APPENDIX 7-52

SUPPLEMENTAL HYDROGEOLOGIC INFORMATION

FOR LBA 11

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Supplemental Hydrogeologic Information For LBA 11

Genwal Resources, Inc. Huntington, Utah

18 March 1997

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Mayo and Associates
Consultants in Hydrogeology

Supplemental Hydrogeologic Information For LBA 11

Genwal Resources, Inc. Huntington, Utah

18 March 1997

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Supplemental Hydrogeologic Information for LBA 11

INTRODUCTION

Genwal Resources, Inc. is currently in the process of acquiring baseline information for LBA 11, a coal lease tract offered by the U.S. Bureau of Land Management. Lease LBA 11 is located immediately south of and contiguous to Genwal's current mining lease area in Crandall Canyon (Figure 1). The U.S. Forest Service (USFS) is currently conducting an environmental assessment (EA) of coal mining in LBA 11. Genwal Resources, Inc. has the opportunity to provide information to the USFS for consideration in the EA. The purpose of this investigation is to provide additional technical analysis to assist the USFS in the preparation of the EA. The scope of our investigation is limited to four specific issues raised by the USFS. These issues are:

1. The potential effects of mining on Little Bear Spring.
2. The potential effects of mining on the recharge to the Rilda Canyon water collection system, particularly subsidence related effects.
3. Groundwater flow associated with the Joes Valley Fault.
4. The potential effects of mining on springs located above LBA 11.

The conclusions presented in this study are based on 1) a limited stable and unstable isotopic investigation of groundwater systems in the vicinity of the mine area carried out by Mayo and Associated as part of this study, 2) an analysis of existing chemical, flow-rate, and piezometric data collected by Genwal Resources, Inc over the past several years, 3) analysis of existing scientific reports dealing with the hydrogeology in the vicinity of the mine area, and 4) integration of the knowledge and experience Mayo and Associates has gained in many similar investigations carried out at other coal mines in the Wasatch Plateau.

BACKGROUND

A brief description of the physiography, geology and structure of the region in vicinity of the Crandall Canyon Mine is presented below. This is not intended as a complete description, but is included to provide background information for the discussion of the specific concerns dealt with in this report.

Location

The Genwal lease areas are located in the central Wasatch Plateau region of central Utah. The region is bounded on the west by Joes Valley and on the east by Huntington Canyon.

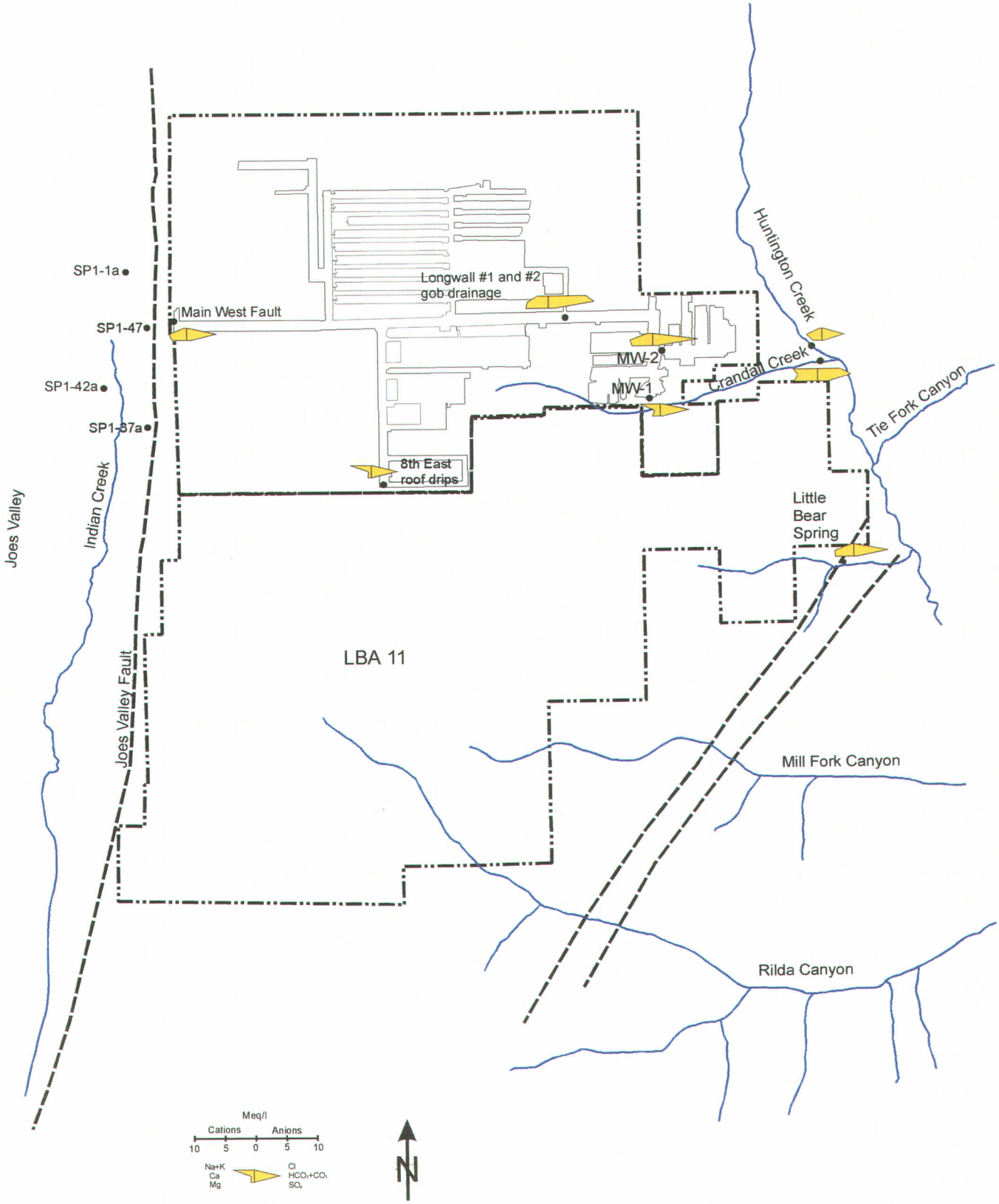

Figure 1 Location of the Genwal study area with Stiff diagrams representing solute compositions of groundwaters and surface waters.

Elevations in the study area range from approximately 7,000 feet in Huntington Canyon to over 10,700 feet on East Mountain. Most of the surface drainage in the lease areas is toward the east into Huntington Creek, which drains into the San Rafael River. A small area in the extreme western portion of the lease areas drains into Indian Creek in Joes Valley. Generally, the land surface in the lease areas is extremely steep and rugged, and is not easily accessable.

Stratigraphy

Seven bedrock formations, all Cretaceous or Tertiary in age, outcrop in the vicinity of the Genwal lease areas. These formations are briefly described below.

Flagstaff Limestone (Tertiary)

The Flagstaff Limestone is a freshwater limestone which typically forms a prominent cliff atop the Wasatch Plateau. It is only present in the uppermost elevations of East Mountain in LBA 11. A thickness of 105 feet was measured on Trail Mountain south of the lease areas (Davis and others, 1977).

North Horn Formation (Tertiary-Cretaceous)

The North Horn Formation is composed primarily of shale with thin interbeds of sandstone, limestone, and conglomerate, and typically forms slopes on the upper surfaces of the Wasatch Plateau. Lenticular sandstone channels exist throughout the formation. The lower two-thirds of the formation consists primarily of bentonitic mudstones. The thickness of the formation averages from 750 to 800 feet in the area.

Price River Formation (Cretaceous)

The Price River formation is made up of sandstone with interbedded shale and some conglomerate. It typically forms alternating ledges and slopes of resistant and non-resistant layers.

Castlegate Sandstone (Cretaceous)

The Castlegate Sandstone consists of coarse-grained fluvial sandstones with some siltstone, claystone, and conglomerate. It forms a prominent cliff above the underlying Blackhawk Formation.

Blackhawk Formation (Cretaceous)

The Blackhawk Formation consists of interbedded sandstones, mudstones, and shales and contains the mineable coal deposits in the Wasatch Plateau. The coal mined at the Crandall Canyon Mine, and the coal to be mined in LBA 11, is from the Hiawatha seam of the Blackhawk Formation. The Hiawatha seam is separated from the underlying Star Point Sandstone by a thin layer (~0-15' thick) of shaley lagoonal deposits. Individual rock layers in the Blackhawk Formation are lenticular and discontinuous with abundant shaley interbeds. Sandstone paleochannels are present in the formation, particularly in its upper portion. The thickness in the area ranges from 625 to 800 feet.

Star Point Sandstone (Cretaceous)
The Star Point Sandstone forms a prominent cliff beneath the Blackhawk Formation and consists of three main massive sandstone layers with interbedded siltstone, shale, and sandstone. The three sandstone members are (from top to bottom) the Spring Canyon, the Storrs, and the Panther members. The sandstone members intertongue with the underlying Masuk member of the Mancos Shale.

Masuk Member of the Mancos Shale
The Masuk Member of the Mancos Shale consists of calcareous, gypsiferous and carbonaceous marine shale. It is approximately 1,300 feet thick.

Structure
The western edge of the Genwal lease areas is constrained by the north-south trending Joes Valley Fault system. Two parallel faults have been mapped by Genwal which trend northeast-southwest and lie immediately to the southeast of LBA 11. No other major faults are known to exist in the lease areas. Northwest-southeast trending faults with displacements on the order of 10 feet have been identified adjacent to Little Bear Spring.

PRESENTATION OF DATA

Methods of Study

On February 3, 1997, Mayo and Associates collected samples for stable and unstable isotopic compositions from one in-mine Blackhawk Formation roof-drip, two wells completed in the Star Point Sandstone beneath the mine workings, one location on the Joes Valley Fault system within the mine, and two samples from Huntington and Crandall Creeks. A single sample of in-mine process water (a mixture of water from natural in-mine drainage and Crandall Creek water pumped from the surface) was collected from an in-mine sump. The information from this sample is not useful for the purposes of this investigation. Additionally, Little Bear Spring was sampled in October 1995 and September 1996 by the Castle Valley Special Services District. The solute and isotopic compositions of these samples are listed in Table 1. Sample locations are plotted on Figure 1. The solute compositions of these waters are presented graphically as Stiff (1951) diagrams on Figure 1.

Isotopic samples for δ^2H, $\delta^{18}O$, and ^3H analyses were collected and preserved in appropriate sealed glass or HDPE plastic bottles. Isotopic samples for $\delta^{13}C$, $\delta^{34}S$, and ^{14}C were precipitated with $BaCl_2 \cdot 2H_2O$.

Stable isotopic analyses for δ^2H, $\delta^{18}O$, $\delta^{13}C$, and $\delta^{34}S$ compositions and unstable ^{14}C contents were performed by Geochron Laboratories, Cambridge, Massachusetts. ^3H analyses were performed by the Tritium Laboratory, University of Miami, Florida using electrolytic enrichment and low level counting methods.

Table 1 Solute and isotopic composition of surface waters and groundwaters in the vicinity of the Crandall Canyon Mine.

genchem.xls 11 March 1997

	T	pH	Cond.	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	HCO_3^-	CO_3^-	Cl^-	SO_4^{2-}	δ^2H	$\delta^{18}O$	$\delta^{13}C$	^{14}C	^3H
	°C		umhos/cm	mg/L								‰			pmc	TU
Springs and Creeks																
Little Bear Spring	8.9	7.6	556	62	37	7	1	341	0	7	29	-124	-16.8	-9.7[1]	71.12[1]	22.00[1]
Crandall Creek	2.5	8.6	1120	66	47	89	5	326	0	130	85	-126	-17.2	-7.2	62.74	9.3
Huntington Creek	0.6	8.7	387	51	17	5	0	225	0	8	15	-123	-16.8	-10.2	73.22	11.5
Blackhawk Formation																
8th East roof drips	11.9	8.4	407	10	7	77	3	264	0	5	0	-134	-18.2	-8.4	8.41	0.02
Main West fault	9.3	7.95	507	57	28	5	7	304	0	5	32	-130	-17.7	-10.7	40.07	0.06
Star Point Sandstone																
MW-1	12.7	7.95	500	19	16	73	4	293	0	12	18	-134	-18.2	---	---	---
MW-2	10.9	7.3	731	74	41	14	5	456	0	5	39	-133	-18.2	-11.2	5.79	0.03

[1] Samples collected Oct. 95 and Sept. 96 by Castle Valley Special Services District

Groundwater mineral saturation indices were calculated using the computer program WATEQF (Plummer and others, 1976).

Tritium (^3H) and Carbon-14 (^{14}C)

In this investigation, two unstable isotopes, tritium (^3H) and carbon-14 (^{14}C) have been used to evaluate mean residence times. Using methods described by Pearson (1970), Mook (1980), and Fontes (1979), mean groundwater residence times were calculated for the six samples which were analyzed for ^{14}C (Table 2). The concept of groundwater age is difficult to define because water arriving at a well or spring seldom travels via pure piston flow. Instead, it is commonly a mixture of water molecules which recharged at different locations and at different times, thus water typically has no unique age. It is, therefore, best to think of groundwater age as the *mean residence time* of the individual water molecules sampled at the well, spring, or stream.

Tritium is a qualitative tool indicating if groundwater has a component of water which recharged since about 1954. Groundwater which recharged prior to about 1954 will contain essentially no tritium. Carbon-14 provides information regarding the number of years which have elapsed since the groundwater became isolated from soil zone gasses and near-surface waters.

δ^2H and $\delta^{18}O$

The δ^2H and $\delta^{18}O$ composition of a water molecule falling as precipitation is determined by the temperature at which nucleation of the water droplet occurs. Precipitation which occurs under cold conditions will plot more negative than precipitation which occurs under warmer conditions. The δ^2H and $\delta^{18}O$ composition of a non-thermal groundwater is determined at the time of recharge and is not subject to change during its residence in the groundwater system. The δ^2H and $\delta^{18}O$ composition of both in-mine groundwaters and groundwaters from springs and creeks in the vicinity of the lease area are plotted on Figure 2. All groundwaters in the study area plot near the meteoric water line (MWL) suggesting a meteoric recharge origin (i.e. rain and snow). It is apparent that groundwaters from the Blackhawk Formation and Star Point Sandstone plot more negatively than do waters from Huntington Creek and Little Bear Spring. This is may be indicative of cooler paleoclimatic conditions at the time of recharge of the older groundwaters. Crandall Creek, which contains about 25% mine discharge water (Personal communication; Gary Gray, 1997), plots slightly lower than do the other surface waters because of the influence of the Blackhawk Formation component of water from the mine.

DISCUSSION

Each of the four primary areas of concern in this investigation are discussed below.

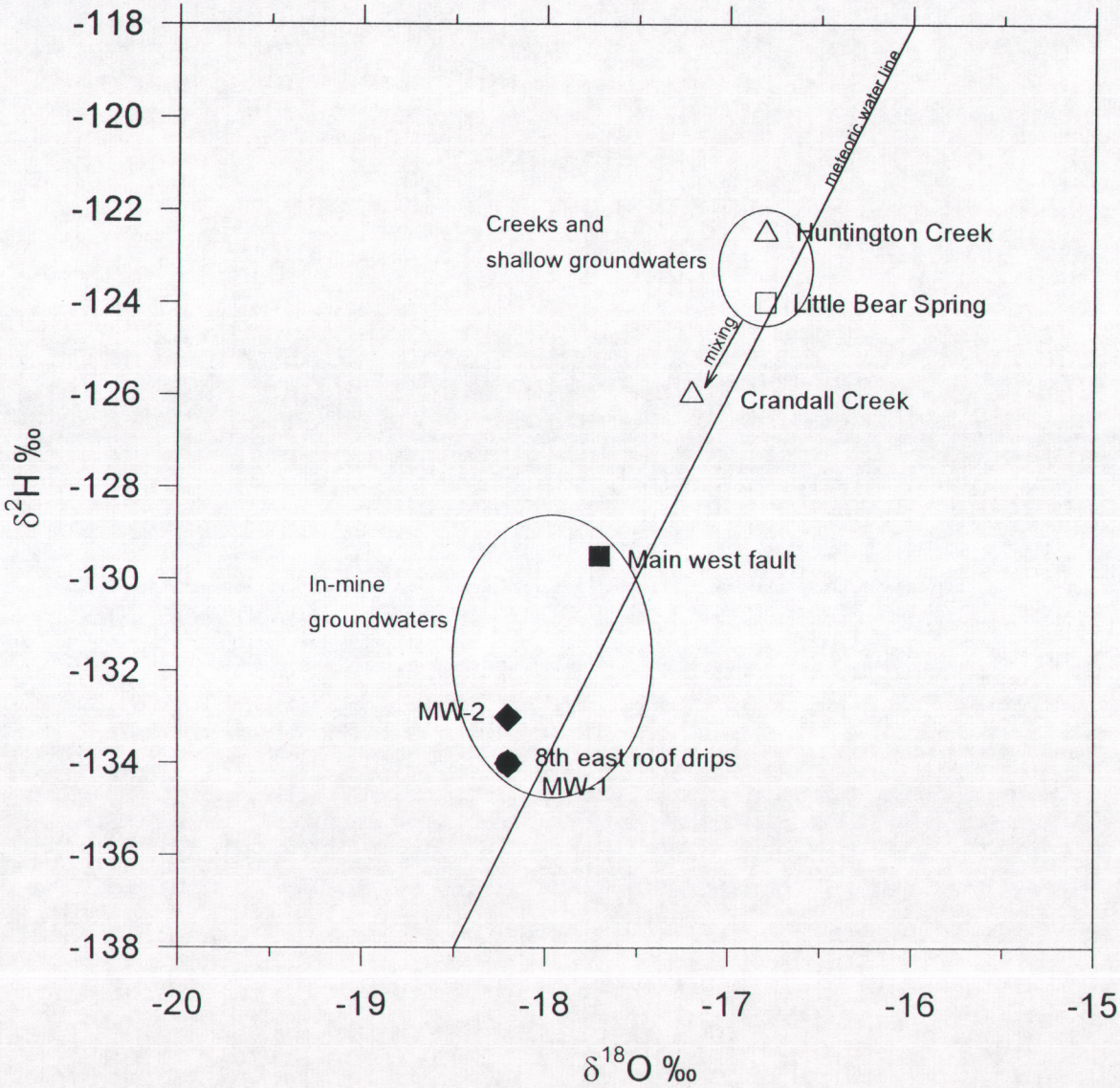

Figure 2 Deuterium and oxygen-18 plot of groundwaters and surface waters in the vicinity of the Crandall Canyon Mine.

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Table 2 Calculated ^{14}C - ^{3}H mean groundwater residence times for the Genwal Mine area.

genage.xls 11 Mar 1997

	Mean residence time (years)								
	$\delta^{13}C$ = -20‰ (gas) assumption			$\delta^{13}C$ = -18‰ (gas) assumption					
	Pearson Model	Mooks Model	Fontes Model	Pearson Model	Mooks Model	Fontes Model	^{14}C pmc	$\delta^{13}C$ ‰	^{3}H TU
Creeks and springs									
Little Bear Spring	modern	modern	modern	modern	modern	modern	71.12	-9.7	22.00
Huntington Creek	modern	modern	modern	modern	modern	modern	73.22	-10.2	11.50
Crandall Creek	modern	modern	modern	modern	modern	modern	62.74	-7.2	9.30
Spring SP1-1a	---	---	---	---	---	---	---	---	29.20
Spring SP1-47	---	---	---	---	---	---	---	---	38.20
Spring SP1-37	---	---	---	---	---	---	---	---	33.30
Spring SP1-42a	---	---	---	---	---	---	---	---	19.20
Blackhawk Formation									
8th East roof drips	13,300	14,800	14,800	14,200	14,800	14,800	8.41	-8.4	0.02
Main West fault	2,400	2,100	2,100	3,600	2,100	2,100	40.07	-10.7	0.06
Starpoint Sandstone									
MW-2	18,800	18,800	18,800	19,600	18,800	18,800	5.79	-11.2	0.03

Assumptions used in all calculations:

$\delta^{13}C$ mineral = 0‰

Activity ^{14}C gas = 100 pmc

Activity ^{14}C mineral = 0 pmc

Potential Effects of Mining on Little Bear Spring

A determination of the precise recharge locations and mechanisms for Little Bear Spring is beyond the scope of this investigation. However, based on stable and unstable isotopic information, stream and spring hydrographs, and geologic information, several important conclusions regarding the relationship between groundwaters encountered in the mine and groundwaters issuing from Little Bear Spring can be drawn:

1) The groundwater discharging from Little Bear Spring is modern (i.e. it has recharged in the last 50 years). The spring water, sampled during low-flow (base-flow) conditions, contains abundant tritium (22.0 TU) and anthropogenic ^{14}C (71.1 pmc). The fact that the base-flow component of the spring is modern water greatly diminishes the likelihood that there is any significant component of old water discharging from the spring. By contrast, the groundwater systems encountered in the mine (i.e. Blackhawk Formation roof drips, Star Point Sandstone wells beneath the mine, and Joes Valley Fault water) discharge water which is thousands of years old. Each of the in-mine samples contain no tritium (Table 2) which suggests that there is no component of modern water.

2) The stable isotopic δ^2H and $\delta^{18}O$ composition of base-flow discharge from Little Bear Spring is very similar to surface water discharging in Huntington Creek, and similar to flow from Crandall Creek (Figure 2). As discussed previously, Crandall Creek contains approximately 25% mine discharge water, which shifts its plotting position in Figure 2 downward relative to the other modern surface waters. The stable isotopic compositions of each of the four in-mine samples plot significantly more negative than do the above ground samples in Figure 2, clearly distinguishing them from the modern, near-surface waters. It is likely that the lower plotting positions of the older, in-mine groundwaters are the result of recharge under cooler, paleoclimatic conditions.

3) There is significant data to suggest that the recharge for Little Bear Spring is closely tied to shallow, seasonal groundwater systems. The discharge hydrograph of Little Bear Spring shows large annual discharge fluctuations and the hydrograph shows response to climatic variability. There is also correlation between stream-flows in Huntington Creek and discharge in the spring.

It is likely that the recharge to Little Bear Spring is closely tied to stream flow in Huntington and/or Crandall Creeks. Groundwater recharge may enter the Star Point Sandstone at nearby up-gradient locations where the creeks flow across exposed, fractured outcrops. However, there is presently insufficient data to completely substantiate this idea. In contrast, seasonal variations in groundwater inflow rates into the mine workings (away from cliff faces and shallow cover) are not observed in the Crandall Canyon Mine (Personal communication, Gary Gray, 1997), nor are they observed in other coal mines in the Wasatch Plateau. This suggests that the groundwater systems encountered within the mine workings are not in hydraulic communication with the groundwater system from which Little Bear Spring discharges.

4) The isolated, perched groundwater systems encountered in the Crandall Canyon Mine workings are hydraulically isolated from the lower sandstones of the Star Point Sandstone from which Little Bear Spring discharges. Many layers of interbedded shale, claystone, and mudstone separate these two systems. Groundwater in the Blackhawk Formation above the mine occurs in isolated sandstone horizons within the mine and is not in hydraulic communication with the underlying groundwaters.

Potential Effects of Mining on the Recharge to the Rilda Canyon Collection System, Particularly Subsidence Related Effects

The Rilda Canyon collection system is operated by the North Emery County Water Users Association and the Castle Valley Special Services District for the purpose of collecting shallow alluvial groundwaters in Rilda Canyon for use as cullinary water. The collection system is not located within the Genwal lease areas, although the uppermost reaches of the Rilda Canyon drainage are within LBA 11. The North Horn Formation is continuously exposed at the surface over the entire reach of Rilda Canyon Creek in LBA 11.

The U.S. Bureau of Mines (Kadnuck, 1994) conducted research at the Deer Creek and Cottonwood Mines located immediately south of LBA 11 and found little or no detrimental effect on North Horn Formation springs which were undermined using longwall mining techniques. The work of the USBM in the central Wasatch Plateau was in agreement with a study by Tieman and Rauch (1986) in Appalachian coal fields which found that springs occurring above longwall panels where the ratio of overburden to panel width was greater than 1 were not adversely impacted by mining operations. The overburden-to-panel width ratio in LBA 11 beneath the Rilda Canyon drainage ranges from 1.8 to 2.8 and, thus, no adverse effects on the shallow groundwater systems or ephemeral drainage are anticipated there.

A relationship was developed by Peng (1992) in Appalachian coal fields which estimates the maximum vertical propagation of fracturing and caving of the overburden above longwall mining to be 30 times the mining thickness. Using this relationship, a maxium vertical fracture propagation of less than 200 feet is calculated beneath the Rilda Canyon drainage in LBA 11. The minimum projected overburden thickness beneath Rilda Canyon in LBA 11 is approximately 1,500 feet, which indicates that there will be a thick sequence of unfractured, low permeability rock between the shallow alluvial deposits of upper Rilda Canyon and the uppermost subsidence fractures. If any subsidence related fractures were to somehow propagate to the surface, the abundant hydrophylic clays present in the underlying Price River and North Horn Formations would swell when wetted and rapidly seal the fractures, impeding the downward migration of groundwaters (Kadnuck 1994; EarthFax Engineering, 1992).

The low permeability shale of the North Horn Formation upon which the Rilda Canyon drainage is developed serves as an effective barrier to the downward migration of

groundwaters into underlying formations. The shales also have a tendency to deform plastically rather than fracture when stresses are applied.

A determination of the specific recharge locations and mechanisms for the alluvial groundwater systems associated with the Rilda Canyon collection system is beyond the scope of this investigation. However, it is our opinion that if a potential recharge location was determined to be within LBA 11, the likelihood of any adverse impacts to the shallow groundwater systems in upper Rilda Canyon due to underground mining operations would be negligible.

Nature of the Groundwater Flow Associated with the Joes Valley Fault

Sufficient data is not presently available to completely characterize of the nature of groundwater flow related to the Joes Valley Fault system in the vicinity of Genwal's lease areas. However, based on solute and isotopic data obtained as part of this investigation and available information from investigations carried out by other researchers, several important conclusions may be drawn.

A single sample of groundwater from the Joes Valley Fault system was collected within the Crandall Canyon Mine at the west end of the west mains where the mine workings have intersected the fault system. Groundwater along the fault at this location is physically upwelling through the fractured coal in the floor of the mine workings. Groundwater slowly seeps through the floor along the entire exposed reach of the fault in the mine. The upwelling water does not appear to be under great confining pressure.

A mean ^{14}C "age" of 2,100 years was calculated for the fault system groundwater encountered in the mine (Table 2). No tritium was detected in the sample, indicating that there is no component of modern (post 1954) water associated with the water in the fault. The stable δ^2H and $\delta^{18}O$ composition of groundwater from the fault system has an affinity for other groundwaters encountered in the Blackhawk Formation and in wells in the Star Point Sandstone beneath the mine (Figure 2). The isotopic composition is dissimilar to waters encountered at the surface (i.e. Little Bear Spring, Huntington and Crandall Creeks).

EarthFax Engineering (1992) conducted a tritium and geochemical analysis of groundwaters discharging from springs near the Joes Valley Fault system and from the western slope of East Mountain. The purpose of the investigation was to determine whether there was a detectable component of discharge from Joes Valley Fault contributing water to the springs at the surface. The results of the tritium analysis (Table 2) strongly suggest that the water is of modern origin. Tritium concentrations of the four samples ranged from19.2 to 38.2 TU (Table 2). Carbon-14 data is not available for these samples. It is unlikely that the Joes Valley Fault system is contributing any significant flow to these springs. A low-flow sampling of these springs would help confirm this idea.

In August 1996, Mayo and Associates conducted stream gaging on Indian Creek between the Indian Creek Campground and the confluence with Lowry Water as part of an investigation for Energy West Mining. We found no significant measurable increases in flow over this reach of the creek, suggesting that the Joes Valley Fault system is not contributing any measureable groundwater to the creek flow in this location. Similar findings were reported by Lines (1985).

An in-mine drilling program is currently being conducted by Genwal to better define the residence times and hydraulic characteristics of groundwaters in the Star Point Sandstone below the mine in the vicinity of the Joes Valley Fault system. Stable and unstable isotopic sampling of groundwater in the Spring Canyon tongue of the Star Point Sandstone will be performed as part of the program.

In summary, we can conclude that 1) the groundwater in the Joes Valley Fault system within the Crandall Canyon Mine is thousands of years old, with no component of modern water, 2) the fault system groundwater has a stable isotopic affinity for other groundwaters encountered within the mine, suggesting that the recharge source for the fault waters is different from the recharge source for modern, shallow groundwaters and surface waters, 3) no expression of groundwater discharge from the fault system into springs and creeks at the surface in the vicinity of the Genwal lease area was identified, suggesting that groundwater discharge at the surface is either minimal or non-existent, and 4) groundwaters are upwelling from beneath the mine along the fault system, and do not appear to be under great confining pressure.

Potential Effects of Mining on Springs Located Above LBA 11

A complete determination of the probable hydrologic consequences of mining on springs located within LBA 11 is beyond the scope of this investigation. No chemical or isotopic sampling of the springs in LBA 11 was performed due to the timing of this project and the inaccessibility of the springs due to heavy winter snows. However, some general statements can be made based on our experiences at other coal mines in the Wasatch Plateau.

Our experience at other mines in the area leads us to believe that the groundwater systems occurring in the Flagstaff Limestone, North Horn Formation, Price River Formation, and Castlegate Sandstones occur primarily as perched systems and are not part of "regional aquifers" in the traditional sense. These groundwater systems, almost without exception, discharge "modern" groundwaters which have recharged since about 1954. These groundwaters typically show strong and rapid response to both seasonal changes in precipitation as well as longer term climatic cycles (i.e. periods of above normal precipitation and periods of drought).

As we have demonstrated in previous sections of this report, all of the groundwaters encountered in the mine (Blackhawk Formation roof drips, Star Point Sandstone wells, and

Joes Valley Fault system waters) are thousands of years old and contain no tritium, suggesting that there is not a mixed component of modern water associated with the in-mine groundwaters. The groundwaters encountered in the roof of the mine during mining operations are not part of a regional aquifer, but typically occur as isolated pockets of water in permeable sandstone units, usually within sandstone paleochannels. Typically, much of the sandstone above the mine roof is unsaturated when it is encountered during mining.

As has been the case at other mines in the Wasatch Plateau, the groundwater systems in the formations overlying the horizon to be mined are likely not in communication with the deeper in-mine groundwaters. Hundreds of feet of interbedded sandstone, mudstone, and shale separate these systems and prevent the downward migration of groundwater from the shallow, near-surface groundwater systems.

As was demonstrated in a previous section, detrimental effects on overlying springs and creeks due to subsidence from longwall mining techniques are not anticipated.

SUMMARY

Based on existing hydrologic information, and the new information collected as part of this investigation, we conclude that there is a strong likelihood that mining will not have significant detrimental impacts on shallow groundwater systems in the vicinity of LBA 11.

Little Bear Spring discharges modern water and responds to seasonal changes in precipitation. There appears to be correlation between flow in Little Bear Spring and stage fluctuations in Huntington Creek. The waters discharging from Little Bear Spring are isotopically different from groundwaters encountered in the mine and from groundwaters in the Star Point Sandstone beneath the mine. Discharge from Little Bear Spring does not appear to be related to groundwater flow systems encountered in the mine.

The shallow groundwater systems which support the Rilda Canyon water collection system are hydraulically isolated from deeper, underlying groundwater systems by a thick sequence of interbedded siltstones, mudstones, shales, and hydrophyllic clays. Subsidence fractures which might effect spring or creek discharges in the Rilda Canyon area are not predicted.

Groundwater encountered in the Joes Valley Fault within the Crandall Canyon Mine is approximately 2,100 years old, with no component of modern (post 1954) water. No surface expression of fault water discharging in Joes Valley was identified.

The groundwaters encountered in the Crandall Canyon Mine are thousands of years old and are not in hydraulic communication with adjacent shallow groundwater systems. Our experience at other mines in the Wasatch Plateau leads us to believe that groundwaters which discharge from springs directly overlying LBA 11 are likely hydraulically isolated from groundwater systems encountered within the mine.

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APPENDICES

Chemical and Isotopic Laboratory Reporting Sheets

GEOCHRON LABORATORIES a division of
KRUEGER ENTERPRISES, INC.

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TELEPHONE: (617) 876-3691 TELEFAX: (617) 661-0148

STABLE ISOTOPE RATIO ANALYSES

REPORT OF ANALYTICAL WORK

Submitted by: Erik C. Petersen
Mayo and Associates
710 East 100 North
Lindon, UT 84042

Date Received: 02/05/97
Date Reported: 02/20/97
Your Reference: Letter of Feb. 4, 1997 Genwal

Our Lab. Number	Your Sample Number	Description	δD*	$\delta^{18}O$*
HOR-92254	MW-2	Water	-133	-18.2
HOR-92255	#1 and 2 longwall gob water	Water	-129	-17.6
HOR-92256	Main West Fault	Water	-130 -129 **	-17.7
HOR-92257	8th East roof drips	Water	-134	-18.2
HOR-92258	Huntington Creek above C.K.	Water	-122 -123 **	-16.8 -16.8 **
HOR-92259	MW-1	Water	-134	-18.2
HOR-92260	Crandall Creek	Water	-126	-17.2
HOR-92261	Little Bear Spring	Water	-124	-16.8

** Duplicate preparations and analyses.

*Unless otherwise noted, analyses are reported in ‰ notation and are computed as follows:

$$\delta R_{sample}‰ = \left[\frac{R_{sample}}{R_{standard}} - 1 \right] \times 1000$$

Where:

D/H standard is SMOW
$^{18}O/^{16}O$ standard is SMOW

And:

$D/H_{standard}$ = 0.000316**
$^{18}O/^{16}O_{standard}$ = 0.0039948**

**Double atom ratio

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TELEPHONE: (617) 876-3691 TELEFAX: (617) 661-0148

RADIOCARBON AGE DETERMINATION

REPORT OF ANALYTICAL WORK

Our Sample No. GX-22800-PRI

Date Received: 02/05/97

Your Reference: letter of 02/04/97

Date Reported: 02/11/97

Submitted by: Mr. Erik C. Petersen
Mayo & Associates
710 East 100 North
Lindon, Utah 84042

Sample Name: MW-2
groundwater precipitate

AGE = 22,890 +/- 1,270 C-14 years BP (C-13 corrected).
(5.79 +/- 0.91) % of the modern (1950) C-14 activity.

Description: Sample of groundwater precipitate.

Pretreatment: The barium salt precipitate was rapidly vacuum filtered and immediately hydrolyzed, under vacuum to recover carbon dioxide from the barium carbonates for the analysis. C-13 analysis was made on a small portion of the same evolved gas.

Comment:

$\delta^{13}C_{PDB}$ = -11.2 ‰

Y = .89795

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error stated is $\pm 1\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. GX-22802-PRI — Date Received: 02/05/97

Your Reference: letter of 02/04/97 — Date Reported: 02/11/97

Submitted by: Mr. Erik C. Petersen
Mayo & Associates
710 East 100 North
Lindon, Utah 84042

Sample Name: Main West Fault
groundwater precipitate

AGE = 7,350 +/- 310 C-14 years BP (C-13 corrected).
(40.07 +/- 1.54) % of the modern (1950) C-14 activity.

Description: Sample of groundwater precipitate.

Pretreatment: The barium salt precipitate was rapidly vacuum filtered and immediately hydrolyzed, under vacuum to recover carbon dioxide from the barium carbonates for the analysis. C-13 analysis was made on a small portion of the same evolved gas.

Comment: Very small sample; approximately 0.6 grams carbon.

$\delta^{13}C_{PDB}$ = -10.7 ‰

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error stated is $\pm 1\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid. The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION

REPORT OF ANALYTICAL WORK

Our Sample No. GX-22801-PRI

Date Received: 02/05/97

Your Reference: letter of 02/04/97

Date Reported: 02/11/97

Submitted by: Mr. Erik C. Petersen
Mayo & Associates
710 East 100 North
Lindon, Utah 84042

Sample Name: #1 and #2 longwall gob water
groundwater precipitate

AGE = 15,700 +/- 510 C-14 years BP (C-13 corrected).
(14.17 +/- 0.91) % of the modern (1950) C-14 activity.

Description: Sample of groundwater precipitate.

Pretreatment: The barium salt precipitate was rapidly vacuum filtered and immediately hydrolyzed, under vacuum to recover carbon dioxide from the barium carbonates for the analysis. C-13 analysis was made on a small portion of the same evolved gas.

Comment:

$\delta^{13}C_{PDB}$ = - 7.7 ‰

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error stated is $\pm 1\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. GX-22803-PRI — Date Received: 02/05/97

Your Reference: letter of 02/04/97 — Date Reported: 02/11/97

Submitted by: Mr. Erik C. Petersen
Mayo & Associates
710 East 100 North
Lindon, Utah 84042

Sample Name: 8th East roof drips
groundwater precipitate

AGE = 19,890 +/- 1,140 C-14 years BP (C-13 corrected).
(8.41 +/- 1.19) % of the modern (1950) C-14 activity.

Description: Sample of groundwater precipitate.

Pretreatment: The barium salt precipitate was rapidly vacuum filtered and immediately hydrolyzed, under vacuum to recover carbon dioxide from the barium carbonates for the analysis. C-13 analysis was made on a small portion of the same evolved gas.

Comment:

$\delta^{13}C_{PDB}$ = - 8.4 ‰

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error stated is $\pm 1\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION

REPORT OF ANALYTICAL WORK

Our Sample No. GX-22804-PRI

Date Received: 02/05/97

Your Reference: letter of 02/04/97

Date Reported: 02/11/97

Submitted by: Mr. Erik C. Petersen
Mayo & Associates
710 East 100 North
Lindon, Utah 84042

Sample Name: Huntington Creek above C.K.
groundwater precipitate

AGE = 2,505 +/- 170 C-14 years BP (C-13 corrected).
(73.22 +/- 1.56) % of the modern (1950) C-14 activity.

Description: Sample of groundwater precipitate.

Pretreatment: The barium salt precipitate was rapidly vacuum filtered and immediately hydrolyzed, under vacuum to recover carbon dioxide from the barium carbonates for the analysis. C-13 analysis was made on a small portion of the same evolved gas.

Comment: Small sample; approximately 0.60 grams carbon.

$\delta^{13}C_{PDB} = -10.2$ ‰

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error stated is $\pm 1\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

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RADIOCARBON AGE DETERMINATION — REPORT OF ANALYTICAL WORK

Our Sample No. GX-22904 — Date Received: 02/25/97

Your Reference: letter of 02/24/97 — Date Reported: 03/07/97

Submitted by: Mr. Erik C. Petersen
Mayo & Associates
710 East 100 North
Lindon, Utah 84042

Sample Name: Crandall Creek, 21 Feb 97
groundwater precipitate

AGE = 3,745 +/- 155 C-14 years BP (C-13 corrected).
(62.74 +/- 1.22) % of the modern (1950) C-14 activity.

Description: Sample of groundwater precipitate.

Pretreatment: The barium salt precipitate was rapidly vacuum filtered and immediately hydrolyzed, under vacuum to recover carbon dioxide from the barium carbonates for the analysis. C-13 analysis was made on a small portion of the same evolved gas.

Comment:

$\delta^{13}C_{PDB}$ = - 7.2 ‰

Notes: This date is based upon the Libby half life (5570 years) for ^{14}C. The error stated is $\pm 1\sigma$ as judged by the analytical data alone. Our modern standard is 95% of the activity of N.B.S. Oxalic Acid.

The age is referenced to the year A.D. 1950.

Client: MAYO and ASSOCIATES - GENWAL SAMPLES Purchase Order: 97-101
Recvd : 97/02/06 Contact: E. Petersen, K. Payne, 801/796-0211
Job# : 927 710 East 100 North (F)/785-2387
Final : Preliminary Results Lindon, Utah 84042

Cust	LABEL INFO	JOB.SX	REFDATE	QUANT	ELYS	TU	eTU
MAYO-	MW-2	927.01	970203	1000	275	0.03	0.09
MAYO-	1, 2 LONGWALL GOB WATER	927.02	970203	1000	275	4.68	0.15
MAYO-	MAIN WEST FAULT	927.03	970203	1000	275	0.06	0.09
MAYO-	8TH EAST ROOF DRIPS	927.04	970203	1000	276	0.02	0.09
MAYO-	HUNTINGTON CRK	927.05	970203	1000	274	11.5	0.4

Client: EARTHFAX ENGINEERING
Recvd : 92/06/17
Job# : 409
Final : 92/07/08

Purchase Order: CHECK
Contact: Brent Bovee 801/561-1555
7324 SOUTH 1300 EAST STE 100
MIDVALE UT 84047

Cust LABEL INFO	JOB.SX	REFDATE	QUANT	ELYS	TU	eTU
EARTHFAX- 1	409.01	920611	1000	161	29.2	1.0
EARTHFAX- 2	409.02	920611	1000	157	38.2	1.3
EARTHFAX- 3	409.03	920611	1000	275	33.3	1.1
EARTHFAX- 4	409.04	920611	1000	273	19.2	0.6

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SINCE 1908
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PLEASE ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1020, HUNTINGTON, UT 84528
TEL: (801) 653-2311
FAX: (801) 653-2436

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Huntington Creek

Rec'd 1115 hr.
Sampled 1635 hr.

Field Measurements
pH 8.7
DO 11.2
Conductivity 387
Temperature 0.6°C

NOTE: Dissolved Iron filtered at lab!

Kind of sample reported to us Water

Sample taken at Genwal

Sample taken by Genwal

Date sampled February 3, 1997

Date received February 4, 1997

Analysis report no. 59-16965

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	225	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	184	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	4.2	----	meq/l	---------	02-25-1997 1100 RJ
Calcium, Total	51	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	4.2	----	meq/l	---------	02-25-1997 1100 RJ
Chloride	8	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	380	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	197	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1100 RJ
Iron, Total	0.3	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	17	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	8.35	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	<1	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	5	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	189	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	11	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	15	5	mg/l	EPA 375.4	02-24-1997 1230 SW
Cation/Anion Balance	-0.8	----	%		02-25-1997 1100 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

COMMERCIAL TESTING & ENGINEERING CO.
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TEL: (801) 653-2511
FAX: (801) 653-2436

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Huntington Creek

Kind of sample reported to us: Water

Rec'd 1115 hr.
Sampled 1635 hr.

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Field Measurements
pH 8.7
DO 11.2
Conductivity 387
Temperature 0.6°C

NOTE: Dissolved Iron filtered at lab!

Analysis report no. 59-16965

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	225	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	184	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	4.2	----	meq/l	---------	02-25-1997 1100 RJ
Calcium, Total	51	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	4.2	----	meq/l	---------	02-25-1997 1100 RJ
Chloride	8	1	mg/l	SM4500-Cl B	02-10-1997 1030 SW
Conductivity	380	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	197	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1100 RJ
Iron, Total	0.3	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	17	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	8.35	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	<1	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	5	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	189	10	mg/l	EPA 160.1	02-06-1997 0700 JG
Solids, Total Suspended	11	5	mg/l	EPA 160.2	02-06-1997 0700 JG
Sulfate	15	5	mg/l	EPA 375.4	02-24-1997 1230 SW
Cation/Anion Balance	-0.8	----	%		02-25-1997 1100 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory

COMMERCIAL TESTING & ENGINEERING CO.
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TEL: (801) [illegible]
FAX: (801) [illegible]

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Main West Fault

Rec'd 1115 hr.
Sampled 1325 hr.

Field Measurements

pH	7.95
DO	8.7
Conductivity	507
Temperature	9.3°C

Kind of sample reported to us	Water
Sample taken at	Genwal
Sample taken by	Genwal
Date sampled	February 3, 1997
Date received	February 4, 1997

Analysis report no. 59-16961

Parameter	Result	MRL	Units	Method	Analysed Date/Time/Analyst
Potassium, Total	7	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Potassium, Dissolved	xxxx	1	mg/l	EPA 258.1	- -
Selenium, Total	xxxx	0.01	mg/l	EPA 270.2	- -
Selenium, Dissolved	xxxx	0.01	mg/l	EPA 270.2	- -
Silica	xxxx	1	mg/l	SM4500-Si B	- -
Sodium, Total	5	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Sodium, Dissolved	xxxx	1	mg/l	EPA 273.1	- -
Solids, Settleable	xxxx	0.5	ml/l	EPA 160.5	- -
Solids, Total Dissolved	252	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	6385	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	32	1	mg/l	EPA 375.4	02-24-1997 1230 SW
Sulfide	xxxx	0.1	mg/l	EPA 376.1	-
Turbidity	xxxx	0.1	NTU	EPA 180.1	- -
Zinc, Total	xxxx	0.01	mg/l	EPA 289.1	- -
Zinc, Dissolved	xxxx	0.01	mg/l	EPA 289.1	- -
Cation/Anion Balance	xxxx	----	%		

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

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FAX: (801) 653-2436

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: MW-1

Kind of sample reported to us Water

Rec'd 1115 hr.
Sampled 1610 hr.

Sample taken at Genwal

Sample taken by Genwal

Field Measurements
pH 7.95
DO 7.8
Conductivity 500
Temperature 12.7°C

Date sampled February 3, 1997

Date received February 4, 1997

NOTE:Dissolved Iron filtered at lab!

Analysis report no. 59-16966

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	293	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	240	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	5.5	----	meq/l	---------	02-25-1997 1100 RJ
Calcium, Total	19	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	5.5	----	meq/l	---------	02-25-1997 1100 RJ
Chloride	12	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	517	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	113	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1100 RJ
Iron, Total	0.8	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	16	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	7.96	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	4	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	73	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	244	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	18	5	mg/l	EPA 375.4	02-24-1997 1230 SW
Cation/Anion Balance	0.2	----	%		02-25-1997 1100 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Grant

COMMERCIAL TESTING & ENGINEERING CO.
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TEL: (801) 653-6311
FAX: (801) 653-8436

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Main West Fault

Kind of sample reported to us: Water

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Rec'd 1115 hr.
Sampled 1325 hr.

Field Measurements

pH	7.95
DO	8.7
Conductivity	507
Temperature	9.3°C

Ca^{2+} & Mg^{2+} will be retested

Analysis report no. 59-16961

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Acidity	xxxx	10	mg/l as $CaCO_3$	D1067-92	- -
Alkalinity, Bicarbonate	304	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	249	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Aluminum, Total	xxxx	1	mg/l	EPA 202.1	- -
Aluminum, Dissolved	xxxx	1	mg/l	EPA 202.1	-
Anions	xxxx	----	meq/l	----------	- -
Arsenic, Total	xxxx	0.01	mg/l	EPA 206.2	- -
Arsenic, Dissolved	xxxx	0.01	mg/l	EPA 206.2	-
Barium, Total	xxxx	1	mg/l	EPA 208.1	- -
Barium, Dissolved	xxxx	1	mg/l	EPA 208.1	-
Boron, Total	xxxx	0.1	mg/l	EPA 212.3	- -
Boron, Dissolved	xxxx	0.1	mg/l	EPA 212.3	- -
Cadmium, Total	xxxx	0.01	mg/l	EPA 213.1	- -
Cadmium, Dissolved	xxxx	0.01	mg/l	EPA 213.1	- -
Calcium, Total	600	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Calcium, Dissolved	xxxx	1	mg/l	EPA 215.1	-
Cations	xxxx	----	meq/l	---------	- -
Chloride	5	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Chromium, Total	xxxx	0.1	mg/l	EPA 218.1	- -
Chromium, Dissolved	xxxx	0.1	mg/l	EPA 218.1	- -
Conductivity	516	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Copper, Total	xxxx	0.1	mg/l	EPA 220.1	- -
Copper, Dissolved	xxxx	0.1	mg/l	EPA 220.1	- -

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 11

To CRIK	From JEAN
Co.	Co.
Dept.	Phone #
Fax # 801/789-2387	Fax #

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

COMMERCIAL TESTING & ENGINEERING CO.
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TEL: (801) 653-2511
FAX: (801) 653-2436

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Main West Fault

Kind of sample reported to us: Water

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Rec'd 1115 hr.
Sampled 1325 hr.

Field Measurements

pH	7.95
DO	8.7
Conductivity	507
Temperature	9.3°C

Analysis report no. 59-16961

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Fluoride	xxxx	0.01	mg/l	SM4500-F-C	- -
Hardness, Total	xxxx	----	mg/l as $CaCO_3$	SM2340-B	- -
Iron, Total	54.0	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MY
Lead, Total	xxxx	0.1	mg/l	EPA 239.1	- -
Lead, Dissolved	xxxx	0.1	mg/l	EPA 239.1	- -
Magnesium, Total	244	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Magnesium, Dissolved	xxxx	1	mg/l	EPA 242.1	
Manganese, Total	1.4	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
Mercury, Total	xxxx	0.2	ug/l	EPA 245.1	- -
Mercury, Dissolved	xxxx	0.2	ug/l	EPA 245.1	- -
Molybdenum, Total	xxxx	0.1	mg/l	EPA 246.1	- -
Molybdenum, Dissolved	xxxx	0.1	mg/l	EPA 246.1	-
Nickel, Total	xxxx	0.1	mg/l	EPA 249.1	- -
Nickel, Dissolved	xxxx	0.1	mg/l	EPA 249.1	- -
Nitrogen, Ammonia	xxxx	0.5	mg/l as N	EPA 350.3	- -
Nitrogen, Nitrate-Nitrite	xxxx	0.1	mg/l as N	EPA 353.3	- -
Nitrogen, Nitrite	xxxx	0.01	mg/l as N	EPA 354.1	- -
Oil & Grease	xxxx	2	mg/l	SM5520-B	- -
Oxygen, Dissolved	xxxx	----	mg/l	EPA 360.1	- -
pH	7.92	----	pH units	EPA 150.1	02-04-1997 1245 MK
Phosphorous, Ortho-PO_4	xxxx	0.01	mg/l as P	SM4500-P-E	- -
Phosphorous, Total	xxxx	0.05	mg/l as P	SM4500-P-B,E	- -

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Huntington Laboratory

Due to a positive interference's from high settleable matter in the sample, dissolved calcium and dissolved magnesium were ran. This was done so the calculate cation/anion charge balance be with in ± 10.

Larry Stout
RG

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FAX: (801) 653-2436

March 5, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Main West Fault

Kind of sample reported to us: Water

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Rec'd 1115 hr.
Sampled 1325 hr.

Field Measurements

pH	7.95
DO	8.7
Conductivity	507
Temperature	9.3°C

Dissolved Fe,Mg & Cl filtered at lab!

Analysis report no. 59-16961

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	304	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	249	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	5.8	----	meq/l	---------	03-05-1997 0900 RJ
Calcium, Total	600	10	mg/l	EPA 215.1	02-12-1997 1030 MK
Calcium, Dissolved	57	1	mg/l	EPA 215.1	03-05-1997 0730 MK
Cations	5.6	----	meq/l	---------	03-05-1997 0900 RJ
Chloride	5	1	mg/l	SM4500-Cl B	02-10-1997 1030 SW
Conductivity	516	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	263	----	mg/l as $CaCO_3$	SM2340-B	03-05-1997 0900 RJ
Iron, Total	54.0	10.0	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	244	10	mg/l	EPA 242.1	02-12-1997 1100 MK
Magnesium, Dissolved	28	1	mg/l	EPA 242.1	03-05-1997 0745 MK
Manganese, Total	1.4	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	7.92	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	7	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	5	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	252	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	6385	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	32	10	mg/l	EPA 375.4	02-24-1997 1230 SW
Cation/Anion Balance	+1.3	----	%		03-05-1997 0900 RJ

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To ERIK	From JEAN
Co.	Co.
Dept.	Phone #
Fax # 801/285-2387	Fax #

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Gant

Huntington Laboratory RJ

Due to a positive interference's from high settleable matter in the sample, dissolved calcium and dissolved magnesium were ran. This was done so the calculate cation/anion charge balance be with in ± 10.

Larry Stout
RS

COMMERCIAL TESTING & ENGINEERING CO.
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March 5, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: MW-2

Kind of sample reported to us: Water

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Rec'd 1115 hr.
Sampled 1520 hr.

Field Measurements
pH 7.3
DO 8.5
Conductivity 731
Temperature 10.9°C

Dissolved Iron filtered at lab!

Analysis report no. 59-16962

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	456	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	374	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	8.4	----	meq/l	---------	03-05-1997 0900 RJ
Calcium, Total	109	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Calcium, Dissolved	74	1	mg/l	EPA 215.1	03-05-1997 0730 MK
Cations	7.8	----	meq/l	---------	03-05-1997 0900 RJ
Chloride	5	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	748	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	354	----	mg/l as $CaCO_3$	SM2340 B	03-05-1997 0900 RJ
Iron, Total	4.5	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	60	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Magnesium, Dissolved	41	1	mg/l	EPA 242.1	03-05-1997 0745 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	7.29	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	5	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	14	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	413	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	136	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	39	50	mg/l	EPA 375.4	02-24-1997 0900 SW
Cation/Anion Balance	-3.8	----	%		03-05-1997 0900 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory

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February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Crandall Creek

Kind of sample reported to us: Water

Rec'd 1115 hr.
Sampled 1625 hr.

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Field Measurements

pH	8.6
DO	11.7
Conductivity	1120
Temperature	2.5°C

NOTE: Dissolved Iron filtered at lab!
NOTE: Dissolved Mang. filtered at lab!

Analysis report no. 59-16964

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	326	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	267	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	10.8	----	meq/l	---------	02-25-1997 1100 RJ
Calcium, Total	66	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	11.2	----	meq/l	---------	02-25-1997 1100 RJ
Chloride	130	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	1073	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	358	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1100 RJ
Iron, Total	0.3	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	47	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	8.35	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	5	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	89	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	601	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	18	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	85	20	mg/l	EPA 375.4	02-24-1997 1230 SW
Cation/Anion Balance	1.7	----	%		02-25-1997 1100 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory RJ

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February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: Little Bearspring

Kind of sample reported to us Water

Sample taken at Genwal

Sample taken by Genwal

Date sampled February 3, 1997

Date received February 4, 1997

Rec'd 1115 hr.
Sampled 1005 hr.

Field Measurements
pH 7.6
DO 3.6
Conductivity 556
Temperature 8.9°C

NOTE: pH expired when received!
NOTE: Dissolved Iron filtered at lab!

Analysis report no. 59-16960

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst		
Alkalinity, Bicarbonate	341	5	mg/l as HCO_3	SM2320-B	02-10-1997	1100	SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997	1100	SW
Alkalinity, Total	279	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997	1100	SW
Anions	6.4	----	meq/l	---------	02-25-1997	1030	RJ
Calcium, Total	62	1	mg/l	EPA 215.1	02-12-1997	1030	MK
Cations	6.5	----	meq/l	---------	02-25-1997	1030	RJ
Chloride	7	1	mg/l	SM4500-Cl-B	02-10-1997	1030	SW
Conductivity	580	1	umhos/cm	SM2510-B	05-05-1997	1230	SW
Hardness, Total	307	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997	1030	RJ
Iron, Total	<0.1	0.1	mg/l	EPA 236.1	02-12-1997	0730	MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997	0730	MK
Magnesium, Total	37	1	mg/l	EPA 242.1	02-12-1997	1100	MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997	0800	MK
pH	7.52	----	pH units	EPA 150.1	02-04-1997	1245	MK
Potassium, Total	1	1	mg/l	EPA 258.1	02-12-1997	0830	MK
Sodium, Total	7	1	mg/l	EPA 273.1	02-12-1997	0900	MK
Solids, Total Dissolved	306	10	mg/l	EPA 160.1	02-06-1997	0700	JC
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	02-06-1997	0700	JC
Sulfate	29	5	mg/l	EPA 375.4	02-24-1997	0900	RJ
Cation/Anion Balance	0.6	----	%		02-25-1997	1030	RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

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February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: LW 1 & 2 Gob Water

Kind of sample reported to us Water

Rec'd 1115 hr.
Sampled 1450 hr.

Sample taken at Genwal

Sample taken by Genwal

Date sampled February 3, 1997

Date received February 4, 1997

Field Measurements

pH	7.4
DO	7.9
Conductivity	752
Temperature	10.9°C

Analysis report no. 59-16963

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	457	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	375	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	8.7	----	meq/l	---------	02-25-1997 1300 RJ
Calcium, Total	70	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	8.9	----	meq/l	---------	02-25-1997 1300 RJ
Chloride	219	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	788	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	356	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1300 RJ
Iron, Total	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	44	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
Manganese, Dissolved	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	7.39	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	10	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	36	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	444	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	49	50	mg/l	EPA 375.4	02-24-1997 0900 RJ
Cation/Anion Balance	1.3	----	%		02-25-1997 1300 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory RJ

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February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: MW-1

Kind of sample reported to us: Water

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Rec'd 1115 hr.
Sampled 1610 hr.

Field Measurements
pH 7.95
DO 7.8
Conductivity 500
Temperature 12.7°C

NOTE: Dissolved Iron filtered at lab!

Analysis report no. 59-16966

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	293	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	240	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	5.5	----	meq/l	--------	02-25-1997 1100 RJ
Calcium, Total	19	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	5.5	----	meq/l	---------	02-25-1997 1100 RJ
Chloride	12	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	517	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	113	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1100 RJ
Iron, Total	0.8	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	16	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	7.96	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	4	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	73	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	244	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	18	5	mg/l	EPA 375.4	02-24-1997 1230 SW
Cation/Anion Balance	0.2	----	%		02-25-1997 1100 RJ

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory RJ

COMMERCIAL TESTING & ENGINEERING CO.
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P.O. BOX 1020, HUNTINGTON, UT 8452
TEL: (801) 653-231
FAX: (801) 653-243

February 26, 1997

GENWAL RESOURCES, INC.
P.O. BOX 1420
HUNTINGTON UTAH 84528

Sample identification by
GENWAL COAL CO.

ID: 8th East Roof Drips

Kind of sample reported to us: Water

Sample taken at: Genwal

Sample taken by: Genwal

Date sampled: February 3, 1997

Date received: February 4, 1997

Rec'd 1115 hr.
Sampled 1155 hr.

Field Measurements
pH 8.4
DO 4.7
Conductivity 407
Temperature 11.9°C

NOTE: pH exp'red when received!
NOTE: Dissolved Iron filtered at lab!

Analysis report no. 59-16959

Parameter	Result	MRL	Units	Method	Analyzed Date/Time/Analyst
Alkalinity, Bicarbonate	264	5	mg/l as HCO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Carbonate	<5	5	mg/l as CO_3	SM2320-B	02-10-1997 1100 SW
Alkalinity, Total	218	5	mg/l as $CaCO_3$	EPA 310.1	02-10-1997 1100 SW
Anions	4.5	----	meq/l	---------	02-25-1997 1030 RJ
Calcium, Total	10	1	mg/l	EPA 215.1	02-12-1997 1030 MK
Cations	4.5	----	meq/l	---------	02-25-1997 1030 RJ
Chloride	5	1	mg/l	SM4500-Cl-B	02-10-1997 1030 SW
Conductivity	415	1	umhos/cm	SM2510-B	02-05-1997 1230 SW
Hardness, Total	54	----	mg/l as $CaCO_3$	SM2340-B	02-25-1997 1030 RJ
Iron, Total	0.8	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Iron, Dissolved	<0.1	0.1	mg/l	EPA 236.1	02-12-1997 0730 MK
Magnesium, Total	7	1	mg/l	EPA 242.1	02-12-1997 1100 MK
Manganese, Total	<0.1	0.1	mg/l	EPA 243.1	02-12-1997 0800 MK
pH	8.14	----	pH units	EPA 150.1	02-04-1997 1245 MK
Potassium, Total	3	1	mg/l	EPA 258.1	02-12-1997 0830 MK
Sodium, Total	77	1	mg/l	EPA 273.1	02-12-1997 0900 MK
Solids, Total Dissolved	226	10	mg/l	EPA 160.1	02-06-1997 0700 JC
Solids, Total Suspended	<5	5	mg/l	EPA 160.2	02-06-1997 0700 JC
Sulfate	<5	5	mg/l	EPA 375.4	02-24-1997 0900 RJ
Cation/Anion Balance	0.4	----			02-25-1997 1030 RJ

Bottle

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Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Larry Stout

Huntington Laboratory RJ