by photogrammetric means to an accuracy of ±1 foot and compared to corresponding elevations derived from the baseline survey conducted in August 1980~~. The operator shall continue monitoring all areas undermined until it is mutually agreed by the operator and DOGM that the subsidence in a given area has become stable and no further monitoring is necessary. The findings of the survey shall be reported to DOGM annually in a summary report.

Special Monitoring - Castlegate Cliff Escarpment

North Castlegate Escarpment - North Rilda Area

The Castlegate Sandstone escarpment, within the northern portion of the North Rilda Area, has very limited surface exposure due to presence of talus slopes and vegetation that cover the formation in this area. Due to the limited surface exposure of the Castlegate escarpment, no special monitoring or mine layout protection measures are planned for the escarpment in this area (refer to R645-301-500: Appendix 1 for a comparison of the North Castlegate Escarpment to previously mined areas).

South Castlegate Escarpment - North Rilda Area

The Castlegate escarpment, within the southern portion of the North Rilda Area, has well established surface exposure. Based on an on-going geotechnical study of evaluating the potential effects of longwall (full-extraction) mining on the stability of the Castlegate Sandstone

escarpment, i.e. Cottonwood Newberry Canyon/Corncob Wash and Trail Mountain 5th East Cottonwood Canyon Test Areas, development of a predictive escarpment/mining model is in progress. The model developed from these studies will be used to forecast anticipated effects of proposed mining under the escarpment within the southern portion of the North Rilda Canyon Area, i.e. two (2) southern-most longwall panels proposed in the Blind Canyon and Hiawatha Seams - North Rilda Area (See R_2P_2 Mine Plan Maps Vol 5, Maps 3-6 & 3-7). Based on the predictive escarpment/mining model, areas of potential cliff escarpment failure will be monitored with photogrammetric methods, augmented by conventional survey data. Site selection of the conventional survey monuments will be done in cooperation with the surface land management agency.

If cliff escarpment failures are predicted from the geotechnical evaluation, PacifiCorp will cooperate with the surface land management agency (U.S.D.A. Forest Service) in an environmental analysis of the potential impacts. Final mining approval of the referenced southern longwall panels will be based on the objective evaluation of the predictive model and assessment of potential surface impact from full-extraction mining within the affected area.

Mitigation of Subsidence Damage Effects

Should significant subsidence impacts occur, the applicant will restore, to the extent technologically and economically feasible, those surface lands that were reduced in reasonably foreseeable use as a result of such subsidence to a condition capable of supporting presubsidence reasonably foreseeable uses.

In order to restore any land affected by operations to a condition capable of supporting the current and postmining land uses stated herein, the operator will replace water determined to have been lost or adversely affected as a result of operator's mining operations if such loss or adverse impact occurs prior to final bond release. The water will be replaced from an alternate source in sufficient quantity and quality to maintain the current and postmining land uses as stated herein.

During the course of regular monitoring activities required by the permit, or as the operator + surface managing agency. otherwise acquires knowledge, the operator will advise DOGM of the loss or adverse occurrence discussed above, within ten working days of having determined that it has occurred. Within ten working days after DOGM notifies operator in writing that it has determined that the water loss is the result of the operator's mining operation, the operator will meet with DOGM to determine if a plan for replacement is necessary and, if so, establish a schedule for submittal of a plan to replace the affected water. Upon acceptance of the plan by DOGM, the plan shall be implemented. The operator reserves the right to appeal DOGM's water loss determinations as well as the proposed plan and schedule for water replacement as provided by Utah Code Ann. 40-10-22(3)(a). As outlined earlier, there are no springs or seeps located above the projected mining activities in the North Rilda Area. Most of the streams within the permit area are ephemeral and/or intermittent. Only the lower portion of Rilda Canyon Creek below the forks is considered perennial. The streams are fed by springs that emanate primarily in the North Horn Formation west of the permit boundary. Second mining, ie. longwall extraction, room & pillar, of the North Rilda area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur beneath the stream channels of these canyons. First mining, ie. mainline, gateroad development, will occur below the Right Fork of Rilda Canyon. For a

complete analysis of the proposed "no subsidence / long term stability" design of the 4th North Mains development within the Right Fork of Rilda and long-term stability analysis refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the Right Fork of Rilda Canyon a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the Hiawatha Seam, the lowest seam to be mined. The riparian zone within the Right Fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial fill with the canyon's side slopes. The angle of draw was calculated from the Hiawatha Seam horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. The referenced 15 degree angle of draw is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full extraction mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above (refer to Annual Subsidence Reports of the Deer Creek MPR).

Subsidence Control

The operator will conduct the underground mining operations so as to prevent subsidence from causing material damage to the surface and to maintain the value and reasonable foreseeable use of that surface in accordance with the preceding subsidence control plan.

A 200 feet barrier will protect the northern mine permit boundary from mine-induced subsidence. The northern boundary projection of mine-induced subsidence is shown on Figure

R645-301-500c.

As mentioned in the PROBABLE HYDROLOGIC CONSEQUENCES DETERMINATION section, (728: Hydrologic Balance - Surface Water System), the drainages conveying runoff away from the permit areas are streams in Rilda, and Mill Fork canyons. Second mining, ie. longwall extraction, room & pillar, of the North Rilda area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur beneath the stream channels of these canyons. First mining, ie. mainline, gateroad development, will occur below the Right Fork of Rilda Canyon. For a complete analysis of the proposed "no subsidence / long term stability" design of the 4th North Mains development within the Right Fork of Rilda and long-term stability analysis, refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the Right Fork of Right Fork of Rilda Canyon, a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the Hiawatha Seam, the lowest seam to be mined. The riparian zone within the Right Fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial fill with the canyon's side slopes. The angle of draw was calculated from the Hiawatha Seam horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. The referenced 15 degree angle of draw is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full extraction mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above (refer to Annual Subsidence Reports of the Deer Creek MPR).

insert figure 500c

Public Notice

The operator will not mine in any areas that would allow potential subsidence effects (as indicated by the angle of draw) to affect any area outside of the lease and permit boundary until this constraint on coal recovery is resolved by OSM and BLM or permission is granted by the adjacent surface agencies. A mining schedule which details the area in which mining is to take place and the planned date of the mining activity has been submitted to the affected surface owners.

526. MINE FACILITIES (R645-301-526)

Introduction

No new surface facilities are planned for the North Rilda Area. Coal production from the area will be transported by an underground conveyor belt system to the Deer Creek Mine facility.

The Deer Creek Mine facility is located on a 20 acre site at the junction of Deer Creek Canyon and Elk Canyon. The site is characterized by moderate vegetation and rugged, steep terrain. Surface facilities include the following: sediment pond, embankment fills, coal surge bin, transfer tower, breaker station, crusher station, coal weigh bin, truck load-out, facility conveyors, overland conveyor, parking lot, parking garage, office-bathhouse, warehouse-shop, materials storage area, access and service roads, mine ventilation fan, power supply and substations, water treatment system, high pressure pumphouse, sewer treatment system, and drainage system (see Vol. 5, Maps 3-9 and 3-9A).

There are also support facilities located in Rilda Canyon, a tributary of Huntington Canyon. The facilities pad and access road of this area occupy approximately 2.01 acres of Manti-La Sal National Forest land in the NW1/4, W1/2, SE1/4 of Section 29, T16S, R7E, SLM. These facilities include an access road and a pad area which supports two portals, a substation, power line, fan, water storage tank, and pumphouse. Topsoil removed prior to construction of the site is stored within the permit area of the Rilda Canyon facilities.

Vehicular access to the road is controlled by a locked barrier gate near the public turn-around

area. However, the road continues to serve as a Forest Development Trail, allowing access by horseback and foot travel up the Left Fork and beyond the facilty area. Access to the facility pad is controlled with fencing and a locked gate at the point where the road enters the pad. The existing trail continues beyond this point.

Vehicular use of the road within the Rilda Canyon facilities will only occur in emergency situations. Access for routine equipment inspection and maintenance will be from underground. Surface environmental compliance inspections will be conducted on foot from the turn-around area. Snow removal will only occur in emergency situations.

Specific locations and other information regarding the access road and facility pad in Rilda Canyon are shown in Vol. 4, Maps 2-15A and 2-17A; Vol. 5, Maps 3-9A and 3-9B; and Vol. 6, Maps 4-1A and 4-4A (Sheets 1, 2 and 3). More specific information about each of the structures and facilities is provided in the MRP. [Volume 2, Part 3 entitled "MINE FACILITIES (Rilda Canyon)"].

All facility plans are on file at PacifiCorp-Interwest Mining Company, One Utah Center, 201 South Main, Suite 2100, Salt Lake City, Utah 84140-0021. They are available for public inspection.

With the exception of roads and conveyors, a narrative explaining the construction, use, maintenance, and removal of the forenamed facilities can be found in Vol. 2, Part 3 of the MRP.

527. TRANSPORTATION FACILITIES (R645-301-527)

The Deer Creek Mine operation utilizes roads and conveyors, in association with facilities described in the Operation Plan (Vol. 2, Part 3). All portal facilities are shown in Vol. 5, Maps 3-9 and 3-9A. A description of the construction, maintenance, and removal of each transportation facility at Deer Creek Portal follows.

Roads

The Deer Creek Mine operation utilizes four facility roads as follows:

a. Mine Access Road

b. Coal Facilities Access Road

c. Mine Fan Access Road

d. Rilda Canyon Access Road

The Deer Creek mine access road is asphalt surfaced. It extends approximately three miles from State Highway 31 in Huntington Canyon. A general road plan is shown in Vol. 6, Maps 3-18 and 3-19 and in the Deer Creek Coal Mining Permit Amendment, Rilda Canyon Surface Facilities, Vol. 5, Map 3-9A.

Road width averages 20 feet. Road gradient averages approximately 8% until it nears the facilities area. A 1,000 foot length of road from the truck loadout to the parking lot has a gradient of 18%. Steep narrow canyon terrain allows no leeway for a more gradual gradient. Sufficient evidence was provided to OSM and DOGM to make a determination whether a

variance should be granted. Correspondence regarding a determination seemed to concur with PacifiCorp's (formerly UP&L's) findings that "major construction of complying roadways would increase environmental degradation".

Asphalt and road base thicknesses are variable due to periodic resurfacing. Asphalt thicknesses are at least 4 inches. The mine access road is crowned in the center, gradually sloping to the sides.

Runoff from the access road outside the portal area is collected in open ditches which drain into Deer Creek. Within the disturbed area, runoff is collected in open ditches, slot drains, and catch basins and routed through the sediment pond. Diversions are discussed in the Operation Plan (Vol. 2, Part 3). Road drainages outside the portal area beyond the mine gate are maintained by Emery County Road Department.

The access road was constructed and is maintained by the County and will remain in place between the mine gate and State Highway 31 to provide access to USDA Forest Service and fee lands.

The coal facilities access road is a 1,000 feet long winding gravel road up Elk Canyon which provides access to major components of the coal handling circuit. It has variable width and grade. It is utilized daily at low speeds by coal handling facilities labor and service personnel. Road construction was limited mainly to shallow blade work in the existing canyon soils.

Runoff from this road is collected in open ditches, sediment traps and inlets and carried to the

sediment pond.

The mine fan access road is a 1,500 feet long gravel road winding up Deer Creek Canyon behind the office-bathhouse to the mine ventilation fan. Road gradient averages approximately 20%. Travel on this road is limited to once a day at low speed. Road width averages 12 feet. Drainage from the mine fan access road is collected in an open ditch in the "disturbed" drainage system.

The Rilda Canyon Facility Access Road is approximately 1150 feet in length. It follows the north side of the Left Fork of Rilda Canyon from the end of the county road to the facility pad. The existing road/trail was upgraded to a gravel surfaced road with an average width of 11 feet and an average grade of approximately 8%. The road was designed in accordance with recommendations from the surface management agency(Manit-LaSal National Forest). See Volume 2, Part 3 for additional information.

Maintenance of all facility roads includes snow and debris removal, grading and resurfacing as needed.

Removal of all facility roads is discussed in Reclamation Plan of the Deer Creek MRP.

Conveyors

Eight facility conveyors are utilized at Deer Creek Mine. They are identified as follows:

a. Run-of-Mine Conveyor

b. Surge Bin Reclaim Conveyor

c. Fines Conveyor

d. Breaker Feed Conveyor

e. Breaker Reclaim Conveyor

f. Reject Conveyor

g. Crusher Feed Conveyor

h. Overland Conveyor

Two alternate conveyors are available for use if needed. They are the weigh bin conveyor and the truck loadout conveyor.

All facility conveyors are 48 inches wide and are covered to prevent wind erosion with the exception of the truck loadout conveyor which is seldom used. All conveyors are steel frame idler supported conveyors except for the overland conveyor and run-of-mine conveyors which are steel frame cable supported conveyors.

The 1,350 feet run-of-mine conveyor delivers 9 inches x 0 inches size coal to the coal surge bin from the mine. This conveyor will deliver as much as 2,500 tph.

The surge bin reclaim conveyor is approximately 150 feet long and delivers a maximum 1,500 tph to the primary screen for passage to either the breaker feed belt or the fines belt.

The 60 feet long breaker feed belt delivers a maximum 1,500 tph to the breaker station. The 80 feet fines belt delivers a maximum 1,000 tph to the overland conveyor. The 100 feet long breaker reclaim belt delivers a maximum 1,500 tph -6 inches to the crusher feed belt. Breaker reject delivers coal to the reject conveyor for delivery to the reject pile.

The crusher feed conveyor is approximately 70 feet long and delivers up to 1,500 tph to the crusher station.

Final -1 5/8" coal product from the crusher station is generally delivered to the overland conveyor which carries it directly to the Huntington Power Plant. The 1.8 mile long overland conveyor can deliver up to 1,200 tph. It is constructed in two long sections, one 3,000 feet and the other 6,400 feet.

If weighing of the plant product is desired, coal may be delivered to a 200 ton capacity coal weigh bin via the weigh bin conveyor.

Standard mechanical maintenance procedures are followed to ensure smooth operation and long life of the facility conveyors.

During reclamation, the conveyors will be dismantled and sold for salvage. Concrete foundations will be broken out and used for coarse backfill.

528. HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL, AND COAL MINE WASTE. (R645-301-528)

The Deer Creek MRP includes a narrative explaining the construction, modification, use, maintenance, and removal of coal, overburden, excess spoil, and coal mine waste.

529. MANAGEMENT OF MINE OPENINGS (R645-301-529)

No portals or surface facilities area planned for the North Rilda Area. The Deer Creek mine permit includes a description of the measures to be used to seal or manage mine openings within the general permit area.

530. OPERATIONAL DESIGN CRITERIA AND PLANS (R645-301-530)

The Deer Creek MRP includes a general plan for each sediment pond, water impoundment, and coal processing waste bank, dam or embankment within the permit area (see Vol. 2, Part 3). No additional sediment ponds, impoundments, coal processing waste piles, dams or embankments are planned for the North Rilda Area.

532. SEDIMENT CONTROL (R645-301-532)

No surface facilities, sediment control, or other disturbance is planned for the North Rilda Area.

The MRP describes designs for sediment control for the Deer Creek facilities.

533. IMPOUNDMENTS (R645-301-533)

No impoundments are planned for the North Rilda Area.

534. ROADS (R645-301-532)

No new roads are planned for the North Rilda Area. For a discussion on the access road for the Deer Creek Mine, refer to Vol. 2, Part 3 of the MRP.

535. SPOIL (R645-301-535)

For a discussion on spoil of the Deer Creek Mine, refer to Vol. 2, Part 3 of the MRP.

536. COAL MINE WASTE (R645-301-536)

Underground development waste, coal processing waste, and excess spoil will continue to be disposed of in accordance with plans approved by DOGM and MSHA. There are no plans to return coal processing wastes to the underground at the Deer Creek Mine.

There are three waste rock disposal areas associated with the Deer Creek Mine. The first location (Area 1) in known as the Main Yard Extension, located north of the access road between the parking lot and the truck loadout. Area 1 was utilized for placement of waste rock until 1988 when it reached its capacity.

The second location (Area 2) known as the Elk Canyon Storage Pad, is located on the western slope at the mouth of Elk Canyon. Area 2 was utilized for placement of waste rock when Area 1 reached its capacity and while Area 3 was being permitted. Area 2 is no longer used for waste rock disposal.

The third location (Area 3) is located east of the Huntington Power Plant within Section 6 T17S, R8E, SLM. Area 3 was approved by DOGM September 13, 1988 and currently serves the waste rock disposal requirements of the Deer Creek Mine. All permitting criteria for Area 3 are discussed in Appendix XII, Volume 10. Areas 1 and 2 are discussed in Vol. 2, Part 3 of the MRP. The discussion includes disposal locations, chemical analyses of the wastes, estimated waste volume calculations, designs, construction and operation, maintenance, slope stability analysis, surface runoff, hydrologic analysis, ditch designs, and final reclamation.

The quantity of material to be disposed of is estimated using the past history of waste rock generated by the mining operations. The allowable quantity generated per year is 50,000 tons.

Potential sources of waste rock at Deer Creek Mine are (1) rock slopes and raise construction, (2) entry rehabilitation, and (3) trommel screen reject from the breaker station.

540. RECLAMATION PLAN (R645-301-540)

No surface disturbance is planned for the North Rilda Area. A reclamation plan for the Deer Creek Mine is described in Volume 2, Part 4 of the MRP. This plan includes narrative, maps, designs and plans for the mine.

Because no surface disturbance in planned for the North Rilda Area, a reclamation plan is not necessary for expansion into this area.

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600 GEOLOGY (R645-301-600)

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600 GEOLOGY (R645-301-600)

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600. GEOLOGY (R645-301-600)

The geology of East Mountain, including the North Rilda Area, has been studied extensively from previous coal mining operations. The permit applicant has been collecting data from the area since 1971. Over 110 exploratory drill holes have been drilled from the surface. Some have been core drilled through the coal zone and geophysically logged. A total of 17 exploration boreholes have been drilled on the permit application area. These holes have been drilled to investigate the coal resources, overburden, geologic structure, and hydrology of the permit application area. Upon completion of each hole, drilling fluids and cuttings have been disposed of properly and each hole has been sealed or plugged from total depth to surface collar with cement or cement and bentonite "hole plug" (refer to R645-301-600: Appendix 1 for exploration drillhole Table 1, Existing Exploration Drillhole Completion Details).

Regulatory oversight authority for the various phases of exploration drilling and data analysis is delegated as follows:

a.	Determine if mineable coal reserves are present	BLM
b.	NEPA analysis	BLM/Surface Management Agency (SMA), DOGM comment on reclamation
c.	Exploration license or drill permit approval	BLM with SMA concurrence
d.	Inspections	BLM, SMA, DOGM (shared resources)
e.	Enforcement	BLM, SMA, DOGM with SMA cooperation
f.	Appeals	BLM, SMA, and/or DOGM

Additionally, over 500 holes have been drilled from within the mines of the area, all provide information about the geology of the area. Finally, coal seams exposed by outcrops and within the mine workings have been mapped in detail, providing data and knowledge of the geology in the area.

A discussion of the geology has been presented previously in the MRP (Vol. 8). Geology has also been briefly discussed in the Hydrology section of this document (Section 700). The geologic discussion summarizes the structural geology, stratigraphy, and economic coal deposits of the region and the permit area located within the East Mountain property. The North Rilda Area has been included in most of these studies. Furthermore, geologic maps of the entire permit area showing locations of exploratory drill holes, coal seam structure contours, geologic cross sections, cliff stability, and isopach maps also include the North Rilda Area (Vol. 8).

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700 HYDROLOGY (R645-301-700)

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700 HYDROLOGY (R645-301-700)

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710. INTRODUCTION (R645-301-710)

This application provides a detailed description of the hydrology, including groundwater and surface water quality and quantity, of the land within the permit and surrounding area (refer to Figure R645-301-700a).

Since 1989 detailed data on the hydrology of the land within the permit and surrounding area have been collected, compiled and analyzed by PacifiCorp and several governmental agencies. Information collected by PacifiCorp is the result of exploratory drilling, field investigations, geologic mapping, aerial photography, spring surveys, groundwater tests, monitoring of numerous wells and stream stations, climatological monitoring, and investigations by independent consultants. The data collection program is part of a complete Hydrologic Monitoring Program which has been approved by the State of Utah, Division of Oil, Gas and Mining (DOGM) and the Office of Surface Mining (OSM). All data collected have been and will continue to be submitted to OSM, DOGM, United States Forest Service (USFS), and the Bureau of Land Management (BLM) each year in the annual Hydrologic Monitoring reports.

PacifiCorp has a policy of close cooperation with many agencies and has invited, encouraged, and permitted numerous agencies to conduct investigations and experiments within and adjacent to the permit area. The resulting information produced by these investigations is quite extensive and has been utilized throughout this application.

FIGURE R645-301-700a: GENERAL LOCATION MAP

711. GENERAL REQUIREMENTS (R645-301-711)

711.100	Existing hydrologic resources as given under R645-301-720
711.200	Proposed operations and potential impacts to the hydrologic balance as given under R645-301-730
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711.500	Reclamation activities as given under R645-301-750

712. CERTIFICATION (R645-301-712)

All cross sections, maps, and plans required by R645-301-722 as appropriate and R645-301-731.700 will be prepared and certified according to R645-301-512.

713 INSPECTION (R645-301-713)

No impoundments are planned for the North Rilda Area. Impoundments associated with the current Deer Creek Mine facilities will be inspected as described under R645-301-514.300.

720. ENVIRONMENTAL DESCRIPTION (R645-301-720)

721. GENERAL REQUIREMENTS

The existing pre-mining hydrologic resource of the East Mountain property is subdivided into the following sections:

A. EXISTING GROUNDWATER RESOURCES
   1. Regional and Permit Area Groundwater Hydrology
   2. Regional and Permit Area Geology
   3. Regional and Permit Area Groundwater Characteristics
   4. Springs and Seeps
   5. Groundwater Quality
   6. Mine Dewatering
   7. Groundwater Rights and Users
   8. North Emery Water Users Association (NEWUA)
      Rilda Canyon Springs

B. EXISTING SURFACE RESOURCES
   1. Regional and Permit Area Surface Water Hydrology
   2. Surface Water Quality
   3. Soil Loss and Sediment Yield

A. EXISTING GROUNDWATER RESOURCES

1. REGIONAL AND PERMIT AREA GROUNDWATER HYDROLOGY

The characteristics and usefulness of a groundwater resource are dependent upon the geology of the water-bearing strata and on the geology and hydrology of the recharge area. Groundwater movement and storage characteristics are dependent on the characteristics of the substratum. To facilitate an understanding of groundwater of the East Mountain property including the North Rilda Area, a discussion of pertinent regional geologic features is presented below.

2. REGIONAL AND PERMIT AREA GEOLOGY

The East Mountain property is located in the central portion of the Wasatch Plateau Coal Field in Emery County, Utah. Generally, this area is a flat-topped mesa surrounded by heavily vegetated slopes which extend to precipitous cliffs dropping steeply to the valley below. Relief of up to 2,500 feet is measured from the Castle Valley lowland to the plateau above. The following discussion summarizes the structural geology and stratigraphy of the region and the permit areas located within the East Mountain property.

Strata in the East Mountain permit area are gently down-folded in the area of the Straight Canyon Syncline which is present in the central portion of the East Mountain (see Vol. 8 - Geologic Section of the Deer Creek MRP). The bearing of the Straight Canyon Syncline is approximately N30^{O}E and the structure plunges to the southwest. Dips in the syncline range from two to six degrees with the north limb dipping the steepest.

In the area south of the Straight Canyon Syncline the coal seam dips gently in a northwest direction toward the syncline; however, to the northwest of the Straight Canyon Syncline both the Hiawatha and Blind Canyon seams dip in a southeast direction at three to five degrees.

The strata within the property have been offset by a series of north-south trending normal fault zones. Generally, the faults are nearly vertical and do not have significant amounts of fault gouge or drag associated with them. One of the major faults present in the region, the

Pleasant Valley Fault, has been intersected in both the Deer Creek and Cottonwood/Wilberg mines.

The Pleasant Valley Fault consists of two parallel faults about 150 feet apart. The faults' total displacement (where it was intersected in the Deer Creek Mine) to the north is 150 feet with its down thrown side on the east. The displacement diminishes to less than one foot where it was intersected in the Wilberg Mine near the south end of the property.

Another north-south trending fault, the Deer Creek Fault, is present to the east of the Pleasant Valley Fault. It limits the eastward development of the Wilberg/Cottonwood and Deer Creek mines. The displacement of the Deer Creek Fault ranges from 100 to 170 feet with the east block being down thrown.

A northeast-southwest trending fault system, the Roans Canyon Graben, is present along the axis of the Straight Canyon Syncline. The system contains up to six normal faults having displacements ranging from a few feet to over 150 feet. Coal deposits present to the north of the fault have been accessed through rock tunnels driven from the 3rd North section of the Deer Creek Mine.

The rock formations exposed in the East Mountain area range from Upper Cretaceous to Tertiary in age (see Vol. 8 - Geologic Section of the Deer Creek MRP). The formations, in ascending order, are the Masuk Shale member of the Mancos Shale, Star Point Sandstone, Blackhawk, Castlegate Sandstone, Upper Price River, North Horn, and Flagstaff Limestone. The coal deposits are restricted to the lower portion of the Blackhawk Formation.

The Masuk Shale is the upper member of the Mancos Shale and consists of light to medium gray marine mudstones. Usually this formation weathers readily, forming slopes which are often covered by debris. It is generally devoid of water.

Overlying and intertonguing with the Masuk Shale is the Star Point Sandstone. In the East Mountain area the Star Point Sandstone consists of three or more massive cliff-forming sandstones totaling about 400 feet in thickness. Generally, the sandstones are fine to medium-grained and moderately well-sorted. The upper contact of the Star Point Sandstone is usually quite abrupt and readily identifiable on the outcrop. Even though the Star Point Sandstone formation exists throughout the entire East Mountain property, the low permeability and lack of recharge, i.e., very little outcrop exposure and limited vertical groundwater migration caused by the mudstone layers of the North Horn and Blackhawk formations, limit its usefulness as a water producing aquifer. Locally, the Star Point Sandstone exhibits aquifer characteristics. These are isolated occurrences where regional faults have created secondary permeability and have been intersected by major canyons with perennial streams. An example is Little Bear spring located in Huntington Canyon.

The Blackhawk Formation consists of alternating mudstones, siltstones, sandstones, and coal. Although coal is generally found throughout the Blackhawk Formation, the economic seams are restricted to the lower 150 feet of the formation. The sandstones contained within the Blackhawk Formation are fluvial and increase in number in the upper portions of the formation. Many of the tabular sandstone channels form local perched water tables. The total thickness of the Blackhawk Formation in the East Mountain area is about 750 feet.

The Castlegate Sandstone, the lower member of the Price River Formation, generally caps the escarpment which surrounds the eastern limit of the property. The Castlegate Sandstone consists of about 250 feet of coarse-grained, light gray, fluvial sandstones; pebble conglomerates; and subordinate zones of mudstones.

The Upper Price River Formation, which overlies the Castlegate Sandstone member, is about 350 feet thick and forms slopes which extend upward from the Castlegate escarpment. Although some mudstones are present, fine-grained, poorly sorted sandstones dominate the Upper Price River Formation.

The North Horn Formation is the youngest formation exposed in the North Rilda Area and is about 200 to 250 feet thick. Mudstones dominate the rock types present and are generally gray to light brown in color. Localized, lenticular sandstone channels are present throughout the formation. The sandstone beds are more common near the upper and lower contacts of the formation.

The Flagstaff Limestone Formation overlies the North Horn Formation and consists of white to light gray lacustrine limestone. An erosional remnant of 100 to 150 feet of this formation remains, forming a cap on the highest plateaus to the west and south of the North Rilda Area.

3. REGIONAL AND PERMIT AREA GROUNDWATER CHARACTERISTICS

Waters entering the groundwater system are mostly from snow melt. The amount of water which enters the groundwater system is highly variable from one site to another. The low

surface relief on the top of East Mountain to the south of the North Rilda Area encourages the infiltration of melting snow. Conversely, in the North Rilda Area where steep slopes are common, infiltration is limited. All of the geologic formations which are exposed in the area have relatively low permeability which further reduces the amount of water entering the groundwater system. Probably less than five percent of the annual precipitation recharges the groundwater supply (Price and Arnow, 1974; U. S. Geological Survey, 1979).

Geology controls the movement of groundwater. Because of the low permeability of the consolidated sedimentary rocks in the East Mountain area, groundwater movement is primarily "through fractures, through openings between beds, and, in the case of the Flagstaff Limestone, through solution openings" (Danielson et al., 1981, p. 25).

The majority of the groundwater which infiltrates the Flagstaff Limestone flows down vertical fractures which intersect sandstone channel systems in the North Horn Formation. The majority of the groundwater reaching this point intersects the surface in springs located in the North Horn Formation. Very little recharge intersects the upper Price River Formation and Castlegate Sandstones; consequently, they are not water saturated where intersected in the numerous drill holes penetrating those units. Due to the topographic configuration of the North Rilda Area, recharge is limited and only two springs and two seeps were located during spring and seep surveys.

Data have been collected from numerous coal exploration drill holes, from within the mine workings, from surface drainages, and from the springs in the area. The data have identified two separate isolated aquifer systems on the East Mountain property; the first is localized

perched water zones in the North Horn Formation, and the second is a combination of localized perched water tables in the Blackhawk Formation and the Star Point Sandstone which exhibits some limited potential as a regional aquifer. Stratigraphy is the main controlling factor restricting groundwater movement and development of regional and perched aquifer systems within the East Mountain property. A complete description of the various formations and how they influence the groundwater systems is located in Vol. 9 - Hydrologic Section: *Regional Groundwater Characteristics*. A secondary factor controlling existance and movement of groundwater in North Rilda Area is topographic configuation(incised canyons) of the area. To document the geologic and hydrologic characteristics of the North Rilda Area, a total of seventeen surface exploration holes have been completed, including a series of holes in the Right Fork of Rilda Canyon in the area of the proposed mainline development crossing of the Right Fork. Due to the limited surface area for infiltration, topographic configuration of the area (incised canyons), and outcropping of the Star Point Sandstone Formation around the entire North Rilda Ridge, the Star Point appears to be unsaturated within the North Rilda Area. The following table documents the holes completed, total depth, amount of non-sandstone lithology directly below the Hiawatha seam, amount of Star Point Sandstone penetrated and the hydrologic data.

NORTH RILDA SURFACE EXPLORATION DATA

Drill Hole #	Total Depth (feet)	Total Depth (below base of Hiawatha Seam) (feet)	Non-Sandstone Lithology Below Hiawatha Seam (feet)	Star Point Sandstone Penetrated (feet)	Hydrologic Data
EM-47	300	114.9	4.9	119.8	Est. @ 5 GPM from the Colluvial/Alluvial deposits
EM-48	1860	160.0		160	No Measureable Quantities
EM-49	1680	102.4		102.4	No Measureable Quantities
EM-50	1680	81.6	6.6	88.2	No Measureable Quantities
EM-51	1660	83.4	1.4	84.8	No Measureable Quantities
EM-52	1560	68.1	2.1	70.2	No Measureable Quantities
EM-53	716	7.7		7.7	Dry
EM-55	1680	63.9	2.9	66.8	No Measureable Quantities
EM-56C	422	29.9	26.4	29.9	Est. @ 15 GPM from the Colluvial/Alluvial deposits
EM-105	1620	84.9	0.9	85.8	No Measureable Quantities
EM-107	767	8.5		8.5	Dry
EM-153	796	12.1	1.0	13.1	Dry
EM-154	795	15.6	1.1	16.7	Dry
EM-155	716	14.5		14.5	Dry
EM-156	755	13.1		13.1	Dry
EM-157	436	17.0	4.6	21.6	Dry
EM-158	226	13.8	9.2	23.0	Est. @ 5 GPM from the Colluvial/Alluvial deposits

Structural Hydrologic Features

Structural features, such as the Roans Canyon Fault Graben, the Straight Canyon Syncline, and the Deer Creek Fault, had a influence on the hydrologic regime south of the North Rilda Area within the East Mountain permit area (detailed in Vol. 9 - Hydrologic Section). Geology of the North Rilda Area is less complex than that of the central portion of the East Mountain property (see Vol. 8 - Geology Section). A fault system referred to as the Mill Fork Canyon Graben is located to the west of the projected mine workings. The Mill Fork Canyon Graben was intersected and crossed to the north of the North Rilda Area permit extension in the Beaver Creek No. 4 Mine and consisted of series of faults with a total displacement of approximately thirty (30) feet. Beaver Creek No. 4 Mine was a relatively dry mine with only few isolated roof drippers associated with the Mill Fork Fault system.

Alluvial Aquifers

Utah regulations require that the presence of alluvial valley floors in or adjacent to the mine project area be identified. The regulations define an alluvial valley floor as "unconsolidated stream-laid deposits holding streams with water availability sufficient for sub-irrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff or slope wash together with talus, or other mass-movement accumulations, and wind blown deposits". The drainage systems of the North Rilda Areas are examples of colluvial deposits, consisting of alluvium in part and containing angular rock fragments, talus, cliff debris, and material from avalanches. Even

though these deposits are defined as colluvial/alluvial, mining below the stream segments in the North Rilda Area will be restricted to first mining only (refer to HM-9, HM-10, HM-11 and Engineering Section, R645-301-500, of this document for mine plan layouts and subsidence impacts). Alluvial deposits in and adjacent to the North Rilda permit area have been mapped and reported in Doelling's "Wasatch Plateau Coal Fields" (1972). The report indicated that alluvia in the area are found solely along Huntington Creek below the Rilda Canyon confluence in the Huntington drainage system. A complete description of the alluvial aquifers is outlined in Vol. 9 - Hydrologic Section.

4. SPRINGS AND SEEPS

The 1979 water reconnaissance program of East Mountain Springs was initiated with an aerial survey of East Mountain properties via helicopter. During the survey, the locations of 102 possible springs were plotted on aerial photographs. Subsequent field work confirmed the locations of forty-eight (48) springs producing measurable amounts of water. The remaining sightings proved to be minor seeps, dry or runoff from other springs. Between 1979, the time PacifiCorp began monitoring springs on East Mountain, and 1991, additional field reconnaissance projects increased the number of springs from less than fifty (50) to nearly eighty (80). Each spring site on East Mountain has been studied to determine the geologic circumstances that cause the springs to occur. The mode of occurrence for each spring has been tabulated on the "Springs Geologic Conditions Inventory" sheets located in the annual Hydrologic Monitoring reports (refer to Vol. 9 - Hydrologic Support Information). The springs on East Mountain originate in several different ways (see Vol. 9 - Hydrologic

Section or Annual Hydrologic Monitoring Reports); however, many springs share the same mode of occurrence and, in some cases, are related.

The most frequent occurrences of springs are those located about 150 to 350 feet below the top of the North Horn Formation (see Vol. 9 - Hydrologic Section: Figure HF-6). The drill hole data show a predominance of fluvial siltstone and sandstone at that stratigraphic interval. These sedimentary rocks represent many isolated fluvial systems which are water-bearing. The springs are formed where the fluvial channels intersect the land surface. Because the fluvial channels within this zone are generally not interconnected, the springs are not interrelated but share the same mode of occurrence.

Numerous springs located in the lower portion of the North Horn Formation occur when water flowing through fluvial sandstones, which are underlain by a thin zone of impervious mudstone at the base of the North Horn Formation, intersect the land surface. The surface drill hole data indicate that impervious mudstone units occur at the upper and lower portion of the North Horn Formation. Even though these individual mudstone layers are discontinuous, the occurrence of this type of strata exists throughout the East Mountain Property. As part of Vol. 9 - Hydrologic Support Information, logs of representative holes from the East Mountain exploration programs are included to document the occurrence of this type of strata (additional drill hole data are located at PacifiCorp's Salt Lake or Huntington offices). The springs related to this mode of occurrence are not generally interrelated because they are fed by waters flowing through isolated fluvial channel sandstones and siltstones.

Several springs are located along the Roans Canyon Fault Graben. Generally, the springs are located within the North Horn Formation along the fault zone. Few springs are located in the area below the base of the North Horn Formation below where the impervious mudstone is located, supporting the fact that water percolating down a fracture or fault is stopped from further downward travel when it reaches the impervious clay zone which forms a seal along the fracture. Many of the largest springs on East Mountain are located along this fault system. Because the fault system is located along the trough of the Straight Canyon Syncline, water from both the north and the south flows toward the fault where it is allowed to migrate to the land surface. The springs located along this fault zone are generally interrelated.

A few springs are located within both the Flagstaff and Price River formations; however, their occurrence is insignificant in comparison to springs located in the North Horn Formation.

Generally springs with discharges exceeding 50 gpm are associated with faulting where permeability has been increased by fracturing. The discharge of the springs varies directly with the amount of precipitation and also varies seasonally. Discharge is greatest during the snow melt period, normally from late April through the month of June. Following periods of groundwater recharge the discharge recedes fairly rapidly at first, then gradually, indicating a double porosity effect. At the end of the water year the remaining discharge is only twenty to thirty percent (20-30%) of the peak discharge. Annual variations and historical comparisons are depicted in the annual Hydrologic Monitoring reports. During reconnaissance surveys of the North Rilda Area, only two springs were located within the

permit extension area, spring 80-50 in Section 29 and the Rilda Canyon Springs located in Section 28. In addition to the springs, two minor seeps were located within the permit extension area, one along the trace of the Mill Fork Canyon fault, and the second seep is located at the formational contact between the Blackhawk/Star Point Sandstone (refer to Vol. 9 - Hydrologic Section).

5. GROUNDWATER QUALITY

Groundwater chemical quality is very good in strata above the Mancos Shale. The USGS reports a range in dissolved solids from 50 to 750 mg/l for samples from 140 springs in the region issuing from the Star Point Sandstone and overlying formations (Danielson et al., 1981). Danielson et al. (1981) identified the regional trends of decreasing water quality from north to south and west to east across the Wasatch Plateau. Waters percolating through the underlying Mancos Shale quickly deteriorate, with total dissolved solids concentrations frequently exceeding 3000 mg/l.

Additional studies by PacifiCorp have confirmed the primary findings of the USGS concerning regional trends in quality. Originally, decreasing quality from north to south was believed to depict the groundwater flow direction, and the quality decreased as a function of the time it traveled through the strata. The time travel component is probably an important factor. In 1985 a surface exploration program identified the existence of an area of residual heat from an ancient burn on the outcrop throughout the southern portion of East Mountain. The high temperature was also explored within the mine and a portion of reserves were lost because of the situation. It is now theorized that the high temperature water dissolved the

mineral constituents of the formations, thereby altering the water chemistry. The quality also decreases vertically because of the influence of marine sediments along with the trend of decreasing quality from north to south.

An examination of Figure HF-7 (refer to Vol. 9 - Hydrologic Section of the Deer Creek Mine MRP) indicates that a relationship exists between elevation and the total dissolved solids concentration of the springs and the surface streams. A distinct relationship exists with respect to surface and water emanating from the springs. The data indicate that concentrations of dissolved materials increase with diminishing elevation for both surface streams and springs. The change in quality is a function of the differences in the chemical character of geologic formations which outcrop at different elevations (see Table HT-2 for East Mountain springs water quality, refer to Vol. 9 - Hydrologic Section of the Deer Creek Mine MRP).

To more closely identify springs which are related, water samples are analyzed to determine the percentage of cations and anions in solution. These percentages have been graphically represented as cation-anion diagrams in the annual Hydrologic Monitoring reports. The purpose of the diagrams is to identify groups of related springs by water chemistry. The diagrams clearly show the similarity of water quality of springs originating in the same geologic formation. To better visualize this concept, the cation-anion diagrams are presented by the geologic formation in which they originate. A general pattern for the Flagstaff Limestone and Price River formations can be recognized for each year in which the cation/anions were analyzed. A consistent pattern for the North Horn Formation is less obvious due to the complex geology of the formation itself. One aspect the cation-anion

diagrams demonstrate is that, even though the quality varies slightly from individual sites as well as from different formations, seasonal variations do not exist.

PacifiCorp began in-mine water quality monitoring in 1977. With the collection of numerous samples throughout the extent of the mine workings, the quality has remained relatively constant (refer to Vol. 9 - Hydrologic Section of the Deer Creek Mine MRP, Maps HM-2 and HM-3). As with the springs, quality varies from individual sites, but quality from the individual sites remains constant versus time (refer to Vol. 9 - Hydrologic Section of the Deer Creek Mine MRP Figure HF-8). The overall quality collected from each mine is shown in (refer to Vol. 9 - Hydrologic Section of the Deer Creek Mine MRP Table HT-3).

The predominant dissolved chemical constituents of the groundwater from both surface springs and samples collected in the mine are calcium, bicarbonate, magnesium, and sulfate. Concentrations of magnesium are normally about one-half the concentration of calcium. Sulfate concentrations are typically higher in water from springs issuing from the Starpoint-Blackhawk aquifer zone or confined aquifers intersected by mine workings. As mentioned early, water quality degrades from the north to the south and also vertically.

6. MINE DEWATERING

Water encountered within the Deer Creek mine has generally been confined to the perched aquifer systems and fractures and faults associated with the Blackhawk Formation. Water enters the mines through various avenues including roof drippers from overlying fluvial

sandstone channels, bolt holes, tension cracks in the overlying strata, longwall caved areas, and where fractures or faults have been intersected by the mine workings. The lower Blackhawk/Star Point Sandstone Formation appears to be unsaturated within the North Rilda Area. This is due to the limited surface area for infiltration, topographic configuration of the area (incised canyons), and outcropping of the Blackhawk and Star Point Sandstone formations around the entire North Rilda Ridge. Based on extensive surface exploration data, (refer to REGIONAL AND PERMIT AREA GROUNDWATER CHARACTERISTICS), intercepted groundwater in the North Rilda ridge will be limited primarily to perched aquifers in the lower Blackhawk Formation. Mountain Coal's No. 4 Mine located to the north of the North Rilda Area with a similar topograhic location intercepted only minor quanities of groundwater and discharge from the mine was not required. Excess water intercepted in the mine will be ~~excess of water not utilized in the mining operation or for domestic~~ ~~use is~~ ~~either~~ pumped to storage areas or discharged from the mine under approved UPDES permits (refer to Vol. 9 - Hydrologic Section: Appendix B for UPDES permit information). A complete description of the quality and quantity is reported in the Annual Hydrologic Monitoring reports and also in the PHC (Section 728).

7. GROUNDWATER RIGHTS AND USERS

Nine springs have been developed in Huntington Canyon to provide for domestic, industrial, and commercial water needs. Currently, Huntington City utilizes two springs in Huntington Canyon, Big Bear Canyon Springs and Little Bear Canyon Springs. The North Emery Water Users Association (NEWUA) also utilizes springs in Huntington Canyon to provide for

domestic and industrial water needs in areas outside of Huntington City. Along with springs in Huntington Canyon, NEWUA is currently utilizing water from three springs in Rilda Canyon (see Map HM-1 and HM-5).

8. NORTH EMERY WATER USERS ASSOCIATION (NEWUA)

Of concern to PacifiCorp-Fuel Resources is the proximity of proposed mining activities in Rilda Canyon to the Rilda Canyon Springs which currently serve as a culinary water source to the North Emery Water Users Association (NEWUA) serving some 410 connections. Due to the importance of these springs, a separate discussion is provided herein describing the nature of NEWUA's Rilda Canyon Springs and the sources of the waters issuing from them. The structural geologic setting is described, followed by an analysis of spring flow quality and quantity.

Although no significant north-south trending faults are known to exist in the area of the Rilda Canyon springs, other physical features in the area indicate that the major springs issuing from the Star Point Sandstone in the Huntington Canyon, and Little Bear Canyon are fault or fracture related (refer to Map HM-6 [Vol. 9 - Hydrologic Section of the Deer Creek MRP] for spring locations). A noteworthy feature related to the occurrence of the principal Starpoint springs is the location of each spring with regard to a known fault or the location with regard to the linear orientation of significant north-south trending side drainage channels. As illustrated on Map HM-6, Little Bear Spring is directly in line with the western edge of the graben identified in Beaver Creek Coal Company's No. 4 Mine. The Rilda Canyon Springs lie directly in line with a north-south trending side canyon to the south as

well as one to the north. From examination of topographic features of the area under a stereoscope, it appears that the linear relationship of side drainage channels (or lineament) can be traced through Mill Fork Canyon to the north, intersecting the northeast-southwest trending graben (encountered by Beaver Creek Coal) near the northern ridge of Mill Fork Canyon. Two separate geophysical techniques were employed in Rilda Canyon to assist interpreting the occurrence and movement of groundwater. First, Very Low Frequency Electromagnetic Analysis (VLFEM) and second, resistivity and induced polarization were utilized to verify the existence of fracture zones in line with the lineament traced from Rilda into Mill Fork Canyon.

The VLFEM study consisted of two transects in an east-west direction across the Rilda Canyon Spring area, one along the road that bypasses the springs to the north and one along the road bypassing the springs to the south. Data from the east-west transect are shown on Figure HF-9B (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). In both transects, a significant subsurface anomalous condition was encountered in the vicinity of the springs and directly in line with the north and south canyons. In addition to the east-west transect, three north-south transects were conducted in order to delineate possible fracture zones parallel to the stream. Data from the north-south transect are illustrated in figures HF-9D through 9E (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP) and locations of the transect are shown on Figure HF-9F (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). Analysis of the north-south transect shows an anomalous area, which might indicate the existence of a fault or fracture in the westernmost transect as shown on Figure HF-9C (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). This anomalous area was also evident on the resistivity-IP survey which will be discussed below.

The two transects which were conducted lower in the canyon do not show strong evidence of any anomalous areas [see figures HF-9D and 9E (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP)].

VLFEM surveys conducted in Rilda Canyon were performed by Hansen Allen & Luce (HA&L) of Salt Lake City, Utah. Survey procedures utilized by HA&L consisted of selecting a transmitter station which provides a field approximately parallel to the traverse direction, i.e., approximately perpendicular to the expected strike of a conductor. VLFEM transmitter stations are located at several points around the globe. They broadcast at frequencies close to 20,000 Hz, which is low compared to the normal broadcast band. Data were collected utilizing a hand held instrument manufactured by Corne Geophysical Limited on fifty-foot intervals along the transect with two readings collected at each location: 1) field strength, and 2) dip angle (in degrees from a horizontal plane). It should be stressed that data collected during VLFEM surveys are very sensitive to sharp changes in topography and natural and manmade metallic material such as fences, pipelines, etc. In Rilda Canyon very little manmade materials exist except for wire fence which surrounds the NEWUA spring collection area shown on Figure HF-9B (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). Pipelines used to collect and transport the spring water in Rilda Canyon are constructed of PVC and are considered to have little or no adverse impact on the data that was collected. It should also be stressed that the VLFEM data should only be considered one facet of the hydrologic investigation conducted in Rilda Canyon and not the sole source of hydrologic interpretation.

PacifiCorp contracted Geowestern to conduct a resistivity and induced polarization (I.P.) Survey in Rilda and Mill Fork canyons in the summers of 1989 and 1992 (refer to Vol. 9 - Hydrologic Support Information). The intent of the survey was to identify fractures in the strata and the depth of alluvium in Rilda Canyon by contrasting areas of Resistivity and I.P. response. As with the VLFEM data, resistivity-I.P. assisted in the hydrologic interpretation and was utilized to plan the location and depth of wells constructed for hydrologic drawdown conducted in November 1990.

Resistivity-I.P. surveys have been utilized for many years to map out subsurface occurrences of groundwater or mineralization. Because groundwater within the Wasatch Plateau tends to be concentrated along fractures, Resistivity-I.P. surveys can effectively identify fractures, faults included. Where strata are present at depths having highly contrasting resistivity or I.P. response, displacement along a fault can be detected by the offset of the depth to the contrasting beds. Where faults are present within a survey area but the strata is fairly uniform in resistivity and I.P. response, no displacement will be recognized in the data collected but the fault plane itself will most likely be easily detected. The latter scenario is normally the case within the permit area; therefore, the surveys will identify water-filled fractures and faults but will not always differentiate between the two. Most of the anomalies identified will be fractures, and differentiating between faults and fractures requires additional geologic data provided by field mapping or published data.

The resistivity-I.P. survey was conducted on nine separate lines, eight in Rilda Canyon and one in Mill Fork Canyon (see Map HM-7 [refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP]). Three of the lines (longitudinal) were along roads in the canyon bottoms in

both Rilda and Mill Fork canyons. Six lines were transverse, across Rilda Canyon, and were designed to identify the depth of alluvial fill in the canyon bottom.

The resistivity survey used the pole-dipole configuration with station intervals of fifty (50) feet on longitudinal lines and twenty (20) feet on transverse lines. Resistivity and I.P. values were measured at separate intervals of 100, 200, 300, and 400 feet on each of the longitudinal lines and 20, 40, 60, and 80 feet on the transverse lines. These separations in data collection allowed the recovery of data that revealed conditions up to 400 feet in depth on both the longitudinal and transverse lines. The I.P. survey used the time-domain method and reflects areas where the ground has a greater electrical capacitance, a condition normally caused by disseminated sulfides which, on our property, would most likely be minor amounts of pyrite along fractures.

Rapid changes in the resistivity or I.P. response of the surveys are almost always associated with fractures in a geologic setting and can follow a distinct trend at depth which allows the determination of the angle of dip of the fracture. The Resistivity-I.P. Survey identified several anomalies indicating fractures and/or faults. The fractures which cause the anomalies dip steeply in a westerly direction or are vertical. The degree of dip associated with each fracture is shown on Map HM-7 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). Each of the anomalous areas representing fractures was examined in the field and on aerial photographs to determine the significance of the anomalies. The geophysical data was then compared with geologic data collected in the field and from publicly available reports, making it possible to locate a fault graben (Mill Canyon Graben) system trending in a northeast direction which cuts across the western portion of our northern reserves (see Map

HM-7 [refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP]). The southernmost fault of the graben was intersected in Beaver Creek Coal Company's #4 Mine in Mill Fork Canyon and has a displacement of about twenty (20) feet down on the northwest side. Where it crosses the northern end of East Mountain, the fault has been mapped to have a displacement of thirty (30) feet down on the northwest side. All other faults in the graben system have a relative displacement which is up on the northwest side.

Several anomalies to the southeast of the Mill Fork Canyon Graben were identified by the Resistivity-I.P. Survey. No displacement is identified on any of them. The anomalies are on the same geologic trend as areas mined in the Beaver Creek Coal Company #4 Mine where no faults exist; therefore, in all probability they are water saturated fractures having no vertical displacement.

The transverse lines (R-3 through R-5, and R-7 through R-9) were designed to provide data regarding the depth of the alluvium in the canyon bottom. The alluvial/bedrock contact is identifiable on the profiles and provides important information on the hydrology of the springs located in the canyon. The alluvial floor is up to seventy (70) feet thick as indicated by resistivity profiles R-3 through R-5 and drill hole information obtained from P-6 and P-7 (see Figure HF-10 [refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP]). Again, it should be stressed that the resistivity data should only be considered one facet of the hydrologic investigation conducted in Rilda Canyon and not the sole source of hydrologic interpretation.

Description of NEWUA Spring Collection System

The NEWUA spring system consists of a series of collection lines extending westward up Rilda Canyon and southward up a small side drainage as shown on Map HM-8 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). The NEWUA spring system is metered at four locations. Meter 1 (Side Canyon Spring) is located at the downstream end of a collection line which enters Rilda Canyon from the South. Meter 2 (Side Canyon Spring plus South Spring) is located near the bottom of the main east-west trending collection line which lies to the south of Rilda Canyon Creek at a point just upstream (west) of the main spring collection box. Meter 2 records combined flows from both the Side Canyon (Meter 1) as well as additional inflows which enter the system below Meter 1 known as South Spring. Meter 3 (North Spring) records flows for the east-west central collection line which was constructed through the central portions of the valley near Rilda Canyon Creek. Meter 4 (North Spring) collects data from the north collection line located on the north side of Rilda Canyon Creek. Meter 3 and Meter 4 were combined in 1995 during the Rilda Canyon road improvement project.

In addition to the main spring collection lines, there are two flumes in the vicinity which monitor flow rates within Rilda Canyon Creek. The upper flume, RCF-2, is located adjacent to the extreme west end of the spring collection system monitored by Meter 4. Flume RCF-3 is located in Rilda Canyon Creek adjacent to spring collection Meter 2.

Initially five shallow wells were located in the area surrounding the spring collection system to monitor groundwater level fluctuations through time. The locations of the wells are

shown on Map HM-9 (included with this submittal). Wells 1 through 5 are relatively shallow wells which were constructed prior to 1989. In 1990 two additional large diameter wells were developed, (Wells 6 and 7) adjacent to wells P-2 and P-3, respectively, in order to obtain more complete groundwater data through aquifer testing. Wells P-2 and P-3 were abandoned and sealed in 1995.

Quantity

Through the cooperative efforts of PacifiCorp and NEWUA, flow meters were installed in September 1990 to isolate individual spring areas for quantity and quality [refer to Map HM-8 (Vol. 9 - Hydrologic Section of the Deer Creek MRP)]. Flow from Rilda Canyon Springs is directly related to the spring runoff (i.e. precipitation received from the previous winter). Spring output ranges from approximately 300 GPM during high runoff to approximately 75 GPM during the winter months. Based on measurements collected prior to the time when Meters 3 and Meter 4 were combined, the majority of the flow was from Meters 3 and 4, approximately 46% and 49%, respectively (refer to Annual Hydrologic Reports for detailed flow information). The seasonal variation of the monthly average flow from all NEWUA's Rilda Canyon Springs is shown in the Annual Hydrologic Monitoring Reports. With the installation of the flow meters, individual spring contribution to the total flow can be plotted over time.

PacifiCorp contracted Hansen, Allen & Luce (HA&L) in 1990 to conduct a hydrologic test in Rilda Canyon. The overall purpose of the hydrologic testing was to determine to the degree possible: 1) general hydrologic conditions associated with the NEWUA springs, including

the general direction of groundwater movement; 2) the potential origin of waters feeding the NEWUA springs; and 3) a determination of general aquifer characteristics, including transmissivity. Earlier reports (April 1983 and March 1984) prepared by Vaughn Hansen Associates identified the source of water from the North Spring to originate from two general sources. The earlier report concluded that the source of water originated from a north-south trending subsurface anomaly which may be a strike slip fault located immediately downstream of the main North Spring area. The latter, using additional data collected, concluded that there also appears to be an east-west trending anomaly which intersects the north-south anomaly just north of the North Spring. Water collected in the east-west anomaly from surface and/or fault sources located higher in the canyon may issue forth at the North Spring as the water comes in contact with the north-south trending anomaly. It was believed at the onset of the project that the source of water (whether from the north-south trending anomaly or from sources farther up the canyon) could be determined by pumping strategically placed wells near the sources of water.

Upon initiation of the project PacifiCorp and HA&L met to determine the most efficient method of proceeding with the proposed pumping tests. It was mentioned that because of the proximity of Well P-6 to the main spring collection area, pumping Well P-7 might produce clearer test results. Pumping P-6 would have an impact upon the main spring collection system; however, any attempts to determine the source of spring water could be masked by the influence of the drawdown cone. That is, by pumping P-6 both sources of recharge to the North Spring would be drawn upon, thereby making the attempt at isolation more difficult.

Soon after initiation of the project it was decided that the most complete data could be obtained by pump testing P-7 because of its location upgradient of the main spring collection area. If P-7 could be pumped sufficiently, the potential source of recharge water feeding the North Spring from the alluvial canyon fill west of the spring could be reduced without affecting water recharging the springs from the north-south trending anomaly or fault system. The level of impact due to pumping P-7 would then be an indicator of the general source of water issuing from the NEWUA springs.

The purpose of the pump test performed on P-7 was to pump the well to its maximum potential for a period of time sufficient to note and record impacts upon the NEWUA springs or other wells located in the vicinity. The amount of pumping and the level of impact on the local systems was used subsequent to the test to help document the source of water discharging into the NEWUA spring collection system. A pump test was run on P-7 continuously from 4:00 p.m. on November 13 through 12:30 p.m. on November 20, 1990. Throughout this period records were kept related to pumping conditions and flow rate discharging P-7, water levels in wells P-1 through P-7, and spring flows recorded at NEWUA spring collection meters 1 through 4. Well P-3 was dry throughout the test.

Aquifer Characteristics

The local groundwater system in the vicinity of the NEWUA springs consists of an unconfined alluvial valley fill aquifer as well as bedrock and fracture systems. Resistivity data provided by PacifiCorp indicate that the total maximum depth of alluvium ranges from 50 to 73 feet at the three locations where cross sections were taken. The locations of the

resistivity cross sections within Rilda Canyon are shown on Map HM-7 (refer to Vol. 9 - Hydrologic Section). The width of the unconfined aquifer varies due to the influence of side drainages which also feed the area.

Water moving throughout Rilda Canyon appears to originate from at least three sources. The first and most obvious source is through the alluvial valley fill, the second is through an east-west trending fracture which is believed to lie to the north of the canyon floor, and the third is potentially through a north-south trending fracture which bisects the canyon just west of the NEWUA spring collection system. Extensive exploration conducted in Rilda and Mill Fork canyons parallel to the trend of the fracture systems outlined in earlier reports have failed to identify structural features which could contribute to the groundwater system. More is mentioned about water quality from these sources later in this document.

Springs within Rilda Canyon are believed to indicate and verify the locations of changes in geologic structure. Examples of local geologic structures and their impact on hydrology have been verified historically through stream and spring flow observations. The canyon drainage west (or above) the interface with the upper contact of the Star Point Sandstone is generally a discharging stream section. When alluvial waters come in contact with the more impermeable members of the upper Star Point Sandstone/Mancos Shale interface, they are often forced to the surface, creating springs. Local NEWUA springs confirm a recharging stream section. When these more impermeable formations are crossed, the stream once more becomes a losing stream until subsurface waters again come in contact with the more impermeable members of the Star Point Sandstone and underlying Mancos Shale formations.

Some sections of the stream within Rilda Canyon gain flow, thereby evidencing the locations where subsurface water is forced to the surface by the tighter formations.

Data collected during and following the pump test of P-7 were used to provide estimates of local valley fill aquifer characteristics. For these analyses, data from both pumped Well P-7 and from observation Well P-6 were used during both the drawdown and recovery portions of the test. Well P-6 was used as an observation well over other local wells because 1) it is the closest to the pumped well, 2) it is upgradient from the north-south trending anomaly associated with the spring, 3) it showed the most response to pumping, and 4) the data were more consistent than other data collected.

In order to analyze the data in an acceptable fashion, the data sets were broken into three separate portions. The first data set has been termed the "initial" data set and includes time and drawdown data from P-7 for the beginning period of the test where the flow rate was recorded to be equal to 8.22 gpm. The "intermediate" data set includes data subsequent to that time when the flow rate was increased to an average value over time of 16.4 gpm. The third data set includes data taken during the "recovery" portion of the test after the pump in P-7 was shut off.

Three basic analytical methods--the Cooper-Jacob, Theis, and Neuman methods--were used to estimate aquifer transmissivity for the data contained herein. Each method, along with applicable data, is discussed separately in the following sections.

Cooper-Jacob Drawdown and Recovery Analyses

Drawdown Methods

The Cooper-Jacob straight line method of analysis utilizes a semi-log plot for the display and analysis of the data as shown on Figure HF-12 (refer to Vol. 9 - Hydrologic Section). The data shown on the plot entitled "PacifiCorp P-7 Initial Data Q=8.22 gpm" have three general slopes. The first few data points are usually ignored in a pump test because they reflect initial drawdown anomalies generally due to evacuation of the well drill stem or casing. The next set of data, beginning at two minutes and running through 100 minutes, show a good aquifer response and an associated transmissivity of approximately 35,650 gpd/ft. The plot, however, shows that a change in the slope of the data occurred at about 100 minutes. Such a change in grade generally indicates the presence of a boundary condition which, in the case of Rilda Canyon, reflects the bedrock of the canyon walls. Generally under such conditions the slope of the curve after the time in which the boundary was encountered will double (refer to Figure HF-13, Vol. 9 - Hydrologic Section). The slope of the straight line for the latter part of the data shows a transmissivity on the order of 21,100 gpd/ft, a forty percent decrease. Based upon this data it is believed that the initial transmissivity of the alluvial valley is on the order of 35,000 gpd/ft for the initial period of pumping, during which time the aquifer is unaffected by distant barriers. After a barrier influences groundwater hydrology, the transmissivity reduces to the estimated 21,100 gpd/ft.

Intermediate data provide similar results. The barrier effects discussed occurred within the first 100 minutes of pumping, before data was collected for this data set; therefore, the

majority of the impacts due to the barrier already will have been accounted for although some effects should occur due to an increased pumping rate. With this in mind, the straight line Cooper-Jacob analysis produces a transmissivity of 17,550 gpd/ft, as shown in Figure HF-14 (refer to Vol. 9 - Hydrologic Section). Although slightly less, this value is similar in nature and magnitude to that found for the last half of the initial data set.

An analysis of the intermediate data was also made by using data collected from P-6 located approximately 500 feet to the east of P-7. The analysis shown in Figure HM-15 (refer to Vol. 9 - Hydrologic Section) indicates that the long-term transmissivity for this data set is in the rage of 23,800 gpd/ft. Again, this is in the general range of estimates already made above.

Recovery Methods

Straight line methods of analysis are also used for well recovery data taken after the pump is shut off. In the case of P-7 the recovery curves are shown as Figures HM-16 and HM-17 (refer to Vol. 9 - Hydrologic Section). Immediately after pumping ceases in a well, water levels recover at an abnormally high rate in a similar fashion to what occurred during the first two minutes of the pumping test as shown in Figure HM-12 (refer to Vol. 9 - Hydrologic Section). By taking the next set of data, a straight line can be fit to obtain an approximation of long-term transmissivity on the order of 13,700 gpd/ft, as shown in Figure HF-16 (refer to Vol. 9 - Hydrologic Section). Although this estimate is a little low compared to the estimate given above, it is of the same order of magnitude.

Short-term transmissivity is checked for the recovery data by fitting a straight line through the low end of the data. The transmissivity under short-term pumping is estimated at 35,900 gpd/ft, which matches very well the 35,650 gpd/ft estimate made by utilizing the Cooper-Jacob straight line drawdown analysis discussed above.

Theis Drawdown Analysis

The Theis method of solution utilizes a log-log plot of drawdown versus time as shown on Figure HM-18 (refer to Vol. 9 - Hydrologic Section). The solution is achieved by matching a well function curve to the data as shown. It should be noted that the data utilizing this method of solution does not readily show the boundary condition which was identified by the Cooper-Jacob solution method. There is a slight curvature of the data at about the 100-minute time mark as shown on the plot; however, without other methods it is unlikely that a boundary condition would have been identified for this data set. Since the solution does not identify a boundary condition, the solution reached is a mix of both short- and long-term transmissivities. An analysis using this approximation method (resulting in an average transmissivity) results in an estimate of 28,450 gpd/ft.

A check of the estimate can be made by averaging transmissivities for both the initial short-term and intermediate long-term data sets obtained using the Cooper-Jacob method. The average of 35,650 and 21,100 gpd/ft is 28,380 gpd/ft, which is within one-half of a percent of the estimate given above using the Theis method.

An analysis of the intermediate data shown on Figure HM-19 (refer to Vol. 9 - Hydrologic Section) shows that the estimated long-term transmissivity using the Theis method is on the order of 17,900 gpd/ft, which can be compared to the 17,550 gpd/ft estimate made using the Cooper-Jacob method. The estimates indicated are within two percent of each other, again showing good correlation.

Neuman Drawdown Analysis

The third method of analysis is based upon unconfined aquifer solutions as determined by Neuman. His analysis utilizes two basic curve types. The "Type A" curve is characteristic of that shown on Figures HM-20 and HM-21 (refer to Vol. 9 - Hydrologic Section) where the curve is a power curve asymptotic to the horizontal line. "Type B" curves bend in the opposite direction, i.e., they start relatively flat and turn upward as one moves to the right on the plot. Slight trends toward both the "Type A" and "Type B" curves can be seen on Figure HM-20 (refer to Vol. 9 - Hydrologic Section). A "Type A" curve could be fit to the data between times 1 and 30, and a "Type B" curve could be fit to the data between times 30 and 1000; however, because the data is influenced by the presence of a boundary condition (as discussed above) and because the Neuman solution does not identify boundary conditions in its methodology, such an analysis would provide inaccurate results. As a compromise, an average solution is attempted by analyzing the data based upon the complete data set wherein an estimate of 13,150 gpd/ft is obtained. Although lower than some of the earlier estimates made, this estimate again has the same relative order of magnitude.

The intermediate data set was also analyzed using the Neuman approach as shown in Figure HM-21 (refer to Vol. 9 - Hydrologic Section). From the data it is seen that this solution predicts a low value of transmissivity. It is believed that the other predictions of transmissivity given above are more accurate and reliable than this estimate because of the reasons discussed in the previous paragraph.

Aquifer transmissivities as determined by the methods listed above range from a low of 6,100 gpd/ft to a high of 35,900 gpd/ft. As a summary of values determined, the following table is provided. The table contains a column identified as "Credibility of Results" which is intended to be a guide to the numbers given. A high credibility rating indicates that the method basically accounts for conditions believed to exist within Rilda Canyon. A medium credibility indicates that the numbers are within the range expected but that the solution may not be as accurate as another method. A low credibility indicates that, for these conditions, the solution does not appear to fully account for identified field conditions. As outlined in the table, it is believed that long-term transmissivities are on the order of 20,000 gpd/ft and short-term transmissivities are on the order of 35,000 gpd/ft. The variation in results appears to be due to boundary effects created by the canyon walls. If used for further analyses, the short-term transmissivity estimates should govern.

SUMMARY OF CALCULATED TRANSMISSIVITIES

Analysis Used	Data Type	Well Data Used	Estimated Transmissivity (gpd/ft)		Credibility of Results		
			Short-Term	Long-Term	High	Medium	Low
Cooper-Jacob	Drawdown	P-7	35,650	17,550-21,000	XXX		
Cooper-Jacob	Drawdown	P-6		23,600	XXX		
Cooper-Jacob	Recovery	P-7	35,900	13,700	XXX	XXX	
Theis	Drawdown	P-7	28,450	17,900	XXX	XXX	
Neuman	Drawdown	P-7	13,150	6,100			XXX

Quality

Initial water quality investigations (sampling consisted of wells P-1 through P-5 and three spring collection areas) conducted by West Appa Coal Company in the fall of 1982 indicated two distinct classes of groundwater (primarily defined by sulfate concentrations). Illustrated on Figures HF-22, 23, and 24, (refer to Vol. 9 - Hydrologic Section), are the percent reacting values for major cations and anions for the five piezometers and three spring collection areas as determined from samples collected on September 16, October 15, and December 6, 1982, respectively. As illustrated on the figures, there are two distinct groupings of data from the various sources with regard to sulfate concentrations and total dissolved solids (TDS) concentrations. In general, the Side Canyon Spring, the South Spring collection zone, and well P-4 contain groundwater higher in TDS and sulfate concentrations than do the North Spring collection zone, wells P-2 and P-5.

Differences in the above-referenced groupings of data reflect differences in the groundwater source or the origin of groundwater for the various springs issuing within the Rilda Springs area. The Side Canyon Spring is located at or near the base of the Blackhawk Formation. The higher sulfate concentrations and TDS concentrations from the spring are characteristic of waters associated with the Blackhawk Formation. The similarity in water quality between the Side Canyon Spring and the South Spring collection area, Meter 2, would indicate that South Spring waters are also primarily of Blackhawk origin. The slightly better quality of

South Spring water over the Side Canyon Spring water indicates that some of the South Spring water is derived from waters moving within the alluvial deposits.

As illustrated by TDS concentrations on Figures HF-22, 23, and 24, (refer to Vol. 9 - Hydrologic Section), waters issuing from the North Spring, (Meters 3 and 4), collection area are of a better quality than waters from the Side Canyon and South Spring collection areas. Waters issuing from the North Spring originate primarily from water moving within the alluvial valley sediments and are not derived from the Blackhawk Formation.

Additional water quality sampling conducted by PacifiCorp during 1990 confirmed the early results obtained by West Appa. In summary, water quality of the North Spring does not generally correlate well with waters originating from the south as measured by Meter 1 (Side Canyon) and Meter 2 (South Spring), and are similar to surface waters monitored within Rilda Canyon. The water appears to be more highly correlated with waters moving toward the NEWUA springs from the west. Water movement from the west is most likely through alluvial deposits associated with Right and Left forks of Rilda Canyon. Additional sources may be through faulting and fracturing systems within Rilda Canyon or through the north-south anomaly which passes through the west end of the spring collection system. Extensive exploration conducted in Rilda and Mill Fork canyons parallel to the trend of the fracture systems outlined in earlier reports have failed to identify structual features which could contribute to the groundwater system. The waters originating through the alluvial valley fill appear to have different water quality characteristics than those of the southern springs (refer to Annual Hydrologic Monitoring Reports for a detailed analysis of the water characteristics of the individual springs and Rilda Canyon Creek).

Piezometric Surface

Water level data collected at each of the wells or piezometers within Rilda Canyon has been compiled to indicate the general orientation and direction of groundwater within the vicinity of the NEWUA springs as shown on Map HM-8 (refer to Vol. 9 - Hydrologic Section). Note from the map that the general direction of groundwater continues to be to the east along the axis of Rilda Canyon with flow contributions being received by the drainage entering from the south. Water table gradients for the area are dependent upon the time of year as well as overall groundwater recharge characteristics. For example, from the map it can be found that the average slope of the monitored water table lying between wells P-7 and P-5 was 4.3 percent in November 1990. At the same time, the average water table gradient increases downgradient of P-5 where it was found to be 6.4 percent. The fact that the water table gradient increases downstream of P-5 still tends to confirm the presence of the north-south anomaly, (stratigraphic interface or fracturing). A check of water table gradients during high flow periods shows larger values than were noted in the latter part of 1990. Analysis of historic data shows that, although flow patterns are relatively unchanged during high flow periods, the water table gradient above P-5 may have been as high as 7.4 percent in 1987.

Groundwater Quantity Based on Pump Test Results

An approximation of the total groundwater flow moving eastward down Rilda Canyon was made using data collected from the resistivity studies completed by PacifiCorp and from data

collected at local area wells. The flow approximation was made by applying the general flow equation Q=VA. The area of groundwater flow was determined using the inferred cross sectional area identified in the resistivity study as "R-3" (see Map HM-7 Vol. 9 - Hydrologic Section) for the canyon adjacent to P-7. The velocity of groundwater movement was determined from the relationship between hydraulic permeability and groundwater gradient, V=ki. Permeability was determined from the estimate for short-term transmissivity obtained using the methods discussed earlier. It was felt that under flow conditions uninfluenced by man, the short-term transmissivity is most representative of natural conditions. Using these relationships, the estimated amount of groundwater moving down Rilda Canyon was determined for both high and low flow conditions.

Based on historic data, low flow conditions were found to dominate during the period of the 1990 pump test; however, it has been noted by PacifiCorp that a rise in water level occurs within Rilda Canyon wells each year as the groundwater aquifer responds to snow melt runoff. Historical data reproduced in Figure HF-25 (refer to Vol. 9 - Hydrologic Section) for wells 1 through 5 shows seasonal and annual water level fluctuations. Note the relative change in water level between wells. Little overall variation is noted except for P-3 which shows changes over time totaling approximately thirteen to fourteen (13-14) feet. Changes recorded in P-3 are likely greater than those indicated by Figure HF-25, (refer to Vol. 9 - Hydrologic Section) because P-3 is only thirty-eight (38) feet deep and water levels have been known to drop below the bottom of the well. A comparison of water level variations between P-3 and adjacent P-7 indicates that the total water level fluctuation may be as much as twenty-two (22) feet(actual data collected from 1990 through 1996 reveals the maximum

rise in water level of approximately twenty eight [28] feet, refer to Annual Hydrologic Monitoring Reports).

Low Flow. The first condition analyzed was based upon the relatively low flow condition found in November 1990. Using the relationship Q=VA as discussed above, the total alluvial valley aquifer flow in the area of P-7 was estimated to be approximately 151 gpm. Subtracting an average pumped Vol. of 16.4 gpm from P-7, an estimated flow of 135 gpm bypassed P-7 and continued downstream toward the NEWUA spring collection system. Impacts noted upon the NEWUA spring system as a result of pumping P-7 appear to be confined to a reduction in flow from the springs on the order of ten percent. Before pumping began, total combined spring flows were approximately 85 gpm. During the later stages of pumping, just prior to termination of the test, spring flows had reduced to approximately 77.5 gpm, indicating a reduction in flow of 7.5 gpm during the pump test. Additional reductions in flow will probably occur as flows continue to stabilize.

High Flow. High flow conditions were estimated by adding to the 151 gpm base flow calculated for the November 1990 period the additional flow which would move down the canyon given a twenty-two (22) foot rise in water level which would occur during a wet year. The additional flow projected to occur during wet years was estimated by 1) measuring the cross sectional area which would result from a twenty-two (22) foot rise in the water table and 2) by applying the flow relationship Q=kiA. As indicated earlier, the water table gradient (i) used in this equation was found to be greater in 1987 than during the November 1990 test. Based on these assumptions, increased water levels measured during the high flow period of 1987 resulted in an estimated alluvial valley aquifer flow rate of 372 gpm.

B. EXISTING SURFACE RESOURCES

Presented within this section of the report is the regional hydrologic setting as well as the site specific description of hydrologic surface water characteristics of the permit area.

1. REGIONAL AND PERMIT AREA SURFACE WATER HYDROLOGY

The PacifiCorp permit area is located in the headwater region of the San Rafael River Basin (refer to Vol. 9 - Hydrologic Section: Figure HF-26). The surface drainage system of the North Rilda permit area is confined exclusively to the Huntington Creek drainage system (refer to Vol. 9 - Hydrologic Sction: Map HM-1). Huntington Creek drains approximately 190 square miles of the Wasatch Plateau in central Utah. Altitude changes rapidly across the Wasatch Plateau with steep canyon sides and high mountain peaks. Altitudes range from 6,000 to 10,700 feet. Average precipitation generally increases with altitude and ranges from ten (10) inches near the town of Huntington to thirty (30) inches in the upper reaches of Huntington Creek. Most of the precipitation occurs during winter months in the form of snow.

Water use upstream from Castle Valley (the monoclinal valley containing most of the agricultural land noted in Figure HM-27 [refer to Vol. 9 - Hydrologic Section]) is primarily for stock watering and industrial purposes (coal mining and electrical power generation). Within Castle Valley, agriculture and power production utilize nearly all of the inflowing water (Mundorff, 1972) with minimum flows in the gaged streams occasionally approaching zero. Transbasin diversions occur throughout the area.

In general, the chemical quality of water in the headwaters of the San Rafael River Basin is excellent, with these watersheds providing most of the domestic water needs to the people below; however, quality rapidly deteriorates downstream as the streams cross shale formations (particularly the Mancos Shale in and adjacent to Castle Valley) and receive irrigation return flows from lands situated on Mancos-derived soils (Price and Waddell, 1973). Dissolved solids concentrations range from about 100 to 600 mg/l in the mountain regions and from 600 to 6000 mg/l in Castle Valley.

Huntington Creek above the USGS stream gaging station (0318000) near the town of Huntington drains approximately 190 square miles. Storage reservoirs regulate runoff from fifty-four square miles in the upper part of Huntington Creek. The average channel gradient of Huntington Creek above Huntington is about 100 feet per mile (1.9 percent). Danielson et al. (1981) estimate the average annual precipitation on the Huntington Creek drainage to be on the order of twenty-six (26) inches. The average discharge at the USGS gage near Huntington is approximately ninety-six (96) cubic feet per second (70,000 acre-feet per year). The USGS estimates that "during most years, about 65 percent of the annual discharge at the Huntington Creek station (09318000) occurs during the snowmelt period (April-July)" (Danielson et al., 1981, p. 110). For example, the monthly distribution of flows for Huntington Creek near Huntington for the water year 1978, corrected for the influence of Electric Lake Dam, is shown on Figure HF-28 (refer to Vol. 9 - Hydrologic Section). The annual peak flows recorded for the USGS station near Huntington are plotted on Figure HM-29. While the majority of stream flows are due to snow melt, thunderstorms of high intensity are common in the area during the summer months. A review of the discharge records for Huntington Creek near Huntington shows that twenty-two of seventy-one (31

percent) measured annual peak flows occurred during July, August, or September. The largest annual peak flows have been caused by thunderstorms. Of the measured annual peak flows on Huntington Creek near Huntington, eight annual events have been greater than 1600 cfs (about a 10-year return period), all of which occurred during July, August, or September. The peak discharge of record was 2500 cfs on August 2 or 3, 1930.

The North Rilda permit area is drained by two drainage systems, Rilda, and Mill Fork canyons (refer to HM-9, included with this submittal). Listed below is the individual breakdown for each individual permit area including stream classification.

MINE PERMIT AREAS	DRAINAGE SYSTEM	STREAM CLASSIFICATION
North Rilda	Rilda	Ephemeral-Perennial
	Mill Fork	Ephemeral-Intermittent

The upper reaches of Rilda and Mill Fork canyons are ephemeral. Rilda Canyon Creek is considered perennial below the springs located along the western border of Section 28, Township 16 South, Range 7 East, Mill Fork Canyon is intermittent from Section 21, Township 16 South, Range 7 East to the confluence of Huntington Canyon. Most of the streams in the permit area are spring fed. PacifiCorp has monitored all of the surface waters since 1979 and will continue to monitor them in the future. The data collected is included in each annual Hydrologic Monitoring Report.

North Rilda Permit Area Watershed Characteristics

All of the streams within the permit extension boundary are ephemeral-intermittent/perennial, as mentioned earlier. Elevations in the permit area range from approximately 7000 feet to near 10,400 feet. General land slopes in the permit area range

from near vertical along the Castlegate escarpment to less than four percent. Vegetative cover consists of sagebrush, juniper, and grasses on the south-facing slopes and dense conifer and aspen complexes on the north-facing slopes.

Water sources within the mine plan area include springs and seeps, which were discussed earlier in the Existing Groundwater Resources section of this report. There are no major water bodies located within or immediately adjacent to the mine plan area.

2. WATER QUALITY AND QUANTITY

PacifiCorp maintains an extensive surface monitoring program to evaluate both quantity and quality of the two major drainage systems which incorporate the permit area. The following will be divided into major and contributing tributary drainage systems.

Huntington Creek Drainage System

a). *Huntington Creek*

Huntington Creek is comprised of many smaller tributary systems that feed the main stream. Rilda and Mill Fork canyon creeks are the only tributaries to Huntington Creek that emanate from within and adjacent to North Rilda permit area.

Huntington Creek flow data are recorded on a continuous basis by UP&L at two locations; one station is located near the Huntington Power Plant, the other below Electric Lake which is about twenty-two miles upstream from the Huntington Plant. Flow records are maintained by UP&L in order to determine water entitlements and reservoir storage allocation for the various users on the river.

The UP&L station near the plant was established in the fall of 1973. Prior flow records were obtained from the USGS station located about one mile downstream from UP&L's existing station. The USGS station was established in 1909 and discontinued in 1970 after determination of available water supply for the Electric Lake Dam. The dam was completed in December 1973, and water storage commenced shortly afterward.

The calculated natural flow rates, which consider actual flow recorded at the plant, plant diversions, Electric Lake storage, and lake evaporation along with yearly comparisons, are reported annually in the Hydrologic Monitoring Report.

Huntington Creek water quality information is compiled on a monthly basis for stations above and below the Huntington Plant, while samples for Huntington Creek below Electric Lake and the Right Fork are taken quarterly. The location of water quality sampling stations on Huntington Creek that were considered for this report are listed below (refer Vol. 9 - Hydrologic Section: Map HM-1).

Below Electric Lake+*
Above the Forks+*
Below the Power Plant Diversion*
Below the Power Plant*

+ Not listed on map due to scale

* The sites listed above are not considered part of PacifiCorp's Hydrologic Monitoring Program but will be included in the annual report as long as data is available.

In addition to the sites monitored by Huntington Plant-Environmental Service, three sites were added on Huntington Creek near the Deer Creek confluence in conjunction with the Deer Creek discharge permit.

Specific water quality data as well as yearly comparisons are reported annually in the Hydrologic Monitoring Report. This practice will continue throughout the life of the permit.

In general, the water shows a gradual increase in concentration of dissolved minerals as the flow proceeds down Huntington Canyon.

The values at the station below Electric Lake do not express the actual natural drainage water quality characteristics because of the lake effect, but it appears that the surface flow in Huntington Canyon is of very high quality in the upper reaches with some natural degradation occurring as the flow proceeds to the canyon mouth.

b). *Rilda Canyon Creek*

Rilda Canyon Creek is a tributary of Huntington Creek and is monitored according to the following schedule (see Hydrologic Monitoring Schedule included herein).

Locations:

(1). Right Fork of Rilda - RCF1*
(2). Left Fork of Rilda - RCLF1 (Field data only)
(3). Left Fork of Rilda - RCLF2 (Field data only)
(4). Rilda Canyon - RCF2 (Field data only)
(5). Rilda Canyon - RCF3
(6). Rilda Canyon - RCW4 (Map HM-1, Vol. 9 - Hydrologic Section and; Map HM-10, included with this submittal).

* During the development of the 4th North Mains below the Right Fork an additional site will added upstream of RCF1 to monitor surface/groundwater relationships.

Flow information is collected during the first or second week of each month. Water samples will be collected and analyzed quarterly (one sample at low flow and high flow) during the first or second week of the quarter. Parameters analyzed are those listed in the DOGM Guidelines for Surface Water Operational Quality. The program was initiated in June 1989. Field measurements, including pH, specific conductivity, temperature, and dissolved oxygen, will be performed at the perennial stream locations, i.e., RCF3 and RCW4, monthly in conjunction with quantity measurements. Data regarding flow in Rilda Canyon Creek is presented in the annual Hydrologic Monitoring Report.

As stated above, flow information is collected monthly throughout the year with the use of three Parshall flumes and one V-notch weir (Vol. 9 -

Hydrologic Section: Map HM-1). Hydrographs comparing yearly flows are reported in the annual Hydrologic Monitoring Report and also as Figure HF-33 Vol. 9 - Hydrologic Section: Map HM-1.

In accordance with the Hydrologic Monitoring Plan baseline quality analysis will be for a two-year period, 1989-90 (refer to the respective Annual Hydrologic reports). Baseline analysis will be repeated once every five (5) years. Quality sampling was initiated in 1989; results of the samples collected are presented in Table HT-7, (Vol. 9 - Hydrologic Section: Map HM-1), and in the Hydrologic Monitoring Report.

c. *Mill Fork Canyon Creek*

Mill Fork Canyon Creek is a tributary of Huntington Creek and will be included PacifiCorp's monitoring program starting in 1997. Monitored of Mill Fork will be according to the following schedule (see Hydrologic Monitoring Schedule included herein).

Locations:

(1). Above old mines - MFC1
(2). Mill Fork Canyon Culvert - MFC2 (Vol. 9 - Hydrologic Section).

Flow information is collected during the first or second week of each month. Water samples will be collected and analyzed quarterly (one sample at low flow and high flow) during the first or second week of the quarter. Parameters analyzed are those listed in the DOGM Guidelines for Surface Water

Operational Quality. The program will be initiated in 1997. Field measurements, including pH, specific conductivity, temperature, and dissolved oxygen, will be performed at the perennial stream locations, i.e., MFC2, monthly in conjunction with quantity measurements. Data regarding flow in Mill Fork Canyon Creek is presented in the annual Hydrologic Monitoring Report.

As stated above, flow information is collected monthly throughout the year (Vol. 9 - Hydrologic Section: Map HM-1). Hydrographs comparing annual flows are reported in the annual Hydrologic Monitoring Report.

Historical monitoring data collected by Beaver Creek Coal Company - No. 4 Mine will be incorporated in PacifiCorp's hydrologic database. In accordance with the Hydrologic Monitoring Plan baseline quality analysis will be for a two-year period, 1997-98 (refer to the respective Annual Hydrologic reports). Baseline analysis will be repeated once every five (5) years.

3. SOIL LOSS AND SEDIMENT YIELD

Sediment load concentrations in the area of the permit vary dramatically depending on the percentage of disturbed areas, ruggedness of the terrain, geologic formations present, the amount of precipitation the area receives, and stream flow Vol..

As part of the U.S. Geological Survey water monitoring program in Utah coal fields (Open File Report #81-359), fourteen water samples associated with the permit area were collected between August 1978 and September 1979 at gaging station 09318000 on Huntington Creek to determine suspended-sediment concentrations and loads. Three samples each were collected at gaging stations 09317919, 09317920, and 09324200 in Crandall and Tie Fork canyons. Five additional samples were collected by project personnel from these and other streams in the study area. Representative suspended-sediment concentrations and loads of streams in the study area are listed below.

		Suspended sediment		
Stream	Site No.	Date	Concentration (mg/L)	Loads (tons per day)
Huntington Creek	88	8-13-78	104	27.00
(gaging station		11-17-78	72	2.50
09318000)		6-13-79	114	66.00
		8-7-79	44	15.00
Crandall Canyon	51	8-12-78	49	0.14
(gaging station		11-18-78	60	0.08
09317919)		6-14-79	15	0.41
		8-6-79	56	0.15
Tie Fork Canyon	67	8-13-78	12	0.03
(gaging station		11-18-78	57	0.12
09317920)		6-14-79	38	0.68
		8-6-79	66	0.17
Bear Creek	81	10-25-78	8,860	1.90
Deer Creek	87	6-14-79	609	3.10

As indicated from the samples collected by the USGS, the suspended-sediment concentrations varied widely among the drainages analyzed. The relatively low concentrations of suspended sediment were attributed to well established channels, low flow periods, and a scarcity of roads. Higher concentrations appeared to be associated with the activities of man and erosion of large exposures of the Mancos Shale formation in the lower reaches of the drainages. Sediment concentrations generally increased with increased stream discharge. Note that the highest values at all of the locations occurred during the spring runoff period, but not enough data were available to compute daily sediment discharge.

PacifiCorp has collected samples on a quarterly basis from the streams within and adjacent to the permit area. Samples taken at periods of both high and low flow have been tested for total suspended solids (TSS) to identify stream stability and are reported annually in the Hydrologic Monitoring Report. Tables HT-5 through HT-8 show the TSS results for streams monitored by PacifiCorp (refer to Vol. 9 - Hydrologic Section).

723. SAMPLING AND ANALYSIS (R645-301-723)

Water quality sampling and analysis of samples collected by PacifiCorp will be done according to the "Standard Methods for the Examination of Water and Wastewater." Refer to Appendix A for sample documentation and analytical methods and detection limits (refer to Vol. 9 - Hydrologic Section).

724. BASELINE INFORMATION (R645-301-724)

PacifiCorp maintains an extensive groundwater and surface monitoring program to characterize pre-mining and any mining-related impacts both to quality and quantity. As an integral part of the permit application, an annual Hydrologic Monitoring Report is prepared by PacifiCorp and submitted to appropriate government agencies. Baseline information for the East Mountain property will be divided into the following categories: 1) Groundwater, and 2) Surface Water.

Groundwater

The characteristics of the groundwater resource are dependent upon the geology of the water-bearing strata and on the geology and hydrology of the recharge area. Groundwater movement and storage characteristics are dependent on the characteristics of the substratum. To characterize the baseline quality and to document the existence of seasonal variations, PacifiCorp developed a groundwater monitoring program which includes sampling both surface springs and in-mine groundwater sources. The program was initiated during a period from 1977 through 1979. Routine monitoring continues to support the quality data collected during the initial phase. In general, data from the springs and in-mine sources are representative of the groundwater quality in the geologic strata from which the groundwater sources issue. Cation-anion diagrams have been utilized to depict the groundwater characteristics and to monitor quality trends. Results of the data collected have shown that, in both the surface springs and in-mine groundwater sources, variations in quality from individual sources do exist, but the quality from the individual sources remains consistent

with time. Spring water is mostly calcium-bicarbonate with some magnesium and sulfate. As discussed in the General Requirement Section - R645-301-711, quality decreases with increasing downward vertical movement and from north to south with sulfate becoming a major constituent. Cation-anion diagrams have been included in the Annual Hydrologic Reports to support the lack of seasonal variation. A copy of the 1991 quality information is included in Vol. 9 - Hydrologic Support Information, Baseline Section (additional information concerning groundwater quality can be found in the Annual Hydrologic reports).

Surface Water

The North Rilda permit area is drained by two drainage systems: Rilda Canyon, and Mill Fork Canyon. PacifiCorp has documented that all of the stream reaches emanating from within the North Rilda permit area with the exception of the lower portion Rilda Canyon creek cease flowing in the fall or winter, suggesting that they are not perennial but ephemeral/intermittent. Flow in the drainage is a combination of snow melt and springs. Most of the runoff occurs during the months of April through July. Even though the drainage systems are ephemeral, except for the lower reaches of Rilda Canyon, variations in quality do exist. Total dissolved solids increase gradually in concentration as flow proceeds from the upper plateau areas to the confluences of the major drainage of Huntington Canyon. Surface waters in the mine permit extension area are predominantly bicarbonate, calcium, and magnesium in the upper reaches with sulfate becoming a major constituent in the lower reaches. The increase in sulfate concentration is due to the influence of the Mancos Shale, a marine shale which outcrops in the lower reach of each of the drainage systems. Seasonal total suspended solids variations also occur with the highest concentrations occurring during

the initial runoff period. A annual summary sheet for each drainage is included in Vol. 9 - Hydrologic Support Information, Baseline Section.

R645-301-724.100 GROUNDWATER INFORMATION

A detailed description of the ownership of existing wells, springs, and other groundwater resources, including seasonal quality and quantity of groundwater and usage, is given in sections R645-301-721 and 722.

R645-301-724.200 SURFACE WATER INFORMATION

A detailed description of all surface water bodies, i.e., streams and lakes, including quality, quantity, and usage is given in section R645-301-711.

R645-301-724.300 GEOLOGIC INFORMATION

Applicable geologic information can be referenced in the Geologic section of the MRP.

R645-301-724.400 CLIMATOLOGICAL INFORMATION

PacifiCorp operates a network of weather stations, including two at low elevations (Hunter and Huntington power plants) and two at high elevations (Electric Lake and East Mountain).

Precipitation

The climate of the permit area has been described by the U.S. Geological Survey, which states that it is semi-arid to subhumid and precipitation generally increases with altitude. The average annual precipitation ranges from about ten (10) inches in the lowest parts of the permit area (southeast) to more than twenty-five (25) inches in the highest parts (northwest). PacifiCorp's weather station, located in Section 26, Township 17 South, Range 7 East, has provided data which shows that the summer precipitation in the form of thundershowers averages about the same as the winter precipitation in the form of snowfall. Because much of the summer precipitation runs off without infiltration, the winter precipitation has the greatest impact on groundwater.

Precipitation amounts have been and will continue to be recorded at the Hunter and Huntington power plants, at Electric Lake Dam, and on East Mountain. Precipitation data can be found in the annual Hydrologic Monitoring Report (refer to Vol. 9 - Hydrologic Section: Table HT-9 for East Mountain data).

Temperatures

Air temperatures vary considerably both diurnally and annually throughout the permit area Midsummer daytime temperatures in lower areas commonly exceed 100° F, and midwinter nighttime temperatures throughout the area commonly are well below 0° F. The summer temperatures are accompanied by large evaporation rates. Although not recorded, there probably also is significant sublimation of the winter snowpack, particularly in the higher plateaus which are unprotected from dry winds common to the region. Temperature information is collected at the UP&L weather stations at each power plant, at Electric Lake, and on East Mountain. These data will continue to be included in the annual Hydrologic Monitoring Report (refer to Vol. 9 - Hydrologic Section: Table HT-9 for East Mountain data).

Winds

The winds in the area are generally variable. The wind rose presented in Figure HF-36 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP) displays the variability for the Meetinghouse Ridge area for January to December 1978.

R645-301-724.600 SURVEY OF RENEWABLE RESOURCES LANDS

Information describing the existing groundwater resources, including descriptions of permit area aquifers and areas of recharge can be found in section R645-301-721. Impacts related to mine subsidence can be found in section R645-301-728.

R645-301-724.700 ALLUVIAL VALLEY FLOORS

Utah Regulations require that the presence of alluvial valley floors in or adjacent to the mine project area be identified. A detailed description of the alluvial valley floor deposits were described in the "REGIONAL GROUNDWATER CHARACTERISTICS" (refer to Vol. 9 - Hydrologic Section).

725. BASELINE CUMULATIVE IMPACT AREA INFORMATION (R645-301-725)

Hydrologic and geologic data required to assess the probable cumulative impacts of the coal mining and reclamation activities are presented in the Hydrologic (including the Annual Hydrologic reports), Operational, and Reclamation sections of the permit applications.

728. PROBABLE HYDROLOGIC CONSEQUENCES (PHC) DETERMINATION (R645-301-728)

Probable hydrologic consequence determinations are based on extensive investigations conducted to determine existing groundwater and surface water resources along with ongoing hydrologic research and comprehensive monitoring programs including hydrologic and subsidence. Data utilized to arrive at the conclusions presented in this section were discussed earlier (see Section R645-301-711), and specific information pertaining to impacts to the hydrologic balance will be discussed under the appropriate section.

Description of the Mining Operation

The North Rilda permit area is located in the central portion of the Wasatch Plateau coal field in Emery County, Utah. Generally, this area is a flat-topped mesa surrounded by heavily vegetated slopes which extend to precipitous cliffs leading to the valley below. Much data has been collected regarding the geology and the hydrology of the East Mountain property. In all, over 120 drill holes have been completed from the surface, over 500 from within the mines; and a comprehensive hydrologic data collection program is ongoing, all of which have provided data used in this PHC. The most applicable data have been included in this document. For a review of additional data it is suggested that the reader refer to the annual Hydrologic Monitoring Report.

Geology

A detailed description of the geology (structure and stratigraphy) has been presented in a previous section and will not be duplicated here. (Refer to R645-301-711).

Mining Methods

Mining of the North Rilda permit area will be conducted entirely by underground mining methods consisting of continuous miner and longwall techniques. Two minable coal seams exist within the property. In ascending order they are the Hiawatha and Blind Canyon (see operational plans of each separate permit application).

The chemical and physical properties of the overburden have been identified and described in the Geologic section (refer to Vol. 8).

Because mining is limited to underground mining techniques, only minor amounts of overburden directly in contact with the seam, either roof or floor, will be removed during mining operations.

Surface Water System

A detailed description of the regional and permit area surface water resources has been presented in previous sections and will not be duplicated here. (Refer to R645-301-722). In general, the surface drainage system of the North Rilda area is divided into two drainages; the southern portion forms part of Rilda Canyon Creek, and the northern portion contributes

to Mill Fork Canyon. The Rilda Canyon drainage covers seventy-four percent (74%) of the North Rilda leases held by PacifiCorp. PacifiCorp has observed that all of the streams reaches emanating from within the permit boundary, with the exception of the lower portion of Rilda Canyon Creek, cease flowing in the fall or winter and periods of drought, suggesting that they are not perennial but ephemeral/intermittent. Rilda Canyon Creek is perennial below the springs located along the western border of Section 28, Township 16 South, Range 7 East, as it flows year round there. Most of the streams are spring fed. PacifiCorp has monitored all of the surface waters since 1989 and will continue to monitor them in the future (Mill Fork Canyon was monitored in the past by Beaver Creek Coal Company). The data collected is included in each annual Hydrologic Monitoring Report.

Impacts to surface water due to the underground operations of Deer Creek - North Rilda area will be minor, both in terms of quality and quantity. Due to the type of mining and no surface disturbance, surface water impacts are limited. A detailed analysis of the associated impacts is described in the Hydrologic Balance section below.

Hydrologic Balance - Surface Water System

As mentioned previously in this report, the drainages conveying runoff away from the permit areas are streams in Rilda, and Mill Fork canyons. Second mining, ie. longwall extraction, room & pillar, of the North Rilda area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur beneath the stream channels of these canyons. First mining, ie. mainline, gateroad development, will occur below the Right Fork of Rilda Canyon. For a complete analysis of the proposed "no subsidence / long term stability"

design of the 4th North Mains development within the area of the right fork of Rilda and the long-term stability analysis refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the right fork of Rilda Canyon a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the Hiawatha Seam, the lowest seam to be mined. The riparian zone within the right fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial fill with the canyon's side slopes. The angle of draw was calculated from the Hiawatha Seam horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. The referenced 15 degree angle of draw is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full extraction mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above (refer to Annual Subsidence Reports of the Deer Creek MPR).

The angle of draw of subsidence produced by full-extraction mining can be influenced by many factors. These include the size of the area mined, number of seams mined, fractures or faults in the overburden, adjacent mine workings, and adjacent areas of burned coal and clinker. If mine workings extend to an area of burned coal, experience has shown that the overburden stresses above the mined area can be transferred to the adjacent burned coal and clinkers which can cause the clinkered areas to fail. In this case, the angle of draw may appear to be very shallow, when the crushing of the clinkered areas are the source of subsidence outside the normal area of influence.

Faults can also influence the angle of draw. If mining occurs adjacent to an existing fault, the area of subsidence will follow the natural plane of weakness formed by the fault. In this case, the angle of draw will be the same as the dip of the fault.

Based on data collected by the U.S. Bureau of Mines and eighteen years of subsidence data collection on East and Trail mountains, the angle of draw is found to be between 0 and 15 degrees from vertical. In some limited areas, the angle of draw is greater than 15 degrees, but in every case, the angle is greater due to the influence of one of the other factors mentioned above.

For planning purposes, any barrier of protection left in the mine to protect surface features should use a 15 degree angle of draw unless one of the factors mentioned above is known to exist in the immediate area.

In the majority of cases, cracking due to subsidence is not anticipated to extend to the surface; therefore, surface runoff patterns will not be significantly affected. Data collected by PacifiCorp over a eighteen-year period concerning subsidence and surface drainages has not detected any surface stream impacts. Consequently, subsidence should not cause significant impacts to the surface water system.

Underground coal mines in the Wasatch Plateau coal field typically intersect groundwater from strata surrounding the coal seams. Both Deer Creek and Wilberg/Cottonwood mines have intersected quantities of water in excess of operational needs and therefore have discharged intercepted groundwater. Dewatering of Deer Creek has had only a minor impact

on surface quality and quantity on a regional basis; however, on a site specific basis the flow in Deer Creek has increased from pre-mining conditions. During periods of high runoff changes in quality are insignificant; however, in low flow conditions some degradation is likely due to the fact that the mine discharge waters are higher in TDS than the surface waters. It is difficult to assess the degradation because it is not known from where or how much of the water discharged from the mine would naturally have been discharged into the receiving streams by natural groundwater flow. The section below will describe the dewatering of Deer Creek area and related surface impacts.

Excess water not utilized in the mining operation or for domestic use is either pumped to storage areas or discharged from the mine at the Deer Creek portals. (Quality and quantity is reported in the Annual Hydrologic Report.) Flow meters are utilized to record the amount of water discharged from the mine, after which it passes through underground sedimentation sumps (refer to Vol. 9 - Hydrologic Section: Figure HF-38).

Mitigation and Control Plans

No surface disturbance will be assoicated with the extension of the Deer Creek Mine to the North Rilda area. Any mine discharge will be routed through the underground sediment pond, reservoirs in the old workings or specialized sump areas and will be monitored in accordance with UPDES permit standards and state and federal regulations. (refer to Vol. 9 - Hydrologic Section: Appendix B for UPDES permit information.)

The effects of the mining operation on the surface water system will be analyzed through the surface water monitoring plan described below. In the event that monitoring shows that the surface water system is being adversely affected by mining activities, additional steps will be taken to rectify said impacts in cooperation with local, state, and federal regulatory agencies.

Surface Monitoring Plan

A hydrologic surface monitoring program, initiated in 1979 (sites in Meetinghouse and Rilda canyons were added in 1986 and 1989, respectively, [Mill Fork Canyon was monitored by Mountain Coal Company from 1984-95 and will be included in PacifiCorp's hydrologic monitoring in 1997]), has been underway at each of the surface monitoring stations shown on Map HM-1 (refer to Vol. 9 - Hydrologic Section). An additional surface site will be added in 1997 in Rilda Canyon in the right fork above the proposed mainline development to monitor the surface/groundwater relationship of the right fork. Stations were established to monitor water quality and quantity above and below the mine permit areas. The parameters for laboratory analyses are those established by DOGM in "Guidelines for Surface Water Quality" (refer to Vol. 9 - Hydrologic Section: Appendix A). Once baseline data have been collected (two-year period), the surface sites described in the hydrologic monitoring schedule in Appendix A will continue to be monitored quarterly (when accessible) throughout the operational phase of the mine. The quarterly monitoring during the mine operational phase will include flow and quality to delineate seasonal variation and assess changes in water quality.

Future data may show that modifications of the monitoring schedule are justified. Any changes to the monitoring schedule (frequency or parameters) will be made only with the approval of DOGM. Results of all water quality data will be submitted to that agency quarterly, with an annual summary.

Post-mining monitoring of surface water will continue at representative stations determined with the aid and approval of DOGM. Representative surface water stations will be monitored biannually during high and low flow conditions. Monitoring will continue until the release of the reclamation bond or until an earlier date to be determined after appropriate consultation with local, state, and federal agencies.

Groundwater System

PacifiCorp has collected an extensive database of information pertaining to the groundwater quality and quantities of the East Mountain region and adjacent areas. Included in the database is long-term quality and flow information both for springs and for groundwater intercepted by mining.

Detailed descriptions of the regional and permit area groundwater resources have been presented in previous sections and will not be duplicated here (refer to R645-301-722). In general, the majority of all natural groundwater discharge points located on the East Mountain property are in the form of seeps and springs. PacifiCorp has mapped approximately eighty (80) springs ranging in discharge from <1 gpm to as high as 450 gpm (refer to Vol. 9 - Hydrologic Section: Map HM-4).

The USGS has conducted extensive studies to determine the regional groundwater system for the central Wasatch Plateau Coal Field. The studies indicate a regional aquifer exists in the coal-bearing sequence of the Blackhawk and the underlying Star Point Sandstone formations. The studies have also concluded that several isolated or perched aquifers existed above the Blackhawk-Starpoint aquifer. PacifiCorp agrees with conclusions of the USGS studies concerning the perched aquifers above the coal-bearing sequence of the Blackhawk Formation but has some reservations about the significance of the Blackhawk-Starpoint aquifer which will be discussed below. The majority of the groundwater is discharged from the perched aquifers which occur along the base of the North Horn Formation in the form of seeps and springs (refer to Vol. 9 - Hydrologic Section: Map HM-4, Figure HF-6, and Table HT-1). Several other perched aquifers exist mainly along the formational contacts with the North Horn Formation, including the upper contact with the Flagstaff Limestone and the lower contact with the Price River Formation.

The majority of the groundwater recharge on East Mountain comes from the winter snowpack which melts and infiltrates into the surface of East Mountain. The water flows down vertical fractures which intersect sandstone channel systems in the North Horn Formation. The majority of the groundwater reaching this point intersects the surface in springs located in the North Horn Formation. Very little recharge intersects the upper Price River Formation and Castlegate Sandstone; consequently, they are not water saturated where intersected in the numerous drill holes penetrating those units. As discussed earlier in the Groundwater Section, recharge to the North Rilda area is very limited due to the topographic configuration of the region (refer to Map HM-9, included with this submittal).

The hydrogeologic characteristics of the coal-bearing Blackhawk and overlying formations effectively limit the extent of impacts to the hydrologic system. Impacts to water quality are negligible and may be slightly beneficial. As discussed previously, two separate aquifers-water bearing zones occur on the East Mountain property: 1) perched aquifers associated mainly with the North Horn Formation, and 2) Blackhawk-Starpoint regional aquifer, which exhibits limited potential as a property wide, water saturated zone. The following hydrologic balance section will segregate the two zones and describe the significance and possible impacts to each zone.

Hydrologic Balance - Groundwater

Mining within the North Rilda area will have negligible impact on the regional hydrologic balance, but there could be some possible local impact. This section discusses the possible mining-related impact on the hydrologic balance due to:

A. Subsidence - Perched Aquifer Systems,
B. Mining in the Rilda Canyon Area - NEWUA Springs, and
C. Interception of Groundwater by Mine Workings
D. Mining Below the Right Fork of Rilda Canyon

A. SUBSIDENCE: PERCHED AQUIFER SYSTEMS ABOVE THE MINE HORIZON

As discussed earlier, most of the groundwater in the permit and adjacent areas discharges in the form of seeps and springs. No springs will be undermined in the North Rilda area. Only two springs are within the North Rilda permit area, 80-50 located in Section 29 and the Rilda Canyon Springs located in Section 28 (refer to HM-9 included with this submittal for the

location of the springs and Vol. 9 - Hydrologic Section of the Deer Creek MRP: Appendix A for sampling sites and monitoring schedule). A Spring Geologic Conditions Inventory sheet has been completed for each spring inventoried on the East Mountain Property and can be found in Vol. 9 - Hydrologic Support Information.

PacifiCorp has conducted a series of exploration programs to identify the geologic and hydrologic characteristics of the North Rilda area including the proposed crossing of the right fork of Rilda Canyon (refer to Map HM-10 included within this submittal).

To identify any mining related impacts PacifiCorp monitors a significant number of springs which have been undermined or will be undermined within the next five years (refer to Vol. 9 - Hydrologic Section: Hydrologic Monitoring Schedule and Map HM-5). A field verification meeting will be held each year with the government agencies involved to determine if changes in the springs monitored are required. Each year in the annual Hydrologic Monitoring Report spring flow rates are compared to East Mountain climatology as to how closely spring discharge follows local annual precipitation or to verify any mining related impacts.

Data collected by PacifiCorp continues to show the relationship between the variation in groundwater discharge quantity and precipitation. Hydrologic monitoring completed on the East Mountain property has failed to identify any changes in the quantity or quality of groundwater discharge from the springs which have been undermined. The U.S. Bureau of Mines completed an independent study (1994) of the mining impacts on the Hydrology of East Mountain (Response of Springs to Longwall Coal Mining at the Deer Creek and

Cottonwood Mines, Wasatch Plateau, UT. Informational Circular 9405, U.S. Bureau of Mines). PacifiCorp personnel collected the data in this study from springs determined to represent hydrologic conditions on East Mountain. This determination was made by an ad hoc committtee including representatives of DOGM and the Forest Service. This study failed to find any springs that have been impacted by mining (refer to 645-301-700 Appendix 1).

B. MINING IN THE RILDA CANYON AREA-NEWUA SPRINGS

As discussed in R645-301-721, North Emery Water Users Association (NEWUA), a major concern to PacifiCorp is the proximity of proposed mining activities in Rilda Canyon to the Rilda Canyon springs.

PacifiCorp contracted Hansen, Allen & Luce (HA&L) to conduct a hydrologic test in Rilda Canyon. (Refer to Vol. 9 - Hydrologic Support Information, Rilda Canyon Pump Test.) The findings from this test were then compared to the Wellhead/Drinking Water Source Protection criteria to determine the appropriate mitigation measures. The local groundwater system in the vicinity of the NEWUA springs consists of an unconfined alluvial valley fill aquifer as well as bedrock and fracture systems. Resistivity data provided by PacifiCorp indicate that the total maximum depth of alluvium ranges from 50 to 73 feet at the three locations where cross sections were taken. The locations of the resistivity cross sections within Rilda Canyon are shown on Map HM-7 (refer to Vol. 9 - Hydrologic Section). The width of the unconfined aquifer varies due to the influence of side drainages which also feed the area.

Water moving throughout Rilda Canyon appears to originate mainly from the alluvial deposits assoicated with the right and left forks of Rilda Canyon. Earlier studies indicated two other potential sources; an east-west trending fault which is believed to lie to the north of the canyon floor, and the third is potentially through a north-south trending fault which bisects the canyon just west of the NEWUA spring collection system. Extensive surface exploration conducted in Rilda and Mill Fork canyons parallel to the trend have failed to identify structural features which would contribute to the groundwater system.

Springs within Rilda Canyon are believed to indicate and verify the locations of changes in stratigraphy. Examples of local stratigraphy and their impact on hydrology have been verified historically through stream and spring flow observations. The canyon drainage west (or above) the interface with the upper contact of the Star Point Sandstone is generally a discharging stream section. When alluvial waters come in contact with the more impermeable members of the upper Star Point Sandstone formation, they are often forced to the surface, creating springs. Local NEWUA springs confirm a recharging stream section. When these more impermeable formations are crossed, the stream once more becomes a losing stream until subsurface waters again come in contact with the more impermeable members of the Star Point Sandstone and underlying Mancos Shale formations. Some sections of the stream within Rilda Canyon gain flow, thereby evidencing the locations where subsurface water is forced to the surface by the tighter formations.

Data collected during and following the pump test of Well P-7 were used to provide estimates of local valley fill aquifer characteristics. For these analyses, data from both

pumped P-7 and from observation Well P-6 during both the drawdown and recovery portions of the test were used.

Aquifer transmissivities as determined by the methods described in R645-301-721 range from a low of 6,100 gpd/ft to a high of 35,900 gpd/ft. As a summary of values determined, the following table is provided. The table contains a column identified as "Credibility of Results" which is intended to be a guide to the numbers given. A high credibility rating indicates that the method basically accounts for conditions believed to exist within Rilda Canyon. A medium credibility indicates that, for these conditions, the solution does not appear to fully account for identified field conditions. As outlined in the table, it is believed that long-term transmissivities are on the order of 20,000 gpd/ft and short-term transmissivities are on the order of 35,000 gpd/ft. The variation in results appears to be due to boundary effects created by the canyon walls. If used for further analyses, the short-term transmissivity estimates should govern.

SUMMARY OF CALCULATED TRANSMISSIVITIES

Analysis Used	Data Type	Well Data Used	Estimated Transmissivity (gpd/ft)		Credibility of Results		
			Short-Term	Long-Term	High	Medium	Low
Cooper-Jacob	Drawdown	P-7	35,650	17,550-21,000	XXX		
Cooper-Jacob	Drawdown	P-6		23,600	XXX		
Cooper-Jacob	Recovery	P-7	35,900	13,700	XXX	XXX	
Theis	Drawdown	P-7	28,450	17,900	XXX	XXX	
Neuman	Drawdown	P-7	13,150	6,100			XXX

Groundwater Quantity Based on Pump Test Results

An approximation of the total groundwater flow moving eastward down Rilda Canyon was made using data collected from the resistivity studies completed by PacifiCorp and from data collected at local area wells. The flow approximation was made by applying the general flow equation Q=VA. The area of groundwater flow was determined using the inferred cross sectional area identified in the resistivity study as "R-3" (refer to Vol. 9 - Hydrologic Section: Map HM-7) for the canyon adjacent to P-7. The velocity of groundwater movement was determined from the relationship between hydraulic permeability and groundwater gradient, V=ki. Permeability was determined from the estimate for short-term transmissivity obtained using the methods discussed earlier. It was felt that under flow conditions uninfluenced by man, the short-term transmissivity is most representative of natural conditions. Using these relationships, the estimated amount of groundwater moving down Rilda Canyon was determined for both high and low flow conditions.

Based on historic data, low flow conditions were found to dominate during the period of the 1990 pump test; however, it has been noted by PacifiCorp employees that a rise in water level occurs within Rilda Canyon wells each year as the groundwater aquifer responds to snow melt runoff. Historical data reproduced in Figure HF-25 for wells 1 through 5 shows seasonal and annual water level fluctuations (refer to Vol. 9 - Hydrologic Section). Note the relative change in water level between wells. Little overall variation is noted except for P-3 which shows changes over time totaling approximately thirteen to fourteen (13-14) feet. Changes recorded in P-3 are likely greater than those indicated by Figure HF-25 because P-3 is only thirty-eight (38) feet deep and water levels have been known to drop below the

bottom of the well. A comparison of water level variations between P-3 and adjacent P-7 indicates that the total water level fluctuation may be as much as twenty-two (22) feet, (actual data collected from 1990 through 1996 reveals the maximum rise in water level of approximately twenty eight [28] feet, refer to Annual Hydrologic Monitoring Reports).

Low Flow. The first condition analyzed was based upon the relatively low flow condition found in November 1990. Using the relationship Q=VA as discussed above, the total alluvial valley aquifer flow in the area of P-7 was estimated to be approximately 151 gpm. Subtracting an average pumped Vol. of 16.4 gpm from P-7, an estimated flow of 135 gpm bypassed P-7 and continued downstream toward the NEWUA spring collection system. Impacts noted upon the NEWUA spring system as a result of pumping P-7 appear to be confined to a reduction in flow from the springs on the order of ten percent. Before pumping began, total combined spring flows were approximately 85 gpm. During the later stages of pumping, just prior to termination of the test, spring flows had reduced to approximately 77.5 gpm, indicating a reduction in flow of 7.5 gpm during the pump test. Additional reductions in flow will probably occur as flows continue to stabilize.

As stated above, not all the water moving down Rilda Canyon in the alluvial valley aquifer was collected through pumping of P-7. In order to obtain an estimate of the total possible impact should the entire alluvial aquifer be eliminated as a source of water, a straight line extrapolation was made of pumped flows versus decreased spring flows. A straight line extrapolation of the data in this fashion should be considered an approximation only, not an accurate method of determining precise impacts. At an average pump rate of 16.4 gpm at P-7, NEWUA spring flows decreased by approximately ten percent. Assuming all alluvial

valley recharge bypassing P-7 was eliminated as a potential source of water, the estimated impact to the NEWUA springs (using the straight line extrapolation method) could be approximately 69 gpm. The estimated spring impact based in percent would then be 69 gpm over an uninfluenced flow rate of 85 gpm or eighty-one percent. Using this methodology, the remaining nineteen percent of the flow contributing to the NEWUA springs appears to be coming from other sources.

High Flow. High flow conditions were estimated by adding to the 151 gpm base flow calculated for the November 1990 period the additional flow which would move down the canyon given a twenty-two (22) foot rise in water level which would occur during a wet year (actual data collected from 1990 through 1996 reveals the maximum rise in water level of approximately twenty eight [28] feet, refer to Annual Hydrologic Monitoring Reports). The additional flow projected to occur during wet years was estimated by 1) measuring the cross sectional area which would result from a twenty-two (22) foot rise in the water table and 2) by applying the flow relationship Q=kiA. As indicated earlier, the water table gradient (I) used in this equation was found to be greater in 1987 than during the November 1990 test. Based on these assumptions, increased water levels measured during the high flow period of 1987 resulted in an estimated alluvial valley aquifer flow rate of 372 gpm.

Data shows that total NEWUA spring flow during high flow periods is typically on the order of 400 gpm (refer to Vol. 9 - Hydrologic Section: Figure HF-11). If all alluvial flow entered the springs, then the total impact to the springs resulting from the loss of said flow would be on the order of ninety-three percent (372 gpm/400 gpm). An alternate method of approximating the potential impact is through the use of the same impact ratio as was

determined from the low flow pump test completed on P-7. Using this method, the total expected decrease in spring flows during high flow periods would be approximately 170 gpm, or a forty-three percent decrease (170 gpm expected decrease/400 gpm total spring flow).

Wellhead/Drinking Water Source Protection

The State of Utah has been required by the federal government under the Federal Safe Drinking Water Act to establish a Wellhead Protection Program to protect groundwater that supply drinking water to public water supply systems. Included in this classification is the NEWUA spring collection system within Rilda Canyon. During the time frame of the NEWUA springs investiagation, (1989-90), the wellhead protection rules were in draft form and were being considered for adoption. ~~At this time the rules proposed to be adopted~~ by the Utah Safe Drinking Water Committee. ~~can only be considered to be preliminary in nature since they are still in draft form at the time of the writing of this report.~~ A brief summary of the proposed draft rules is included as Table HT-11 (refer to Vol. 9 - Hydrologic Section). The wellhead protection rules were adopted by the Utah Safe Drinking Water Committee and referred to as the *"DRINKING WATER SOURCE PROTECTION"* rules, R309-113, on July 26, 1993. Delineation of protection zones and management areas remained unchanged from the draft guidelines listed in Table HT-11 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP).

Based upon information contained in the table, it appears that the property included within Zone 1, a 100-foot radius around the NEWUA spring collection system, should be owned by

the water supplier and be fenced. In addition, Zone 1 should be protected against anthropogenic sources of contamination. The "Master List of Potential Anthropogenic Sources of Contamination in Utah" as given in R449-113-8.1 includes coal companies within the designation, "Concrete, asphalt, tar and coal companies." Note the designation difference between new and existing sources in the table just discussed in that "new sources" indicates a definitive action whereas "existing sources" indicates that the action "should" be done. This distinction implies that existing facilities will be treated with more latitude than new facilities. It appears that this wording has been added to take into account the many possible configurations of public water supplies wherein little can be done to modify or correct long standing conditions.

Because the area has a characteristically high groundwater velocity, the criteria identified by zones 2 and 3 in the table do not apply. For example, a 250-day travel time for water found within the alluvial aquifer (using a permeability of 167 ft/day as estimated by the pump test results) would be 7.9 miles. Since the criteria require that the zone not extend beyond the natural hydrologic boundaries, the zone is reduced to the limit or extent of the canyon in which the NEWUA springs are located. Using this criteria, the north and south limits would include the land to the ridgeline of Rilda Canyon. The west boundary line would be placed at a two mile radius from the NEWUA spring collection system, and the east boundary would be located along the contour line 100 feet lower in elevation from the groundwater source. A map showing the approximate groundwater protection zone boundary as defined by the preliminary draft regulation is presented in Figure HF-41 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). It should be noted that this boundary is only an approximation of the two mile radial zone as defined in the regulation, and refinement will

be needed as the regulation is further defined.

Spring Impacts

Impacts noted on NEWUA springs during the pump test completed in November 1990 were found to be in the range of approximately ten percent. The impacts are based upon the pump test, water level data collected from P-7, other local piezometers, and spring discharge data. Continued pumping beyond the length of the test completed will likely result in additional declines beyond those noted during the seven-day test. The impacts to the springs based upon varying local conditions and flow patterns have been reviewed as a result of this reporting effort. Some of the changes which could potentially occur to the local groundwater system, thereby impacting local springs, are discussed below.

Total Elimination of Alluvial Flow. In the event that all alluvial aquifer flow from the west up Rilda Canyon was eliminated as a spring recharge source, impacts to the NEWUA springs may be more severe than forty-two of the ninety-three percent estimate made through the use of pumping test data. Impacts to the NEWUA springs would be most severe in the event that local alluvial water provides the majority of the head driving the spring collection system during peak periods. Based on the large fluctuations noted in Well P-3 ,(replaced with P-7), this appears to be the case. Other flows, including those related to faults and fractures, may provide a relatively constant base flow to the spring collection system; however, the majority of impact potential to the springs at this time appears to be related to alluvial recharge.

Elimination of Other Sources. Other sources of spring recharge water include fractures as well as alluvial flow in the side canyon located adjacent to the NEWUA springs to the south. Should recharge waters feeding the fractures originate from areas proposed to be mined and mining diverts the water from its natural course, impacts to the springs could be cumulative with those resulting from a reduction of alluvial flow as discussed above. Obviously, under these conditions the impacts will be greater than those estimated herein based upon alluvial flow near P-7 alone.

With the exception of P-3, little seasonal variation was noted in the water level within the wells shown in Figure HF-25 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP). The variation noted in P-3 is insufficient, however, to account for the total flow variation measured in the NEWUA springs between high and low flow years. High and low flow alluvial recharge from the main canyon area was estimated earlier to be approximately 372 and 151 gpm, respectively. The increase in alluvial recharge is then the difference between the two values, which is 221 gpm; however, the increase in spring discharge between high and low flows has been reported to be approximately 320 gpm, thirty-one percent higher than the total alluvial flow increase originating from the main canyon area. This may indicate that the remaining portion of NEWUA spring flows come from either other "non alluvial" sources or additional alluvial flow from the south tributary.

Overall Impact Potential. PacifiCorp conducted a pump test project in Rilda Canyon to determine the groundwater characteristics and source. As documented by the pump test, the major source of groundwater to the Rilda Canyon Springs is from the alluvial deposits (refer to Vol. 9 - Hydrologic Support Information, Rilda Canyon Pump Test). The majority of the

recharge to the alluvial deposits is from the right fork of Rilda Canyon. Recharge to the alluvial deposits of Rilda Canyon occurs above the Castlegate Sandstone to the west of the permit boundary (refer to Map HM-9: included with this submittal). Little impact to spring flow may actually occur unless geologic conditions change as a result of mining. Subsidence could potentially result in the development of cracking or fracturing of the subsurface geologic stratum above the mine workings. Local recharge crossing these hypothetically subsided areas could be lost from the spring recharge system, thereby directly affecting local spring flows. Mining below the right fork of the Rilda Canyon drainage will consist of first mining only (main entry development) which will minimize the potential impacts related to subsidence (refer to Map HM-10 included with this submittal and the approved Deer Creek R_2 P_2 [Refer to Vol. 5, Maps 3-6 and 3-7]). Mitigation for the loss of spring flow has been based on the elimination of the alluvial recharge which is unlikely to occur based upon the projected extent of the mine compared to the recharge area. Mitigation efforts based on the worst case scenario have been outlined in the following section.

Mitigation

Through intensive negotiations and investigations of possible alternatives, PacifiCorp and NEWUA agreed upon mitigation plan on August 12, 1993. The plan included construction of a slow sand water treatment plant with a 0.5 million gallon storage reservoir (the mitigation alternative information is found in Appendix G of Vol. 9 - Hydrologic Section). Construction of the plant and reservoir begin in March of 1994 and was completed in November 1994. The plant was brought on-line in November 1994 utilizing Rilda Springs as

one of the sources of water. PacifiCorp will continue monitoring springs in Rilda Canyon for potential mining related impacts (refer to Vol. 9 - Hydrologic Section: Appendix A).

C. INTERCEPTION OF GROUNDWATER BY MINE WORKINGS

As previously discussed in this section, the Blackhawk Formation consists of interbedded layers of sandstone and mudstone separated by various minable and non-minable coal seams. The sandstone beds-fluvial channel systems are generally massive while the mudstone layers are fine textured and have a tendency to swell when wet and decompose into an impervious clay. Because of the aquiclude formed by mudstone layers in the North Horn Formation and topography, recharge to the Blackhawk Formation is limited, even along major fault systems. Due to the lithologic characteristics of the Blackhawk, both vertical and horizontal migration is constricted.

The interception of groundwater varies and is dependent on several factors. One of the most significant is that when the mine enters previously umined country, a significant amount of water is liberated. In virtually all cases the amount of water which flows into the mine exceeds the recharge and, in time, the water inflow decreases in volume. If new areas are not mined, the discharge from the mine will decrease accordingly. As reported in the annual Hydrologic Monitoring reports, flow rates for individual areas including fault zones normally decrease to less than ten percent of the initial flow rate.

Long-term monitoring of water producing zones in both Deer Creek and Wilberg/Cottonwood mines has established that once base flow has been reached, the flow is

consistent over time. Monitoring has not indicated any seasonal or yearly variations (refer to the Annual Hydrologic Monitoring reports for in-mine long-term flow information).

As pointed out by Theis (1957, p. 3), water discharged from a well or, in this case, underground mines, must be balanced by 1) an increase in recharge to the groundwater system, 2) a decrease in natural discharge from the system, or 3) a decrease of groundwater in storage, or by a combination of all of these. As hydrologic studies have shown and monitoring of intercepted groundwater has verified, recharge into the underground workings is limited even in areas of faults and fractures. Based on the hydrologic characteristics of the Blackhawk and the underlying Star Point Sandstone (low porosity and hydraulic conductivities) and data from surface hydrologic monitoring, decrease in the natural discharge of the system is considered to be only a minor factor; therefore, groundwater intercepted in the permit area is concluded to be from storage. One factor which verifies this conclusion is rapid dewatering of intercepted groundwater with no apparent change in the surface hydrological system. As the USGS pointed out in Open File 81-539 and monitoring by PacifiCorp has shown, the majority of surface flow is due to the runoff from the winter snowpack and not from groundwater recharge.

D. MINING BELOW the RIGHT FORK of RILDA CANYON

A portion of the Right Fork area of Rilda Canyon lies within the proposed North Rilda Canyon Permit Application area of the Deer Creek Mine. Due to the environmental sensitivity of the Right Fork area (specifically the sub-surface hydrologic alluvial system and associated surface riparian vegetation zone), a complete analysis of a proposed "no-subsidence / long term stability" design of the 4th North Mains development within the area of the right fork of North Rilda Canyon has been conducted addressing the long term ground stability and subsidence protection of the area with regards to proposed mining. All pre-mining and post-mining conditions have been evaluated based on the best geologic and engineering information currently available (refer to R645-301-500 Engineering Section: Appendix 1).

The 4th North Mains, as projected, consiss of a 5-entry development section, bearing northwest from the Deer Creek 10th West Mains. Initial location of the 10th West/4th North intersection was based on the following:

(1) Existing Blind Canyon Seam conditions encountered with regard to 10th West Mains development.
(2) Proximity to the projection of the Mill Fork Fault Graben.
(3) Most practical access route to the North Rilda - Blind Canyon and Hiawatha coal reserves, across the North Rilda Canyon Forks area.

A complete analysis of the to location and long term ground stability of the 4th North / 10th West Mains and the Left Fork of Rilda Canyon was prepared and submitted by PacifiCorp to the BLM on November 15, 1996. Approval to proceed with relocation and development of the 4th North Mains was given by the BLM (per letter) February 13, 1997.

With regard to PacifiCorp's North Rilda Canyon Area Permit Application, the 4th North Mains are projected to be developed northwest (approximately 3000 feet), from the 4th North/10th West Mains intersection. The 4th North Mains development then changes course to a northeast bearing, with development proceeding across the Right Fork area of Rilda Canyon. The proposed location and layout of the 4th North #1/4th North #2 intersection is currently **only** a projection. Preliminary mine plan sequence and layout provides for the current 4th North Mains to continue as a 5-entry development system to a point just south of the proposed 4th North #1/4th North #2 intersection. At this point, the development is planned to be reduced to a 2-entry "exploration" section, continuing on the initial northwest bearing to delineate the western margin of the Blind Canyon coal seam or to intersect the projected Mill Fork Fault Graben. Based on the information gained from this proposed 2-entry "exploration" development, a detailed plan will be developed to position the 4th North #1/4th North #2 intersection to optimize the "no-subsidence" design of long term entry stability for the 4th North #2/Rilda Canyon right fork crossing route and rock slope access into the lower Hiawatha Seam as well as maximizing overall reserve recovery within the area.

During the development of the 4th North Mains, PacifiCorp will monitor intercepted groundwater from all sources including roof drippers and groundwater inflow from floor of the mine as specified in R645-301-200: Groundwater Monitoring. Surface water/groundwater interrelationships will monitored above and below the proposed mine crossing as specified in R645-301-200: Surface Water Monitoring.

Depletion of Storage

Three main areas-types of groundwater depletion have been documented to occur within the East Mountain permit area. They include: 1) fluvial sandstone channel systems, 2) faults and fractures, and 3) structural low areas. Each area-type will be discussed separately as it pertains to the North Rilda area.

1. *Fluvial Sandstone Channel Systems*

The majority of the intercepted groundwater was confined to dewatering or perched fluvial sandstone systems. The sandstone channels (ancient river systems) overlie and scour into the underlying strata (refer to Vol. 9 - Hydrologic Section: Maps HM-2 and HM-3). The locations of the channels shown on HM-2 and HM-3 are based on data collected from in-mine mapping and numerous drill holes, both in-mine and surface, that have been completed on the property. These channel systems were part of a deltaic depositional setting active during and after the coal-forming peat accumulation. The largest influx of water originates from the roof when mining advances beneath sandstone top. The sandstone, which is semi-permeable and porous, affords an effective route of water transport. Mudstone, siltstone, and interbedded materials generally act as aquicludes which impede water flow unless fracturing of the formation has allowed for secondary permeability. Of the water producing areas, those closest to the active mining face exhibit the greatest flows. As mining advances, the area adjacent to the active face continues to be excessively wet and previously mined wet areas experience a decrease in flow. Data collected from

1978 through 1996 indicate a ninety percent reduction in water flows from roof sampling sites over a five-month period (or less) as the mining face is advanced (review annual Hydrologic Monitoring reports). It has also been noted that the outermost entries of a multiple entry system remain wet for a longer period of time than the inner entries. It appears that the water source is being dewatered since excavated areas of the mine do not continue to produce water indefinitely. The water source must be either of limited extent, i.e., a perched aquifer, or have a limited recharge capacity, i.e., poor horizontal and vertical permeability. Figure HF-42 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP) depicts an idealized view of the dewatering process.

To monitor and to quantify the effects of dewatering the perched aquifers overlying the coal seams and on the Star Point Sandstone, PacifiCorp installed a series of holes both in the Deer Creek and Cottonwood/Wilberg mines. These holes are located in main development entries and are shown on maps HM-2 and HM-3 (hole development information can be found in Vol. 9 - Hydrologic Support Information). Holes in the Cottonwood/Wilberg Mine were developed in the upper member of the Star Point Sandstone - Spring Canyon. Pressure transducers were installed and monitored on a continuous basis to quantify the impacts to the Star Point Sandstone due to dewatering of the isolated perched aquifers above the Hiawatha Seam. As shown in Figure HF-44 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP) the water elevations remained constant over time with no apparent evidence of an impact-cone of depression due to dewatering of the perched aquifers. In the Deer Creek Mine a series of holes was developed in the lower portion of the Blackhawk

and upper member of the Star Point Sandstone. These holes are located along the axis of the Straight Canyon Syncline and are in close proximity to the Roans Canyon Fault system (see HM-2). Monitoring of these wells has shown a decline of between two to seven feet in elevation thought to be related to interception of groundwater in the development entries off 4th South, Deer Creek Mine. Mining in the 4th South area was completed in May of 1992 and seals were installed in 4th South between crosscuts 24 and 25 (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP: Figure HF-45). Monitoring of a well adjacent to the sealed area (3rd North xc-8) revealed the level of the water returned pre-mining level within approximately two years of the seal installation (refer to the 1995 Hydrologic Monitoring Report). To develop an possible area of influence-cone of depression on a regional basis, PacifiCorp installed a series of groundwater monitoring wells in Cottonwood Canyon downgradient of future mining north of the Roans Canyon Fault system (refer to Vol. 9 - Hydrologic Section of the Deer Creek MRP: Appendix F).

Lithologic and hydrologic characteristics of the North Rilda area were evaluated through a series of exploration programs conducted from 1979 through 1996. A total of sixteen (16) surface exploration holes were completed utilizing both conventional drilling techniques and helicopter supported operations. Even though sandstone deposits exist overlying the coal seams no measurable water quantities were detected during the drilling operations.

2. *Faults and Fractures*

Another source of intercepted groundwater is faults and fractures, especially in the Deer Creek Mine. As discussed in the regional and permit area geology (see R645-301-721) the strata within the property have been offset by a series of north-south trending fault zones. Generally, the faults are nearly vertical and do not have significant amounts of fault gouge or drag associated with them. One of the major faults present in the region, the Pleasant Valley Fault, has been intersected in both the Deer Creek and Wilberg mines.

The Pleasant Valley Fault consists of two parallel fractures about 150 feet apart. The faults' total displacement (where it was intersected in the Deer Creek Mine) to the north is 150 feet with its down thrown side on the east. The displacement diminishes to less than one foot where it was intersected in the Wilberg Mine near the south end of the property. Where the fault has been intersected by mine workings, groundwater inflow has been insignificant.

Another north-south trending fault, the Deer Creek Fault, is present to the east of the Pleasant Valley Fault. It limits the eastward development of the Wilberg/Cottonwood and Deer Creek mines and also forms an aquiclude preventing water migration to the east. The displacement of the Deer Creek Fault ranges from 100 to 170 feet with the east block being down thrown.

A northeast-southwest trending fault system, the Roans Canyon Graben, is present along the axis of the Straight Canyon Syncline. The system contains up to six normal faults having displacements ranging from a few feet to over 150 feet. Coal deposits present to the north of the fault have been accessed through rock tunnels driven from the 3rd North section of the Deer Creek Mine.

Based upon the extensive surface exploration programs and surface mapping, no faulting is projected within the proposed mine plan (refer to Map HM-9 enclosed within this document). The projection of the Mill Fork Canyon fault system is to the west of the proposed mine plan area (refer to Map HM-9 enclosed within this document).

3. *Structural Low Areas*

Structural features such as the Roans Canyon Fault Graben, the Straight Canyon Syncline, and the Deer Creek Fault, had a influence on the hydrologic regime south of North Rilda within the East Mountain permit area (detailed in Vol. 9 - Hydrologic Section). Geology of the North Rilda Area is less complex than that of central portion of the East Mountain property (see Vol. 8 - Geology Section). The fault system that crosses Mill Fork canyon (referred to as the Mill Fork Canyon fault system) trends to the west of the projected mine workings. The Mill Fork Canyon fault system was intersected and crossed to the north of the North Rilda permit extension in the Beaver Creek Coal Company No. 4 Mine. The graben consisted of series of faults with a total displacement of approximately thirty (30) feet. Beaver

Creek No. 4 Mine was a relatively dry mine with only few isolated roof dippers associated with the Mill Fork Fault system.

Quality

The mines in the coal fields of the Wasatch Plateau tend to act as interceptor drains. The groundwater that is brought to the surface has a lower dissolved solids content than would have existed were the water to continue its downward movement through shale layers, dissolving increased amounts of salt with distance (Southeastern Utah Association of Governments, 1977; Vaughn Hansen Associates, 1979; Danielson et al., 1981). The quality also decreases vertically because of the influence of marine sediments as well as along the trend of decreasing quality from north to south.

Post Mining

The monitoring of in-mine water sources has shown that the long-term water flow from a given area is much less than ten percent (10%) of the initial flow from the area. Most of the current inflow into the mine workings is from areas where water storage has not been depleted. After the storage has been depleted, the flow will reduce to roughly equal the recharge rate which is expected to be less than ten percent (10%) (data presented earlier in this report) of the current discharge rate.

Post mining discharge from the North Rilda Area is not anticipated due to the limited extent of the groundwater resources. As discussed in section 721 GENERAL REQUIREMENTS -

EXISTING GROUNDWATER RESOURCES: REGIONAL AND PERMIT AREA GROUNDWATER CHARACTERISTICS groundwater resources in the the North Rilda Area is limited due to several factors including; stratigraphic controls, limited surface area for infiltration, topographic configuration of the area (incised canyons), and outcropping of the Star Point Sandstone Formation around the entire North Rilda Ridge. If intercepted perched aquifers are encountered in the North Rilda Area, water will migrate downdip to the south/southeast, (refer to Vol. 8 - Geologic Section of the Deer Creek MRP for structual contour maps of the Blind Canyon and Hiawatha seams). If the impounded water exceeds the capacity of the abandoned workings, water from the North Rilda Area will migrate to the northern portion of 3rd North and eventually flow to the south/southwest.

729. CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT (CHIA) (R645-301-729)

The Division will provide an assessment of the probable cumulative hydrologic impacts of the proposed coal mining and reclamation operation and all anticipated coal mining and reclamation operations upon surface and groundwater systems in the cumulative impact area.

730 OPERATION PLAN (R645-301-730)

Water Monitoring Location Map: refer to Vol. 9 - Hydrologic Section: Map HM-1.

731 GENERAL REQUIREMENTS (R645-301-731)

PacifiCorp has submitted a plan to minimize disturbance to the hydrologic balance, to prevent material damage, and to support approved post-mining land use (see Operational and Reclamation plans of the individual PAP's).

R645-731-100 HYDROLOGIC BALANCE PROTECTION

Groundwater Protection

Although the analysis of the overburden samples tested has shown that no toxic or hazardous materials are present, groundwater quality will be protected by handling earth materials and runoff in a manner that minimizes infiltration to the groundwater system.

Surface Water Protection

Surface water quality will be protected by handling earth materials, groundwater discharges, and runoff in a manner that minimizes the potential for pollution.

R645-731-200 WATER MONITORING

Groundwater

Groundwater within the East Mountain permit area (including North Rilda area) will be monitored according to the schedules in Appendix A (refer to Vol. 9 - Hydrologic Section). Monitoring equipment, structures used in conjuction with monitoring the quality and quantity of groundwater on-site and off-site will be properly installed, maintained, operated, and will be removed by PacifiCorp when approved by the Division.

Groundwater will be monitored and data will submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the quarter. When the analysis of any groundwater sample indicates noncompliance with the permit conditions, PacifiCorp will promptly notify the Division and immediately take actions provided for in R645-300-145 and R645-301-731.

PacifiCorp has conducted baseline and operational monitoring of the groundwater resources ~~springs and in-mine water sources~~ in and adjacent to the North Rilda permit area. The data collected have provided information useful in the understanding of potential hydrologic consequence of mining. Monitoring of the following groundwater resources will proceed through mining and continue during reclamation until bond release. Removal of the groundwater monitoring structures, *(Rilda Canyon piezometers)*, will be approved by the Division in conjuntion with the Utah State Division of Water Rights.

A. *East Mountain Springs*: No springs will be undermined in the North Rilda area. Only two springs are within the North Rilda permit area, 80-50 located in Section 29 and the Rilda Canyon Springs located in Section 28 (refer to HM-9 included with this document). Spring 80-50 will be monitored ~~Water samples will be collected and analyzed~~ during the months of July and October (included in the East Mountain Spring Monitoring Program, refer to Vol. 9 - Hydrologic Section: Appendix A). Rilda Canyon Springs will be monitored in cooperation with NEWUA on a monthly basis for flow and quarterly for quality. Parameters analyzed are those listed in the "DOGM Guidelines for Groundwater Water Quality" (refer to Vol. 9 - Hydrologic Section: Appendix A). ~~The springs located within or immediately adjacent to areas overlying coal to be mined in the next five (5) years or areas overlying previously mined areas will be monitored (except that the discharge recession curve springs will be monitored in the future regardless of their position relative to mining).~~

B. *In-Mine*: Intercepted groundwater sampling sites, (either roof drippers or contribution from the floor), will be established according to the Special Condition Stipulation in the Deer Creek permit renewal, (February 6, 1996), *"If during entry development, sustained quantities of groundwater are encountered which are greater than 5 gpm from a single source in an individual entry, and which continue after operational activities progress beyond the area of groundwater production, PacifiCorp must monitor these flows for quality and quantity under the approved monitoring plan".* ~~Two water samples will be collected and analyzed per mine quarterly.~~ Parameters analyzed are those listed in the "DOGM Guidelines for Groundwater Water Quality" (refer to Vol. 9 - Hydrologic Section: Appendix A).

C. *Waste Rock Wells:* One water sample will be collected and analyzed per location quarterly. Parameters analyzed are those listed in the "DOGM Guidelines for Groundwater Water Quality" (refer to Vol. 9 - Hydrologic Section: Appendix A).

D. *Rilda Canyon Springs - NEWUA:* One water sample will be collected and analyzed per location quarterly. Parameters analyzed are those listed in the "DOGM Guidelines for Groundwater Water Quality" (refer to Vol. 9 - Hydrologic Section: Appendix A).

E. *Rilda Canyon Wells - NEWUA Spring Area:* Water level will monitored on a monthly basis depending upon access (refer to Vol. 9 - Hydrologic Section: Appendix A).

Surface Water

PacifiCorp has conducted baseline monitoring of surface waters within and adjacent to the permit area (refer to Annual Hydrologic Monitoring Reports). Long-term monitoring sites in Rilda Canyon have been equipped with Parshall style flumes to facilitate monitoring. Monitoring equipment, structures used in conjuction with monitoring the quality and quantity of surface water on-site and off-site will be properly installed, maintained, operated, and will be removed by the PacifiCorp when approved by the Division. Water samples will be collected and analyzed quarterly (one sample at low flow and high flow) during the first or second week of the quarter. Parameters analyzed are those listed in the "DOGM Guidelines

for Surface Water Quality." Locations of all surface monitoring sites and sampling schedules can be found in Appendix A (refer to Vol. 9 - Hydrologic Section).

Surface water will be monitored and data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the quarter. When the analysis of any surface water sample indicates noncompliance with the permit conditions, PacifiCorp will promptly notify the Division and immediately take actions provided for in R645-300-145 and R645-301-731. For point source discharges, monitoring will be conducted in accordance with 40 CRF Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for National Pollutant Discharge Elimination System permit.

R645-301-731.300 ACID AND TOXIC-FORMING MATERIALS

Refer to Waste Rock Permit applications.

R645-301-731.500 DISCHARGES

Refer to Mine Dewatering R645-301-721 and UPDES information in Appendix B in Vol. 9 - Hydrologic Section of the Deer Creek Mine MRP.

R645-301-731.600 STREAM BUFFER ZONES

Mining related activities will not occur within 100 feet of a perennial or intermittent stream unless the Division authorizes such activities.

As mentioned in the PROBABLE HYDROLOGIC CONSEQUENCES DETERMINATION section, (728. Hydrologic Balance - Surface Water System), the drainages conveying runoff away from the permit areas are streams in Rilda, and Mill Fork canyons. Second mining, ie longwall extraction, room & pillar, of the North Rilda area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur beneath the stream channels of these canyons. First mining, ie. mainline, gateroad development, will occur below the right fork of Rilda Canyon. For a complete analysis of the proposed "no subsidence" design of the 4th North Mains development within the Right Fork of Rilda and the long-term stability analysis, refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the Right Fork of Right Fork of Rilda Canyon, a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the Hiawatha Seam, the lowest seam to be mined. The riparian zone within the right fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial fill with the canyon's side slopes. The angle of draw was calculated from the Hiawatha Seam horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. The referenced 15 degree angle of draw is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full extraction

mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above (refer to Annual Subsidence Reports of the Deer Creek MPR).

R645-301-731.700 CROSS SECTION AND MAPS

R645-301-710 thru R645-301-720 and R645-301-750

A water supply intake system known as "North Emery Water Users Association - Rilda Canyon Springs" is located in Section 28, Township 16 South, Range 7 East (refer to Map HM-9 within this volume, a detailed drawing of the collection system is provided in Volume 9 - Hydrologic Section of the Deer Creek Mine MRP). The intake system consists of a series of french drains collecting near surface alluvial water as a supply source for culinary water (for complete description of the NWEUA system refer to R645-711 "Existing Groundwater

~~There are no water supply intakes within the permit or adjacent areas.~~

No surface disturbance is planned within the boundaries of the North Rilda Area. ~~All disturbed area drainage will flow into an approved sediment control device.~~ Accordingly, it will not be necessary to divert, collect, convey, store, or discharge water from disturbed areas. ~~Maps showing water diversion, collection, conveyance, treatment, storage, and discharge can be found in the Operational section of the individual PAP's.~~

R645-301-731.800 WATER RIGHTS AND REPLACEMENT

In order to fulfill the requirements to restore the land affected by applicant's mining operations to a condition capable of supporting the current and post-mining land uses stated herein, the applicant will replace water determined to have been lost or adversely affected as a result of applicant's mining operations if such loss or adverse impact occurs prior to final bond release. The water will be replaced from an alternate source in sufficient quantity and quality to maintain the current and post-mining land uses.

As outlined in the Existing Groundwater and Surface Resources and Probable Consequences Determination, second/full extraction mining of the North Rilda Area will be limited to the ridge separating Rilda and Mill Fork canyons and subsidence will not occur below the stream channels of these canyons. No springs will be undermined in the North Rilda Area. First mining, ie. mainline, gateroad development, will occur below the right fork of Rilda Canyon. For a complete analysis of the proposed "no subsidence" design of the 4th North Mains development within the Right Fork of Rilda and the long-term stability analysis refer to the Engineering Section R645-301-500 Appendix 1. To protect the alluvial/colluvial system of the right fork of Rilda Canyon a stream buffer zone was established based on the extent of the riparian zone and the angle of draw from the lowest seam to be mined - Hiawatha Seam. The riparian zone within the right fork of Rilda Canyon was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial/colluvial

fill and the canyon's side slopes. The angle of draw was calculated from the lowest seam to be mined, Hiawatha, horizon/elevation @ 15 degrees to the point of intersection on the surface. The stream buffer zone delineates the area restricted to full extraction mining. If necessary to prevent groundwater infiltration below the right fork of Rilda Canyon, PacifiCorp will utilize a pressure grout system similar to the technic applied at the Roans Canyon Fault to limit groundwater infiltration.

732 - 764 SEDIMENT CONTROL (R645-301-732 thru R645-301-764)

No surface disturbance is planned in the North Rilda permit area.

748., 755., 765. CASING AND SEALING OF WELLS

(R645-301-748-755, R645-301-748, R645-301-765)

Each water well will be cased, sealed, or otherwise managed, as approved by the Division.

751. WATER QUALITY STANDARDS AND EFFLUENT LIMITATIONS

(R645-301-751)

Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with effluent imitations for coal mining promulgated by the EPA set forth in 40CFR Part 434 (refer to Vol. 9 - Hydrologic Section : Appendix B for UPDES permit information).

LIST OF REFERENCES

Danielson, T.W.; Remillard, M.D.; Fuller, R.H., Hydrology of the Coal-Resource areas in the Upper Drainages of Huntington and Cottonwood Creeks, Central Utah; U.S. Geological Survey-Water Resource Investigations, Open-File Report 81-539.

Doelling, H.H., 1972, Wasatch Plateau Coal Fields, in Doelling, H.H. (ed.), Central Utah Coal Fields; Sevier-Sanpete, Wasatch Plateau, Book Cliffs and Emery, Utah Geological and Mineralogical Survey Monograph Series No. 3, Salt Lake City, Utah.

Graham, M.J.; Tooley, J.E.; Price, D., Preliminary Hydrological Evaluation of the North Horn Mountain Coal-Resource Area, Utah, U.S. Geological Survey, Open-File Report 81-141.

Lines, G.C., The Ground-water System and Possible Effects of Underground Coal Mining in the Trail Mountain Area, Central Utah, U.S. Geological Survey, Open-File Report 84-067.

Price, D.; Arnow, T., Summary Appraisals of the Nation's Groundwater Resources-Upper Colorado Region, U.S. Geological Survey Professional Paper 813-C, Washington, D.C.

PACIFICORP
ENERGY WEST
HYDROLOGIC MONITORING PROGRAM
DEER CREEK, WILBERG/COTTONWOOD, DES-BEE-DOVE and TRAIL MOUNTAIN MINES

I. MONITORING LOCATIONS

A. Surface Water Hydrology (see Map HM-1 for East Mountain / Map 7-1 and 7-2 for Trail Mountain locations listed below)

1. Cottonwood Creek Drainage System

a. Cottonwood Canyon Creek

(1) SW-1 - Above Trail Mtn. Mine
(Approximately 5000 feet upstream from the inlet culvert for the disturbed area.) 2150 feet South, 2000 feet East of the Northwest corner of Section 24, Township 17 South, Range 6 East.

(2) SW-2 - Below Trail Mtn. Mine
(Approximately 200 feet downstream from the outlet culvert for the disturbed area.) 1300 feet South, 1750 feet West of the Northeast corner of Section 25, Township 17 South, Range 6 East.

(3) CCC01 - USGS Flume:
(Approximately 7800 feet downstream from the outlet culvert for the disturbed area.)1500 feet North, 200 feet East of the Southwest corner of Section 31, Township 17 South, Range 7 East.

(4) SW-3 - Below Trail Mtn. Mine
(Approximately 3800 feet above confluence with Straight Canyon) 2400 feet South, 2400 feet East of the Northeast corner of Section 6, Township 18 South, Range 6 East.

b. Unnamed Drainage off Straight Canyon

(1) T-19
(Approximately 200 feet upstream from the from confluence with Straight Canyon) 2500 feet South, 1100 feet East of the Northeast corner of Section 3, Township 18 South, Range 6 East

c. Grimes Wash

(1) GWR01 - Right Fork:
(Approximately 1500 feet upstream from the inlet culvert for the disturbed area.) 550 feet North, 1500 feet West of the Southwest corner of Section 22, Township 17 South, Range 7 East.

(2) GWR02 - Left Fork:
(Approximately 50 feet upstream from the inlet culvert for the disturbed area.) 200 feet South, 2350 feet East of the Northwest corner of Section 27, Township 17 South, Range 7 East.

(3) GWR03 - Below the mine:
(Approximately 500 feet downstream from the outlet culvert below the disturbed area.) 1770 feet South, 1820 feet West of the Northeast corner of Section 27, Township 17 South, Range 7 East.

2. Huntington Creek Drainage System

a. Huntington Creek

(1) HCC01 - Above Deer Creek Confluence:
1400 feet north, 2200 feet west of the southeast corner of Section 36, Township 16 South, Range 7 East.

(2) HCC02 - Below Deer Creek Confluence:
300 feet north, 300 feet west of the southwest corner of Section 31, Township 16 South, Range 8 East.

(3) HCC03 - Below Huntington Power Plant:
2500 feet north, 1500 feet east of the southeast corner of Section 6, Township 17 South, Range 8 East.

(4) HCC04 - @ Research Farm*
800 feet north, 200 feet east of the southwest corner of Section 5, Township 17 South, Range 8 East.

* Not listed on map due to scale.

b. Deer Creek
   (1) DCR01 - Above the mine:
   (Approximately 600 feet upstream from the mine facility.) 200 feet North, 800 feet West of the Southeast corner of Section 10, Township 17 South, Range 7 East.
   (2) DCR04 - Near C1/C2 Belt Intersection:
   (Approximately 5,000 feet downstream from the mine facility.) 300 feet North, 2000 feet East of the Southeast corner of Section 2, Township 17 South, Range 7 East.
   (3) DCR06 - @ Huntington Creek Confluence:
   (Approximately 15,000 feet downstream from the facility) 1400 feet north, 1100 feet east of the southeast corner of Section 36, Township 16 South, Range 7 East.

c. Meetinghouse Canyon - South Fork:
   (Approximately 200 feet upstream from the north and south convergence.) 800 feet North, 1500 feet East of the Southwest corner of Section 35, Township 16 South, Range 7 East.

d. Rilda Canyon:
   (1) RCF-1 - Rilda Canyon - Right Fork:
   (Approximately 4000 feet upstream from the Right and Left fork convergence.) 400 feet South, 200 feet West of the Northeast corner of Section 30, Township 16 South, Range 7 East.
   (2) RCLF1 - Rilda Canyon - Left Fork, below Rilda Canyon Portals: (Approximately 200 feet upstream from the Right and Left fork convergence.) 2400 feet North, 2100 feet West of the Southeast corner of Section 29, Township 16 South, Range 7 East.
   (3) RCLF2 - Rilda Canyon - Left Fork, above Rilda Canyon Portals: (Approximately 1600 feet upstream from the Right and Left fork convergence.) 1600 feet North, 2300 feet West of the Southwest corner of Section 29, Township 16 South, Range 7 East.
   (4) RCF2 - Rilda Canyon - Above NEWUA springs: 2500 feet South, 400 feet West of the Northeast corner of Section 29, Township 16 South, Range 7 East.

(5) RCF3 - Rilda Canyon - Below NEWUA springs: 2550 feet South, 1000 feet East of the Northeast corner of Section 28, Township 16 South, Range 7 East.

(6) RCW4 - Rilda Canyon: (Approximately 1000 feet upstream from the confluence with Huntington Creek.) 850 feet North, 1900 feet West of the Southeast corner of Section 26, Township 16 South, Range 7 East.

e. Mill Fork Canyon:

(1) MFA01 - Mill Fork Canyon - Above Old Mine: (Approximately 2000 feet above old mine portals @ end of USFS development road.) 100 feet North, 1500 feet West of the Southeast corner of Section 17, Township 16 South, Range 7 East.

(2) MFB02 - Mill Fork Canyon - Above Huntington Creek Confluence: (Approximately 200 feet above confluence with Huntington Creek @ culvert outfall.) 100 feet South, 1900 feet East of the Northwest corner of Section 22, Township 16 South, Range 7 East.

3. Reclamation Monitoring: Following stage 1 final reclamation backfilling and grading monitoring will be conducted at points immediately above and below the last sediment pond(s).
Cottonwood Fan Portal: reclamation monitoring will occur at points above and below the two sediment basins (see Map 3-14).

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DEER CREEK, WILBERG/COTTONWOOD, DES-BEE-DOVE
and TRAIL MOUNTAIN MINES

B. Groundwater Hydrology

1. **East Mountain Springs** (see maps HM-4 and HM-5)

Burnt Tree *+	80-41
Elk Spring *+	80-43
Sheba Springs *+	80-44*+
Ted's Tub	80-46*+
79-2	80-47
79-10 *+	80-48
79-15	80-50
79-23 *+	82-51
79-24	82-52*+
79-26 *+	84-56*+
79-28 (Flag Lake)	89-60(Alpine Spring)
79-29 *+	89-61
79-32	89-65
79-34	89-66
79-35 *+	89-67
79-38	89-68
79-40	Rilda Canyon-(Meters 2&3)

* Recession Study Springs (Flow August & September)
\+ Baseline analysis performed in 1996 and will be repeated every five years.

2. **Trail Mountain Springs** (see Trail Mountain Spring Map 7-1)

T-6
T-8
T-9
T-10
T-14
T-15
T-16

3. **Piezometric Data**
   a. Surface
      (1) Rilda Canyon (see Map HM-1 for locations)
         P1
         P5
         P6
         P7
         EM-47
      (2) Cottonwood Canyon Creek
         EM-31
         CCCW-1A
         CCCW-1S
         CCCW-2A
         CCCW-3A
         CCCW-3S U
         CCCW-3S L
         TM-1B
         TM-3
   b. Underground: In-Mine
      (1) Deer Creek Mine (Refer to Annual Hydrologic Reports for Locations : HM-2)
4. **In-Mine Water Locations**
   a. Deer Creek Mine (Refer to Annual Hydrologic Reports for Locations : HM-2)
   b. Wilberg/Cottonwood Mines (Refer to Annual Hydrologic Reports for Locations : HM-3)
   c. Trail Mountain Mine (Refer to Annual Hydrologic Reports for Locations : PLATE 7-3)
5. **Waste Rock Wells** (see Map HM-1 for locations)
   a. Deer Creek
   b. Cottonwood

6. UPDES Monitoring Locations

a. Deer Creek Mine
UPDES UT-0023604
001- Sediment Pond
002- Mine Discharge

b. Des-Bee-Dove Mines
UPDES UT-0023591
001- Sediment Pond

c. Wilberg/Cottonwood Mines
UPDES UT-0023604
001- Mine Discharge @ Grimes Wash
002- Sediment Pond Discharge @ Cottonwood Canyon
003- Sediment Pond @ Mine Facilities
004- Mine Discharge @ Miller Canyon
005- Sediiment Pond Discharge @ Waste Rock Site

d. Trail Mountain Mine
UPDES UTG040009
001- Sediment Pond
002- Mine Discharge

II. MONITORING SCHEDULE (see attached monitoring table)

A. Field Measurements

Field Measurements collected during quality sampling: Listed below are the sites which will be monitored by PacifiCorp - Energy West in accordance with the guidelines established by DOGM; i.e.,

- Date and Time
- Flow
- pH
- Temperature
- Conductivity
- Dissolved oxygen (perennial streams only)

Surface Monitoring

Surface monitoring locations will be field monitored quarterly for all field parameters.

1. Cottonwood Canyon Creek

a. (1) SW-1
(2) SW-2
(3) Cottonwood Canyon Creek - USGS Flume
(4) SW-3

b. Grimes Wash
(1) GWR01
(2) GWR02
(3) GWR03

c. Straight Canyon
(1) T-18 (Oliphant Mine Discharge)
(2) T-19 (Unnamed Side Drainage)

2. Huntington Canyon Drainage

a. Deer Creek
(1) DCR01
(2) DCR04
(3) DCR06

b. Huntington Creek
   (1) HCC01
   (2) HCC02
   (3) HCC04

   Flow in Huntington Creek is measured only at HCC01 by Utah Power , and will be reported in the Annual Hydrologic Report.

c. Meetinghouse Canyon - South Fork

d. Rilda Canyon
   (1) RCF1
   (2) RCLF 1
   (3) RCLF 2
   (4) RCF2
   (5) RCF3
   (6) RCW4

e. Mill Fork Canyon
   (1) MFA1
   (2) MFB2

Groundwater Monitoring

1. East Mountain Springs (see monitoring location list)
2. Trail Mountain Springs (see monitoring location list)

   East/Trail Mountain Springs will be field monitored during the months of July and October. In addition, the East Mountain Recession Study Springs (denoted by asterisks in the Monitoring Location section) and Trail Mountain Springs will be field monitored for flow only from July through October. Rilda Canyon Springs - NEWUA (meters 2 & 3) will be field monitored monthly depending upon access.
3. In-Mine
   a. Deer Creek
   b. Wilberg/Cottonwood
   c. Trail Mountain

   In-mine locations will be field monitored quarterly for all field parameters except pH, conductivity, and dissolved oxygen.

4. Piezometric Wells
   a. Surface
   Piezometric surface wells will be field monitored for level only on a monthly basis depending upon access.
   (1) Rilda Canyon (see Map HM-1 for locations)
      P1
      P5
      P6
      P7
      EM-47
   (2) Cottonwood Canyon Creek
      EM-31
      CCCW-1A
      CCCW-1S
      CCCW-2A
      CCCW-3A
      CCCW-3S U
      CCCW-3S L
      TM-1B
      TM-3

5. Waste Rock Wells
   a. Deer Creek
   b. Cottonwood

UPDES Monitoring

1. Deer Creek
2. Des-Bee-Dove
3. Wilberg/Cottonwood
4. Trail Mountain

UPDES sites will be monitored as speicfied in the individual permits.

B. Quality Sampling (Laboratory Measurements)

1. **Surface Water Hydrology:** Water samples will be collected and analyzed quarterly (one sample at low flow and high flow) during the first or second week of the quarter. Parameters analyzed are those listed in the DOGM Guidelines for Surface Water Quality (see Table #1). Quarterly sampling was initiated during March 1988 and will continue throughout the year; i.e., June, September, and December. Baseline analysis was performed in 1996 and will be repeated every five years thereafter.

   a. **Cottonwood Creek Drainage**
      - (1)Cottonwood Canyon Creek
        - (a) SW-1
        - (b) SW-2
        - (c) SW-3
      - (2)Grimes Wash
        - (a)GWR01
        - (b)GWR02
        - (c)GWR03
      - (3) Straight Canyon
        - (a) T-18
        - (b) T-19

   b. **Huntington Creek Drainage**
      - (1) Deer Creek
        - (a) DCR01
        - (b) DCR04
        - (c) DCR06
      - (2) Huntington Creek
        - (a) HCC01
        - (b) HCC02
        - (c) HCC04
      - (3) Meetinghouse Canyon - South Fork: MCH01
      - (4) Rilda Canyon
        - (a) RCF1
        - (b) RCF3
        - (c) RCW4
      - (5) Mill Fork Canyon
        - (a) MFA1
        - (b) MFB2

2. Groundwater Hydrology

a. East/Trail Mountain Springs: Water samples will be collected and analyzed during the months of July and October. Rilda Canyon Springs (NEWUA: Meters 2 & 3) monitored for quality quarterly. Parameters analyzed are those listed in the DOGM Guidelines for Groundwater Water Quality (see Table #2).

b. In-Mine: Two water samples will be collected and analyzed per mine quarterly. Parameters analyzed are those listed in the DOGM Guidelines for Groundwater Water Quality (see Table #2).

c. Wells: TM-1B will be sampled quarterly. Parameters analyzed are those listed in the DOGM Guidelines for Groundwater Water Quality (see Table #2).

d. Waste Rock Wells: One water sample will be collected and analyzed per location quarterly. Parameters analyzed are those listed in the DOGM Guidelines for Groundwater Water Quality (see Table #2).

3. UPDES Monitoring Sites

a. Deer Creek Mine
b. Des-Bee-Dove Mines
c. Wilberg/Cottonwood Mines
d. Trail Mountain Mine

UPDES sites will be monitored as speicfied in the individual permits.

III. ANNUAL REPORTS

All data collected regarding the hydrology of East/Trail Mountain will be summarized by the applicant in an annual Hydrologic Monitoring Report. Copies of the report will be submitted to the OSM; U.S. Forest Service; and the Utah State Division of Oil, Gas and Mining. In addition, any raw data collected will be submitted to the Utah State Division of Oil, Gas and Mining on a quarterly basis.