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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

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Michael O. Leavitt
Governor

Lowell P. Braxton
Division Director

October 16, 1998

TO: File

THRU: Mary Ann Wright, Associate Director, Mining

FROM: Pamela Grubaugh-Littig, Permit Supervisor

RE: Findings for Cottonwood Spring Citizen Complaint and Recommendations as a Result of Reviewing Cottonwood Spring Issue, PacifiCorp, Deer Creek Mine, ACT/015/018, Folder #3, Emery County, Utah

BACKGROUND

Citizen Complaint

On August 1, 1991, the Division received a letter from Mr. Jim Peacock stating that he was the owner of ranch property located about eight miles west of Orangeville, Emery County at the junction of Cottonwood Canyon and Straight Canyon (see attached letter). He had irrigated fields in this vicinity that were divided into:

1) Approximately 40 acres of cultivated fields that are irrigated from two water sources,
2) Approximately 18 acres irrigated from a gravity flow ditch taken from the Cottonwood River with a diversion approximately one mile up Straight Canyon, and
3) Approximately 22 acres irrigated from a gravity flow ditch from Little Cottonwood Creek in Cottonwood Canyon (this ditch irrigates approximately 15 acres that lie above the other ditch out of Cottonwood River.)

Mr. Peacock went on to explain that these irrigated fields were some of the earliest farms worked on in the Cottonwood Drainage and had been continuously farmed and irrigated since the 1880s. He also said that the Little Cottonwood Canyon water comes "primarily from one large spring (Cottonwood Spring) in the creek bed about one-half mile above Rhones Canyon (about 5-6 miles above the Peacock Ranches and the unction of the canyons). He also stated that "there has always been continuous water from Cottonwood Spring."

In his letter he stated that "the Cottonwood Spring totally dried up (partially in 1989, completely in 1990 and 1991) and that there isn't a drop of water in the whole creekbed area where the spring has run uninterruptedly for over 100 years of known and verified observation and use.".

He explained his interest in the matter "only extends to the loss of irrigation water in Little Cottonwood Canyon and the solution I seek is a restoration of sufficient water to irrigate the approximately

22 acres that has been previously and continuously irrigated out of Little Cottonwood Creek. He continued to state that "if the water has indeed been interrupted by a mining operation, then I must have replacement water brought out of the main Cottonwood River by a reconstructed higher-line ditch or pipeline or some other irrigation method."

On-Site Meeting

A memo dated September 11, 1991 by Division Hydrologist, Ken Wyatt, documented the on-site meeting and the results of the investigation (see attached memo). A meeting was held on August 20, 1991, in response to this concern with representatives from Cottonwood Creek Consolidated Irrigation Company, Emery Water Conservancy District, PacifiCorp, Mr. Peacock, Water Rights, and Division. The tour included observations of the Cottonwood Spring (a discharge pipe.) During the tour, Mr. Eugene Johansen indicated that this spring has been diminishing for 8 to 10 years.

The review memo continued to state that "USGS records from 1977 to 1982 indicated that the spring had flowed between 40 to 100 gpm continuously. The Cottonwood Creek between the spring and the Mountain Coal Mine was wet with very limited surface water." He made an analysis of stiff diagrams that were generated for the Cottonwood Spring and Cottonwood Creek, as well as a review of flow records, and geologic information presented in the PAP. This review suggested that intercepted ground water quantities may have caused the decreased flow, although six years of drought presented the possibility that the loss of this spring may have been drought related. In other words, a review of the information as well as the onsite tour was inconclusive.

Remedy - Request for Updated PHC

At that time, the Division requested PacifiCorp revise their Probable Hydrologic Consequence (PHC) because a review of the information was inconclusive. The revised PHC was submitted December 19, 1991 to address the citizen complaint. The Division sent a review of the PHC on February 10, 1992 and more information for the PHC was received on February 21, 1992 and March 23, 1992, including a drilling plan. The Division PHC review was sent on May 15, 1992. A revised drilling plan for Cottonwood Canyon was submitted July 15, 1992 and approved on November 6, 1992 and the wells were completed on January 19, 1993. The PHC was again revised (to include results of drilling and resistivity) and submitted on March 30, 1993. Deficiencies were sent on April 20, 1994. PacifiCorp responded on May 6, 1994 and submitted subsequent information to include aquifer test results on June 27, 1994. The Cumulative Hydrologic Impact Analysis (CHIA) was updated in September 1994.

Complaint Resolved

On May 6, 1994, Mr. Jim Peacock signed an agreement with PacifiCorp that resolved the dispute and water for irrigation was restored to Mr. Peacock as he had originally requested in the August 31, 1991, complaint.

FINDINGS AND RESOLUTION OF CITIZEN COMPLAINT

On May 12, 1998, during an interagency conference call, the Cottonwood Spring was discussed and the question of whether or not the citizen complaint had been resolved was raised. It was discovered,

through a review of Division records, a finding for the resolution of the citizen complaint was never made.

The original citizen complaint was submitted to the Division for the loss of irrigation water in Little Cottonwood Canyon and the solution Mr. Peacock sought was restoration of sufficient water to irrigate the approximately 22 acres that had been previously and continuously irrigated out of Little Cottonwood Creek. Mr. Peacock entered into an agreement with PacifiCorp on May 6, 1994, that resolved the dispute of loss of irrigation water in Little Cottonwood Canyon and restoration of sufficient water to irrigate out of Little Cottonwood Creek. Therefore, the citizen complaint was resolved in 1994.

RECOMMENDATIONS

Discussions about this spring have been continuing since May 1998. Division Hydrologist, Ken Wyatt, reviewed and analyzed all the documents available at the Division on the Cottonwood Spring (see memo dated October 16, 1998).

As a result of his report, there are four recommendations that should be made:

1) The Cumulative Hydrologic Impact Analysis (CHIA) for East Mountain should be updated,
2) In-mine drilling activities should be approved by the BLM (other appropriate agencies),
3) Division should consider requiring monitoring of springs outside the permit area, and
4) If the hydrologic regime is affected, permittee should be proactive in providing necessary information to all appropriate agencies (e.g. Division for the PHC/CHIA process, and BLM (lease stipulations)).

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October 16, 1998

TO: Mary Ann Wright, Associate Director, Mining

THRU: Pam Grubaugh-Littig, Permit Supervisor

FROM: Ken Wyatt, Reclamation Hydrologist

RE: Cottonwood Spring Chronology and Information Related to Roans Canyon Graben Crossing, PacifiCorp, Deer Creek Mine, ACT/015/018, Emery County, Utah

On May 12, 1998, the Bureau of Land Management, US Forest Service, the Office of Surface Mining, and the Division of Oil, Gas and Mining, hereinafter referred to as the Interagency Coal Team (ICT), had a regularly scheduled conference telephone call where the Cottonwood Spring issue as it relates to a lease relinquishment at the Deer Creek Mine was discussed. The Cottonwood Spring was the subject of a citizen complaint in 1991 and was associated with the Deer Creek Mine. No formal resolution to this citizen's complaint has been recorded by the Division. The complainant, Mr. Jim Peacock, has since received water shares from Cottonwood Creek (Straight Canyon) and a pressure irrigation system. The issue of hydrologic material damage must be considered.

The ICT met again on June 2, 1998. PacifiCorp has been working to relinquish several mined leases. Lease U-084923 is one of the leases being examined for relinquishment, which is also associated with the area in the Deer Creek Mine where significant quantities of ground water was encountered in the late 1980s through the early 1990s. This area of the mine is geologically situated near the trough of the Straight Canyon Syncline and along the Roans Canyon Fault Graben.

On July 7, 1998, the ICT met with technical staff from the various agencies to discuss current theories and information regarding this spring and the hydrogeology of the area. Following the meeting, PacifiCorp presented the group with a summary of their research and information that they have collected. No new information or theories were provided by PacifiCorp during this meeting. A tour of the spring in Cottonwood Canyon followed.

Attachment A is a chronological summary of DOGM files and correspondence associated with Cottonwood Spring and mine water issues in the region. Developing the chronological summary revealed information which associates the mining with water removal from the graben and syncline which may have affected flows at the Cottonwood Spring and Cottonwood Creek. These are discussed below as they relate to the issues requiring reconciliation as identified during the ICT meeting on July 7.

1. **Cottonwood Canyon Wells Water Elevations:**

The ground water conditions reported from the Cottonwood Creek wells do not support the company's theory that the spring was alluvial water which would flow after water levels have risen 12 feet. Based on the resistivity survey in Cottonwood Creek in 1992, (Appendix 9, Volume 9B, Deer Creek MRP) the company indicated that the water levels in the alluvium were about 10 feet below the level of the

spring. Based on this information it was presumed in the 1994 CHIA, that spring flow would resume when water levels rose 12 feet. (Attachment B) The water levels have risen over 20 feet since the well installation in 1993, with no resultant flow at the spring.

When asked on July 7, 1998 why flow had not resumed, PacifiCorp had no explanation except that the Cottonwood Creek basin was large and would take a long time to fully recharge. If this were the case water levels in the Cottonwood Creek basin probably would not have shown the effects of the drought in such a short time period. Large basins have the capacity to withstand the effects of drought much better than small ones. According to the East Mountain precipitation data, the East Mountain area did not receive below normal precipitation until 1989.

The average gradient of the alluvial water in Cottonwood Creek can be calculated using the water level elevations collected from the Cottonwood Creek wells. The gradients between wells are presented in the table below based on December 1997 data. No gradient could be calculated between CCCW-1A and the spring since no well exists near the spring. For water table aquifers, gradients can generally be calculated based on topography which in this case produces a gradient of about 0.05 ft./ft.

Gradient Calculations using Cottonwood Creek Wells and Cottonwood Spring				
	Water Elevation Dec. 1997	Head Difference From above	Distance from above	Gradient (ft/ft)
Cottonwood Spg	7749 (if flowing)	*	*	
CCCW-1A	7744.8	-5	1400	-0.003
CCCW-2A	8117.6	372.8	6600	0.056
CCCW-3A	8324.3	206.7	5600	0.037
AVERAGE	-	-	-	0.047

The water level at the spring in December 1997 can be estimated by extrapolating the gradient from the closest well to the spring (CCCW-1A). The following table presents the estimated December 1997 water level elevations at the spring, using the three gradients calculated above and the topographic gradient of 0.05 ft./ft.:

Water Elevation Determination based on different gradients from Cottonwood Creek Well Data			
Gradient (ft./ft.)	Horizontal Distance (ft.)	Head difference expected at spring (feet)	Calculated WL at Spring CCCW-1A: Dec. 1997 WL 7744.8
0.037	1400	51.8	7744.8 - 51.8 = 7693.0
0.047	1400	65.8	7744.8 - 65.8 = 7679.0
0.050 *	1400	70.0	7744.8 - 70.0 = 7674.8
0.056	1400	79.8	7744.8 - 79.8 = 7665.0

* 0.05 ft/ft based on topographic relief.

The 1992 resistivity survey in Cottonwood Canyon (Appendix 9, Volume 9B Deer Creek Mine MRP) indicated that the alluvium was 62 feet deep at the spring location. Comparing the bottom of the alluvium to calculated water levels at the spring for each gradient, one can observe that the water level elevations calculated at the spring would be below the alluvium in all cases except where the lesser gradient of .037 ft/ft is used. This gradient is more representative of the upper canyon near CCCW-3A and not the lower canyon near the spring. This does not agree with information from the various studies. A well installed at the spring location in the alluvium would provide more site specific ground water information in the immediate area of the spring.

Cottonwood Canyon Wells: Groundwater Flow

A calculation of the amount of water flowing through the alluvium can be made using Darcy's Law (Q=KIA). Based on this calculation the alluvial system is not capable of delivering the quantities of water once observed at the spring.

Q= KiA

K = The measured value from the slug tests in the Cottonwood Creek wells were 5.814×10^{-5} at CCCW-1A, 9.387×10^{-5} ft/min at CCCW-2A, and 7.64×10^{-5} ft/min. at CCCW -3A. The average K = 7.6×10^{-5} ft/min was used in this exercise.

A = the presumed saturated thickness of the alluvium at the spring multiplied by an estimation of the width of the alluvial fill in the canyon at the spring (Line CCCR2 in the resistivity survey, 1992).
Saturated thickness = (62 feet - 10 = 52 feet) X 700 feet Width
52 X 700 = 36400 ft^2

I = 0.056 ft./ft. calculated gradient from CCCW-2A to CCCW-1A using Dec. 1997 data. In this case 0.056 will be used as it is closest to the spring.
0.05 calculated from Mahogany point Quad map topography.
0.047 Average gradient calculated from Cottonwood Creek Wells.

Q =KiA
= (7.6×10^{-5} ft./min.)(0.056ft/ft)(36400 ft^2)
= .155 ft^3/min X 7.48 gallons/ft^3
= 1.2 GPM.

Even conducting the above calculation using the assumption that the Cottonwood Creek basin is filled to the level of the spring (saturated thickness 62 feet, 62 ft. X 700 ft = 43400 ^{ft}), the basin cannot produce the quantities of water observed at the spring in 1979. (40 - 60 GPM, USGS Open File Report 81-539, Pg 29).

Q = KiA
= (7.6×10^{-5} ft/min.)(0.056ft/ft)(43400 ft) = 0.185 ft^3/min * 7.48 Gallon/ft^3 = 1.4 GPM.

Doing the calculation with the Dec. 1997 data, calculated water level at spring 7693, alluvium base 7687. Saturated thickness 6 feet

Q =KiA
= (7.6 X 10-5 ft/min)(0.056 ft/ft)(6 ft X 700 ft)
= 0.018 ft^3/min X 7.48 gallon/ft^3 = 0.13 GPM

2. **Timing of Mining:**

Mining in the Deer Creek mine abutted the Roans Canyon Graben in the 3rd North entries in 1984 and 1985. Mining then moved easterly towards Meetinghouse Canyon where a break out was constructed. Attachment C contains copies of mine workings maps from the 1987 to 1990 Deer Creek Mine Annual Reports. These drawings show that the Deer Creek mine working abutted the Roans Canyon Fault in 1985 as indicated by the dates on these maps which correspond with development of the entries. They also show the entry development sequence through the Roans canyon Fault from 1989 to 1990.

The company was conducting tests and studies attempting to determine feasible way to cross the graben. In 1988, Hydro-Search Inc. Golden, CO, was hired to help with a hydro geologic evaluation of the Roans Canyon Fault. They also developed a plan to drill and dewater the graben system prior to developing entries through the graben. The complete report is located in the Deer Creek Mine MRP Volume 9A, appendix 1. Text portions of the report are included as Attachment D which describes the geologic conditions associated with drilling through the graben, a dewatering plan and the exploratory drill hole conditions through the graben.

Each of the exploratory horizontal drill holes penetrating the graben produced water. The later ones were selected for dewatering since they had been designed for that specific purpose. The report mentions drilling several previous holes (TW-2 through TW-5) which were not very successful due to the screen interval slots plugging with debris. Holes TW-6, and TW-7 were drilled and cased with 1 1/4 inch PVC. This material was crushed and failed due to high lithostatic pressures. Holes TW-8 through TW-10 were cased using 2 9/16 BX Steel and galvanized screens. These holes were developed with the specific function of dewatering the graben prior to entry development. Figure 4-1 in attachment H shows the location of all 9 TW drill holes.

Five holes were drilled prior to TW-6 which, according to the TW-6 drill log was started on April 19, 1988, with completion on May 3, 1988. Each drill hole required between 5 and 15 days for completion as summarized in the table below. The first five holes would have been started prior to April 1988. Additionally, holes TW-2 through TW-5 were drilled prior to the larger diameter holes TW-6 through TW-10. This establishes a direct connection to dewatering activities in the Roans Canyon Fault Graben in early 1988.

A reference included in the Hydro Search Inc report refers to a 1985 report by Williams and Associates entitled: Hydrogeologic Analysis of Test Data from Horizontal Drill Holes Completed in the Roans Canyon Graben, Third North, Deer Creek Mine, Utah. This report includes analysis of horizontal drill holes into the graben area prior to 1985. No copy was available for review. According To Mr. Semborski these holes were small diameter holes drilled as the mine workings approached the graben. Water was produced from these holes, which initiates graben dewatering in 1985. This can be observed in the mine discharge graph for 1985 and 1986.

Drill hole	Start Date	Completion Date	Number of days
TW-6	April 19, 1988	May 3, 1988	14
TW-7	May 12, 1988	May 17, 1988	5

TW-8	May 31, 1988	June 15, 1988	15
TW-9	July 25, 1988	No date given	-
TW-10	August 29, 1988	September 2, 1988	5

Deer Creek Mine water volumes continued to increase significantly from spring 1988 into 1990. Attachment E contains copies of pages from the annual reports of the Deer Creek Mine from 1987 to 1991. These provide quantities of mine water discharges during the period when the Deer Creek Mine was mining in the bottom of the Straight Canyon Syncline and through the Roans Canyon Graben. The data are summarized in the table below.

Deer Creek Mine Groundwater Inflows from 1987 to 1990			
Year	Acre feet discharged	% change from Previous year	Reason for change
1987	1,034	+42	Additional sandstone channels above coal. Related to increased coal production exposing more roof.
1988	1,770	+71	Better metering system for mine water use & discharge Mining in Roans Canyon Graben (TW drill holes & dewatering) Mining in bottom of Straight Canyon Syncline. More sandstone roof exposed.
1989	2,008	+13	Better metering Additional sandstone roof Mining in bottom of Straight Canyon Syncline Mining intersecting Roans Canyon Graben.
1990	4552	+127	4th South Inflows along sympathetic fault of the Roans Canyon Graben. (March 1990)

Several company annual reports indicate that increased coal production was exposing additional areas where fluvial sand channels above the coal seam produced mine water in-flows. These fluvial channels usually have dramatic recession curves after exposure by mining and often have very reduced flows or cease flowing within 30 days. These sources would not produce the continuous large quantities of mine water discharged from the Deer Creek Mine. No other significant water sources have been identified in the annual reports or permit, except from dewatering the Roans Canyon Fault Graben and the Straight Canyon Syncline.

The company continued drilling into the fault throughout 1988. They were conducting hydrologic studies to develop methods to dewater the fault system and to develop a fault crossing plan. The graben crossing and dewatering plan was developed in October 1988 (HSI report, attachment D) and the graben crossing was constructed in 1989 into 1990.

Flows continued to increase annually until March/April 1990 when even larger quantities of water were intercepted in the 4th South long wall panel. The Cottonwood Spring was already dry by this time, most likely due to the graben dewatering during the horizontal drilling period and during entry development across the Roans Canyon Fault. Again, no account for this increased mine inflow has been provided except dewatering the Roans Canyon Fault Graben and the Straight Canyon Syncline.

3. **Stiff Diagrams:**

In August 1991, the Division received a citizen complaint claiming water from the Cottonwood Spring was no longer flowing into Cottonwood Creek. On September 11, 1991, the DOGM completed a preliminary investigation into this complaint. As part of this report, Stiff diagrams were prepared from existing spring data from the Trail Mountain #9 Mine's monitoring program. The Stiff diagrams reflected very consistent water quality, with little seasonal fluctuation, indicating that the source was from groundwater and not alluvial water.

In the USGS Water-Supply Paper 2254, Hem indicates that groundwater quality changes occur slowly over time, versus stream water quality, which fluctuates more rapidly depending on the variable volume of water available for dilution. In Cottonwood Creek, one would expect the dilution from snowmelt to decrease concentrations of water quality parameters causing seasonal shifts in the stiff diagrams. Attachment F contains the discussion from the USGS Water-Supply Paper 2254.

Data from water quality samples were used to plot stiff diagrams for the Cottonwood Spring, horizontal drill hole TW-10, and several surface water sites in Cottonwood Creek associated with the Trail Mountain #9 Mine. These all contain diagrams which have the same basic water chemistry.

Early samples collected in TW-10 would represent inflows from a multitude of sources in the graben profile. Once the graben had been dewatered the base flow would be expected to stabilize. This can be observed in the TW-10 stiff diagrams. The early samples had high variability and after 1993, it stabilized and represents water very closely matching that of the 1988 - 1989 Cottonwood Spring samples.

A single sample from Cottonwood Spring was taken by the USGS on October 14, 1977. This sample contained slightly more Magnesium than the 1988 - 89 samples but the general appearance is the same. It is interesting to note that surface water quality samples in Cottonwood Creek from about 1983 until 1988 was very similar to the water quality of Cottonwood Spring. This would indicate that the stream below the Cottonwood Spring was comprised of water from similar sources as the Cottonwood spring (ie: the graben water being discharged into Cottonwood Canyon from the north side of the Roans Canyon Fault system.) These sources would be removed when the graben was drained and the spring ceased flowing.

Once this source was removed the chemistry in Cottonwood Creek changes. This can be seen in the SW-1 stiff diagrams after about 1992. Plots from SW-3 shows similar trends to SW-1. SW-1 (Surface Water-1) is the above mine sampling location in Cottonwood Creek. SW-3 is located down canyon below the Trail Mountain Mine and could be influenced by mine water discharges from the Trail Mountain Mine. Attachment G contains the Stiff Diagram printouts.

4. **Oxidation at 2000' depth:**

Multiple times the company annual reports indicated that surface water was reaching the mine 2000 feet below the ground surface, since large areas were oxidized at the mine level along the Roans

Canyon Fault crossing. This indicates a direct connection to surface sources for recharge to the fault system. It also indicates that the fault system in some areas is an open conduit and may have been holding water. The drill logs associated with the horizontal drill holes through the graben indicate multiple voids across the length of the core. The company also described fault gouge material up to 30 feet thick with many areas of oxidized yellow staining. This indicates that the Roans Canyon Graben is indeed capable of containing large amounts of water and has a surface recharge source from above. Attachment H, figure 3-2 is a Schematic of the Roans Canyon Graben as described in the 1988 Hydro-Search Inc. report on the graben dewatering.

Hydrostatic testing of the water within the graben in 1988, provided head elevations which are presented in the table below. These data are also included in the Hydro-Search Report. These pressure elevations are all in line with the elevation of the spring with the exception of TW-8. TW-8 was not drilled completely through the graben therefore it was not exposed to the higher hydraulic heads observed on the north side of the fault system. See Figure 1-1, HSI Report in Attachment H. These head elevations were obtained after some dewatering had already occurred which would place the initial head above these levels.

Drill Hole	Observed Pressure Elevation (MSL)	Elevation difference to Cottonwood Spring (7749 ft)
TW-6	7737.5	-11.5
TW-7	7755.9	+6.9
TW-8	7324.7	-424.
TW-9	7750.1	+1.1
TW-10	7758.2	+9.2

When exploratory drilling and then mining opened pathways for water to flow from inside the graben into the mine, the water within the graben was lowered, which eventually eliminated the spring and flow into Cottonwood Creek. Since the Cottonwood Spring was a graben/fault related spring, it is likely that the spring was a surface expression of the piezometric surface(s) within the graben and surrounding areas to the north. Once this surface was lowered due to graben dewatering in 1988 - 1989 the spring disappeared. Cottonwood Spring was last sampled on August 25, 1989 during the Trail Mountain #9 Mine's 1989 3rd quarter monitoring.

The company's hydrologic maps (HM-1) show groundwater flow from areas to the north towards the graben where it is impounded. Flow is then directed along the Roans Canyon Graben discharging towards Cottonwood Creek Canyon. Water captured during the graben crossing within the Deer Creek Mine would no longer follow this flow path. Attachment I contains copies of pages from PacifiCorp's 1989 Annual Report which discuss the Deer Creek Mine's plan to construct the graben crossing in 1989 - 1990. The preliminary hydrologic investigation and drilling in 1988, followed by graben crossing construction in 1989 and 1990 and subsequent graben dewatering corresponds very closely to the loss of the spring and flows in lower Cottonwood Creek.

5. **Mine Discharge Graphs:**

The company submitted the Deer Creek Mine discharges graphed versus time in several annual reports. The graphs show several periods of significant increased mine water production. Water production began increasing in 1985 when the mine workings were approaching the graben and exploratory drilling commenced. Major increases in mine water discharge in 1988 was probably due to drilling into the graben for testing and dewatering purposes. The graben crossing was constructed in 1989 and allowed additional inflows from the graben dewatering. In early 1990 a second major inflow occurred when mining intercepted a sympathetic fault associated with the Roans Canyon Fault in the 4th South long wall panels. No other water significant water sources have been identified which could account for these increased flows. The mine discharge graph is included in Attachment J. Deer Creek Mine water discharges are summarized in the table below.

Year	Mine Discharge Volumes	Reasons for change
1980 - 1985	~500,000 GPD	Typical mining conditions, Fluvial channel sands
1986 - 1987	>1,000,000 GPD	Fluvial channel sands Mining in/near Straight Canyon Syncline and Roans Canyon Fault Graben
1988	>1,500,000 GPD	Fluvial channel sands Roans Canyon Graben dewatering (May 1988)
1989	~2,000,000 GPD	Graben crossing construction and continued dewatering
1990	>5,000,000 GPD	Sympathetic fault interception in 4th South

The following table lists several local reservoirs and the storage capacity at the spillway in acre feet. This list was obtained from the Utah Division of Water Rights and can be used as a volume reference for illustrative purposes comparing the mine discharge volume to the reservoir volume as a percent. The highest annual discharge was in 1990 at 4552 acre feet. Between 1988 and 1990 the mine discharged 9364 acre feet of water.

Reservoir name	Capacity (Acre Feet)	1990 mine discharge as a % of reservoir volume	1988-90 mine discharge as a % of reservoir volume	County
Cleveland	5340	85.2	175.4	Emery
Miller Flat	5560	81.9	168.4	Emery
Huntington	5616	81.1	166.7	San Pitch
Electric Lake	31500	14.5	29.7	Emery
Joes Valley	61538	7.4	15.2	Emery
Scofield	73600	6.2	12.7	Carbon

6. **Cottonwood Creek Flows:**

The company presented a list of flows from the Cottonwood Creek USGS gaging station for years 1984 to 1991. In this list, flows begin to drop in late 1989 and continue to decrease into 1991, with no resumption of flows even in above normal precipitation years. This indicates a loss of base flow to the creek, probably from the Roans Canyon Fault system. The stream was once considered perennial from the Cottonwood Spring down to the confluence with Straight Canyon. Prior to 1989 the base flow was generally over 1 CFS. Some water or recharge water from the East Mountain area has been lost from the Cottonwood Creek watershed due to the mining at Deer Creek.

Well EM-31, located in Cottonwood Canyon above the Trail Mountain Mine, is completed in the Star Point Sandstone. The HSI report, page 3-5, indicated that the graben is a critical component of the vertical recharge to the Star Point. Attachment K is a graph of the water levels in EM-31 and shows a drop greater than 10 feet beginning in early 1988, the same time that graben dewatering began.

The company maintains a weather station on East Mountain. According to the data submitted for East Mountain station, the area was in a drought for several years from 1989 to 1991. The USGS Cottonwood Creek gaging station flow record through 1991 and the company's East Mountain Precipitation graph are included in Attachment L.

7. **Cottonwood Creek Resistivity Survey:**

The 1992 resistivity survey conducted by PacifiCorp in Cottonwood Canyon identified a water bearing anomaly about 35 feet upstream of the Cottonwood Spring. The largest quantity of water intercepted in the Deer Creek Mine was when the mine intercepted a sympathetic fault off of the Roans Canyon Fault system in the 4th South long wall panels. This fracture had minimal displacement but produced in excess of 5,000 gallons per minute. Extrapolation of this sympathetic fault to the southwest could easily line up near the Cottonwood Spring and could be the anomaly identified in the resistivity survey. The spring and creek are geologically associated with the Roan's Canyon Graben and fracture system.

Conclusions

The above information is provided to assist you in making an administrative decision about the Cottonwood Spring and the 1991 citizen complaint. According to documentation from the company, Mr. Jim Peacock has been satisfied with water shares from Joes Valley and a pressure irrigation system.

Norman H. Bangerter
Governor
Dee C. Hansen
Executive Director
Dianne R. Nielson, Ph.D.
Division Director

State of Utah

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340

September 11, 1991

TO: Pamela Grubaugh-Littig, Permit Supervisor

FROM: Ken Wyatt, Tom Munson, Reclamation Hydrologists

RE: Cottonwood Spring Citizen's Complaint, Deer Creek Mine, Pacificorp Electric Operations, ACT/015/018, Folder # 2 and Citizen's Complaint File, Emery County, Utah

SYNOPSIS

On August 1, 1991, the Division received a letter from Mr. Jim Peacock stating that a spring located in Cottonwood Creek had ceased flowing over the last several years. He had heard about the increased flows from the Deer Creek Mine and requested the Division to investigate whether these increased flows from the mine had any relation to this spring. Mr. Peacock has water rights along Cottonwood Creek.

In response to the citizen complaint from Jim Peacock received by the Division on August 1, 1991, a meeting was held on August 20, in the Cottonwood Creek area. The following persons were in attendance.

NAME	AGENCY/AFFILIATION	ADDRESS, PHONE #
Eugene Johansen	Cottonwood Creek Consolidated Irrigation Co.	Castledale
Jay Humphrey	Emery Water Conservancy District	Castledale
Rodger Fry	Pacificorp	SLC, 220-4610
Chuck Semborski	Pacificorp	Huntington, 653-2312
Carly Burton	Pacificorp	SLC, 220-2174
Val Payne	Pacificorp	Huntington, 653-2312
Denise Dragoo	Attorney for Pacificorp	215 S. State, Suite 1200 SLC, 84111; 531-8900
Ken Wyatt	Utah Div. Oil, Gas & Mining	SLC, 538-5266
Tom Munson	Utah Div. Oil, Gas & Mining	SLC, 538-5288
Bill Warmack	Utah Div. Water Rights	Price, 637-1303
Jim Peacock	Ranch Owner	150 E 7060 S, Midvale, 84047; 255-2221
Paul Peacock	Ranch Operator	Orangeville

ANALYSIS

The meeting commenced at 11:00 a.m. at the junction of Straight Canyons and Cottonwood Canyons. Mr Jim Peacock began by describing his properties in the area, the history of these properties and the agricultural practices used on this land. The land being affected by the loss of this spring water is located in Section 7 and 8 of T18S R7E. (See attachment 1)

The tour then went up Cottonwood Canyon to the point of diversion from Cottonwood Creek. At this time approximately .23 CFS flow was observed entering this canal. (Approx. .25 feet in a 6" flume)

Following this observation, we visited the site of the spring. No water was observed in the creek channel or from the spring discharge pipe. The spring previously surfaced from the Northeast hillside slightly above creek level. Discussions were held concerning the flow of this spring. Eugene Johansen indicated that this spring has been diminishing for 8 - 10 years. U.S. Geological Survey records from 1977 - 1982 indicated that the spring flowed between 40 and 110 GPM continuously from the Blackhawk Formation. Cottonwood Creek between Mountain Coal Mine to the Spring was wet with very limited surface water.

The tour then proceeded to the culvert outlet at Mountain Coal Mine where it was observed that the majority of Cottonwood Creek flow was from the mine water discharge pipe below the sediment pond. The stream flow as measured at the USGS monitoring station was .32 CFS (.19 feet through a 12"flume).

Examination of map No.3 (partial copy as attachment 2) included in the Deer Creek Mine UPDES Permit Application shows that the area of major water production within the mine is located just south of the Roans Canyon Fault. The spring is located just south of the Roans Canyon Fault on the down-dipped side of the canyon near the axis of the Straight Canyon Syncline. The mine water discharge at the Deer Creek Mine averaged 6.75 CFS from December 1990, to July 1991.

Using water chemistry data from the Trail Mountain Mine 1986 water monitoring program, Stiff diagrams were generated for this spring and Cottonwood Creek. Pacificorp FAXed the Division data for two springs adjacent to the one in question that they monitored this year. Additionally, I plotted Stiff diagrams for some of the Deer Creek mine inflows and the adjacent springs in Cottonwood Creek. The Stiff diagrams are attached.

The Stiff diagrams did show that the spring water quality was very consistent throughout 1986. The diagrams can be superimposed over the others and they show very little difference. This indicates that the source of the water is groundwater from a formation and probably not from the alluvial stream channel. If it were the stream channel one would expect the diagrams to change over the year from periods of peak flow to base flow in late summer and fall.

After reviewing stiff diagrams, the mine permit application, flow records, and the geologic information presented in the PAP, it is possible that the Deer Creek Mine has intercepted significant groundwater quantities which may have caused the decreased flow at the spring. The last six years have been drought years which presents the possibility that the loss of this spring may have been drought related.

Other theories are that the spring flow originates from stream water present in the alluvial material in the canyon floor and that this water is surfacing at the spring site since the canyon narrows considerably in this area. Based on the conditions present there is insufficient evidence to indicate that the mine has intercepted the entire flow of this spring. More research would be required to collect additional information.

RECOMMENDATION

The Division requested that Pacificorp revise their Probable Hydrologic Consequences (PHC) after the large amount of water was intercepted. This revised document was received on May 1, 1991 and is currently being reviewed. Information in the revised PHC may help answer some of these questions. Sufficient information is not available at this time to confirm or negate the impacts of the Deer Creek Mine on this spring and others. These questions will be addressed in the revised PHC review.

KW/jbe
ATCOTTSPR.MEM

July 31, 1991

RECEIVED
AUG 0 1 1991
DIVISION OF
OIL GAS & MINING

Mr. Robert Morgan
Utah State Engineer
Division of Water Rights
1636 West North Temple
Salt Lake City, Utah 84116

Dr. Dianne Nielsen
Director, Utah Division of Oil, Gas & Mining
3 Triad Center #350
Salt Lake City, Utah 84180-1203

Dear Mr. Morgan and Dr. Nielsen:

I am writing this letter to both of you because the problem I address involves both your offices and authority. The remedy I seek will probably involve direction and action from both offices.

I am the owner of ranch property located about eight miles west of Orangeville, Emery County at the junction of Cottonwood and Straight Canyons. The approximate 350 acres (all or part of nine forty's) are in Sections 7, 8 and 9 TWP 18, Range 7 East. Approximately forty acres are cultivated fields that are irrigated from two water sources. Approximately 18 acres are irrigated from a gravity flow ditch taken from the Cottonwood River with a diversion approximately one mile up Straight Canyon. The other approximate 22 acres are irrigated from a gravity flow ditch from Little Cottonwood Creek in Cottonwood Canyon. This ditch irrigates approximately 15 acres that lie above the other ditch out of Cottonwood River.

These irrigated fields were some of the earliest farms selected and worked on the Cottonwood Drainage. Affidavits place the first irrigation out of Little Cottonwood in the 1880s. It has been continuously farmed and irrigated since that time. The Little Cottonwood Canyon water comes primarily from one large spring (Cottonwood Spring) in the creek bed about one-half mile above Rhones Canyon (about 5-6 miles above the Peacock Ranches and the junction of the canyons). In some years surface runoff from upper Cottonwood Canyon and out of Rhones Canyon increase the flow, however the primary source is the Cottonwood Spring. Little Cottonwood Creek usually runs from one to three second feet of water depending on the wetness of the season and the snowpack. There has always been continuous water from Cottonwood Spring.

THE PROBLEM:

Beginning two years ago (partially in 1989, completely in 1990 and 1991) the Cottonwood Spring has totally dried up. There isn't a drop of water in the whole creek

bed area where the spring has run uninterruptedly for over 100 years of known and verified observation and use.

The Cottonwood Spring is located in the vicinity of Utah Power & Light/PacifiCorp's coal mines in and under East Mountain. These include the Cottonwood-Wilberg mines and the Deer Creek mines.

I have been in contact with Mr. Eugene Johansen, President of the Cottonwood Creek Irrigation Company, concerning this matter. He is fully aware of this situation and informs me that the Cottonwood and Deer Creek mining operations are working westward under East Mountain into the Rhones Canyon area. I was informed that the water flow out of the Deer Creek mine on the Huntington Canyon side of East Mountain has dramatically increased the past year or two.

In a recent brief conversation with you (State Engineer Morgan) you indicated you were aware of the increased water flow being discharged from the Deer Creek Mine. You also indicated that a major fault line aquifer may have been severed by mining operations. You suggested that my concern and correspondence concerning this matter should also be addressed to Dr. Dianne Nielsen as well as the State Engineer's office in as much as this type water issue may directly involve mining plans and water replacement obligations administered by DOGM.

My interest in this matter only extends to the loss of irrigation water in Little Cottonwood Canyon. This water is administered under the State Engineer and managed by the Cottonwood Creek Irrigation Company, so they are certainly involved parties. All acreages and water allocations are verifiable by the Cottonwood Creek Irrigation Company, State Engineer Office records, and ASCS records in the Castle Dale office.

The solution I seek is a restoration of sufficient water to irrigate the approximately 22 acres that has been previously and continuously irrigated out of Little Cottonwood Creek. If the water has indeed been interrupted by a mining operation, then I must have replacement water brought out of the main Cottonwood River by a reconstructed higher-line ditch or pipeline or some other irrigation method.

It would seem to me that if Cottonwood drainage water has been interrupted and diverted via a mining operation to the Huntington drainage then some type of transfer or trade of water would be necessary. Those are matters for the two involved irrigation companies and the State Engineer to determine.

I specifically request Dr. Nielsen to examine the mining plans of the Cottonwood-Wilberg and the Deer Creek mines and determine if there is provision for replacement of mine-interrupted aquifers. If, indeed, the mining operations have severed and interrupted (and consequently diverted) water sources that have been historically reliable, then the mining operation should be directed to replace the water.

Will both of you, State Engineer Robert Morgan, and DOGM Director Dr. Dianne Nielsen, please investigate this matter so that recommendation for solution can be based upon reliable, scientific fact. I will mail copies of my letter to the Cottonwood Creek Irrigation Company and to the appropriate officers of UP&L/PacifiCorp as well as to your offices.

My ranch properties are being operated by my cousin, Paul Peacock, who resides in Orangeville. If on-site examination is desired I suggest Mr. Eugene Johansen, President of Cottonwood Creek Irrigation Company and Paul Peacock be included in any such tour.

We have essentially lost two crop years on the affected lands. There must be some resolve to this matter in the next few months so that another irrigation season will not be lost.

It is to be hoped a negotiated settlement, fair and equitable to all parties, can be reached. I would appreciate hearing from you outlining steps or actions needed to achieve a restoration or replacement of the "lost" irrigation water.

Sincerely,

Jim Peacock

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FAXED TO VAL PAYNE
8/7/91

FAXED TO BOB MORGAN
8/27/91