APPENDIX G
WATER DATA AND INFORMATION

Stream Classifications and Water Quality Standards

STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS

REGION: 11 BASIN: LOWER COLORADO RIVER Stream Segment Description	Desig	Classifications	NUMERIC STANDARDS						TEMPORARY MODIFICATIONS AND QUALIFIERS
			PHYSICAL and BIOLOGICAL	INORGANIC mg/l		METALS ug/l			
11g. All tributaries to East Fork Parachute Creek on the south side of the East Fork Parachute Creek from a point immediately below First Anvil Creek to the confluence with Parachute Creek; all tributaries to Parachute Creek on the east side of Parachute Creek from a point immediately below the East Fork of Parachute Creek to the confluence with the Colorado River; and all tributaries to the Colorado River on the north side of the Colorado River from a point immediately below Cottonwood Creek to the confluence with Parachute Creek.		Aq Life Cold 2 Recreation 2 Agriculture	D.O. = 6.0 mg/l D.O.(sp)=7.0 mg/l pH=6.5-9.0 F.Coli=2000/100ml E.Coli=630/100ml	CN(ac)=0.2 NO_2(ac)=10 NO_3(ac)=100	B(ch)=0.75	As(ch)=100(Trec) Be(ch)=100(Trec) Cd(ch)=10(Trec) CrIII(ch)=100(Trec)	CrVI(ch)=100(Trec) Cu(ch)=200(Trec) Pb(ch)=100(Trec) Mn(ch)=200(Trec)	Ni(ch)=200(Trec) Se(ch)=20(Trec) Zn(ch)=2000(Trec)	
11h. Mainstem of Parachute Creek from the confluence of the West and East Forks to the confluence with the Colorado River.		Aq Life Cold 2 Recreation 1b Agriculture	D.O. = 6.0 mg/l D.O.(sp)=7.0 mg/l pH=6.5-9.0 F.Coli=325/100ml E.Coli=205/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05	As(ch)=100(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Hg(ch)=0.01(tot) Ni(ac/ch)=TVS Se(ac/ch)=TVS	Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
12. All tributaries to East Fork Parachute Creek from its source to a point immediately below the mouth of First Anvil Creek.		Aq Life Cold 1 Recreation 2 Agriculture	D.O. = 6.0 mg/l D.O.(sp)=7.0 mg/l pH = 6.5-9.0 F.Coli=2000/100ml E.Coli=630/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250	As(ac/ch)=TVS Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Hg(ch)=0.01(tot) Ni(ac/ch)=TVS Se(ac/ch)=TVS	Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
13a. All tributaries to the Colorado River including wetlands, from a point immediately below the confluence of Parachute Creek to the Colorado/Utah border except for the specific listings in Segments 13b through 19.	UP	Aq Life Warm 2 Recreation 1b Agriculture	D.O.= 5.0 mg/l pH = 6.5-9.0 F.Coli=325/100ml E.Coli=205/100ml	CN(ac)=0.2 NO_2(ac)=10 NO_3(ac)=100	B(ch)=0.75	As(ch)=100(Trec) Be(ch)=100(Trec) Cd(ch)=10(Trec) CrIII(ch)=100(Trec)	CrVI(ch)=100(Trec) Cu(ch)=200(Trec) Pb(ch)=100(Trec) Mn(ch)=200(Trec)	Ni(ch)=200(Trec) Se(ch)=20(Trec) Zn(ch)=2000(Trec)	
13b. All tributaries to the Colorado River, including wetlands, from the Government Highline Canal Diversion to a point immediately below Salt Creek, downgradient from the Government Highline Canal, the Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and the northeast Colorado National Monument boundary, except for specific listings in Segment 13c.	UP	Aq Life Warm 2 Recreation 1a Agriculture	D.O.= 5.0 mg/l pH = 6.5-9.0 F.Coli=200/100ml E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05	As(ch)=100(Trec) Cd(ac/ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Hg(ch)=0.01(tot) Ni(ac/ch)=TVS Se(ac/ch)=TVS	Ag(ac/ch)=TVS Zn(ac/ch)=TVS	Temporary modifications: Se(ch)=existing ambient quality based on uncertainty. Persigo Wash from Grand Junction discharge to confluence with the Colorado River; and Little Salt Wash from Fruita discharge to confluence with the Colorado River for D.O., F. Coli., NH_3, Cd, Cu, Ag, Ni, B, Hg, NO_2 = existing quality. Expiration date of 2/28/09. NH_3(ac/ch)=TVS(old)(Type i). Expiration date of 12/31/2011.
13c. Walker Wildlife Area Ponds.		Aq Life Warm 1 Recreation 1a Agriculture	D.O.= 5.0 mg/l pH = 6.5-9.0 F.Coli=200/100ml E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05	As(ch)=100(Trec) Cd(ac/ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Hg(ch)=0.01(tot) Ni(ac/ch)=TVS Se(ac/ch)=TVS	Ag(ac/ch)=TVS Zn(ac/ch)=TVS	Temporary modifications: Se(ch)=existing ambient quality, based on uncertainty. Expiration date of 2/28/09.

STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS

REGION: 11 BASIN: LOWER COLORADO RIVER	Desig	Classifications	NUMERIC STANDARDS						TEMPORARY MODIFICATIONS AND QUALIFIERS
			PHYSICAL and BIOLOGICAL	INORGANIC mg/l		METALS ug/l			
14a. Mainstem of Roan Creek including all wetlands, tributaries, lakes, and reservoirs, from its source to a point immediately above the confluence with Clear Creek.		Aq Life Cold 1 Recreation 1b Water Supply Agriculture	D.O.=6.0 mg/l D.O.(sp)= 7.0 mg/l pH=6.5-9.0 F.Coli=325/100ml E.Coli=205/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
14b. Mainstem of Roan Creek including all tributaries, wetlands, lakes and reservoirs, from a point immediately below the confluence with Clear Creek to the confluence with the Colorado River.		Aq Life Warm 1 Recreation 1b Water Supply Agriculture	D.O.=5.0 mg/l pH=6.5-9.0 F.Coli=325/100ml E.Coli=205/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ch)=100(Trec) Cd(ac/ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac/ch)=TVS Zn(ac/ch)=TVS	
15. Mainstem of Plateau Creek including all tributaries, wetlands, lakes, and reservoirs, from its source to the confluence with the Colorado River.		Aq Life Cold 1 Recreation 1a Water Supply Agriculture	D.O.=6.0 mg/l D.O.(sp)= 7.0 mg/l pH=6.5-9.0 F.Coli=200/100ml E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
16. Deleted.									
17. Mainstem of Rapid Creek, including all tributaries, wetlands, lakes and reservoirs, from its source to the confluence with the Colorado River.		Aq Life Cold 1 Recreation 1b Water Supply Agriculture	D.O. = 5.0 mg/l pH = 6.5-9.0 F.Coli=200/100ml E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS Fe(ch)=WS(dis)	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(tot) Ni(ac/ch)=TVS	Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
18. Mainstem of Little Dolores River, including all tributaries, wetlands, lakes and reservoirs, from its source to immediately below the confluence with Hay Press Creek.		Aq Life Cold 1 Recreation 1b Water Supply Agriculture	D.O. = 6.0 mg/l D.O.(sp)=7.0 mg/l pH = 6.5-9.0 F.Coli=325/100ml E.Coli=205/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=50(Trec) Cd(ac)=TVS(tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=WS(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(tr) Zn(ac/ch)=TVS	
19. All lakes and reservoirs tributary to the Colorado River from a point immediately below the confluence of the Colorado River and Parachute Creek to the Colorado-Utah border.		Aq Life Warm 1 Recreation 1a Agriculture	D.O.=5.0 mg/l pH=6.5-9.0 F.Coli=200/100ml E.Coli=126/100ml	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05	As(ch)=100(Trec) Cd(ac/ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Hg(ch)=0.01(tot) Ni(ac/ch)=TVS Se(ac/ch)=TVS	Ag(ac/ch)=TVS Zn(ac/ch)=TVS	

Baseline Hydrologic Data Report and Spring Inventory Prepared for the Dorchester Coal Company Fruita Mine Permit Application

BASELINE HYDROLOGIC DATA REPORT FOR THE FRUITA MINE PERMIT APPLICATION

DORCHESTER COAL COMPANY

PREPARED FOR
DORCHESTER COAL COMPANY
UNITED BANK OF ARAPAHOE BUILDING
SUITE 300, 9350 EAST ARAPAHOE ROAD
ENGLEWOOD, COLORADO 80112

PREPARED BY:
KAMAN TEMPO
A DIVISION OF KAMAN SCIENCES CORPORATION
650 SOUTH CHERRY STREET
DENVER, COLORADO 80222

REVISED
JANUARY, 1984

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SECTION 1

GROUNDWATER

A comprehensive groundwater monitoring program has been undertaken by Dorchester Coal Company to characterize the groundwater resources of the lease areas. A total of 24 monitoring wells have been installed on the three leases to obtain hydrologic data for the overburden, coal seams and the next lower aquifer below the coal seam. Completion data for each of these wells are shown on Table 2.04.7-1. Completion diagrams for wells installed in 1982 are included in the Appendix 2.04.7-A. In addition, four alluvial wells have been installed along Big Salt Wash (M-1, M-2, M-3 and F-50 (Alluvial)). The locations of all wells are also shown on Map 2.04.7-2. The CM and M series wells were installed in 1980; the remaining wells were completed during 1982.

Monitoring wells were installed in conjunction with the exploration drilling program. Selection of the holes to be completed as monitoring wells was, to a large extent, determined by the amount and location of water encountered during drilling. Most of the Northern Lease area is an area of high relief located between two large drainages, East Salt Wash and Big Salt Wash. The Sheridan Enterprises' mine permit application for an area adjacent to the North Lease Area indicates that much of the coal seam and the overburden are unsaturated. Field investigations indicate that, except for Big Salt Wash, all tributaries crossing the North Lease area are ephemeral. In addition, few springs or

TABLE 2.04.7-1

MONITORING WELL DATA

Well No.	Elevation Top of Casing	Total Depth Feet	Strata in Which Completed	Perforated Interval
CM-1	5570	483	Anchor coal seam	454 - 457
CM-2	5719	772	Cameo coal seam	373 - 376
CM-3	5840	620	Overburden	589 - 592
CM-4	6190	1023	Cameo & Interburden	No perforated
CM-7	5640	605	Interburden	559 - 562
43	5533	195	Overburden & Cameo	Open hole
43A	5542	113	Overburden & Cameo	Open hole
41	5991	910	Overburden & Cameo	Open hole
50C	5638	500	Cameo	125 - 140
50 (Alluvial)	5638	500	Alluvium	45 - 55
56C	5650	680	Cameo	228 - 238
56UA	5650	680	Overburden	78 - 88
58OB	5780	836	Overburden	417 - 427
58C	5780	836	Cameo	460 - 470
59UA	5963	1170	Upper Aquifer	51 - 61
59OB	5963	1170	Overburden	711 - 731
59C	5963	1170	Cameo	760 - 770
59W/UA	5966	774	Upper Aquifer	52 - 62
59W/OB	5966	774	Overburden	723 - 733
59W/C	5966	774	Cameo	763 - 773
62OB	6565	1580	Overburden	1040 -1050
62C	6565	1580	Cameo	1150 -1170
69OB	6202	1005	Upper Aquifer	290 - 310
69C	6202	1005	Cameo	620 - 640
70UA	6194	1600	Overburden	670 - 690
70C	6194	1600	Cameo	1119 -1129
71OB	6646	1576	Overburden	1023 -1033
71C	6646	1576	Cameo	1055 -1075

Table 4

Groundwater Monitoring Wells within the Study Area

Drill hole	Monitoring Zone	Monitoring Interval depth (ft)	Remarks
CM1-80	Anchor Coal	454 - 457	
CM2-80	Cameo Coal	373 - 376	
CM3-80	Carbonera Roof	589 - 592	Seam joined w/ Cameo
CM7-80	Anchor Roof	559 - 562	
F-34WW-84	Cameo Coal	170 - 178	
F50-82	Alluvium	0 - 55	
	Cameo Coal	125 - 140	
F54-82	Alluvium	30 - 45	Well sediment filled
F56-82	Sandstone	65 - 90	
	Cameo Coal	215 - 240	
F58-82	Overburden	30 - 435	
	Cameo Coal	440 - 470	
F59-82	Upper Zone	35 - 65	
	Overburden	65 - 740	Well bridged @ 430'
	Cameo Coal	740 - 770	
F59W-82 3	Upper Zone	35 - 65	
	Overburden	65 - 735	
	Cameo Coal	740 - 773	
F62-82	Overburden	25 - 1110	
	Carbonera and Cameo	1115 - 1170	Coals split by ~ 28'
F69-82	Upper Zone	295 - 310	
	Cameo Coal	610 - 640	
F70-82	Upper Sandstone	665 - 690	
	Cameo Coal	1110 - 1130	Well bridged at Cameo
F71-82	Overburden	220 - 1030	
	Cameo Coal	1040 - 1075	
M-2	Alluvium	0 - 40	
M-3	Alluvium	40 - 45	
E Dsrt	Alluvium	28 - 80	

seeps were identified in the North Lease Area. Due to the limited groundwater resource in the vicinity of the Northern Lease, only two monitoring wells were completed in this area. These wells were completed along Big Salt Wash, the area most likely to contain water-bearing zones.

1.1 IDENTIFICATION OF AQUIFERS

During the 1982 drilling program and the well and spring inventory, observations were made in order to determine what geologic strata may be considered aquifers that may potentially be affected by the Fruita Mine operations. All water-bearing zones down through the Anchor Coal Zone were evaluated for their water yielding properties.

The location of the aquifers was determined by data obtained during drilling and through the use of geophysical logging. The selection of drilling procedures is partially controlled by the presence or absence of water in the formations. If the formations being drilled are relatively dry, it is usually possible to drill without fluids, i.e., compressed air drilling. When sufficient water is encountered in the formations, this necessitates that drilling fluids (soap or mud) be injected and circulated.

The presence of a specific water-bearing zone can be detected by a sudden increase in fluid volume and/or pressure during circulation. Increasing the rate and/or viscosity of the injected drilling fluids will counteract the effects of "making water" down the hole. In general, the amount and viscosity of the

drilling fluids added is roughly proportional to amount of water being produced by the formation.

During core drilling in holes where a water-bearing zone was penetrated, water accumulated down the drill hole between coring runs (i.e., 20 ft. sections). This water must be blown out prior to resuming core drilling in order to regain circulation. Approximate inflow rates were determined by estimating the volume of water that accumulated over a specific period of time.

Each hole was logged using gamma ray, density, resistivity and caliper methods. Temperature logs and neutron logs were also taken on selected drill holes.

Generally it was possible to use compressed air drilling methods to drill through the Hunter Canyon Formation, which indicates that this formation is relatively dry. This is supported by data from the spring inventories which showed a lack of springs in the Hunter Canyon Formation.

For many drill holes, it was also possible to drill into the Mount Garfield Formation using compressed air methods. The following representative drill holes were drilled during 1982 to the core point immediately above the Upper Cameo Coal Seam using compressed air drilling methods: F-55, F-57, F-60, F-64, F-65, F-66, F-67, F-68, F-69, F-72, F-73, and F-74.

During core drilling of the holes listed above, no appreciable amounts of water accumulated between core runs. This is further evidence that no water-yielding zones were present in the

overburden. Locations of these drill holes are shown on Map 2.04.7-3.

Drill holes in which drilling fluids were required to drill the overburden zone (i.e., where water-yielding zones were encounterd) were those located along the axis of the syncline or along the major drainages of the study area. Water was encountered in the overburden in the following holes: F-56, F-58, F-59, F-62, and F-70.

The maximum inflow rate, as measured during the drilling program, was in hole F-70 at 680 ft. (approximately 20 gpm). This drill hole is located near the center of the syncline. Inflow rates for the overburden in F-56, F-58 and F-59 ranged from 2 gpm in F-58 to 15 gpm in F-56.

Although certain strata within the overburden were saturated in the drill holes listed above, the saturated zones do not appear to be laterally continuous. The lithology of this zone is very complex due to the deltaic environment in which the strata were deposited. The overburden sequence is composed of multiple sandstone and shale facies. Some of the individual sandstones, for example in holes P(F-56-82), and R(F-59-82), had flow rates as high as 15 gallons per minute (gpm). However, these more permeable zones were determined to be of limited areal extent, thereby limiting any sustained yield of water from these water-bearing zones (US Bureau of Mines, 1983).

Figures 2.04.7-1 through 2.04.7-3 show the electric logs and lithologic logs for drill holes F-56, F-58 and F-59W. The inter-

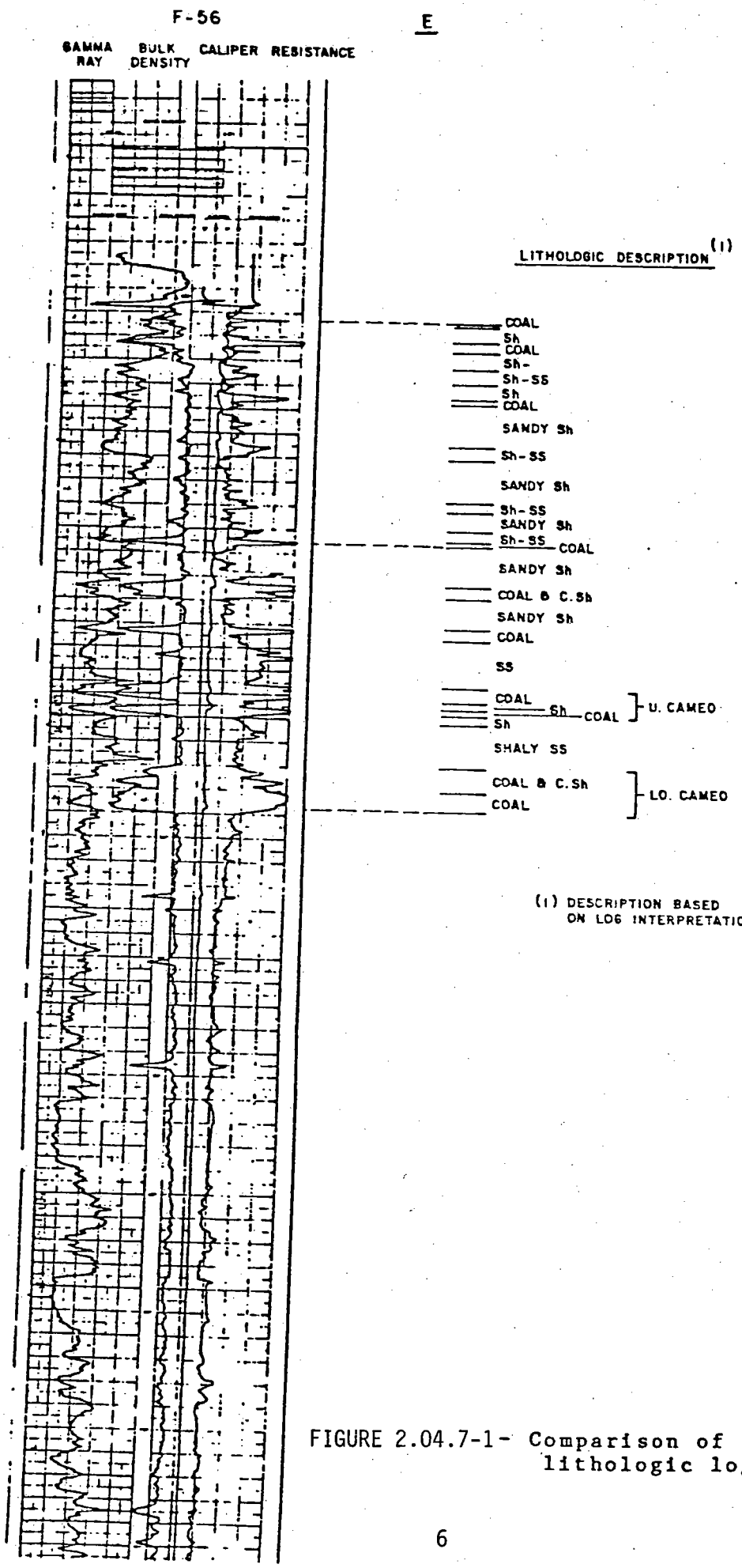


FIGURE 2.04.7-1- Comparison of electric and lithologic logs for F-56.

F-58

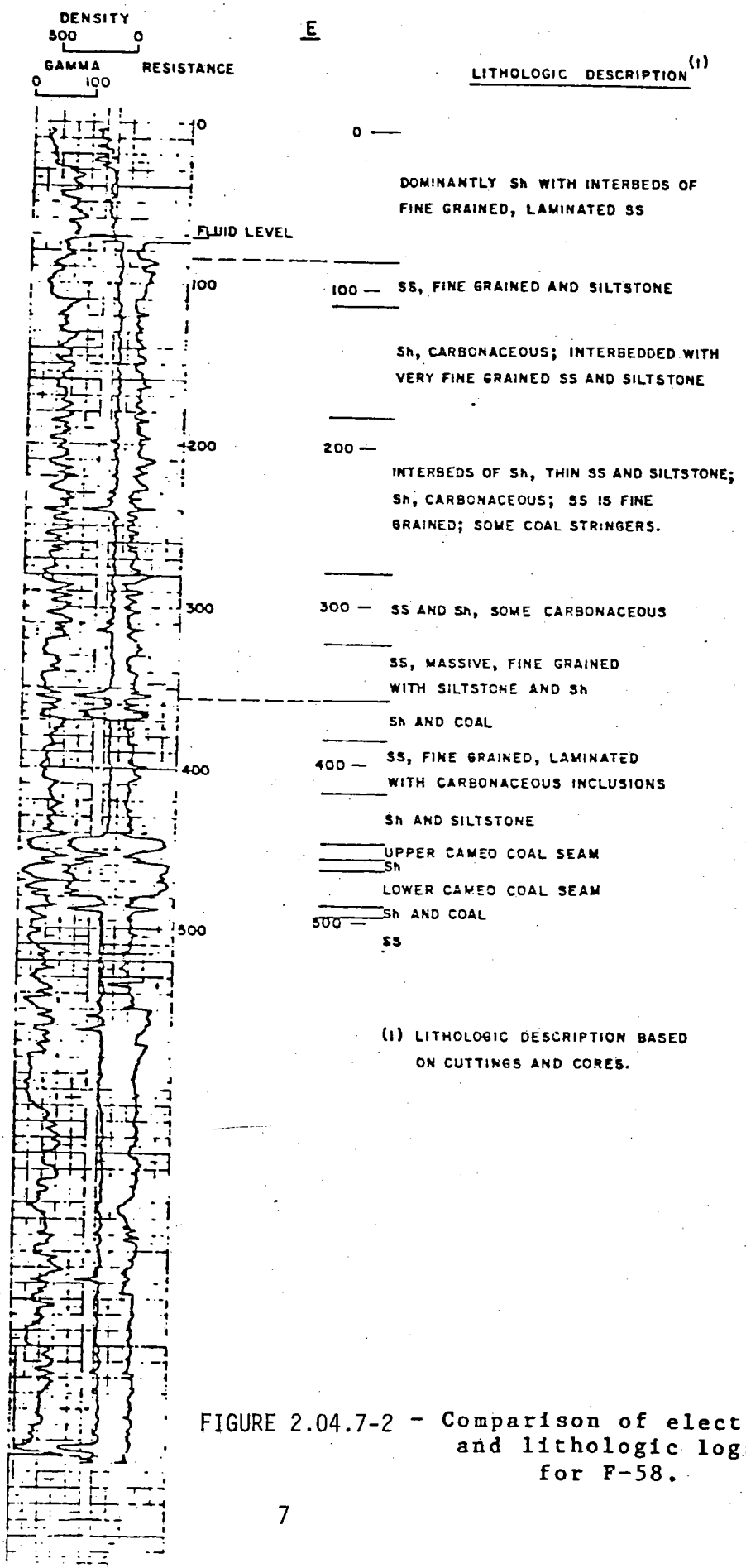


FIGURE 2.04.7-2 - Comparison of electric and lithologic logs for F-58.

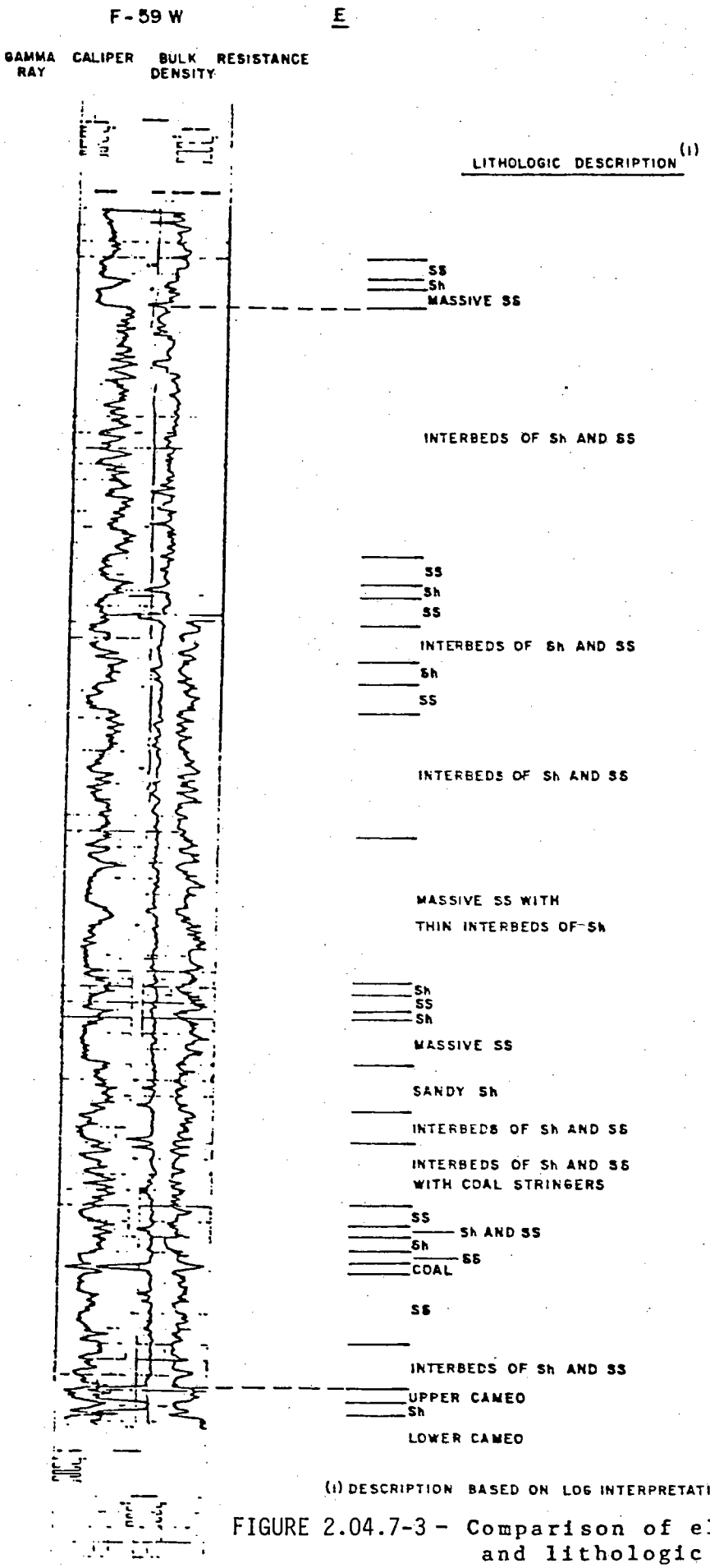


FIGURE 2.04.7-3 - Comparison of electric and lithologic logs for F-59W.

bedding of thin sandstone beds, siltstones and shales, as shown in these logs, is typical of a fluvial depositional environment with rapid changes in the energy of transport (U.S. Bureau of Mines, 1983). Together with the presence of coal beds, the evidence shown by the logs indicates that these clastic sediments were deposited in an alluvial plain which contained swamps. Except for the Cameo Coal Seam and a few other minor coal seams, the rock units do not show continuity between the various boreholes. Lenticular beds are characteristic of an alluvial environment dominated by braided river systems. This was the case in the Rocky Mountains in the Upper Cretaceous (U.S. Bureau of Mines, 1983). Figures 211.10-22 and -23 (Volume 10-Confidential) are geologic cross-sections which illustrate the lenticular nature of strata in the overburden.

Because of these lenticular characteristics, the overburden is not considered an aquifer, but is a water-bearing zone. Further evaluation of the overburden water yielding characteristics is presented in subsequent sections.

Core drilling through the Cameo Coal Seam indicated some water accumulation between core runs when coring the coal seam in holes F-50, F-52, F-54, F-56, F-58, F-59, F-70. The coal seam was dry, however, at drill holes F-55, F-57, F-62, F-64, F-66, F-67 and F-68, F-69, F-71, F-72, F-73, and F-74.

Because of the continuity of the Cameo Coal Seam throughout the leases and the extent of the saturated zone, the Cameo Coal Seam is considered to be an aquifer (i.e., yield sufficient water

for a beneficial use).

A sandstone unit, referred to as the Rollins equivalent sandstone occurs below the Cameo Coal Seam in some areas of the leases. The distribution of this sandstone within the leases and its relationship to the Cameo Coal Seam is shown on the geologic cross-sections (Figures 2.11.10-22 and 23). The Rollins equivalent sandstone was encountered below the Cameo Coal Zone in holes F-58, F-59, F-66, F-67, F-68, and F-71. Holes F-66, F-67, and F-68 were air drilled to the Anchor Coal Zone which indicates that the Rollins equivalent sandstone and the remainder of the interburden is unsaturated in this area. Drilling fluids were used to drill through this sandstone in F-58, F-59 and F-71 because of moisture encountered above this zone. However, there were no detectable changes in fluid, volume or viscosity when drilling through the Rollins equivalent sandstone in these three drill holes.

Inspection of core materials and outcrops indicate that this sandstone is fine grained (very fine sand or silty sand) in the vicinity of the Fruita Mine. This geologic unit is considered a tight zone with little primary or secondary permeability, particularly when compared to the permeability of the Cameo Coal Seam (Tsegaye Hailu, site geologist, J.F. Sato and Associates, March, 1983).

This sandstone is lenticular, varying in thickness from 60 to 80 feet on the face of the Book Cliffs between Layton Wash and Lipan Wash to approximately 10 feet thick to the east and west of

this area. The area of maximum thickness for this sandstone unit may represent a distributary channel for a fluvial system that existed when this lithologic unit was deposited. The thinner deposits to the east probably represent a delta plain depositional environment. To the west, the sandstone interfingers with thin beds of coal. This may represent a swamp environment formed on the fringes of the distributary channel that fed the sand facies.

For the reasons described above, the Rollins equivalent sandstone is not considered to be an aquifer in the vicinity of the leases.

The exploration program included drilling and sampling of the Anchor Coal Seam, a coal seam located about 400 feet below the Cameo Seam. Observations during drilling of the interval between the Cameo and Anchor Seams indicate that continuous sandstone units are present between the Main Cameo and Anchor Coal Seams. This is shown on the geologic cross-sections (Figures 2.11.10-22 and 23, Volume 10). Data from both rotary and core drilling operations indicate, however, that detectable quantities of water were not encountered when drilling through these sandstone units (i.e., no sudden changes in fluid volume or viscosity during rotary drilling and no significant accumulation of water in the hole between runs during core drilling).

Interbedded with these sandstones are numerous shales and siltstone. Several of these units are over 100 feet thick and are continous throughout the leases (see Figures 211.10-22 and

23). These shales and siltstones are an effective barrier to prevent communication of mining impacts to aquifers below the Cameo Coal Seam.

Minor amounts of water were encountered in the interburden immediately above the Anchor Coal Seam in drill hole CM-7. Well CM-7 was completed in this interval to monitor this source of water.

The Sego Sandstone is a massive sandstone unit that intertongues with the Anchor Coal Seam. In the lease area, this sandstone is medium-grained and "dirty", containing coal, shale and clay inclusions. It is cross-bedded and laminated; contacts are often gradational with the siltstone/shale lithologies above. No detectable quantities of water were encountered in this formation during drilling activities.

The next lower unit that could potentially be a water-bearing zone is the Anchor Coal Seam. Water was encountered in the Anchor Coal Seam at hole CM-1 and a monitoring well was completed at that location. This well is located along Coal Gulch in an area where the overburden is relatively shallow (450 feet). It is possible that the Anchor Seam is saturated in this area due to downward percolation of water from the surface or overlying water-bearing zones. Detectable quantities of water were not encountered in this formation in other drill holes that penetrated the Anchor Seam.

Drilling has also been conducted to determine the hydrologic

characteristics of the Big Salt Wash alluvium. This testing indicated that the alluvium of Big Salt Wash is not an aquifer. The upper reaches of the valley contain alluvial groundwater seasonally. The alluvium adjacent to the mine area is dry throughout the year. Alluvial wells M-1, M-2, and M-3 (Map 2.04.7-2) were monitored monthly from 12/80 to 12/81. Wells M-2 and M-3 were dry during the entire period. Well M-1 contained water during the winter and spring, but dried up during the summer months. An additional alluvial well (II(F-50-82)) was installed in 1982. Monitoring has indicated that this well is also dry.

In summary, the Cameo Coal Seam is the only continuous water-bearing zone in the permit and adjacent area associated with the Fruita Mine that is considered to be an aquifer. The overburden is considered to be a discontinuous water-bearing zone and not an aquifer. Although correlateable sandstone units exist below the Cameo Coal Seam, data obtained during the drilling program do not indicate that significant quantities of water are present in these formations.

1.2 AQUIFER CHARACTERISTICS

The groundwater program included testing to determine the hydraulic characteristics of the water-bearing zones. Standard pumping tests were not feasible due to the low yield rates of the water-bearing zones and the depth of some of the well completion intervals. As an alternative, the slug test procedure as described by Ferris and Knowles (1963) was used. A known quantity

of water was injected into the well instantaneously and measurements were made of the falling water level. Results were plotted as residual head versus the reciprocal of time, in minutes. Transmissivity was then determined by solving the following equation for transmissivity,

T: $$s = \frac{114.6\ V}{Tt}$$

Where;

s = residual head

V = volume of water injected

T = coefficient of transmissivity in gallons per day per foot (gpd/ft)

t = length of time since injection stopped

Slug tests were performed in the 1982 program in holes P(F-56-82), FF(F-58-82), R(F-59-82), and R(F-59W-82). The result of these tests are given in Table 2.04.7-2.

Slug tests represent the aquifer characteristics in the immediate vicinity of the monitor hole. The transmissivity values thus represent the inter-granular, or primary, transmissivity. As noted previously, jointing has been identified in the area of the Fruita Mine. The joints impart a secondary transmissivity to the formation which is typically an order of magnitude higher than the primary transmissivity. When considering the behavior of the aquifer systems, both the primary and secondary transmissivities should be considered.

TABLE 2.04.7-2

SUMMARY OF TRANSMISSIVITY AND PERMEABILITY VALUES FROM 1982 WELL INJECTION TESTS

Monitor Well Iden.[1]	Transmissivity, T gpm/ft	gpd/ft	ft^2/day	Aquifer Thickness, L, ft	Saturated Thickness, ft	Permeability, K[2] ft/day
R(F-59C)	0.025	36	5	27.0	27.0	0.19
P(F-56C)	0.009	13	2	18.0	18.0	0.11
FF(F-58C)[3]	0.005	7	1	36.0	36.0	0.03
Average all coal seam tests		19	3	23.5		0.11
R(F-590B)	0.03	43	6	677.0	540.6	0.011
FF(F-580B)[2]	0.006	9	1	435.0	300.8	0.003
Average all overburden tests		26	4	556.0		0.007
R(F-59UA)	3.0	4320	476	26.0	26.0	22.15
P(F-56UA)	2.6	3744	499	30.0	30.0	16.63

[1]C designates casing completed in coal, OB designates overburden, and UA denotes upper aquifer.

[2]K - T/L

[3]From withdrawal, or recovery test.

Legend

UA: Upper Aquifer monitoring well
C: Cameo monitoring well
OB: Overburden monitoring well

Another method of aquifer testing was tried during this program. More specifically, air lift pumping was attempted at hole R(F-59-82) while using R(F-59W-82) as an observation well. However, due to the small changes in the water level and the insufficient degree of submergence, this technique did not give adequate results. However, the air lift testing was suitable for evacuating water from the hole and allowing measurements of the recovery. Recovery measurements were then used in the Ferris and Knowles (1963) equation to estimate transmissivity.

1.3 WATER LEVELS

Water levels in the water-bearing zones have been monitored by both DCC and its consultants. The locations of these monitoring wells are shown on Map 2.04.7-2. Water levels for wells drilled in 1980 are provided in Table 2.04.7-3. Additional data for the monitoring wells drilled in 1982 are given in Table 2.04.7-4.

Figures 2.04.7-4 and 2.04.7-5 show the areal distribution of water levels for wells drilled in 1982 and completed in the Cameo Coal Seam and the overburden. The data indicate a general east-to-west gradient for the water levels in both the coal and the overburden. These data were also used to draw a cross section of the potentiometric surface along Coal Gulch. This cross section is presented in Figure 2.04.7-6.

Springs in upper Coal Gulch emanate from the upper sandstone or from joints which connect the spring outlets to the potentiometric level in the overburden. Springs in lower Coal Gulch

TABLE 2.04.7-3

Water-level measurements in feet from the top of casing for the CM well series, drilled in 1980

1980 Measurements

	11-2-80	11-6-80	11-16-80	12-7-80
CM-1	94.0	94.7	97.8	100.8
CM-2	177.0	178.2	182.2	188.0
CM-3	271.0	270.0	137.4	135.5
CM-7	Not taken	120.0	124.2	113.5

1981 Measurements

	1-3-81	2-14-81	3-21-81	4-12-81	5-25-81	6-14-81	7-19-81
CM-1	104.3	107.1	106.0	107.5	108.1	110.0	110.5
CM-2	191.2	195.3	196.3	199.3	198.0	199.8	199.0
CM-3	136.0	171.3	183.8	189.2	191.3	193.4	192.1
CM-7	124.3	138.3	146.4	149.8	150.8	113.6	146.1

	8-31-81	9-30-81	10-26-81	12-7-81
CM-1	107.8	-	101.3	104.1
CM-2	199.6	-	199.5	201.5
CM-3	192.5	-	196.0	196.0
CM-7	151.0	-	149.7	150.6

1982 Measurements

	5-30-82	6-23-82	7-11-82	7-29-82	10-8-82
CM-1	110.3	109.0	112.7	111.8	
CM-2	203.9	211.3	213.3	213.3	
CM-3	139.3	138.8	139.0	139.5	139.19

TABLE 2.04.7-4

1982-1983 WATER LEVEL MEASUREMENTS FOR MONITOR WELLS[1]

Monitor Well Identification	P(F-56C)[2]	P(F-56UA)[3]	FF(F-58C)[4]	FF(F-58OB)[4]	R(F-59UA)[5]	R(F-59OB)[6]	R(F-59C)[6]	R(F-59W/UA)[7]	R(F-59W/OB)	R(F-59W/C)
Completion Date (1982)	7-17	7-17	7-23	7-27	7-27	7-27	7-27	7-29	7-29	7-29
Date of Measurement										
8-30-82					44.86	168.94	287.08	51.87	364.34	386.38
8-31-82		43.84			44.82			51.68	366.05	
9-01-82					44.87			51.37		
9-02-82					44.68	168.59	290.12	51.19		389.31
9-03-82	102.48	44.10			44.61	164.93				
9-04-82			231.08	127.83	44.05	166.22		50.59		
10-04-82	64.96	43.25								
10-05-82	65.06				41.73		261.35	45.85	373.08	396.04
10-06-82					41.81	229.33	234.79	45.94		
10-07-82			230.73	125.19						
10-28-82	65.72	43.73	229.59	134.18	41.24	203.42	272.55	44.80	364.32	395.42
11-21-82										
6-01-83	66.0	38.0	226.5	149	31.0	175	293.0			
8-15-83	66.0	38.75	275.5	174.26	34.8	182.5	283.75			

[1]All measurements in feet from top of casing.

[2]Casing injected with water on 9-3-82 and airlift pumped on 10-4-82 and 10-5-82.

[3]Casing injected with water on 9-3-82 and airlift pumped on 10-5-82.

[4]Casing airlift pumped on 10-7-82.

[5]Casing injected with water on 9-2-82 and airlift pumped on 9-1-82, 10-6-82, and 10-8-82.

[6]Casing injected with water on 9-2-82 and airlift pumped on 10-5-82.

[7]Casing injected with water on 9-1-82 and airlift pumped on 9-4-82 and 10-6-82.

TABLE 2.04.7-4
(Continued)
1982-1983 WATER LEVEL MEASUREMENTS FOR MONITOR WELLS[1]

Monitor Well Identification	KK(F-54)	M(F-62)	M(F-62C)	M(F-62OB)	O(F-69C)	O(F-69OB)	X(F-70C)	X(F-70UA)	Z(F-71C)	Z(F-71OB)
Completion Date (1982)	7-13	8-08	10-25	10-25	9-03	9-03	9-09	9-17	9-17	
Date of Measurement										
8-30-82										
8-31-82										
9-01-82										
9-02-82										
9-03-82										
9-04-82										
10-04-82							327.42	206.04	dry to 500 ft	dry to 310 ft
10-05-82										
10-06-82					dry to 500 ft	dry to 500 ft				
10-07-82										
10-28-82	25.43	dry to 750 ft								
11-21-82			dry to 1000 ft	996.5	dry to bottom	dry to bottom (310')				
6-01-83			dry	996	dry	dry	329	276.0	dry	956.0
8-15-83			dry	998.9	dry	dry	276.5	285.5	dry	948.5

[1]All measurements in feet from top of casing.

FIGURE 2.04.7- 4
Potentiometric Map Showing Water Levels For
Monitoring Wells Completed in Cameo Coal Seam.
Dashed Line Inferred From Local Topography.

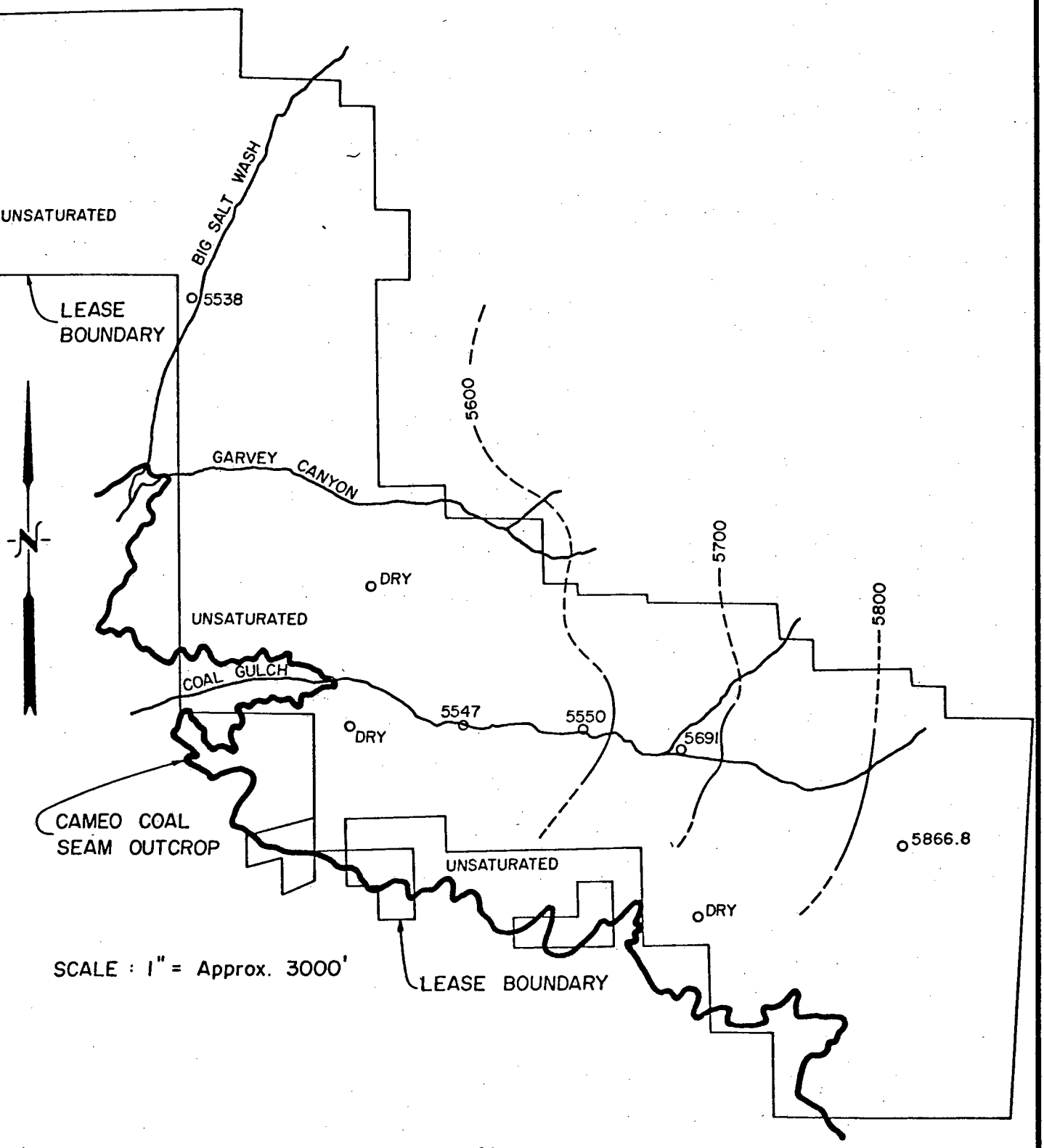
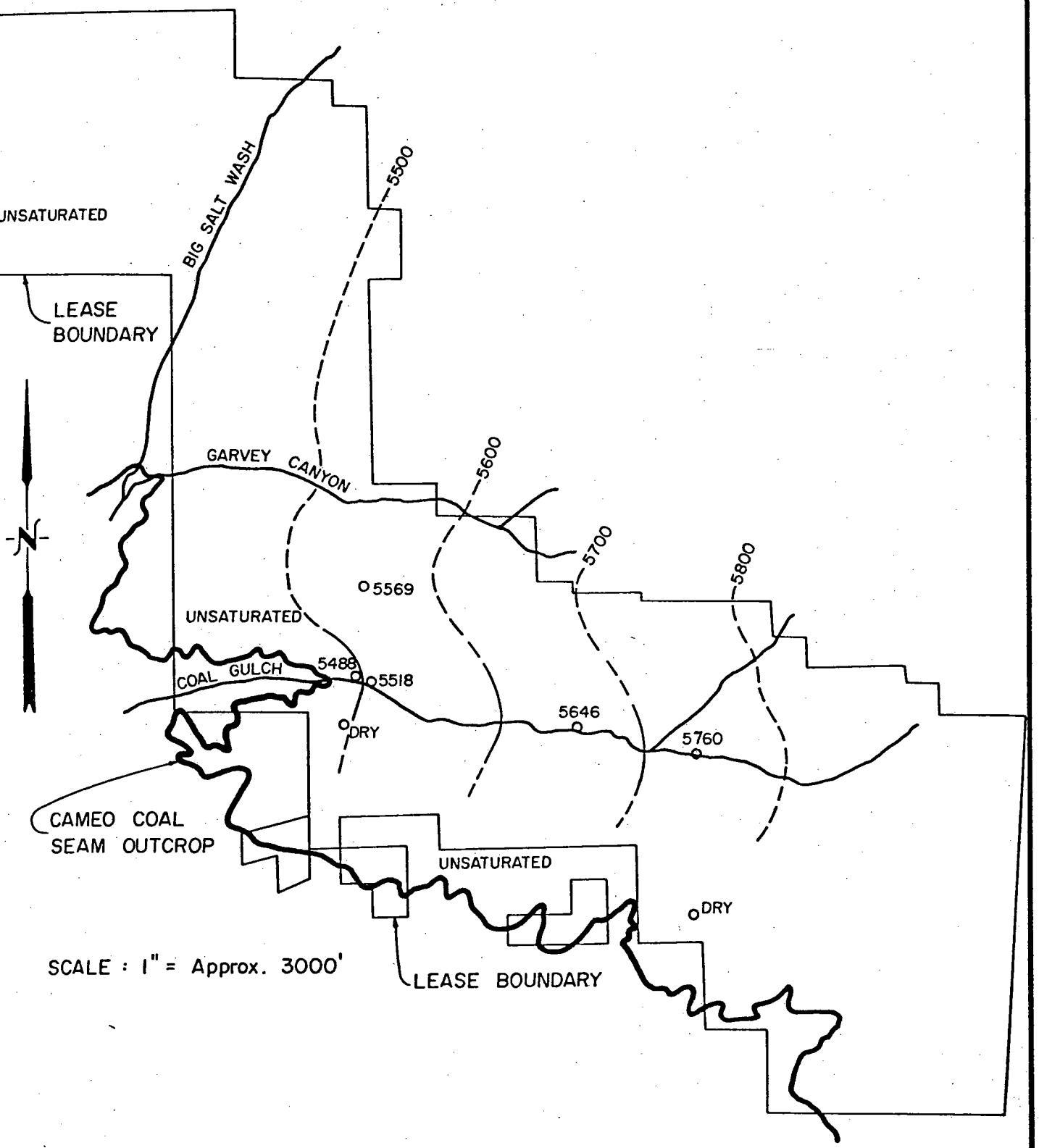


FIGURE 2.04.7-5
Potentiometric Map Showing Water Levels For
Monitoring Wells Completed in Cameo Overburden.
Dashed Line Inferred From Local Topography.



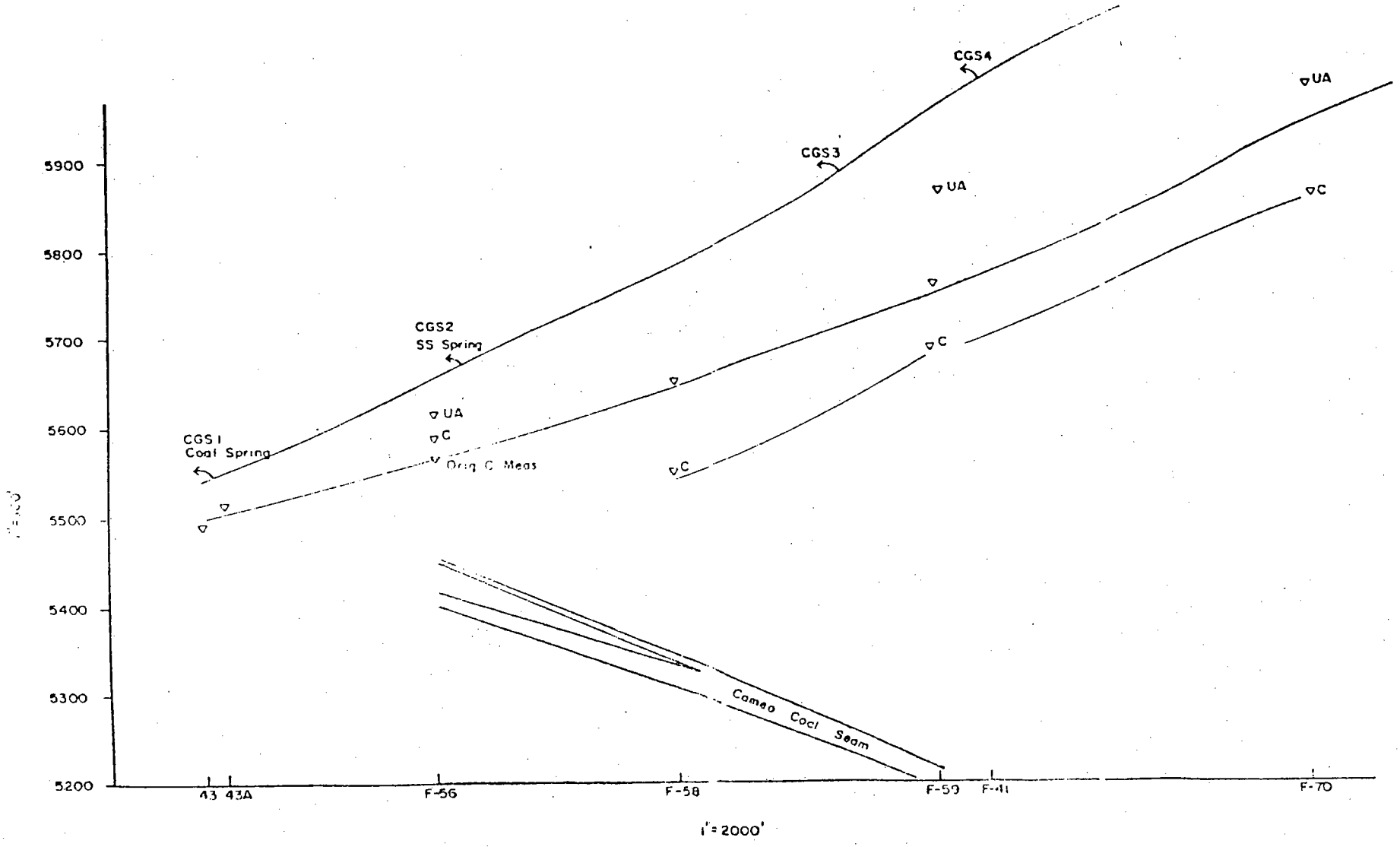


Figure 2.04.7-6

Plot of Potentiometric Surface Along Coal Gulch As Obtained From Monitor Well Data. (Modified From US Bureau of Mines, 1984).

emanate from the coal and overburden water-bearing zones which outcrop just downstream from P(F-56-82). The potentiometric levels measured in P(F-56-82) are very near the surface and suggest that a discharge point is very near. In upper Coal Gulch, the overburden potentiometric level is about 70 feet above the coal potentiometric level. However, in lower Coal Gulch, near the outcrop of the coal seam, the two potentiometric levels move closer together, and the potentiometric level of the coal may even rise above the potentiometric level of the overburden, somewhere in the vicinity of P(F-56-82). Therefore, Coal Gulch represents the primary discharge point for both the Cameo Coal Seam aquifer and the overburden water-bearing zone.

In the upper part of Coal Gulch and in the areas adjacent to Coal Gulch, the potentiometric surface in the overburden is above that in the Cameo Coal Seam which allows groundwater to move vertically downward from the overburden to the Cameo Coal Seam. This downward leakage may be the source of recharge for the coal in the permit area. The groundwater then moves laterally in the coal towards Coal Gulch. In the middle and lower part of Coal Gulch, the potentiometric surface in the coal is above that in the overburden and groundwater from the coal moves vertically upward into the overburden where it is eventually discharged at springs located along Coal Gulch.

1.4 RECHARGE, DISCHARGE, AND GROUNDWATER MOVEMENTS

The groundwater recharge and discharge characteristics are controlled by the local structure and the rugged topography of

the area. This is particularly true for the discharge points as represented by springs, which follow the synclinal axis. (See Map 2.04.7-1)

Recharge occurs along the drainages where streamflow crosses the coal and sandstone outcrops. Recharge areas are also located along the Book Cliffs and the steep valley walls where the Hunter Canyon and Mount Garfield formations are exposed, as well as along the Hunter Canyon Anticline. In the Eastern Lease Area, the Cameo Coal Seam is recharged by downward leakage from the overburden. In much of the Northern Lease Area, the coal seam and the overburden are unsaturated. This area is also a recharge area.

Estimates of groundwater rates recharge of approximately 5 to 20 percent of the average annual precipitation are common in groundwater studies in west central Colorado. The US Geological Survey estimates recharge in Piceance Creek, just to the north of the permit area, as 0.5 to 1.0 inches per year. The climate of the Piceance Creek is similar to the Fruita Mine area, but the terrain is much flatter. Average annual recharge is considered to be very low in this area of the Fruita Mine due to the very steep hillslopes and large areas of bedrock outcrop. Average annual precipitation in the area of the Fruita Mine is estimated as 10 to 11 inches. Therefore, a recharge value of 0.25 inches was determined to be appropriate and represents approximately 2.5 percent of average annual precipitation.

Groundwater movement in the Central and Eastern Lease areas

is primarily east-to-west. The most apparent control on groundwater movement is the unnamed syncline. This structure plunges to the southeast. Fracturing is most severe along the axis of the syncline, and this may provide a preferential path for groundwater movement. The spring survey has identified numerous springs where the synclinal axis intersects Hunter Canyon and Coal Gulch.

Groundwater discharge occurs as springs along the drainage bottoms in the Central and Eastern Lease Areas. In Hunter Canyon, Coal Gulch, and Garvey Canyon, springs support limited reaches of streamflow. No flowing springs were identified in the Northern Lease Area.

During the fall of 1983, a low-flow investigation was conducted along Big Salt Wash to identify groundwater contributions to streamflow. Results of this investigation indicate that the reach of stream crossing the lease area is neither a gaining nor a losing stream. Therefore, groundwater recharge or discharge along this reach is insignificant.

1.5 COMPUTER MODELING

In addition to the field data, a groundwater model was developed for a portion of the lease area by the Bureau of Mines (U.S. Bureau of Mines, 1983). This model was used to refine parameters collected in the minesite. Based on the calibrated model, the following aquifer characteristics have been identified: a local potentiometric surface that shows flow generally

toward Coal Gulch, and then down the Gulch from east to west; average annual recharge of 0.25 inches; transmissivities of 40 ft/day for the coal; permeabilities of 0.07 to 0.5 ft/day for the overburden; and vertical hydraulic conductivities through the confining layer over the coal of 7×10^{-5} ft/day. Permeabilities were used to characterize the hydraulics of the overburden because the extremely variable saturated thicknesses caused corresponding wide ranges in transmissivity.

1.6 WATER QUALITY

Water quality samples from the monitor wells have been analyzed by the US Bureau of Mines (in 1982 and 1983), and by DCC (from 1980 to 1983). Results for the CM series wells are shown on Table 2.04.7-5. Water quality data for wells completed in 1982 are shown on Tables 2.04.7-6 a, b, and c, and 2.04.7-7.

The analyses indicate that sodium is the major cation for water from the overburden and Cameo Coal Seam, with bicarbonate or sulfate dominating the anion species. Wells completed in the coal seam are generally dominated by the bicarbonate ion. Water from wells completed in the interburden and Anchor Coal Seam is dominated, however, by calcium and bicarbonate ions.

Water in the overburden and Cameo Coal Seams is extremely hard, and high in total dissolved solids concentrations. Total dissolved solids (TDS) concentrations in the coal seam samples average 2203 mg/l and in the overburden samples average 2652 mg/l. These concentrations may be excessive for domestic use but are acceptable for agricultural and livestock use.

TABLE 2.04.7-5 - GROUND WATER QUALITY, LABORATORY TEST RESULTS,[a,b]

FRUITA MINE SITE

	11-17-80				2-23-81					5-26-81			
Parameter	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-4	CM-7	M-1	CM-1	CM-2	CM-4	CM-7
Temperature, °C	14	14	13	16	15	14	11	12	10	16	16	14	15
pH	8.35	8.7	8.5	8.3	7.6	8.15	7.75	8.35	7.95	7.0	8.3	7.3	7.5
Turbidity, NTU	15	14	17	10	-	-	-	-	-				
Arsenic, mg/l	0.0	0.0	0.0	0.0	.00	.00	.00	.00	.00	.00	.00	.00	0.004
Barium, mg/l	0.0	0.0	0.0	0.0	.00	.00	.00	.00	.00	.00	.00	.00	.00
Cadmium, mg/l	.000	.002	.001	.001	.00	.00	.00	.00	.00	.00	.001	.00	.00
Chromium, mg/l	.016	.011	.009	.008	.00	.00	.00	.00	.00	.00	.002	.005	.00
Fluoride, mg/l	.80	1.25	.84	.88	1.0	3.2	1.1	1.1	.084	1.1	3.1	1.05	1.05
Lead, mg/l	.012	.056	.010	.003	.00	.009	.003	.00	.00	.001	.003	.00	.001
Mercury, mg/l	.0002	.00	.0002	.00	.00	.00	.00	.00	.00	.00	.00	.00	.0010
Nitrate, mg/l	.19	.35	.46	.00	.04	.59	.325	.025	.16	.00	.018	.017	.00
Selenium, mg/l	.00	.00	.037	.023	.00	.00	.005	.000	.00	.00	.00	.00	.00
Silver, mg/l	.00	.00	.00	.00									
Bicarbonate, mg/l	148	1505	142	150	170	1718	117	149	221	238	1736	107	168
Carbonate, mg/l	1.8	100	8.0	.00	9.6	151	31.2	9.6	43.2	.00	179	28.2	.00
Potassium, mg/l	3.4	7.9	3.4	2.5	3.7	4.0	3.0	3.1	3.4	5.7	3.9	4.2	2.7
Color (Co/Pt Units)	5	0	5	5									
Hardness ($CaCO_3$), mg/l	147	104	149	141	148	30	135	128	167	193	35.8	236	154
Calcium, mg/l	37	14	35	35	34	2.6	33	31	34	43.0	3.0	46	43.0
Magnesium, mg/l	11	14	12	11	15	5.7	13	13	20	14.6	4.7	9.36	13.0
Sodium, mg/l	16	800	16	14.5	16.1	825	14	12.5	65	22.0	860	16.6	13.2
Chloride, mg/l	7.6	24.6	7.2	7.2	9	27	9	8	10	18	41	14	23
Sulfate, mg/l	32.5	375	29.8	29.8	18	140	17	22	46	1.8	66.0	25.2	22.1
Phenol Alkalinity ($CaCO_3$), mg/l	3	83	7.0	.00						.00	149	23.5	.00
Total Alkalinity ($CaCO_3$), mg/l	127	1400	130	123						195	1721	144	138
Dissolved Solds, mg/l	182	2206	212	170	286	2762	218	248	420	306	2130	298	298

TABLE 2.04.7-5 (continued)

Parameter	11-17-80 M-1	CM-1	CM-2	CM-4	CM-7	2-21-81 CM-1	CM-2	CM-4	CM-7	5-26-81 M-1	CM-1	CM-2	CM-4	CM-7
Electroconductivity, micromhos/cm		450	2450	350	330	400	2900	400	380	580	490	2800	430	440
Iron, mg/l		.10	.36	.28	.26	.02	0.014	1.0	0.034	0.257	0.60	1.12	1.3	0.08
Manganese, mg/l		.004	.014	.014	.009	0.061	0.005	0.031	0.002	0.026	0.060	0.005	0.052	0.006
Copper, mg/l		.019	.021	.015	.013	.00	.022	.018	.01	.019	0.028	0.016	0.008	0.010
Zinc, mg/l		.016	.012	.046	.036	.006	.018	.09	.092	.017	0.019	0.062	0.070	0.093
Molybdenum, mg/l		.000	.017	.000	.000	.00	.004	.00	.00	.019	.00	.00	.007	.00
Ammonia, mg/l		.67	.70	1.21	.31	1.44	.133	.253	.482	.458	0.78	0.18	0.64	0.33
Phosphate, mg/l		.075	.055	.070	.030	.125	.041	.105	.087	.107	1.27	0.305	0.365	0.342
Boron, mg/l		.05	.21	.04	.08	.068	.256	.043	.031	.218	0.200	0.340	0.066	0.086
Hydroxide, mg/l														

a All analyses by John C. Kephart & Co., Grand Junction Laboratories, Grand Junction, CO.
b Water quality data for CM-3 is not presented because water was contaminated by cement during well completion.

TABLE 2.04.7-5 (continued)

	8-31-81				12-7-81			5-30-82			
	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-7	CM-1	CM-2	CM-4	CM-7
Temperature °C								15	15	14.5	14
pH	7.4	8.5	7.4	7.8	7.1	8.1	7.6	8.0	8.7	8.8	8.6
Turbidity, NTU	9.0	12	10	5	-	-	-	170	7.2	15	10
Arsenic	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000
Barium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cadmium	0.000	0.000	0.000	0.000	0.026	0.005	0.018	0.000	0.000	0.000	0.004
Chromium	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.002	0.002	0.002
Fluoride	1.50	4.00	1.50	1.19	0.33	3.45	1.13	0.54	3.7	0.000	1.40
Lead	0.002	0.020	0.007	0.003	0.000	0.000	0.000	0.004	0.011	0.002	0.003
Mercury	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nitrate	0.000	0.000	0.000	0.000	0.139	0.017	0.235	0.055	0.000	0.000	0.04
Selenium	0.005	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-
Silver	0.000	0.000	0.000	0.000	-	-	-	0.000	0.000	0.000	0.000
Bicarbonate	185	2096	257	155	150	2133	225	157	2108	58	185
Carbonate	0.00	18.86	0.000	11.3	0.000	0.000	0.000	0.000	73	0.000	0.000
Potassium	3.9	5	4.2	2.6	6.5	6.5	3.0	12.2	8.26	3.0	2.6
Color (Co/Pt. Units)	7	6	6	7	-	-	-	5	0	0	0
Hardness	173	89	187	274	94	47	167	80	82	131	163
Calcium	47.7	6.8	47.7	47.7	19.8	8.6	39.6	31	32	38	40
Magnesium	13.9	15.3	16.7	27.8	8.5	5.8	15.3	0.00	0.00	0.75	13
Sodium	24	829	15	12	38	760	14.5	47	889	23	20
Sulfate	30	138	13	25.5	57	136	29	32	117	25	27
Alkalinity (phenol)	0.000	31	0.000	19	-	-	-	0.0	60.9	76.5	0.00
Alkalinity (total)	153	1795	212	166	-	-	-	130	1864	125	153
Dissolved Solids	276	2104	248	220	264	2126	254	228	2144	228	212
Conductivity (umhos/cm)	440	3190	495	355	290	2100	324	400	3500	400	355
Iron	0.50	0.7	0.32	0.32	1.40	1.73	0.35	0.48	0.16	0.12	0.00
Manganese	0.095	0.85	0.074	0.02	0.028	0.062	0.020	0.05	0.23	0.003	0.008
Copper	0.000	0.045	0.020	0.001	0.022	0.013	0.019	0.02	0.008	0.008	0.022
Zinc	0.044	0.04	0.012	0.09	0.120	0.052	0.220	0.06	0.011	0.037	0.089
Molybdenum	0.006	0.006	0.006	0.006	0.006	0.005	0.002	0.006	0.003	0.005	0.005
Ammonia	1.34	0.29	2.46	0.64	1.19	0.000	0.000	1.78	0.2	0.71	0.20
Phosphate	0.000	0.22	0.18	0.000	0.4	0.3	0.0	0.045	0.175	0.000	0.015
Boron	0.000	0.000	0.000	0.000	0.04	0.22	0.07	0.05	0.3	0.07	0.65
Hydroxide	-	-	-	-	-	-	-	0.000	0.000	9.52	0.00
Chloride	55	35	15	15	12	22	8	24	18	10	8
Suspended Solids					41	20.8	2.8	-	-		
Combustible Solids					156	368	68	-	-		
Aluminum					0.07	0.01	0.01	-	-		

TABLE 2.04.7-5 (cont).GROUND WATER QUALITY, LABORATORY TEST RESULTS,

FRUITA MINE SITE

	12-7-80				1-3-81				3-21-81			
Parameter	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-4	CM-7
pH	7.46	8.42	7.87	7.71	7.56	8.56	7.64	7.58	7.45	8.32	7.74	7.66
Electroconductivity, mmhos/cm	0.29	2.97	0.31	0.27	0.41	2.63	0.37	0.34	0.44	2.84	0.39	0.37
Dissolved Solids, mg/l	226	2313	241	211	238	1993	217	196	262	2218	224	213
Suspended Solids, mg/l	< 10	14	16	< 10	< 10	< 10	12	< 10	14	15	< 10	< 10
Iron, mg/l	0.12	0.09	0.09	0.08	1.62	< 0.02	< 0.02	< 0.02	0.67	0.18	0.74	0.14
Manganese, mg/l	< 0.02	< 0.02	< 0.02	< 0.02	0.11	< 0.02	< 0.02	< 0.02	0.10	0.20	0.05	0.02
Temperature, °C	15	15	13	12	14	14	13	12	14	14	12	13
Sodium, mg/l	15	1032	20	16	36.6	197.4	36.4	26.6	29	990	32	26
Calcium, mg/l	19	4	19	17	25.4	9.8	27.6	32.2	22	8	18	18
Magnesium, mg/l	42	23	41	41	36.8	12.2	33.0	32.2	52	25	39	44

	4-12-82				6-14-81				7-19-81			
Parameter	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-4	CM-7
pH	8.22	11.21	7.64	8.38	8.30	8.82	7.55	7.49	7.53	8.35	7.53	7.54
Electroconductivity mmhos/cm	0.24	4.62	0.37	0.31	0.41	3.37	0.38	0.33	0.56	3.97	0.43	0.49
Dissolved Solids, mg/l	197	4387	286	241	298	3223	290	255	425	3680	325	335
Suspended Solids, mg/l	14	< 10	15	13	< 10	< 10	< 10	10	17	12	14	13
Iron, mg/l	0.82	0.13	0.78	0.19	0.36	0.19	1.27	0.13	0.21	0.15	0.18	0.19
Manganese, mg/l	0.08	0.02	0.28	0.02	0.10	0.10	0.05	0.03	0.12	0.13	0.06	0.04
Temperature, °C	11	13	15	14					17	16	14	15
Sodium, mg/l	98	3200	120	94								
Calcium, mg/l	18	19	7	27								
Magnesium, mg/l	140	1	180	132								

All Analyses by SOLTESCO, Soil and Water Consultants, Grand Junction, Colorado

TABLE 2.04.7-5 (continued)

	9-30-81				10-26-81		
	CM-1	CM-2	CM-4	CM-7	CM-1	CM-2	CM-7
pH	8.29	7.58	8.87	7.74	8.39	8.28	7.72
Electroconductivity (mmhos/cm)	0.32	3.26	0.36	0.33	0.33	3.26	0.34
Dissolved Solids	245	3125	270	250	250	3025	255
Suspended Solids	17	12	15	14	52	< 10	12
Iron	0.05	0.19	0.23	0.11	8.8	0.22	0.17
Manganese	0.04	0.05	0.06	< 0.02	0.06	0.10	< 0.02
Temperature	15	15.3	15	15	13	13.5	-
Sodium	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-

TABLE 2.04.7-6a
GROUNDWATER QUALITY ANALYSES
BY U. S. BUREAU OF MINES, 1982

	9-8-82				10-6-82				10-6-82			
Parameter (mg/l)	P(F-56C)	P(F-56UA)	(F-59OB)	R(F-59UA)	P(F-56C)	P(F-56UA)	FF(F-58C)	FF(F-58OB)	R(F-59C)	R(F-59OB)	R(F-59UA)	R(F-59WUA)
TDS (@ 180°C)	2100.0	2300.0	2800.0	3300.0	2000.0	3100.0	1300.0	1200.0	300.0	2400.0	3400.0	3200.0
Bicarbonate (as HCO_3)	1900.0	2200.0	870.0	890.0	2100.0	1200.0	1100.0	1300.0	160.0	840.0	970.0	930.0
Calcium, dissolved	6.3	5.7	28.0	48.0	4.2	100.0	7.3	6.7	25.0	26.0	52.0	53.0
Carbonate (as CO_3)	150.0	18.0	0.0	0.0	110.0	0.0	72.0	48.0	0.0	0.0	0.0	0.0
Chloride	37.0	74.0	46.0	45.0	27.0	80.0	67.0	77.0	7.0	39.0	60.0	62.0
Magnesium, dissolved	3.7	9.4	43.0	120.0	3.2	78.0	3.9	3.5	7.2	33.0	120.0	110.0
Ammonia (as N)	0.3	0.8	0.5	0.2	0.9	0.6	<0.2	0.2	<0.2	0.4	<0.2	<0.2
Nitrate (as N)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	0.05	<0.05	<0.05	<0.05
Phosphate (as P)	0.47	0.23	0.04	0.03	0.61	0.13	0.72	0.46	0.02	0.05	<0.02	<0.02
Sodium, dissolved	850.0	880.0	850.0	830.0	880.0	870.0	520.0	520.0	68.0	790.0	870.0	850.0
Sulfate (as SO_4)	83.0	180.0	1400.0	1700.0	130.0	1500.0	180.0	260.0	100.0	1300.0	1800.0	1700.0
Arsenic, dissolved	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron, dissolved	0.09	0.11	<0.01	<0.01	0.17	0.12	0.08	0.09	0.07	0.03	0.03	0.02
Manganese, dissolved	0.011	0.028	0.022	0.069	0.008	0.11	0.029	0.038	0.015	0.19	0.074	0.049
Mercury, dissolved	<0.0001	<0.001	<0.0001	<0.0001	<0.0005	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium, dissolved	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc, dissolved	0.030	0.028	0.090	0.35	0.013	0.011	0.005	<0.005	<0.096	0.018	0.022	0.016
Cadmium, dissolved	<0.005	<0.005	0.005	0.009	0.007	0.009	0.005	<0.005	<0.005	<0.005	0.009	0.007
Hardness (as $CaCO_3$)					34.0	590.0	36.0	60.0	100.0	240.0	750.0	700.0
Turbidity, NTC					1700.0	13.0	1100.0	24000.0	6.7	9.8	74.0	930.0

[1]All analyses by Camp, Dresser, McKee, Wheat Ridge, CO. Analytical methods are according to either Amer. Pub. Health Assoc. (1975) or US EPA (1979).

TABLE 2.04.7-6b

GROUNDWATER QUALITY ANALYSIS[a,c]

(U.S. Bureau of Mines, March 31, 1983)

	F-56UA	F56C	F-59UA[b]
Conductance (umhos)	4200	3700	5100
pH (Field)	8.47	8.74	8.24
Alkalinity	967	1740	782
Calcium	95	14	238
Hardness	253	53	752
Magnesium	40	6	150
Sodium	606	901	936
Sulfate	850	48	1750
Iron	0.01	0.78	0.20
Copper	< 0.01	0.01	0.01
Zinc	< 0.001	0.11	0.09
Manganese	0.02	0.08	0.73
Lead	0.035	0.113	0.047
Cadmium	0.001	0.021	0.022
Boron	0.90	< 0.001	< 0.001
Nickel	0.10	0.003	0.48
Flouride	2.90	3.5	1.19
Chloride	5	< 0.01	4
Nitrate	0.4	1.1	0.2
Phosphorus	.008	< 0.001	5.4
Potassium	2.1	5.3	0.000

a Only wells F-56 and F-59 sampled due to poor road conditions and weather constraints

b Equipment malfunction precluded sampling of F-590B and F-59C

c All concentrations in mg/l unless otherwise specifically stated

TABLE 2.04.7-6C
GROUNDWATER QUALITY ANALYSIS
By U.S. Bureau of Mines, August 15-18, 1983

	F-50C	F-56UA	F-56C	F-58C	F-58UA	F-59OB	F-59C	F-59UA	F-62UA	F-70OB(E)	F-70C(W)	F-71OB
Conductance (umhos @25 C)	2088	4699	2938	1938	2415	310	468	4788	3210	2436	1265	3774
pH (field)	8.29	8.31	8.32	8.55	8.63	8.9	8.26	8.93	7.86	8.01	7.31	7.95
Cadminum	0.028	0.041	0.013	0.007	0.026	0.024	0.010	0.026	0.022	0.016	0.008	0.011
Copper	0.45	0.050	0.065	0.001	0.020	0.010	0.35	0.22	0.010	0.38	0.420	0.045
Iron	11.00	6.00	1.19	2.75	1.23	05.9	0.35	0.125	0.095	0.55	2.25	0.120
Lead	<0.010	0.059	<0.010	0.036	0.023	0.046	0.114	0.181	<0.010	0.166	<0.010	<0.010
Magnesium	134.4	105	10.00	7.00	11.6	47.8	15.4	149.6	3.60	60.0	19.00	7.60
Manganese	0.448	0.234	0.094	0.064	0.291	0.170	0.082	0.715	0.115	0.641	1.132	0.052
Nickel	0.038	0.030	0.012	0.022	0.012	0.027	0.021	0.045	0.018	0.027	0.027	0.013
Potassium	17.2	18.0	18.4	21.2	23.0	21.8	26.0	28.0	26.0	29.2	39.2	32.0
Zinc	2.46	0.191	0.052	0.042	0.057	0.086	0.160	0.175	0.123	0.141	0.250	0.372

Metals in milligrams per liter.

TABLE 2.04.7-8

SUMMARY OF DORCHESTER COAL COMPANY'S GROUNDWATER QUALITY
SAMPLING OF AUGUST 15-18, 1983

Parameter	SAMPLE ID (WELL NO.) F-50C	F-56UA	F-56C	F-58C	F-58UA	F-59C	F-590B	F-590UA	F-62UA	F-70C West	F-700B East	F-710B
Bicarbonate (as $CaCo_3$)	777	601	1,850	1,120	1,120	171	713	831	2,150	322	479	1,610
Calcium	56	80	4	4	6	28	38	68	4	52	34	4
Chloride	62	27	38	29	28	8	36	50	39	14	14	29
Conductivity (umhos/cm @ 25°C	2,850	4,400	3,510	2,510	2,310	710	3,640	4,620	3,630	710	2,530	4,070
Magnesium	93	61	2	1	2	8	35	128	1	6	36	2
Mitrogen, Ammonia	0.48	0.34	0.10	0.23	0.02	0.20	0.19	0.12	0.16	0.77	0.06	0.04
Nitrogen, NO_3/NO_2	0.10	5.15	<0.02	<0.02	0.02	0.02	0.02	0.02	0.11	0.02	0.02	0.02
pH (units)	7.9	7.7	8.2	8.0	8.0	7.4	8.1	7.9	8.3	7.2	7.7	8.0
Phosphorus, Ortho	0.03	0.03	0.08	0.24	0.23	0.04	0.04	0.05	0.07	0.09	0.06	0.08
Sodium	499	903	898	628	616	100	822	971	1,000	115	500	1,070
Solids, Dissolved	1,970	3,320	2,270	1,580	1,650	425	2,590	3,600	2,410	655	1,720	2,790
Solids, Suspended	2,100	290	236	<4	472	<4	6	3,320	20	244	48	20
Sulfate	829	1,930	250	243	212	138	1,250	1,910	8	32	852	714
Depth to Water (ft)	82.0	38.8	66.0	275.5	174.3	283.75	182.5	34.8	989	276.5	285.5	948.5

The sulfate levels in the overburden wells exceed 500 mg/l, which is the recommended limit for stock watering (McKee and Wolf, 1963), and substantially exceed 250 mg/l, which is the recommended limit for domestic use (Hem, 1970). Water in the coal seam has lower sulfate concentrations than the overburden, but would be marginal for human consumption because of the high TDS concentrations.

Water in the interburden and Anchor Coal Seam has relatively low hardness total dissolved solids and sulfates and would be suitable for all potential uses.

1.7 GROUNDWATER UTILIZATION

A search for registered water wells was conducted using the records of the Colorado State Engineer in October of 1982, and was updated in August, 1983. Originally, no registered wells were located within 5 miles of the Fruita Mine Lease Area. (This information was verified by conversations with two local ranchers, Don Hitchborne and John Cuddy (personal communication, October, 1982)). The nearest registered wells were the Humphries wells located in T11S, R100W, Section 23. (These wells are completed in the Colorado River alluvial aquifer more than 10 miles from the minesite.)

Recently, one well has been completed in the vicinity of the Fruita Mine. The U.S. Bureau of Land Management? Reclamation has completed a well less than two miles from the lease boundary (Permit #12-90-10, T8S, R102W, Sec. 14, SE, NE). This well is 100 feet deep and

takes water from Big Salt Wash alluvium for stockwatering purposes.

In summary, groundwater utilization in the vicinity of the Fruita Mine (within a 5 mile radius of the lease boundary) is limited to one well. This well is located in Big Salt Wash alluvium downstream from the Fruita Mine Lease Area. No wells are completed in the Cameo Coal Seam.

SECTION 2

SURFACE WATER

The surface water adjacent area associated with the Fruita mine is shown on Map 2.04.7-1. The vast majority of the permit area and adjacent area falls within the Big Salt Wash drainage area. The southern-flowing Big Salt Wash is a perennial stream that joins the Colorado River near Fruita, Colorado. A small area in the northwest corner of the lease area drains to Munger Canyon, an ephemeral tributary of East Salt Creek.

Much of the area to be undermined is drained by Coal Gulch and Garvey Canyon, both of which are ephemeral drainages with intermittent reaches supported by springs. The southeastern portion of the permit area is drained by Layton Wash and Lipan Wash, both of which eventually flow into Big Salt Wash. These drainages are also ephemeral with intermittent reaches supported by springs. The remainder of the drainages in the area to be mined (including Hatchet and Buniger Canyons) and the area along the front of the Bookcliffs, are ephemeral drainages.

2.1 SPRING INVENTORY AND UTILIZATION

Identification of the springs in the Fruita Mine permit and adjacent areas began in the summer of 1982. In 1982, Kaman Tempo and J.F. Sato and Associates conducted an intensive field investigation for springs in the drainages of Big Salt Wash, Garvey Canyon, Coal Gulch, Lipan Wash, and Layton Wash in the study area.

In 1983, additional field investigations by Kaman Tempo expanded the spring inventory to include Hatchet Canyon, two unnamed tributaries to Big Salt Wash (north of Hatchet Canyon and north of Buniger Canyon), Post Canyon, Hunter Canyon, Buniger Canyon, and Stove Canyon. In addition, Coal Gulch and portions of Layton Wash and Lipan Wash were revisited. The springs which were identified are located on Map 2.04.7-1, and Tables 2.04.7-8 through 2.04.7-11, provide additional information on these springs with respect to geologic source, discharge rate, and field water quality parameters (i.e., temperature, pH, and specific electrical conductance).

Three types of springs were identified during the survey. The occurrence of the majority of the springs was stratigraphically controlled. These springs were associated primarily with sandstone outcrops or subcrop, although a few were found to be issuing from coal seams and stringers of coal. Other springs, located along the course of stream channels, appear to be alluvial springs. (In some cases, these springs may actually flow from subcrop.) Finally, some springs were fracture controlled, such as Spring CGS2 in Coal Gulch (Map 2.04.7-1). In 1982, all springs in the study area had low discharge rates (i.e., less than 5 gpm). In most cases, discharge rates were less than 1 gpm. In September of 1983, estimated flow rates were somewhat higher. However, flows for all springs measured in November, 1983 were below two gallons per minute.

Discharge from most of the springs is not constant. The

TABLE 2.04.7-8
1982 SPRING INVENTORY DATA

Designation	Elevation (feet-msl)	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm)	Temp. (C)	Comments
Coal Gulch							
-CGS1		Coal	<1	6.5	4800	21	Very diffuse source Variable flow rates noted summer '82 TDS: 3500 mg/l Sulfate: 750 mg/l
-CGS2	5640	Sandstone joint	5	7.4	4800	14	Point Source TDS: 4000 mg/l Sulfate: 2400mg/l
-CGS3	5820	Not apparent	3-4	N/A	N/A	N/A	
-CGS4	6020	Weathered shale	<1	N/A	N/A	N/A	Small diffuse flow
Tributaries to Coal Gulch							
-T1S1	5630	Coal-sandstone	seep	N/A	N/A	N/A	
-T1S2	5680	Not apparent	<1	7.7	6600	22	Sulfate: 2300 mg/l Turbidity: 9800 ntu
-T1S3	5740	Shale	N/A	7.6	6300	22	Sulfate: 2400 mg/l TDS: 4900 mg/l
-T1S4	5790	Shale	N/A	6.7	4600	15.5	
-T1S5	5960	Coal	5	N/A	N/A	N/A	
-T1S6	6120						
-T2S1	6110	Coal-sandstone	N/A	N/A	N/A	N/A	Sulfate: 3500 mg/l TDS: 6000 mg/l
-T2S2	6140	Coal-sandstone	N/A	7.6	6400	27	Sulfate: 3100 mg/l TDS: 4700 mg/l
-T2S3	6190	Coal-sandstone	N/A	7.9	7600	27	

TABLE 2.04.7-8
1982 SPRING INVENTORY DATA
(continued)

Designation	Elevation	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm)	Temp. (C)	Comments
Garvey Canyon -GCS5	5510	Coal-sandstone	pools	8.04	7800	26	Observed: 9/9/82
-GCS4	5675	Sandstone	.5	7.7	6250	17	Observed: 9/9/82
-GCS1	6000	Alluvium	none	---	----	--	
-GCS2	5580	Slump block	----	---	----	--	Associated with a slump off mesa face
-GCS3	5680	Slump block	----	---	----	--	
Tributaries to Garvey Canyon -GCS4		Slump block	----	---	----	--	
Lipan Wash -LiWS1	6140	Sandstone	seep	---	----	--	No flow-9/9/82 on cliff above channel
-LiWS2	5980	Sandstone	.1	7.2	1850	17	Water from sandstone at lower area of cliff --forms waterfall
-LiWS3	5880	Alluvium	1.5	7.4	1950	20	Spring located below LiWS2 in channel bottom
-LiWS4	5710	Alluvium	.3	7.6	2750	20	
-LiWS5	5680	Sandstone	.2	8.8	3000	20	

TABLE 2.04.7-8
1982 SPRING INVENTORY DATA
(continued)

Designation	Elevation (feet-msl)	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm)	Temp. (C)	Comments
Layton Wash -LWS1	6120	Sandstone over shale	0.1	7.7	1900	20	
-LWS2	6100	Shale	seep	N/A	N/A	N/A	
-LWS3	6140	Shale	0.3	8.3	3000	17	
-LWS4	5920	Conglomerate in channel	0.8	8.2	4200	18	
-LWS5	5780	Sandstone in channel	0.2	8.2	3000	17	
-LWS6	5670	Sandstone in channel	1.7	7.4	4000	18.5	
-LWS7	5640	Seep-alluvial fan in stream	0.2	N/A	N/A	N/A	
-LWS8	5630	Seep-alluvial fan in stream	0.2	7.9	4600	20	
-LWS9	5625	Seep-alluvial fan in stream	0.2	N/A	N/A	N/A	
-LWS10	5760	Seep-bedrock above stream	0	N/A	N/A	N/A	
-LWS11	5560	Coal	0.5	8.5	3600	20	
-LWS12	5240	Sandstone	seep	N/A	N/A	N/A	

TABLE 2.04.7-9

SPRING INVENTORY (MARCH, 1983)

Coal Gulch[a]	Approximate Elevation	Source	Flow (gpm)	pH	Conductance (umhos/cm)	Temp. (°C)	Comments
CGS1	5540	Coal	< 1	7.51	5400	8.4	Flow barely perceptible
CGS2	5640	Sandstone Joint	< 1	7.35	3800	9.9	

a Other springs inaccessible due to weather and poor road conditions.

TABLE 2.04.7-10

SEPTEMBER 1983 SPRING INVENTORY DATA

Designation	Approximate Elevation (feet-msl)	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm)	Temp. (°C)	Comments
Coal Gulch							
-CGS1		Coal	Dry	--	--	--	--
-CGS2	5640	Sandstone	15	7.55	3,800	13	Flow estimated with float
-CGS2A	5780	Joint Sandstone (?)	9	7.84	3,900	16	Flow estimated with float
-CGS3	5820	Not Apparent	7	7.55	3,400	18	Flow estimated with float
Garvey Canyon							
-GCS4	5675	Sandstone	5	--	--	--	Flow estimated with float
Post Canyon							
-PCS1	6190	Sandstone	Seep	--	--	--	Not accessible
-PCS2	6110	Sandstone	Seep	--	--	--	Not accessible
Layton Wash							
-LWS10A	5550	Coal Seam	<1	7.56	5,700	20	Mouth of side drainage
-LWS11A	5300	Alluvium	5	7.34	11,200	21	Visual flow estimate
Lipan Wash							
-LW1S6	5480	Alluvium	--	7.34	5,300	19	

Table 2.04.7-10(continued)

SEPTEMBER 1983 SPRING INVENTORY DATA

Designation	Approximate Elevation (feet-msl)	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm)	Temp. (oC)	Comments
Hunter Canyon -HCS1	5710	Sandstone-shale contact	Numerous seeps	7.27	3,150	26	Sample field tested at truck
-HCS2	5690	Alluvium (?)	--	7.25	3,400	26	" " " " "
-HCS3	5680	Sandstone	Numerous springs and seeps	--	--	--	
-HCS4	5605	Sandstone	Seep	--	--	--	
-HCS5	5600	Colluvium (?)	Seep	--	--	--	
-HCS6	5560	Alluvium (?)	--	--	--	--	
-HCS7	5530	Sandstone	--	--	--	--	
-HCS8	5525	Sandstone	--	7.42	6,000	26	Sample field tested at truck
-HCS9	5520	Sandstone-Coal	Seep	--	--	--	
-HCS10	5515	Sandstone	--	--	--	--	
-HCS11	5500	Alluvium (?)	--	7.35	5,150	26	Sample field tested at truck
-HCS12	5485	Sandstone (?)	--	7.38	4,500	26	Sample field tested at truck

Table 2.04.7-10(continued)
SEPTEMBER 1983 SPRING INVENTORY DATA

Designation	Approximate Elevation (feet-msl)	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm)	Temp. (°C)	Comments
Buniger Canyon							
-BSC1	5790	Sandstone	Seep	--	--	--	Pool of water in stream channel
-BSC2	5720	Sandstone-shale content	Seep	--	--	--	
-BSC3	5630	Colluvium (?)	Seep	--	--	--	
-BSC4	5620	Sandstone	Seep	--	--	--	
Stove Canyon							
-SCS1	5635	Sandstone	Seep	--	--	--	
-SCS2	5615	Sandstone (?)	Seep	7.70	5,600	34	Pools of water along channel No flow observed Sample field tested at truck
-SCS3	5550	Sandstone	Seep	--	--	--	

TABLE 2.04.7-11
NOVEMBER 1983 SPRING INVENTORY DATA

Designation	Approximate Elevation (feet-msl)	Source	Flow (gpm)	Field pH	Field Conductance (umhos/cm) at 25°C	Temp (°C)	Comments
Buniger Canyon							
BCS1A	5850	Sandstone Joint	Seep	-	-	-	
Coal Gulch							
CGS1		Coal	dry				
CGS2	5640	Sandstone Joint	1.8	7.33	4235	16°	
CGS2A	5780	Sandstone (?)	dry				
CGS3	58920	Not Apparent	1.1	7.55	5480	11°	
CGS4	6020	Weathered Shale	0.56	7.26	4917	8°	
Garvey Canyon							
CGS4	5675	Sandstone	<<1.0	7.80	5850	7°	Flow too small to measure
Hunter Canyon							
Baseflow in stream along entire reach where individual springs were previously identified			2.65	7.87	3409	12.5°	Average Values

majority of the springs dry up during the summer. Some of the springs located in Coal Gulch (CGS1, CGS2, CGS3, and CGS4) and Hunter Canyon may be perennial. Springs CGS1, CGS2, CGS3 and CGS4 were flowing in October, 1982. In September and November, 1983, springs in Coal Gulch and Hunter Canyon supported streamflow in limited reaches of the valleys. Estimated total flow from springs in the central part of the study area is on the order of 150 gpm (Bureau of Mines, 1983). Of this amount, 130 gpm is attributed to Coal Gulch Springs, 5 gpm to springs in Layton Wash, 5 gpm to springs in tributary 1, and 5 gpm to springs in tributary 2. (Tributary 1 is a tributary extending from the north into Coal Gulch in the center of the Central Lease mine area. Tributary 2 joins Coal Gulch from the north in the northwest corner of the Eastern Lease mine area. These tributaries are shown on Map 2.04.7-1.) The flow data collected in November, 1983 indicates that these estimates may be high.

The sources of most springs in the study area eminate within the stream channels of the major drainages. During the late spring and early summer flow from these springs is obscured by the natural runoff. Thus, it is not possible to collect flow or water quality data for individual springs during this period of the year. Flow and water quality data for the drainages collected during the spring and early summer months represent a composite of the spring flow and surface runoff.

The rugged topography of the area exposes numerous sandstone units along the valley walls. These sandstone outcrops may contain springs supported by perched water tables. The springs

along tributaries 1 and 2 are probably in this category. In many locations, white salt deposits along the sandstone outcrops suggest the presence of intermittent springs. These intermittent springs do not represent a significant water resource and are not identified on the hydrologic map (Map 2.04.7-1).

The results of water quality analyses on selected springs is provided in Tables 2.04.7-12 through 2.04.7-14. The water is a sodium-sulfate type with high concentrations of TDS, sodium, and sulfate. The water is of poor quality and would not be suitable for domestic use. The sulfate and TDS concentrations both exceed U.S. Public Health Service (1965) standards for drinking water supplies. The remaining parameters analyzed were not excessively high and would not limit water use.

None of the identified springs have been developed for any use. Most springs are located at high elevations in narrow rocky canyons making utilization by wildlife difficult. However, utilization of the lower springs by upland game birds has been observed (Lonnie Renner, consulting wildlife biologist, personal communicatiion, March, 1983). In addition, the water quality of several springs limits their potential use for livestock because of high concentrations of sulfates and TDS. Springs CGS1, CGS2, T1S2, T1S3, T1S4, T2S1, T2S2, and T2S3 have average sulfate concentrations of 2400 mg/l (range 1200-3600 mg/l). This sulfate level is well above the recommended stock water limit of 500 mg/l (McKee and Wolf, 1963). In addition, the TDS concentrations of several spring approach or exceed the recommended stock watering

TABLE 2.04.7-12

RESULTS OF LABORATORY WATER QUALITY ANALYSES FOR SPRINGS IN COAL GULCH[1]

	CGS1	CGS2	CGS3	T1S2	T1S3	T1S4	T2S1	T2S2	T2S3
Date of Sample	7-06-82	7-06-82	7-22-82	7-22-82	7-22-82	7-22-82	7-22-82	7-22-82	7-22-82
pH	7.9		8.3				8.1	7.5	8.3
Hardness	170.0	1300.0	1100.0	1200.0	950.0	750.0	2400.0	2200.0	2500.0
Sulfate (as SO_4)	750.0	2400.0	2200.0	2300.0	2400.0	1200.0	3500.0	3100.0	3600.0
TDS (at 180°C)	3500.0	4000.0	3600.0	4400.0	4900.0	2600.0	6000.0	4700.0	5900.0
Turbidity, JTU	1700.0	0.25	150.0	9800.0	2.2	12,000.0	2.0	55.0	12.0
BOD	8.0	<2.0	<1.0	1.0	<1.0	1.5	<1.0	<1.0	<1.0
Iron, total	23.0	0.02	0.39	0.20	0.09	140.0	0.11	2.7	0.20

[1]All analyses by Comp Dresser & McKee, Inc.; Wheatridge, Colorado. Analytical methods are according to either Amer. Pub. Health Assoc. or US EPA.

TABLE 2.04.7-13

Results of Laboratory Water Quality Analyses for Spring in Coal Gulch (3/83)

	CG-1[a,b]	CG-2[a]
Conductance (umhos)	5400	3800
pH	7.51	7.35
Magnesium	24	138
Sodium	1102	627
Zinc	0.07	0.01
Manganese	0.30	0.02
Lead	0.025	0.034
Cadmium	0.003	0.017
Nickel	0.124	0.059
Potassium	10.2	3.2
Alkalinity	-	375
Calcium	-	475
Hardness	-	1046
Sulfate	-	2300
Iron	-	0.04
Copper	-	0.19
Boron	-	0.10
Fluoride	-	1.38
Chloride	-	6
Nitrate	-	0.9
Phosphorous	-	0.07

a All concentrations in mg/l unless otherwise specified

b Limited analyses due to insufficient sample

TABLE 2.04.7-14
SPRING WATER QUALITY ANALYSES FOR SELECTED SPRINGS

Parameter (mg/l unless otherwise noted	SAMPLE I.D. CGS2A	CGS2	LWS10A	LWS12	LiS5	GCS4
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Bicarbonate (as $CaCO_3$)	371	408	1,100	904	512	481
Cadmium	<0.005	<0.005	0.006	0.016	0.014	<0.005
Calcium	199	217	80	150	278	204
Chloride	28	29	73	130	60	25
Conductivity (umhos/cm @ 75° C)	4,290	4,560	5,830	12,100	5,880	5,390
Iron	0.48	0.11	0.82	0.24	0.26	0.10
Magnesium	140	135	105	735	275	155
Manganese	0.04	0.02	0.73	0.03	0.04	0.10
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrogen, Ammonia	0.07	0.04	0.17	0.08	0.06	0.08
Nitrogen, NO_3, NO_2	0.18	0.19	0.12	<0.02	<0.04	<0.02
pH (units)	7.9	7.9	8.2	7.9	7.5	7.8
Phosphorus (Ortho)	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium	763	831	1,600	2,700	1,000	1,030
Solids, Dissolved	3,870	4,025	4,690	12,300	5,720	4,830
Solids, Suspended	18	76	28	28	30	12
Sulfate	2,320	2,490	2,420	7,790	3,300	2,900
Zinc	0.17	0.026	0.021	0.029	0.033	0.019

NOTE: Metals are total recoverable.

limit of 5,000 mg/l.

2.2 BIG SALT WASH

The Big Salt Wash basin above the discontinued U.S. Geological Survey (USGS) gaging station at Fruita (approximately 12 miles downstream of the Fruita Mine) has an area of approximately 142 square miles. The sustained flow for this stream comes from groundwater and snowmelt in the upper basin and from irrigation return flow just below the confluence with Coal Gulch and below the Highline Canal.

Flow has been diverted from Big Salt Wash (just above the confluence of Coal Gulch and Big Salt Wash) for irrigation since the early 1900's. Three reservoirs were built around 1910 by the Quaker Oats Company to support diversions for domestic consumption and fruit orchards. Echo Lake (original storage capacity of 300 ac-ft) is located high in the Big Salt Wash drainage basin to store and regulate snowmelt runoff. The Ruby Lee Ditch was built to divert flow from Big Salt Wash just above the confluence with Coal Gulch into a shallow reservoir used to settle the high sediment loads. From there, the flow was stored in Ruby Lee Reservoir (capacity of 40 ac-ft) for use in irrigating land in the lower basin. Two of these reservoirs, Echo Lake and Ruby Lee Reservoir, are still used for agricultural purposes. Ruby Lee Ditch has recently been upgraded to facilitate maximum use of the water stored in these reservoirs. In addition, a second diversion ditch currently diverts flow from Big Salt Wash to irrigate fields of tall wheatgrass located

on terraces of Big Salt Wash near the mouth of Coal Gulch. Downstream of the irrigation diversions, Big Salt Wash is frequently dry.

There are two extended flow records for Big Salt Wash. The Bureau of Reclamation collected 43 flow measurements during 1973-1979 at a location above the Government Highline Canal (NW, SW, SE, Sec. 8, T2N, R2W). These data represent instantaneous flow measurements collected throughout the year over a six-year period. The USGS had a continuous recording gage (at Fruita) from March, 1973, to September, 1977. Both of these records were affected by irrigation diversions in the middle of the basin (just above the confluence of Coal Gulch with Big Salt Wash) during the period of sampling. The USGS station was also affected by irrigation return flows.

The Bureau of Reclamation data, presented in Table 2.04.7-15 show a maximum flow of 0.527 cubic meters per second (cms) or 11 cubic feet per second (cfs). A minimum flow of 0.02 cfs was observed.

Four years of USGS flow data for Big Salt Wash (at Fruita) (Table 2.04.7-16) show a mean flow of 61.8 cfs, maximum and minimum instantaneous flows of 1,730 cfs and 5.3 cfs, respectively, and an average annual flow volumes of 44,793 acre-feet (ac-ft). The average and maximum flows calculated from this data may be lower than actually occurred since major diversions were made upstream of the gage during the period of record. Field investigations have indicated that some sections of the

TABLE 2.04.7-15
US BUREAU OF RECLAMATION
INSTANTANEOUS FLOW DATA FOR BIG SALT WASH
ABOVE THE HIGHLINE CANAL

Date	CMS	CFS	Date	CMS	CFS
03/01/73	.280	5.8	04/16/76	.003	0.1
03/23/73	.028	0.6	05/07/76	.003	0.1
04/20/73	.025	0.5	06/11/76	.003	0.1
05/30/73	.130	2.7	07/20/76	.006	0.1
08/23/74	.003	0.1	09/09/76	.028	0.6
09/13/74	.008	0.2	10/29/76	.014	0.3
10/24/74	.042	0.9	11/09/76	.024	0.5
11/01/74	.226	4.7	04/08/77	.003	0.1
11/18/74	.003	0.1	08/10/77	.003	0.1
01/20/75	.003	0.1	12/29/77	.003	0.1
02/12/75	.003	0.1	01/18/78	.001	0.02
02/24/75	.003	0.1	02/09/78	.006	0.1
03/18/75	.034	0.7	03/17/78	.035	0.7
04/21/75	.054	1.1	04/17/78	.467	9.7
05/27/75	.127	2.7	05/19/78	.527	11.0
07/17/75	.071	1.2	11/09/78	.001	0.02
11/21/75	.003	0.1	02/28/79	.042	0.9
12/23/75	.003	0.1	04/04/79	.028	0.01
01/30/76	.003	0.1	05/14/79	.529	11.0
02/25/76	.003	0.1	07/12/79	.003	0.1
03/16/76	.003	0.1	10/29/79	.001	0.02
04/16/76	.003	0.1			

TABLE 2.04.7-16
SUMMARY OF USGS FLOW DATA
FOR BIG SALT WASH, STATION #09153270

Monthly

Year	Flow rate, cfs			Annual Flow volume,
	Mean	Maximum	Minimum	acre-feet
1974	59.1	158	5.4	42,760
1975	63.7	164	6.9	46,110
1976	60.1	145	5.3	43,660
1977	64.4	248	5.3	46,640
4-yr extremes	----	248	5.3	----
4-yr average	61.8	---	---	44,7936

main channel are dry during summer months due to these diversions.

Instantaneous flow measurements for Big Salt Wash have also been collected in conjunction with water quality sampling and other related activities. These data are presented on Table 2.04.7-17. A crest stage gage was installed during the fall of 1982 to record peak flows for Big Salt Wash. Peak flow estimates for Big Salt Wash based on crest stage gage readings (Table 2.04.7-18) range as high as 1600 cfs.

A flume with a continuous recorder has been installed in Big Salt Wash by Dorchester Coal Company. The flume is located downstream of Garvey Canyon and upstream of diversion point of the Ruby Lee Ditch. No diversions exist upstream of the site. Thus, flow, as measured at the flume, is representative of baseline conditions for Big Salt Wash in the study area.

The flume was originally installed in March 1983. Unfortunately, the flume was washed out by flood flows shortly after installation. It was not possible to reinstall the flume until the unusually high flows encountered during 1983 had receded. The flume was reinstalled in October, 1983. Continuous flow records for the period from October 18 to December 18 indicate an average flow of approximately 6 cfs and a range of from 1.2 to 54 cfs.

In November, 1983, a low-flow investigation (seepage run) was conducted on Big Salt Wash for the purpose of identifying surface and ground water interactions. Streamflow, electrical

TABLE 2.04.7-17

Stream Flow (Instantaneous Readings)

BIG SALT WASH

Date	Flow (cfs)
11/17/80	1-2[b]
12/7/80	2[b]
2/14/81	2[b]
3/2/81	1[b]
4/12/81	1[b]
6/14/81	0.75[b]
7/19/81	0.5[b]
8/30/81	0.5[b]
10/26/81	1.5[b]
3/31/83	Moderate[a c]
6/2/83	33[c]
10/16/83	2.5[c]
11/4/83	6[c]

a Flow reported as low, moderate, high or flooding
b Flow measured at S-1
c Flow measured at S-3

TABLE 2.04.7-18

Flood Flow Estimates - Crest Stage Gage

BIG SALT WASH

Date of Reading	Estimated Flow (cfs)
3/31/83	No measureable reading
6/2/83	90
7/7/83	680
8/15/83	1600
9/7/83	570
12/27/83	60

COAL GULCH

7/30/82	750
8/4/82	200
3/31/83	No measureable reading
6/2/83	No measureable reading

GARVEY CANYON

3/31/82	No measureable reading
6/2/83	No measureable reading [a]

a Staff gage missing, apparently removed by vandals

conductivity, and temperature were measured at six locations. The first station was located just upstream of the confluence of Post Canyon and Big Salt Wash, and the last station was located just upstream of the Ruby Lee flow diversion.

Streamflow was determined by surveying a channel cross-section and then measuring flow velocity at various points across the channel. Flow velocity was measured with a Price AA Current Meter using the six-tenths method, except for the fifth station which was measured at the DCC flume on Big Salt Wash.

The results of the low-flow investigation are shown in Figure 2.04.7-7. Discharge ranged from 5.10 cfs to 6.86 cfs with an average of 5.99 cfs. Although the data show some variation, there is no trend. This variation is due to measurement error. There is no pattern of increasing or decreasing flow. The electrical conductivity data is even more consistent. Electrical conductivity values ranged from 1100 to 1140 umhos/cm, with a mean value of 1124 umhos/cm.

The data indicate that Big Salt Wash, from Post Canyon to the Ruby Lee Diversion is neither a gaining nor a losing stream. No groundwater recharge or discharge was identified. Big Salt Wash, in this reach, simply acts as a conduit for upstream flows.

Water quality information on Big Salt Wash is available for the USGS gaging station, the U.S. Bureau of Reclamation monitoring site, and Dorchester Coal Company's own monitoring sites.

FIGURE 2.04.7-7
Results of Low-Flow Investigation Along Big Salt Wash
(November 4, 1983)

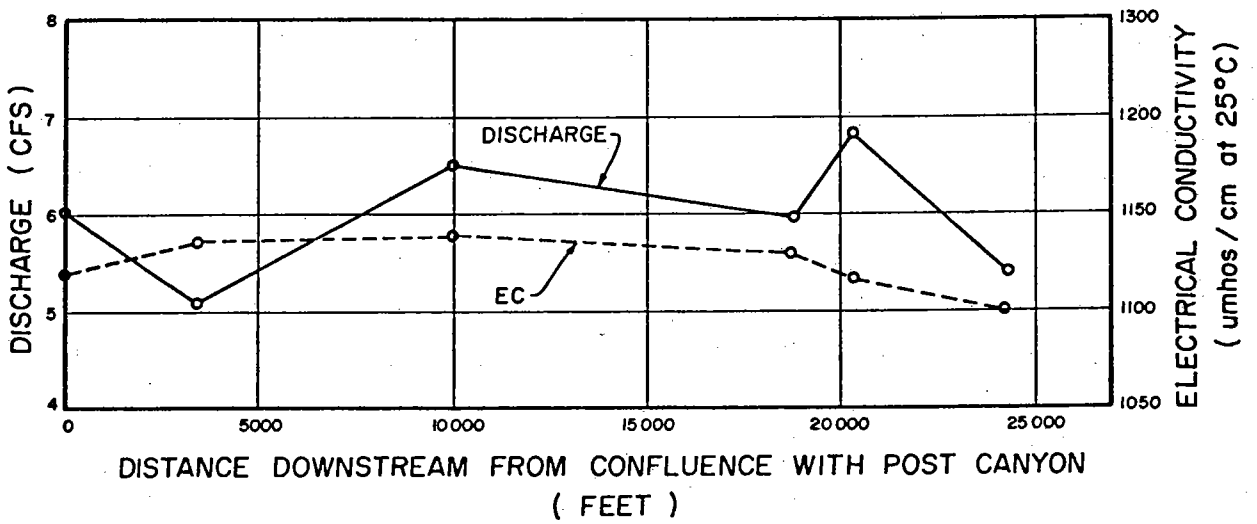


Table 2.04.7-19 presents water quality data collected on Big Salt Wash. Analyses were performed by SOLTESCO Soil and Water Consultants, Grand Junction Laboratories and Book Cliffs Laboratory.

The water of Big Salt Wash within the study area is a sodium bicarbonate type. TDS concentrations (average TDS = 1306 mg/l) preclude the water from domestic use. However, it appears that this water is suitable for general agricultural use (i.e., irrigation).

Total Suspended Solids (TSS) concentrations are highly variable, ranging from less than 10 to 71 mg/l during low flow periods to over 3000 mg/l during high flow periods.

The U.S. Bureau of Reclamation monitored surface water quality and quantity at a station on Big Salt Wash (NW, SW, SE, Sec. 8, T2N, R2W) above the Highline Canal from March, 1973 to February, 1981. The results of that monitoring are summarized in Table 2.04.7-20.

The water at this location is a sodium sulfate type with extremely high average values of TDS (7,748 mg/l). The SAR values ranged from 2.77 to 70.03, with an average value of 21.66. The high sulfate and TDS concentrations preclude this water from domestic and livestock use. This water is also unsuitable for agricultural purposes because of the high TDS and SAR values. (This water would be classified as having a very high salinity hazard and a high sodium hazard).

TABLE 2.04.7-19

SURFACE WATER QUALITY DATA[a]

BIG SALT WASH

	7/9/80[b]	8/12/80[b]	11/17/80[b]	12/7/80[b]	1/3/81[b]	2/14/81[b]	3/21/81[b]	4/12/81[b]
Sample Location	S-4	S-4	S-1	S-1	S-1	S-1	S-1	S-1
pH	8.34	8.6	8.0	8.52	8.5	8.05	8.25	8.08
Electrical Conductivity (μmhos)	1380	1600	1700	1270	2020	1510	1820	2010
Dissolved Solids	1281	1362	1236	996	1524	1266	1375	1607
Suspended Solids	16	47	-	34	22	57	12	38
Iron	<0.1	0.50	0.21	1.16	1.14	1.0	0.15	0.22
Manganese	<0.1	0.009	0.035	<0.02	<0.02	0.03	<0.02	<0.02
Sodium	220	230	190	168	198	202	197	380
Calcium		48	63	47	57	56	52	77
Magnesium		93	96	100	165	13	104	220
Temp.		-	-		2	1		8
Turbidity		-	47			-		
Arsenic		0.00	0.000			0.000		
Barium		170	0.000			0.000		
Cadmium		0.00	0.003			0.000		
Chromium		0.002	0.006			0.000		
Fluoride		0.295	0.23			1.1		
Lead		0.022	0.014			0.003		
Mercury		0.00	0.000			0.000		
Nitrate		0.09	0.00			0.325		
Selenium		0.00	0.000			0.005		
Silver		-	0.001			-		
Bicarbonate		320	415			397		

Table 2.04.7-19 (cont.)
SURFACE WATER QUALITY DATA[a]
BIG SALT WASH

	7/9/80[b]	8/12/80[b]	11/17/80[b]	12/7/80[b]	1/3/81[b]	2/14/81[b]	3/21/81[b]	4/12/81[b]
Carbonate		0.00	-			52.8		
Potassium		5.0	3.2			3.0		
Color (Co/Pt Units)		-	5					
Hardness		515	524			495		
Aluminum		0.000	-			0.038		
Chloride		62	14			16		
Sulfate		681	610			510		
Alkalinity (phenol)		-	24			-		
Alkalinity (total)		-	391			-		
Nickel		-						
Copper		0.007	0.000			0.028		
Zinc		0.001	0.008			0.09		
Molybdenum		0.00	0.018			0.000		
Ammonia		0.375	0.83			0.253		
Phosphate		0.4	0.545			0.105		
Boron		0.07	0.10			0.02		
Dissolved Oxygen		6.2						

a All concentrations in mg/l unless otherwise indicated
b Metals are dissolved unless noted
c Metals are total recoverable

Table 2.04.7-19 (cont.)

1a

SURFACE WATER QUALITY DATA[a]

BIG SALT WASH

Sample Location	5/26/81[b] S-1	6/14/81[b] S-1	7/19/81[b] S-1	8/31/81[b] S-1	10/26/81[b] S-2	12/4/81[b] S-3	6/18/82[b] S-3	3/31/83[c] S-3
pH	8.5	8.37	8.49	8.4	8.34	8.5	8.7	8.6
Electrical Conductivity (μmhos)	1800	2010	2120	1900	1740	1480	1000	1770
Dissolved Solids	1406	1956	1680	1510	1305	1334	616	1240
Suspended Solids	575	14	<10	-	< 10	71	-	3040
Iron	0.54	0.13	0.09	0.50	0.20	1.37	0.05	7.4
Manganese	0.000	<0.03	0.03	0.036	<0.02	0.002	0.013	1.46
Sodium	260		-	250		250	164	234
Calcium	46		-	61		59	17	72
Magnesium	120		-	90		89	22	74
Temp.	17	16	20	-	9	1.5	17	7
Turbidity	-			5		-	140	-
Arsenic	0.006			0.000		0.000	0.000	0.008
Barium	0.000			0.000		0.000	0.000	-
Cadmium	0.000			0.000		0.000	0.000	<0.005
Chromium	0.000			0.000		0.000	0.001	-
Fluoride	0.30			0.35		0.400	0.360	0.10
[illegible]d	0.000			0.000		0.000	0.011	-
[illegible]ury	0.000			0.000		0.000	0.000	<0.001
[illegible]te	0.000			0.000		0.023	0.000	0.14
Selenium	0.000			0.000		0.000	-	<0.002
Silver	-			0.000		-	0.000	-
Bicarbonate	316			411		509	234	328

Table 2.04.7-19 (cont.)

SURFACE WATER QUALITY DATA[a]

BIG SALT WASH

2a

	5/26/81[b]	6/14/81[b]	7/19/81[b]	8/31/81[b]	10/26/81[b]	12/4/81[b]	6/18/82[b]	3/31/83[c]
Carbonate	66			23		25	25	-
Potassium	1.0			4.2		3.6	2.0	-
Color (Co/Pt Units)	-			24		-	2.0	-
Hardness	569			587		521	322	-
Aluminum	0.005			-		0.01	-	6.8
Chloride	168			25		23	6	11
Sulfate	650			750		622	225	590
Alkalinity (phenol)	55			38		-	20	
Alkalinity (total)	391			377		-	234	
Nickel	0.000					0.007	-	
Copper	0.002			0.000		0.000	0.011	0.06
Zinc	0.011			0.016		0.006	0.005	0.067
Molybdenum	0.011			0.02		0.012	0.029	<0.2
Ammonia	0.04			0.7		0.062	0.020	
Phosphate	0.08			0.000		0.028	0.025	0.14
Boron	0.175			0.000		0.37	0.000	
Dissolved Oxygen	7.1					6.6		

a All concentrations in mg/l unless otherwise indicated
b Metals are dissolved unless noted
c Metals are total recoverable

Table 2.04.7-19 (cont.)

1b

SURFACE WATER QUALITY DATA[a]

BIG SALT WASH

	6/2/83[c]						
Sample Location	S-2						
pH	8.3						
Electrical Conductivity (μmhos)	870						
Dissolved Solids	510						
Suspended Solids	3190						
Iron	20.8						
Manganese	2.74						
Sodium	71						
Calcium	49						
Magnesium	44						
Temp.	-						
Turbidity	-						
Arsenic	0.011						
Barium	-						
Cadmium	0.008						
Chromium	-						
Fluoride	-						
Lead	0.15						
Mercury	<0.001						
Nitrate	0.38						
Selenium	<0.002						
Silver	-						
Bicarbonate	276						

Table 2.04.7-19 (cont.)

SURFACE WATER QUALITY DATA[a]

BIG SALT WASH

	6/2/83[c]							
Carbonate	-							
Potassium	-							
Color (Co/Pt Units)	-							
Hardness	-							
Aluminum	17.7							
Chloride	3							
Sulfate	198							
Alkalinity (phenol)	-							
Alkalinity (total)	-							
Nickel	-							
Copper	0.10							
Zinc	0.14							
Molybdenum	<0.2							
Ammonia								
Phosphate	0.07							
Boron								
Dissolved Oxygen								

a All concentrations in mg/l unless otherwise indicated
b Metals are dissolved unless noted
c Metals are total recoverable

TABLE 2.04.7-20

WATER QUALITY SUMMARY FOR BIG SALT WASH
ABOVE HIGHLINE CANAL
(MARCH, 1973 TO FEBRUARY, 1981)

Parameter	Mean	Maximum	Minimum
pH (units)	8.16	8.60	7.40
Temperature (^{o}F)	11.7	32.2	0.0
Electroconductivity (umhos/cm @ 25^{o}C)	8,031	20,032	686
Total Dissolved Solids (mg/l)	7,748	22,538	507
Turbidity (NTU)	1,456	9,999	1.2
Calcium (mg/l)	198	381	19
Magnesium (mg/l)	446	1,143	5
Sodium (mg/l)	1,842	4,552	75
Potassium (mg/l)	13	235	2
Carbonate (mg/l)	0.31	10	0
Bicarbonate (mg/l)	522	863	207
Chloride (mg/l)	137	317	4
Sulfate (mg/l)	5,499	13,875	145
Flow (cfs)	2.97	80.70	0.00

By comparing the water quality at Station S-1 (at the northern-most boundary of the lease area) to the quality at the Bureau of Reclamation station (above the Highline Canal but below the southern-most boundary of the lease area) (Table 2.04.7-21), it is possible to illustrate the natural changes in the water quality of Big Salt Wash as it flows from the Book Cliffs into the Grand Valley. These changes are most likely due to changes in geology and soil type. Bedrock in the lower part of the basin consist primarily of Mancos Shale, a highly-saline, marine shale.

As is evident, the water is transformed from a sodium bicarbonate type to a sodium sulfate type. TDS values increase by an average of about 500% and conductivity increases by an average of about 450%, which indicates an increase in salt loading. These data serve to illustrate the fact that the Big Salt Wash drainage basin is naturally subject to large variations in water quality, particularly with respect to dissolved constituents. It may be deduced that this drainage basin is, generally speaking, one that is unstable with respect to erosional characteristics. Vegetative cover is, in most instances, sparse, especially in the lower reaches of the basin. Large quantities of TSS and TDS are naturally transported into, through, and out of the drainage basin in direct response to snowmelt and the short duration-high intensity rainstorms that are typical of the area.

2.3 COAL GULCH

Coal Gulch is an easterly trending tributary to Big Salt

TABLE 2.04.7-21
COMPARISON OF WATER QUALITY
IN BIG SALT WASH UPSTREAM
AND DOWNSTREAM

Parameter	Station S-1	BUREAU OF RECLAMATION Station
pH (units)	8.32	8.16
Conductivity (umhos/cm)	1816	8,031
Total Dissolved Solids (mg/l)	1456	7,748
Calcium (mg/l)	57	198
Magnesium (mg/l)	114	446
Potassium (mg/l)	3	13
Sodium (mg/l)	231	1,842
Bicarbonate (mg/l)	385	522
Carbonate (mg/l)	48	0.31
Chloride (mg/l)	56	137
Sulfate (mg/l)	630	5,499

Wash and has a total drainage area of 18.8 square miles. The basin is narrow and steep with large areas of bedrock outcrops in both the channel and valley sides, as shown on Map 2.04.7-1. Altitudes in the drainage range from 5150 feet above mean sea level (msl) at the confluence with Big Salt Wash, to 8640 feet msl at the watershed divide. The Coal Gulch basin has very high relief, as much as 1000 feet in less than a mile.

In the upper and middle portions of Coal Gulch, the valley walls directly abut the channel. Only a very small body of alluvium (i.e., a maximum width of approximately 1750 feet) is contained in the lower basin. The maximum depth of alluvium is 50 feet. Overall, the Coal Gulch stream system is degrading, owing to the steep average slopes in the system. However, certain reaches of channel aggrade during flow events when high sediment loads are deposited upstream of rock obstructions.

A total of 14 springs have been identified in the main channel and in some of the northern tributaries to Coal Gulch. Some of the springs dry up in early summer while others flow as late as November and probably flow year-round. All flows from springs percolate into the channel bottom within a short distance (generally less than 0.2 miles) of their origin, and therefore, the lower reach of Coal Gulch is normally dry. It should be noted that the Coal Gulch streambed is primarily flowing on bedrock along the upper valley down to the approximate location of the coal outcrop. The streambed is normally dry along these reaches (except where isolated bedrock springs are located)

indicating that no alluvial aquifer is present in this area. A more complete description of springs in this area is provided in Section 2.1.

There is an abandoned diversion ditch near the mouth of Coal Gulch. In past years, runoff was diverted for use in flood irrigation. Two local ranchers considered flow from Coal Gulch to be insufficient to justify the continued use of the ditch (John Cuddy and Don Hitchborne, personal communication, September, 1982). Springs in the basin provide water for upland game birds (Lonnie Renner, private consultant, personal communication, April, 1983). These are the only past, present, or projected uses of surface water from Coal Gulch.

The US Soil Conservation Service (SCS) has delineated four soil mapping units in Coal Gulch with differing hydrologic characteristics. Roughly 80 percent of the basin is classified as rock outcrop characterized by very steep slopes. There are minor areas of stony soil with little or no trees, forbs, or grasses. Runoff is very high portion of total rainfall and the steep slopes produce high peak runoff rates. Small amounts of groundwater recharge occur through fractured outcrops.

The caps of weathered ridges near the mouth of the Coal Gulch basin are covered with shallow silty to silty clay loam soil units. There are no trees and optimum ground cover is about 20 percent.

The sides of these weathered ridges are classified by the SCS as belonging to the badlands soil mapping unit. The area is

characterized by rolling steep, nearly barren walls of interbedded gypsiferous shales and sandstones. This area produces a large amount of sediment even though soil coverage is only 10 percent. Vegetation on these soils is mainly shrubs with some grases.

The fourth soil mapping unit occurs in the valley bottom in the lower half of the main stem of Coal Gulch. Soils in this study area are deep and well-drained. Underlying layers are sandy clay loams to clays and in some places contain gravel. These soils are nearly level and have a slow to rapid water intake rate. Water movement through the soils is slow to moderate. The plant community is about 65 percent grasses and forbs, and 35 percent shrubs.

Flow observation and instantaneous flow measurements have been made in conjunction with water quality sampling and related field activities. Results are presented in Table 2.04.7-22. These data indicate that most reaches of Coal Gulch are normally dry except during the late spring and early summer months. Continuous flow was maintained along Coal Gulch from late March to mid-August during 1983 due to the unusually high precipitation and snow melt that occurred during that period.

A crest stage gage was installed in July, 1982 near the mouth of Coal Gulch to record peak flows. Estimates of peak flow based on the crest gage readings are presented in Table 2.04.7-18.

TABLE 2.04.7- 22

STREAM FLOW (INSTANTANEOUS READINGS)[a]

Date	Coal Gulch	Garvey Canyon
7/6/82	Dry	Dry
8/23/82	Dry[a]	Dry[b]
9/9/82	Flooding[c]	Flooding[c]
9/21/82	Dry	Dry
10/5/82	Dry	Dry
10/12/82	Dry	Dry
10/27/82	Dry	Dry
11/17/82	Dry	Dry
12/20/82	Dry	Dry
3/31/83	Moderate[c]	Moderate[c]
6/2/83	< 0.1 cfs[b]	< 0.1 cfs[b]
8/16/83	0.1 cfs[b]	< 0.1 cfs[b]
9/5/83	Dry	Dry
10/16/83	Dry	Dry
11/7/83	Dry	Dry
12/28/83	1.25	0.3

a Flow at crest stage gage at mouth of Canyon

b Evidence of recent flood flows

c No flow measurement taken, flow described as low, moderate, high or flooding

During August, 1982, two water quality samples were taken. The results of the analysis of those samples are presented in Table 2.04.7-23. At the time the first water quality sample was taken, the peak flow of Coal Gulch was approximately 750 cfs (with a depth at the crest stage of 44 inches). This event occurred on July 30, 1982. The second runoff event occurred three to four days later on or about August 4, 1982. The depth of flow at the crest stage gage was 24 inches and flow was approximately 200 cfs. The magnitude of these peak flows are capable of destroying irrigation structures.

Calculations of theoretical flood peaks for Coal Gulch are presented in Appendix 2.04.7-B.

Water quality samples have been collected from Coal Gulch on six occasions beginning in July, 1980. Water quality data are presented in Table 2.04.7-24. The dominant cation in this water is sodium, and the dominant anion is sulfate. The high average value for TDS (3640 mg/l) indicates a high salinity hazard (Hem, 1970). The high sulfate concentrations (mean value of 1783 mg/l) preclude this water even from stock watering use. (The recommended sulfate stock water limit is 500 mg/l-McKee and Wolf, 1963). The water quality at the mouth of Coal Gulch is similar to the water in Big Salt Wash just below Garvey Canyon, high concentrations of TDS, and sulfates preclude this water from being used as a domestic water supply. However, it may be suitable for agricultural use. The TSS concentrations are highly variable; a maximum value of 85,400 mg/l was reported during flooding conditions (9/15/82).

TABLE 2.04.7-23

WATER QUALITY ANALYSIS OF GRAB SAMPLES
FROM COAL GULCH

Parameter	Runoff Event 1	Runoff Event 2
pH	7.4	7.3
Conductivity(micromhos/cm)	2000.0	1700.0
Hardness	1000.0	580.0
Sulfate (as SO_4)	880.0	580.0
TDS (at 180C)	2400.0	1100.0
Turbidity, NTU	13,000.0	50,000.0
Iron (total)	6000.0	2500.0
Flow (cfs)	750.0	200.0

TABLE 2.04.7 - 24

SURFACE WATER QUALITY DATA COAL GULCH

	7/9/80[b]	8/12/80[b]	10/26/81	9/15/82[b]	3/31/83[c]	6/2/83[c]
pH	8.07	8.1	8.04	7.58	8.3	8.3
Electrical Conductivity (umhos)	4440	3900	4410	2860	2220	4030
Dissolved Solids	4530	3606	4100	2280	1670	3370
Suspended Solids	14	89	11	85,400	9840	344
Iron	< 0.1	0.22	0.72	<0.02	22	1.87
Manganese	< 0.1	0.03	0.05	<0.02	2.77	0.06
Sodium	760	675		320	273	698
Calcium		172		283	158	165
Magnesium		126		84	58	159
Temp		-	7	-	8	-
Turbidity		-		-	-	-
Arsenic		0.00		< 0.001	0.017	< 0.002
Barium		0.00		-	-	-
Cadimium		0.001		< 0.005	< 0.005	< 0.005
Chromium		0.004		-	-	-
Floride		0.45		-	-	-
Lead		0.03		< 0.02	0.15	0.07
Mercury		0.00		<0.001	< 0.001	<0.001
Nitrate		0.07		0.96	0.88	0.33
Selenium		0.008		0.003	< 0.002	< 0.002
Silver		-		-	-	-
Bicarbonate		225		111	175	208
Carbonate		13		-	-	-
Potassium		10		-	-	-
Color (Co/Pt units)		-		-	-	-
Hardness		964		-	-	-
Aluminum		0.00		< 0.2	25.5	0.2
Oil & Grease		-		-	-	1
Chloride		26		12	6	20
Sulfate		2050		1640	1040	2400
Alkalinity (total)		-		111	-	-
Nickel		0.13		-		-
Copper		0.016		< 0.02	0.11	< 0.02
Zinc		0.002		0.009	0.21	0.034
Molybdenum		0.00		<0.2	< 0.2	<0.2
Ammonia		0.15		-	-	-
Phosphate		0.47		0.01	0.04	0.03
Boron		0.14		-	-	-
Dissolved Oxygen		6.0		-	-	-

a All concentrations in mg/l unless otherwise indicated

b Metals reported as dissolved

c Metals reported as total recoverable

2.4 GARVEY CANYON

Garvey Canyon is an east-west trending tributary to Big Salt Wash, located approximately 2 miles north of Coal Gulch. This tributary is very similar to Coal Gulch in shape, with large areas of bedrock outcrops in both the channel and valley sides.

Garvey Canyon drains an 8.07 square mile watershed. Altitude ranges from 5440 feet msl at the confluence with Big Salt Wash, to 8420 feet msl at the watershed divide. As with Coal Gulch, the Garvey Canyon basin has very high relief, up to 1000 feet in less than a mile.

The valley sides of Garvey Canyon directly abut the channel in the upper and middle portions of the basin. In the lower end of the basin, only a very small body of alluvium is present.

Five springs have been observed in Garvey Canyon. Some of the springs dry up in early summer while others appear to flow year-round. Flows from all of the springs percolate into the channel within a short distance (generally less than 0.2 miles) of their origin. The only use for these springs is to provide water for wildlife. Springs are described in detail in Section 2.1 of this permit application. The soils of Garvey Canyon are nearly identical to those found in Coal Gulch with large areas of rock outcrop. Vegetative characteristics in Garvey Canyon are similar to those for Coal Gulch.

Streamflow in Garvey Canyon is ephemeral except for limited

reaches of flow supported by springs. In November, 1983, baseflow in the reach of stream supported by these springs was less than 2 gpm.

Flow observations and instantaneous flow measurements have been made for Garvey Canyon in conjunction with water quality sampling and related field activities. Stream flow data are shown on Table 2.04.7-22. These data indicate that the flow regime is similar to that in Coal Gulch. Flows are generally lower in Garvey Canyon than in Coal Gulch due to smaller drainage area and fewer springs.

A crest stage gage was installed near the mouth of Garvey Canyon in March, 1983. Observations for the crest stage gage are included on Table 2.04.7-18. No measureable flow was recorded between March and June, 1983. The crest gage was apparently washed out by flood flows that occurred during July or August, 1983. Calculations of theoretical peak flows (using several methods) for Garvey Canyon are presented in Appendix 2.04.7-B.

The general water quality of this sampling point (at the mouth of Garvey Canyon) Table 2.04.7-25, is generally quite similar to that observed for Coal Gulch (Table 2.04.7-24). The water type is also sodium sulfate. As for Coal Gulch, the water in Garvey Canyon has highly variable TSS values, high TDS values (1923 mg/l), and high sulfate values (1219 mg/l). TDS and sulfate concentrations exceed public health standards for domestic use. The high sulfates precludes use as a stock water source. However, the water could probably be used for general

TABLE 2.04.7 - 25

SURFACE WATER QUALITY DATA

	Garvey Canyon			Layton Wash
	9/15/82[b]	3/31/83[c]	6/3/83[c]	6/3/83[c]
pH	7.58	8.6	8.1	8.6
Electrical Conductivity (μmhos)	1100	2170	4140	6050
Dissolved Solids	770	1770	3230	4490
Suspended Solids	98,400	3630	1110	26
Iron	0.14	25	4.15	0.17
Manganese	0.49	1.42	0.21	0.02
Sodium	145	370	678	1370
Calcium	93	91	140	64
Magnesium	36	48	156	132
Temp	-	9		
Turbidity	-	-		
Arsenic	0.002	< 0.002	< 0.002	< 0.002
Barium	-	-		
Cadimium	<0.005	<0.005	<0.005	< 0.005
Chromium	-	-		
Fluoride	-	-		
Lead	< 0.02	0.10	0.09	0.08
Mercury	< 0.001	< 0.001	< 0.001	< 0.001
Nitrate	1.31	0.31	0.18	0.08
Selenium	0.003	0.004	< 0.002	< 0.002
Silver	-	-		
Bicarbonate	151	263	289	777
Carbonate	-	-		
Potassium	-	-		
Color (Co/Pt Units)	-	-		
Hardness	-	-		
Aluminum	< 0.2	22.8	< 0.2	<0.2
Oil & Grease	-	-	<1	-
Chloride	11	7	20	75
Sulfate	459	969	2230	2800
Alkalinity (total)	151	-		
Nickel		-		-
Copper	< 0.02	0.06	0.02	< 0.02
Zinc	< 0.005	0.153	0.039	0.016
Molybdenum	< 0.2	< 0.2	< 0.2	< 0.2
Phosphate	0.03	0.03	0.04	0.03

a All concentrations in mg/l unless otherwise noted

b Metals reported as dissolved

c Metals reported as total recoverable

agricultural activities.

2.5 LAYTON WASH

Layton Wash, along with Lipan Wash, drains the southeast portion of the permit area and is characteristic of the other drainages discussed previously in this report. Layton Wash has a drainage area of 5.46 square miles (above the Fruita Mine permit boundary), with a range in elevation from 5300 feet msl where it leaves the mine plan area boundary, to 7405 feet msl at the watershed divide. High relief, steep valley sides, and large areas of bedrock outcrops characterize Layton Wash, which eventually flows into Big Salt Wash just above the Government Highline Canal.

A total of 14 springs have been observed in Layton Wash. Similar to the springs found in the other drainages in the area, some flow intermittently while others appear to flow year-round. Flows from all of the springs percolate into the channel within a short distance (generally less than 0.2 miles) of their origin.

The soils in Layton Wash are very similar to those found in Coal Gulch with the primary soil type being rock outcrops. Vegetation types are also similar to those found in Coal Gulch.

Observations of flow and instantaneous flow readings have been made for Layton Wash in conjunction with hydrology monitoring and other field activities. Flow data are presented in Table 2.04.7-26. Flow at the mouth of the canyon in Layton Wash has only been observed on one occasion (6/2/83). One water

TABLE 2.04.7-26

STREAM FLOW (INSTANTANEOUS READINGS)[a]

Date	Lipan Wash	Layton Wash
8/23/82	Dry	Dry
9/7/82	Dry	Dry
9/21/82	Dry	Dry
10/5/82	Dry	Dry
10/12/82	Dry	Dry
10/27/82	Dry	Dry
11/17/82	Dry	Dry
12/20/82	Dry	Dry
3/31/83	Dry	Dry
4/15/83	Dry[b]	Dry[b]
6/2/83	Dry[b]	0.1 cfs[b]
7/8/83	Dry[b]	Dry[b]
8/16/83	Dry[b]	Dry[b]
9/5/83	Dry	Dry
10/16/83	Dry	Dry

a Flow as measured at mouth of canyon

b Evidence of recent flood flows

quality sample has been collected. Results of analyses for this sample are presented on Table 2.04.7-25.

Evidence of recent flooding has been detected on four occasions (4/83, 6/83, 7/83 and 8/83). It has not been possible to sample this drainage during runoff conditions because of the inaccessibility of the site. Layton and Lipan Washes are accessible only by 4-wheel drive trails and pedestrian travel. Precipitation events that would generate surface flows, render the roads to these areas totally impassable. Water quality of samples from Layton and Lipan Washes collected during runoff periods would be quite similar to those collected in Coal Gulch and Garvey Canyon due to similar geology and vegetative cover in these drainages. Calculations of peak flows (using several methods) for Layton Wash are presented in Appendix 2.04.7-B.

2.6 LIPAN WASH

Lipan Wash is a northeast-trending tributary to Layton Wash, but does not intersect it until after leaving the Fruita Mine lease area. Lipan Wash is located just northeast of Layton Wash, and is almost identical with respect to drainage basin characteristics. The Lipan Wash watershed (within the lease area) encompasses an area of 4.01 square miles, with a range in elevation from 5190 feet msl where it leaves the lease area boundary, to 7180 feet msl at the watershed divide.

A total of six springs have been noted in the Lipan Wash drainage basin. Some of these springs may flow year-round. Lipan Wash is considered ephemeral because the flow from springs

disappears in a short distance from its source.

Soils and vegetation in the Lipan Wash watershed are very similar to those in Coal Gulch; the primary soil units are rock outcrop.

Flow has not been observed at the mouth of the Canyon of Lipan Wash (Table 2.04.7-26). Evidence of previous flooding has been observed. It has not been feasible to collect flow or water quality data due to the inaccessibility of the area following precipitation events. Calculations (using several methods) for peak flows in Lipan Wash are presented in Appendix 2.04.7-B.

2.7 SURFACE WATER UTILIZATION

Utilization of surface waters (i.e., streams and springs) in the vicinity of the Fruita Mine is quite limited. Upland game birds utilize the few springs on the larger valley floors, while large game animals utilize streams during periods of spring runoff (Lonnie Renner, wildlife biologist, private consultant, personal communication, April, 1983). No springs have been developed for any use. The streams in the area are also utilized by domestic stock and for irrigation diversion.

A review of water rights was conducted in the hydrologic adjacent area of the Fruita Mine to identify which waters are being utilized, and also to identify particular water uses. The review of surface water rights involved a search of the State Engineer's records. The review examined both drainages crossing the mine area (i.e., Big Salt Wash, Coal Gulch, Garvey Canyon,

Hatchet Canyon, Bunniger Canyon, Lipan Wash, and Layton Wash) and drainages adjacent to the mine area (Post Canyon, Stove Canyon, East Salt Creek, and Little Salt Wash). (See Map 2.04.7-1).

Water rights along Big Salt Wash were evaluated down to the Highline Canal. Below the Highline Canal, Colorado River water from the canal is extensively used. The search for surface water rights in and around the study area indicted that several water users take water from Big Salt Wash, East Salt Wash, Salt Wash and East Gulch Creek (Table 2.04.7-27). The uses of the water include irrigation, domestic use, and stock watering. No water rights have been filed on the other small drainages in the mine area (i.e., Coal Gulch, Garvey Canyon, Lipan Wash, Layton Wash, and Hunter Canyon).

Several stockponds are located upon the ephemeral drainage south of the Book Cliffs (Map 2.04.7-1). Many of the stockponds identified are no longer functional. Because of the flashy nature of runoff in the area and the extremely high sediment yields from Mancos shale watersheds, many of these stockponds are breached or filled with sediment.

TABLE 2.04.7-27

SURFACE WATER RIGHTS IN THE FRUITA MINE ADJACENT AREA
INCLUDING BIG SALT WASH DOWNSTREAM TO THE HIGHLINE CANAL

Structure Name	Type	Source	T, R, Sec.	Use	Amount	Adj. Date	Adj. Type
Hasselbusch Ditch	D	Big Salt Wash	7S,101W,10	I	0.9 cfs	2/28/1914	O
Hasselbusch Ditch	D	Big Salt Wash	7S,101W,10	I	1.64 cfs	2/28/1914	O
Hasselbusch Ditch	D	Big Salt Wash	7S,101W,10	I	1.8 cfs	2/28/1914	O
Echo Lake Reservoir	R	Big Salt Wash	7S,101W,10	IND	290.88 cfs	2/28/1914	O
Middlecamp No. 1	D	Big Salt Wash	7S,101W,31NW	I	0.6 cfs	2/28/1914	O
Middlecamp No. 2	D	Big Salt Wash	7S,101W,31NW	I	0.1 cfs	2/28/1914	O
Dentention Reservoir	R	Big Salt Wash	9S,101W,6NESE	DS	7.6 af	7/21/1959	S
No. 5 Reservoir	R	Big Salt Wash	9S,101W,26NENE	DS	31.5 af	7/21/1959	S
Mine Road Reservoir	R	Big Salt Wash	9S,101W,31NENW	DS	4.3 af	7/21/1959	S
Gavin Canal Coal Ditch D	D	Big Salt Wash	8S,102W,13NWNW	I	1.44 cfs	6/01/1916	S
Gavin Canal Coal Ditch D	D	Big Salt Wash	8S,102W,13NWNW	I	7.56 cfs	6/01/1916	S,C
Williams Ditch	D	Big Salt Wash	8S,102W,14SENW	I	1.71 cfs	2/07/1980	O
Ruby Lee Reservoir	R	Big Salt Wash	8S,102W,14	I	367.0 af	6/01/1916	S
Upper Salt Wash	D	Big Salt Wash	8S,102W,23NENW	I	1.7 cfs	2/07/1890	O
Ruby Ditch	D	Big Salt Wash	8S,102W,23NW	I	9.0 cfs	6/01/1916	S
Ruby Ditch	D	Big Salt Wash	8S,102W,23NW	I	46.0 cfs	6/01/1916	S,C
Cuddy Reservoir	R	Big Salt Wash	8S,102W,35SESE	DS	0.7 af	7/21/1959	S
Warner Ditch	D	E. Gulch CK	T7S,R101W,Sec15	I	1.0 cfs	2/28/1914	O
E. Gulch Ditch	D	E. Gulch CK	T7S,R101W,Sec15	ID	.6 cfs	2/28/1914	O
E Canon Ditch	D	E. Canon CK	T75,R101W,Sec23	ID	.6	2/28/1914	O
Dale Mitchell	D	E. Salt CK	T7S,R102W,Sec8	I	.9	4/6/1936	O
McClain Ditch	D	E. Salt CK	T7S,102W,Sec21	I	.65	4/6/1936	O
McClain Ditch	D	E. Salt CK	T7S,102W,	I	1.32	11/30/1934	O
McClain Ditch	D	E. Salt CK	T7S,102W,Sec21	I	2.0	9/5/1952	S
Howard Salt River	D	E. Salt CK	T7S,102W,Sec31	I	1.0	4/6/1936	O
Howard Salt River	D	E. Salt CK	T7S,102W,Sec31	I	2.0	9/5/1952	S
Davenport Ditch	D	E. Salt CK	t7S,R102W,Sec32	I	3.12	11/30/34	O
Davenport Ditch	D	E. Salt CK	T7S,R102W,Sec32	I	1.12	4/6/1936	O
McCabe Ditch	D	E. Salt CK	T7S,3102W,Sec32	I	.8	5/11/1889	O
Dam #9 Reservoir	R	E. Salt CK	T9S,R102W,Sec08	I	15.4 af	7/21/1959	S
Coyle Ranch Ditch	D	Salt Creek	T6S,R102W,Sec36	I	2.0	3/1/1910	O,C
Coyle Ranch Ditch	D	Salt Creek	T6S,R102W,Sec36	I	2.0	3/1/1910	O,CA
Coyle Ranch Ditch	D	Salt Creek	T6S,R102W,Sec36	I	2.2	3/1/1910	O
Coyle Ranch Ditch	D	Salt Creek	T6S,102W,Sec36	I	1.3	9/5/1952	S

LEGEND:

C: conditional
D: ditch
DS: domestic/stock
I: irrigation
ID: irrigation/domestic
IND: industry
O: original
R: reservoir
S: supplemental

SECTION 3

ALTERNATIVE WATER SUPPLY

Surface and groundwater use in the permit and adjacent areas is limited to surface water use along Big Salt Wash, and one alluvial well used for stockwatering purposes. This well is located along Big Salt Wash (T8S, R102W, Sec. 14). It is not anticipated that mining operations would affect either of these uses. However, undeveloped springs in the lower valleys of Coal Gulch and Garvey Canyon may experience reductions in flow. These springs are used by upland game birds (Lonnie Renner, private consultant, wildlife biologist, personal communication, March, 1983). Therefore, an alternate supply of water may be necessary to maintain this water use. In the event that water supplies in the springs along the lower Coal Gulch and Garvey Canyon valleys are lost, Dorchester Coal Company will construct water collection structures, called guzzlers, to provide a water source for wildlife.

There is less potential for affecting springs located in Hunter Canyon. These springs are located outside of the area to be mined, and it is unlikely that their source of water would be affected.

Finally, Dorchester Coal Company could divert waters from the Colorado River and its tributaries for use at the Fruita mine property. DCC has the right to divert water from Big Salt Wash (20 cfs), East Branch Big Salt Wash (10 cfs), and the Colorado

River (10 cfs). Points of diversion for these water rights are described as follows:

Big Salt Wash, tributary to the Colorado River 20 cfs
The point of diversion is located on the East bank of the Big Salt Wash, at a point whence the Southwest Corner of Section 29, T. 2 N., R. 2 W., Ute Meridian, bears S. 55° 36' 05" E. 3,248.36 feet.

East Branch Big Salt Wash, tributary to the Colorado River 10 cfs
The point of diversion is located on the West bank of East Branch of Big Salt Wash at a point whence the Northwest Corner of Section 33, T. 2 N., R. 2 W., Ute Meridian, bears N. 59° 56' 50" W. 559.91 feet

Colorado River Main Stem 10 cfs
The point of diversion is located on the North bank of the Colorado River at a point whence the East Quarter Corner of Section 18, T. 1 N., R. 2 W., Ute Meridian bears N. 71° 55' E. 2,986 feet

Copies of these water right decrees are provided in Appendix 2.04.7-C.

REFERENCES

Ferris, J.G., and D.B. Knowles, 1963. The Slug-Injection for Estimating the Coefficient of Transmissibility of and Aquifer. In, Methods for Determining Permeability, Transmissivity and Drawdown. USGS Water Supply Paper 1536-I.

Hem, J.D., 1970. Study and Interpretation of the Chemical Characteristics of Natural Water. USGS Water Supply Paper 1473, 363 p.

McKee, J.E., and Wolf, H.W., 1963. Water quality Criteria: California State Water Quality Control Board Publ. 3-A, 548 p.

US Bureau of Mines, 1983. The Impact of Long Wall Mining on the Hydrologic Balance, Premining Data Collection, prepared by J.F. Sato and Associates.

A P P E N D I X 2.04.7-A

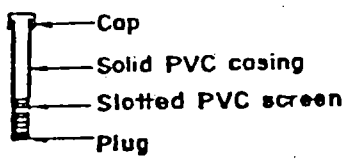
W E L L C O M P L E T I O N D I A G R A M S

General Well Completion Procedure:

PROCEDURE:

1. Install 1 1/2" PVC casing A to TD 774 with 20' of screen and plug at bottom (see key).
2. Set 2" PVC tremie pipe to 752'.
3. Tremie down Fountain Sand to pack the hole up to depth of 754'. Check depth with tremie pipe.
4. Raise tremie pipe to 745'.
5. Tremie down 1/4" rock gravel up to 747'. Check depth.
6. Raise tremie pipe to 740'.
7. Tremie down bentonite pellets up to 742'. Check depth.
8. Pull tremie pipe out.
9. Set 2" PVC casing to 742' with 10' of screen and plug at the bottom.
10. Pour down through the annular space 4 bags of Fountain Sand.
11. Backfill annular space with 1/4" gravel up to 65' below surface.
12. Drop bentonite pellets through annular space to bring level up to 62'.
13. Set 2" PVC casing C to 62' with 10' of screen and plug at the bottom.
14. Pour down through annular space Fountain Sand to bring level up to 52'.
15. Backfill to 36' with 1/4" gravel.
16. Drop bentonite pellets through annular space to bring level to 31'.
17. Backfill to ground level with 1/4" gravel.
18. Cap casings A, B and C.

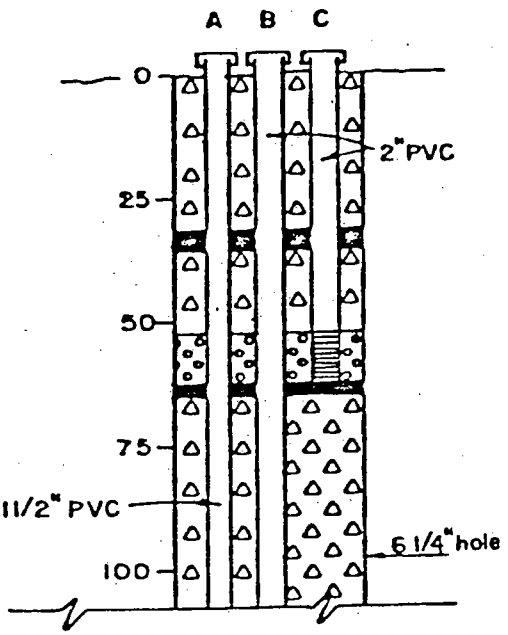
FACTS:

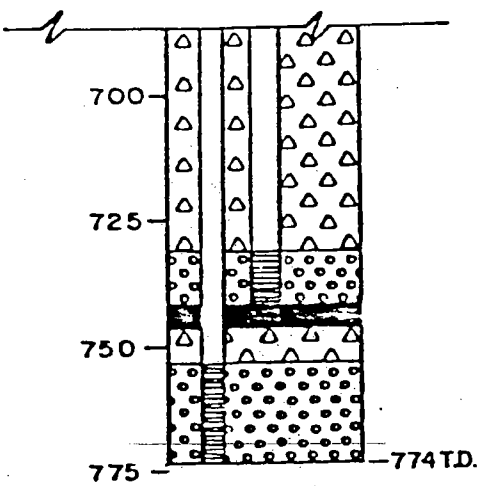


Fountain sand

3/8" gravel

Bentonite pellets





SCALE: 1" = 40'

SURFACE CASINGS:

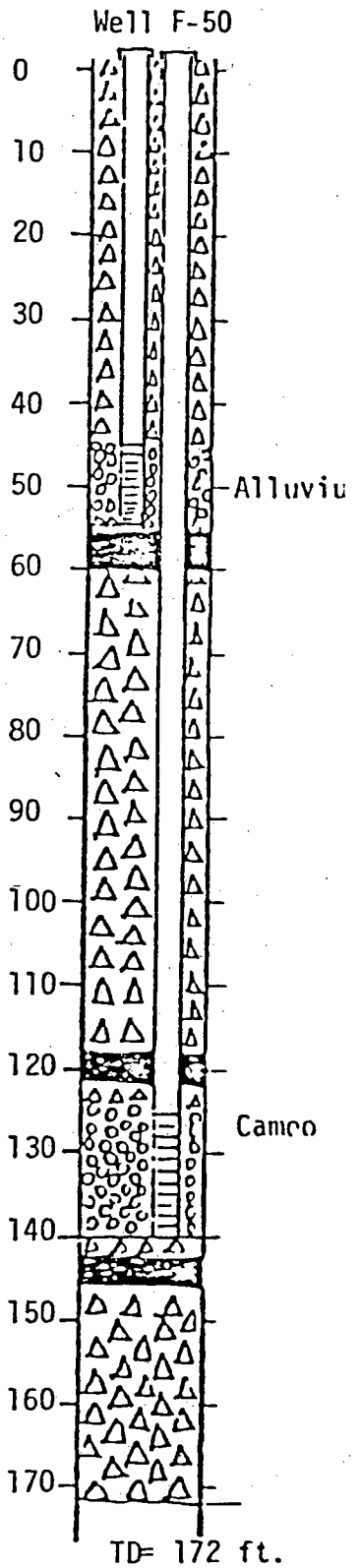
F-59 – 32' of 9 5/8" steel

F-59W – 35' of 6 1/4" steel

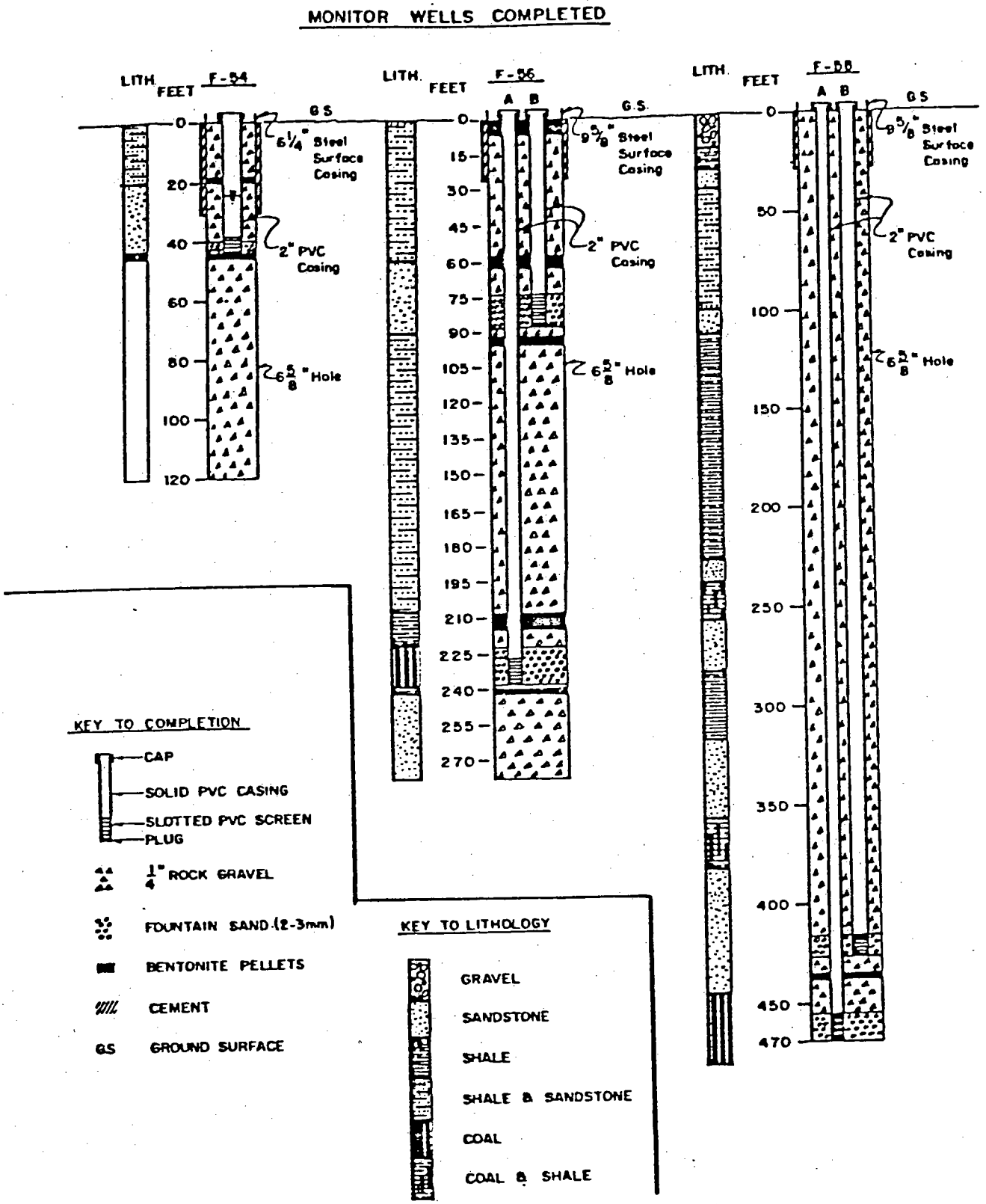
Completion Diagram For Well II(F-50-82(Alluvium,C)).

Procedure:

1) 24 gals. of 3/8" gravel from 145' to 172'
2) 4 gals. of bentonite from 141' to 145'
3) 1 gal. of gravel from 140' to 141'
4) Set 15 ft. of screen in the Cameo coal seam from 125' to 140'
5) 15 gals. of sand from 124' to 140'
6) 2 gals. of gravel from 122' to 124'
7) 4 gals. of bentonite from 118' to 122'
8) Gravel from 60' to 118'
9) 4 gals. of bentonite from 56' to 60'
10) 1 gal. of gravel from 55' to 56'
11) Set 10 ft. of screen from 45' to 55' for Alluvium
12) 9 gals. of sand from 45' to 55'
13) Gravel from top to 45'

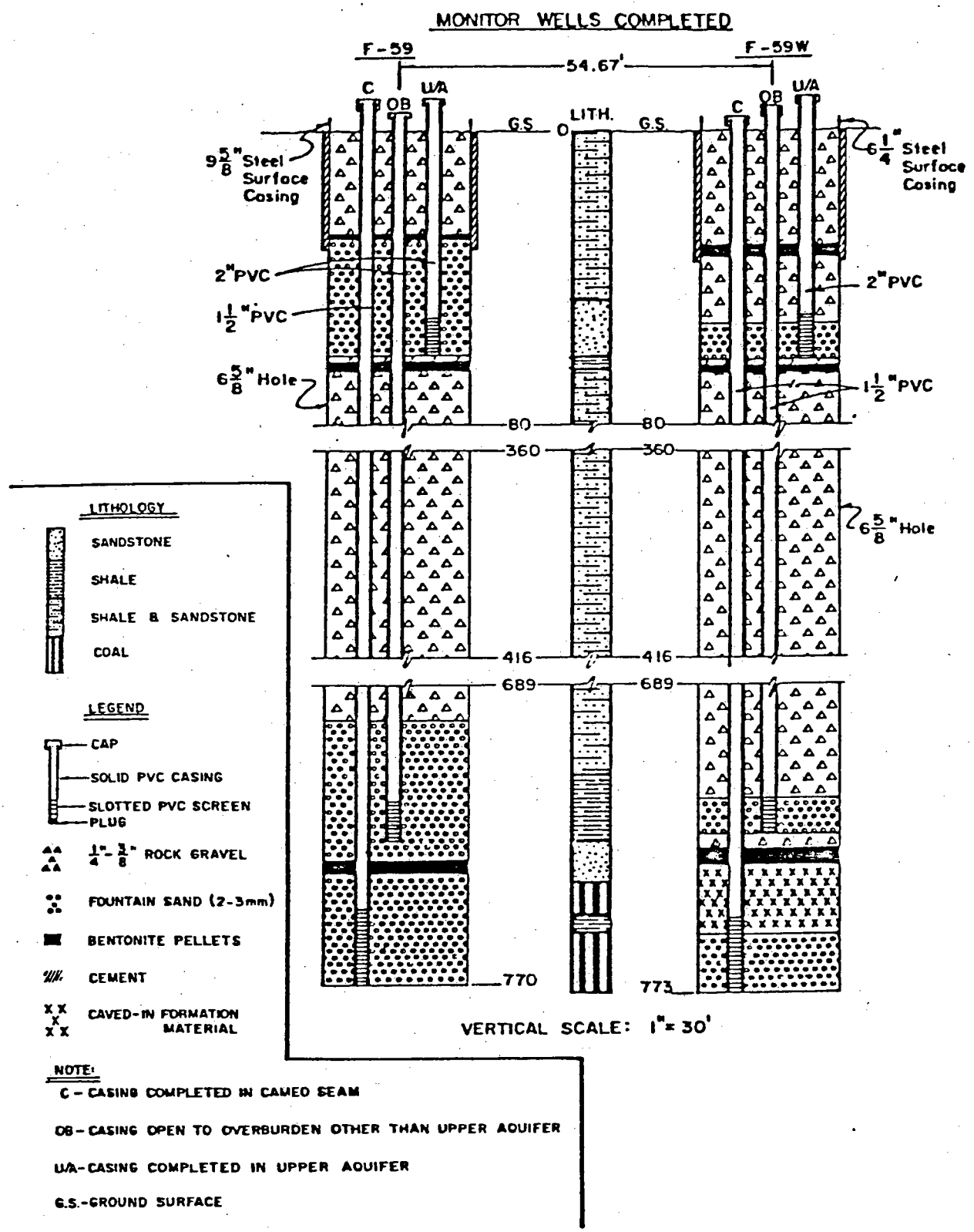


Completion Diagrams For Wells KK(F-54-82(OB/C))[1], P(F-56-82(UA,C)) And FF(F-58-82(OB,C)).



1. Well KK(F-54-82(OB/C)) is dry and therefore will not be monitored.

Completion Diagrams For Wells R(F-59-82(C,OB,UA)) And R(F-59w-82(C,OB,UA)).



Completion Diagram For Well M(F-62-82(OB, Combined Upper No. 2 and Main Cameo Seam)).

PROCEDURE:

1. 2 ft. of 3/8" gravel from 1174' to 1176'.
2. 4 gals. of bentonite from 1171' to 1174'.
3. 1 ft. of gravel from 1170' to 1171'.
4. Set 20 ft. of 1.5" diam. screen in the upper Cameo Seam from 1150' to 1170'.
5. 26 gals. of sand from 1150' to 1170'.
6. 33 gals. of gravel from 1125' to 1150'.
7. 10 ft. of screen set in the upper Cameo seam from 1115' to 1125'.
8. 13 gals. of sand from 1115' to 1125'.
9. 2 gals. of gravel from 1114' to 1115'.
10. 4 gals. of bentonite from 1111' to 1114'.
11. 2 gals. of gravel from 1110' to 1111'.
12. 10 ft. of screen for overburden from 1100' to 1110'.
13. 13 gals. of sand from 1100' to 1110'.
14. 59 gals. of gravel from 1050' to 1100'.
15. 10 ft. of screen for overburden from 1040' to 1050'.
16. 13 gals. of sand from 1040' to 1050'.
17. 1192 gals. of gravel from 25' to 1040'.
18. 5 gals. of bentonite from 21' to 25'.
19. 25 gals. of gravel from top to 21'.

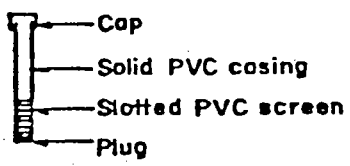
COMMENTS:

H_2O between 240'-250', approx. 5 gpm.

H_2O level at 1110' when logged on 10/18/82.

Metal 8.75" casing to 21'.

FACTS:



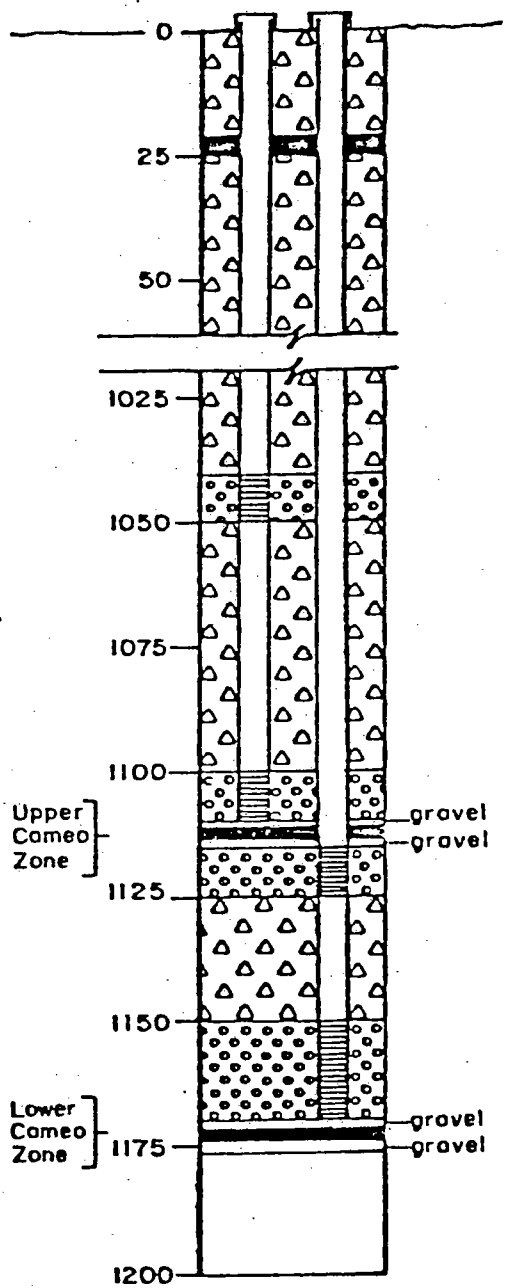
Fountain sand

3/8" gravel

Bentonite pellets

Cement

F-62



SCALE: 1" = 40'

Completion Diagram For Well O(F-69-82(C,OB)).

PROCEDURE:

1. 3/8" washed gravel from 646' to 1003'.
2. 4 buckets of bentonite from 640' to 646'.
3. Set 1.5"/20' screen from 620' to 640' in the Cameo coal zone.
4. 5 bags of sand 612' to 640'.
5. 3/8" gravel from 611' to 612'.
6. 4 buckets of bentonite from 605' to 611'.
7. 3/8" gravel from 314' to 605'.
8. 4 buckets of bentonite from 310' to 314'.
9. Set 1.5"/20' screen from 300' to 310'.
10. 3 bags of sand from 295' to 310'.
11. 4 buckets of bentonite from 289' to 295'.
12. 3/8" gravel from 289' to the top of the hole

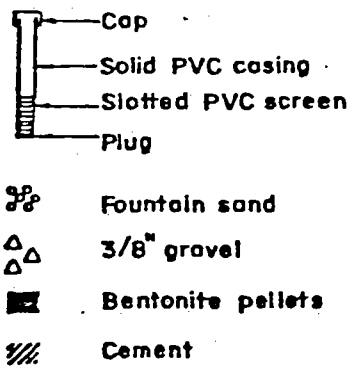
COMMENTS:

Possibly H_2O at 300' to 310', less than 1 gpm.

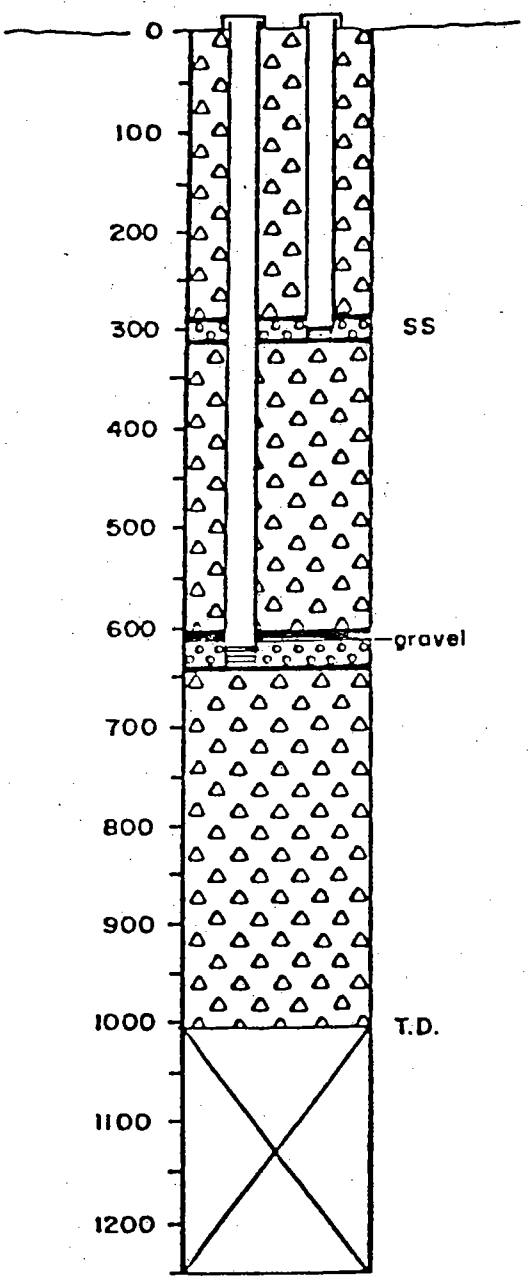
Temperature log indicated approx. 112° F near Cameo zone.

H_2O level was at 780', 9/2/82. On the morning of the next day it was only slightly lower.

FACTS:



F-69



SCALE: 1" = 200'

Completion Diagram For Well X(F-70-82(UA,C)).

PROCEDURE:

1. Hole bridged at 1129', so a 1.5"/10' screen was run down to the bridge in an attempt to break through it. Set the 10' screen from 1119' to 1129' hoping there is still a contact with the Cameo seam.
2. Added 3 bags of sand from 1112' to 1129'.
3. Added 4 buckets of bentonite from 1100' to 1112'.
4. 3/8" gravel from 695' to 1100'.
5. 3.5 buckets of bentonite from 690' to 695'.
6. Set 1.5"/20' screen from 670' to 690'.
7. Added 6 bags of sand from 665' to 690'.
8. 3.25 buckets of bentonite from 660' to 665'.
9. Due to a bridge at 295' we were unable to set gravel below this bridge and our third string which would have been set at 500' to 520'.
10. 3/8" gravel from 295' to the top of the hole.

COMMENTS:

H_2O at 310', approx. 1 gpm.

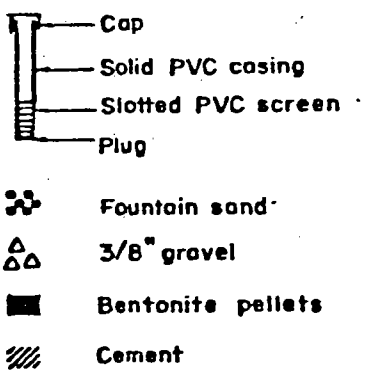
H_2O at 520', approx. 5.5 gpm.

H O at 680', approx. 20 gpm.

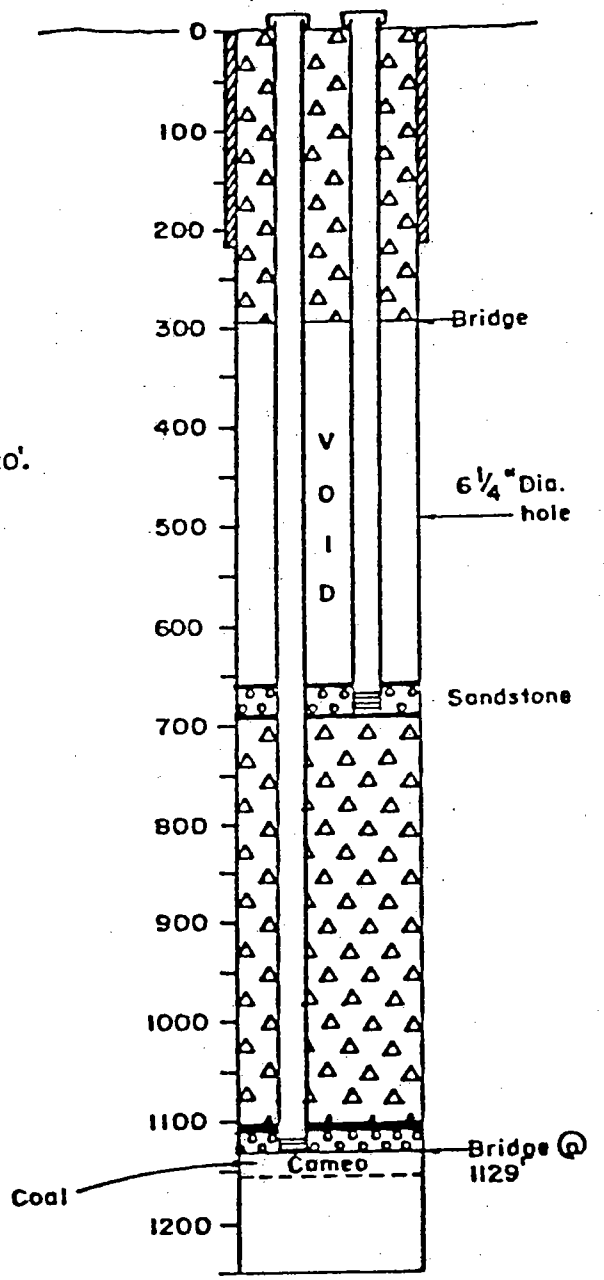
STOPPED drilling at 900' for 7 min. to check H_2O, measured 12 gpm.

H_2O level had risen from 407' to 255" overnight from 9/8/82 to 9/9/82.

FACTS:



F-70



SCALE: 1" = 200'

Completion Diagram For Well Z(F-71-82(OB,C)).

PROCEDURE:

1. Cemented from 1580' to 1360'.
2. 69./5 gal. buckets of washed 3/8" gravel from 1360' to 1069'.
3. 1.5"/20' screen set in lower Comeo from 1055' to 1075'.
4. 5 bags of silica sand from 1041' to 1069'.
5. 2 gal. of gravel on top of the sand.
6. 8 gal. of bentonite from 1033' to 1041'.
7. 1.5"/10' screen from 1023' to 1033' for total overburden.
8. 3 bags of silica sand from 1039' to 1033'.
9. 3/8" washed gravel from 1019' to top of hole.

NOTE:

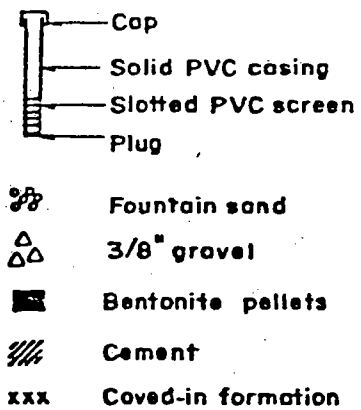
Because of cave-in material falling in the hole overnight which covered the screen up to 1069', it was not possible to use a bentonite seal at the base of the screen.

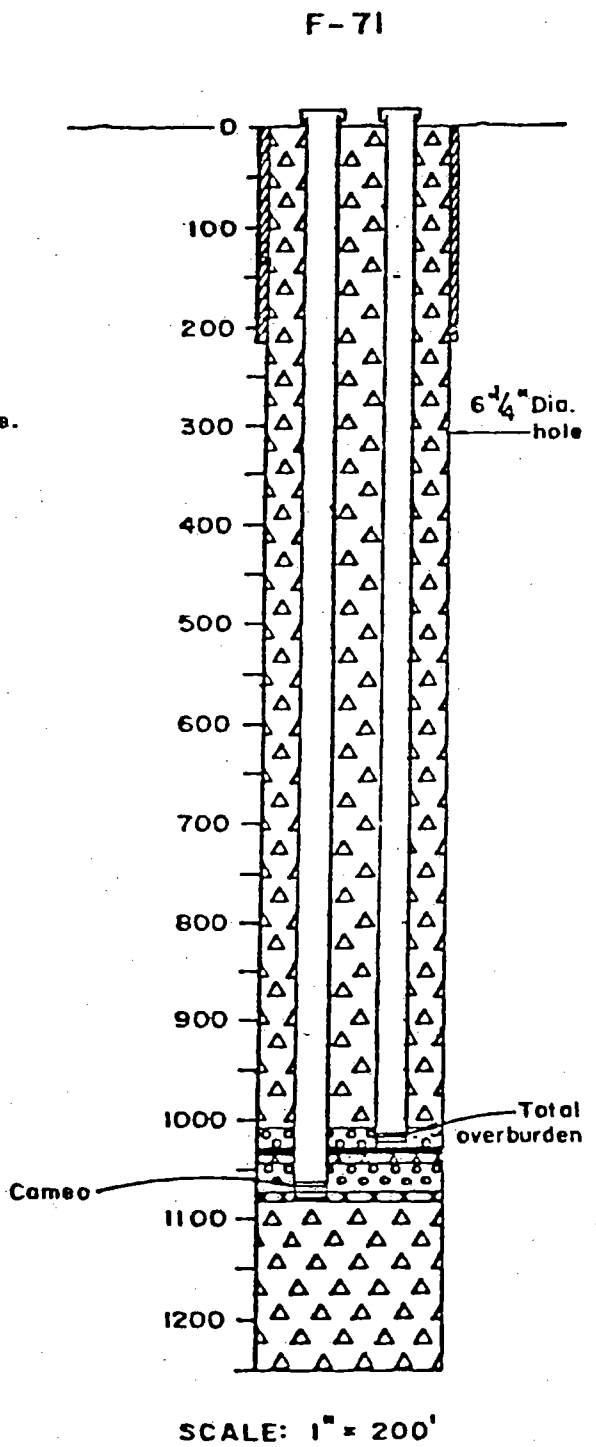
COMMENTS:

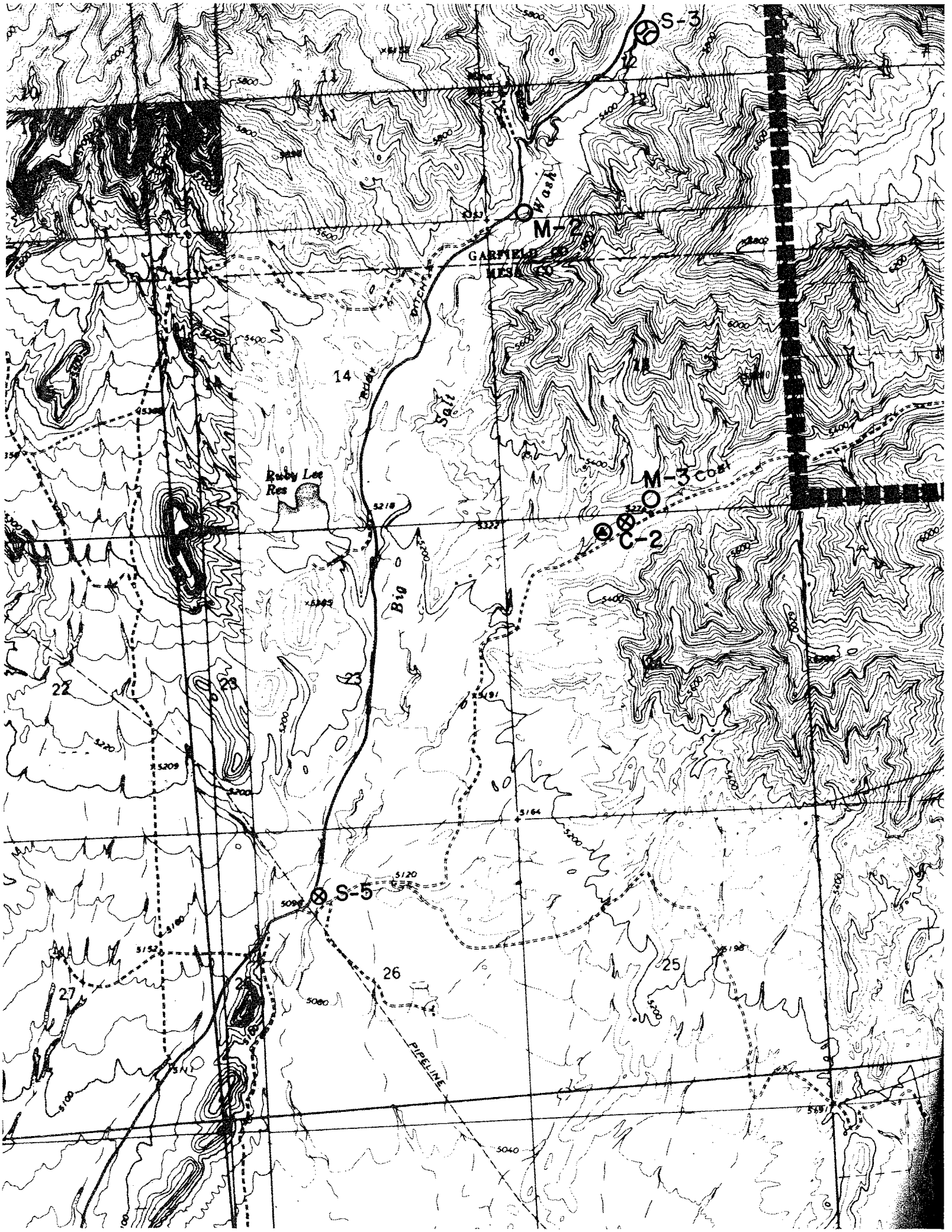
H_2O level at 1272' when logged.

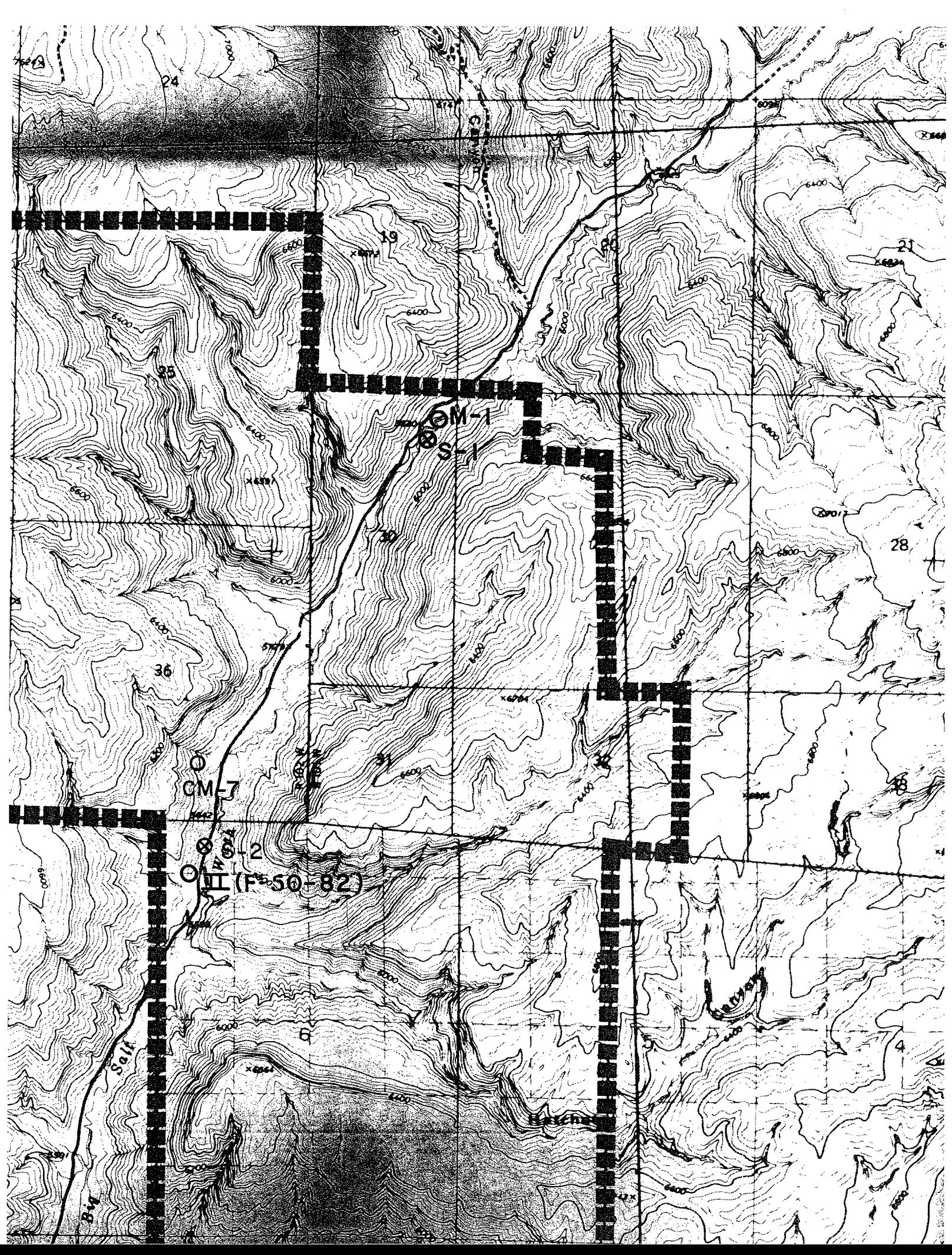
1 gpm or less at 620'.

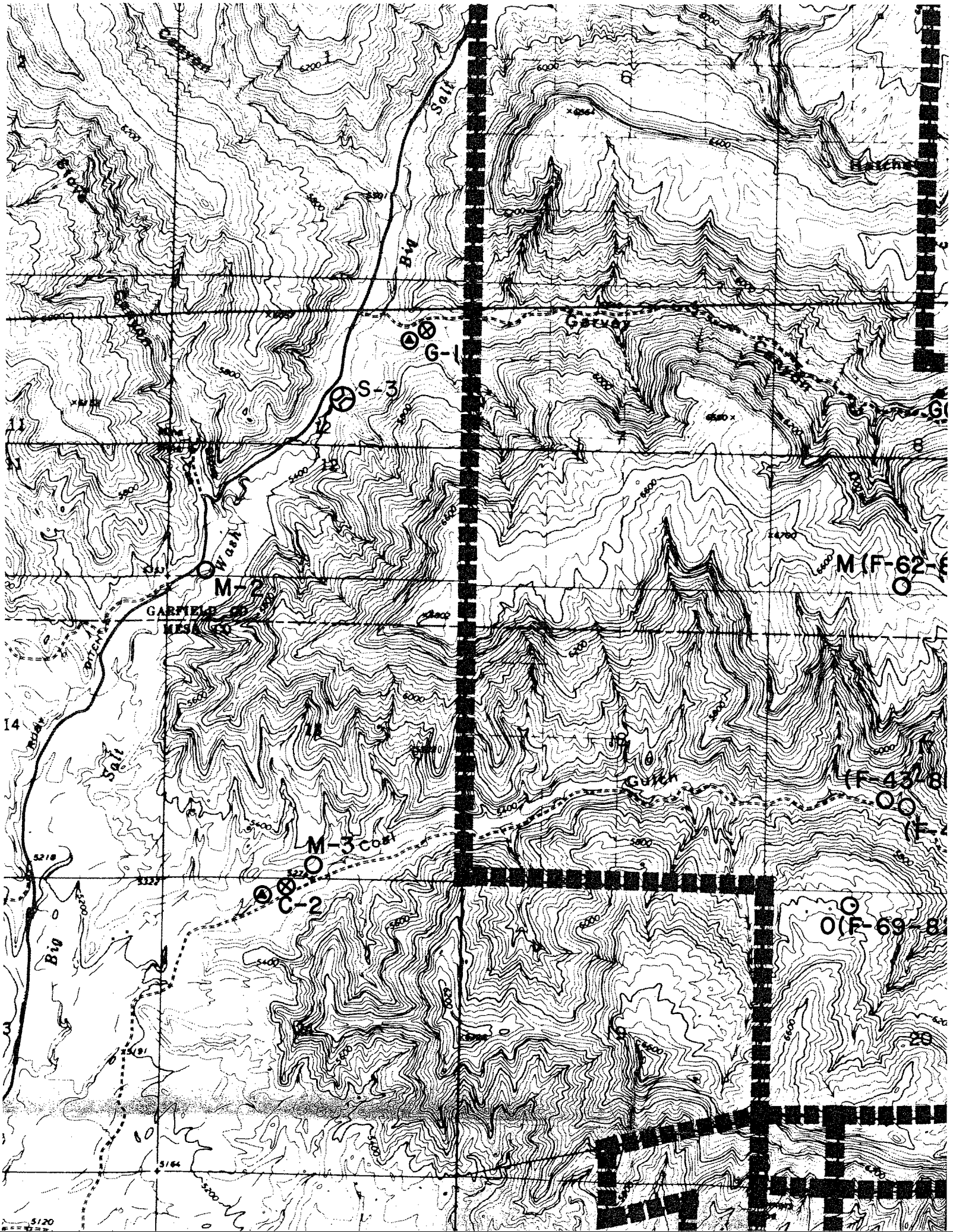
FACTS:






S-3
M-2
Wash
GARFIELD CO
MESA CO
PATENT
14
Salt
Ruby Lee Res
M-3 coal
C-2
Big
22
23
S-5
26
25
27
PIPELINE


CM-1
S-1
CM-7
S-2
II (F-50-82)
Hatches
Salt
Bay


Salt
Big
Garvey
G-1
S-3
Wash
M-2
GARFIELD CO
MESA CO
Salt
Big
M-3 coal
C-2
Gulch
M (F-62-8
(F-43-8
O(F-69-8
5218
5164
5120

Water Quality Data

BLM Surface Water Analytical Data

BLM Water Quality Data

NAME	DATE	Q	PH_L	PH_F	TEMP	COND_F	COND_L	TURBIDITY	ARSENIC	BARIUM	CADMIUM	CHROMIUM	FLUORIDE	LEAD	MERCURY	NITRATE	SELENIUM	SILVER	BICARBONAT	CARBONATE	POTASSIUM	COLOR	HARDNESS	CALCIUM
		cfs	SU	SU	C.	µS/cm	µS/cm	NTU	µg/l	mg/l	µg/l	µg/l	mg/l	µg/l	µg/l	mg/l	mg/l	µg/l	mg/l	mg/l	mg/l	Co/Pt	CaCO3 mg/l	mg/l
BIG SALT WASH ABV DIVERSION (K)	8/25/1981	0.05	9.00	8.80	27.0	2270	2230						0.400			0.110					2.80		470	33.0
BIG SALT WASH ABV DIVERSION (K)	6/29/1982	1.85		8.80	16.0	1180		50.0	0.0	0.00	0.0	2.0	0.180	0.0	0.00	0.000	0.000	0.00	351.0	0.00	2.50	0.0	323	30.2
BIG SALT WASH ABV DIVERSION (K)	9/3/1982	0.90		8.70	22.0	1000		140.0	0.0	0.00	0.0	0.0	0.260	0.0	0.00	0.000	0.000	0.00	283.0	26.40	2.40	0.0	301	27.2
BIG SALT WASH ABV DIVERSION (K)	5/6/1983	28.60	7.80	8.90	8.0	560	650	150.0	0.0	0.00	0.0	0.0	0.230	0.0	0.00	0.000	0.001	0.00	313.0	0.00	1.80	0.0	312	42.9
BIG SALT WASH ABV DIVERSION (K)	8/24/1983	1.72		8.50	17.5	1175		4.0		0.00	0.0	4.0	0.220	0.0	0.00	0.000	0.000	0.00	107.0	10.10	3.40	3.0		43.5
BIG SALT WASH ABV DIVERSION (K)	9/23/1983	0.67	8.40	8.40	15.5	1150		66.0	0.0	0.00	0.4	0.0	0.255	3.0	0.16	0.000	0.000	0.00	387.0	9.00	2.93	0.0		30.1
BIG SALT WASH ABV DIVERSION (K)	3/9/1984	4.34	8.20	8.80	2.5	950	1750	48.0	0.0	0.00	0.4	1.0	0.241	1.0	0.01	0.085	0.000	0.20	425.0	0.00	3.75	0.0		90.2
BIG SALT WASH ABV DIVERSION (K)	8/14/1984	4.03	8.10	8.10	23.0	1350	1490	320.0	0.0	0.00	0.0	0.0	0.500	0.0	0.00	0.210	0.000	0.00	371.0	0.00	3.00	10.0	460	45.3
BIG SALT WASH ABV DIVERSION (K)	6/13/1985	11.60	8.20	8.00	12.0	1250	1700	750.0	0.0	0.00	0.5	0.0	0.270	0.0	0.00	0.740	0.002	0.00	384.0	0.00	14.80	2.0	464	57.4
BIG SALT WASH ABV DIVERSION (K)	9/10/1985	1.70	8.25	8.50	15.0	1500	1900	101.0	0.0	0.00	0.0	0.0	0.280	0.0	0.00	0.000	0.000	0.00	375.0	0.00	2.10	5.0	299	72.1
BIG SALT WASH ABV DIVERSION (K)	6/4/1986	13.40	8.50	8.50	20.5	1170	1300	1580.0	0.0	0.00	0.0	0.0	0.190	0.0	0.00	0.267	0.004	0.00	347.0	15.30	2.00	7.0	440	68.0
BIG SALT WASH ABV DIVERSION (K)	9/9/1986	2.10	8.45	8.80	18.0	1750	1950	280.0	0.0	0.10	0.2	3.0	0.140	0.0	0.00	0.200	0.000	0.00	308.0	36.00	2.90	12.0	572	51.0
BIG SALT WASH ABV DIVERSION (K)	7/8/1987	2.20	8.00	8.80	19.0	1220	1500	175.0	0.0	0.10	0.2	0.0	0.200	1.0	0.13	0.060	0.000	0.80	338.0	0.00	2.40	5.0	406	43.0
BIG SALT WASH ABV DIVERSION (K)	9/1/1987	0.70	8.46	8.75	23.0	1880	2000	60.0	0.0	0.19	0.0	0.0	0.200	0.0	0.00	0.001	0.000	0.00	357.0	26.00	2.60	5.0	515	42.0
BIG SALT WASH ABV DIVERSION (K)	6/14/1988	2.40	8.30	8.20	22.0	1200	1200	74.0	0.0	0.00	1.0	0.0	0.280	5.0	0.22	0.058	0.000	0.00	356.0	0.00	2.00	3.0	390	33.0
BIG SALT WASH ABV DIVERSION (K)	9/14/1988	0.62	8.30	7.40	9.0	1100	1700	75.0	0.0	0.05	0.0	0.0	0.270	3.0	0.00	0.000	0.000	0.20	330.0	30.70	10.00	5.0	436	39.0
BIG SALT WASH ABV DIVERSION (K)	5/23/1989	1.32	8.20	7.90	18.0	1210	1500	65.0	0.0	0.03	0.2	1.0	0.070	0.0	0.69	0.379	0.004	0.00	365.0	0.00	3.00	0.0	401	36.0
BIG SALT WASH ABV DIVERSION (K)	6/21/1990	0.00																						
BIG SALT WASH ABV DIVERSION (K)	9/18/1990	0.00																						
BIG SALT WASH ABV DIVERSION (K)	6/25/1991	0.80	8.35	8.50	15.0	980	1050	278.0	0.0	0.38	0.2	0.0	0.380	1.0	0.00	0.398	0.001	0.20	338.0	37.00	4.10	7.0	349	41.0
BIG SALT WASH ABV DIVERSION (K)	5/22/1992	1.70	8.35	7.70	21.0	900	1070	220.0	0.0	0.00	0.3	0.0	0.390	0.0	0.00	0.220	0.000	0.00	369.0	0.00	3.20	0.0	307	36.0
BIG SALT WASH ABV DIVERSION (K)	7/28/1993	2.50	8.40	8.60	14.0	1100	1350	30.0	0.0	0.62	0.1	0.0	0.310	0.0	0.00	0.340	0.000	0.00	350.0	5.40	2.30	0.0	468	46.0
BIG SALT WASH ABV DIVERSION (K)	9/28/1993	0.67	8.25	8.70	13.0	1320	1850	9.5	0.0	1.02	0.2	0.0	0.340	0.0	0.00	0.330	0.000	0.00	453.0	0.00	3.40	4.0	508	49.0
BIG SALT WASH ABV DIVERSION (K)	5/26/1994	2.68	8.50	8.50	23.0	1220	1410	4.0	0.0	0.04	0.4	0.0	0.320	0.0	0.00	0.440	0.000	0.00	355.0	19.20	3.50	0.0	399	38.0
BIG SALT WASH ABV DIVERSION (K)	7/17/1995	3.10	8.40	8.40	25.0	1300	1160	47.0	0.0	0.14	0.0	1.0	0.380	0.0	0.00	0.260	0.000	0.00	243.0	24.60	1.70	0.0	314	37.0
BIG SALT WASH ABV DIVERSION (K)	9/11/1995	0.69	8.70	8.50	19.0	1400	1470	125.0	0.0	0.00	0.0	0.0	0.400	1.0	0.00	0.600	0.004	0.00	268.0	44.30	4.90	1.0	341	41.0
BIG SALT WASH ABV DIVERSION (K) averages		**3.47**	**8.3**	**8.4**	**17.4**	**1256**	**1512**	**202.2**	**0.0**	**0.12**	**0.2**	**0.5**	**0.279**	**0.7**	**0.05**	**0.196**	**0.001**	**0.06**	**338.0**	**12.35**	**3.65**	**3.0**	**404**	**44.7**
EAST SALT CREEK ABOVE CANAL (I)	8/15/1984	5.30	7.85		23.5	3420	5000	375.0	0.0	0.00	0.0	0.0	0.450	4.0	0.00	0.248	0.000	0.3	100.0	0.00	11.70	10.0	1040	125.0
EAST SALT CREEK ABOVE CANAL (I)	6/13/1985	18.60	7.95	7.95	27.0	2550	2750	600.0	0.0	0.00	0.0	0.0	0.270	0.0	0.00	0.590	0.004	0.0	338.0	0.00	21.20	3.0	765	79.9
EAST SALT CREEK ABOVE CANAL (I)	9/10/1985	2.50	7.95	8.40	17.0	4400	5400	42.0	0.0	0.20	0.0	0.0	0.330	0.0	0.00	0.177	0.000	0.0	341.0	0.00	7.80	3.0	1500	205.0
EAST SALT CREEK ABOVE CANAL (I)	6/4/1986	34.20	8.40	8.40	21.0	2250	2500	163.0	0.0	0.00	0.0	0.0	0.210	0.0	0.09	0.630	0.000	0.0	309.0	28.10	4.80	10.0	784	77.0
EAST SALT CREEK ABOVE CANAL (I)	9/9/1986	0.92	8.50	8.50	21.0	7200	7350	34.0	0.0	0.00	0.0	5.0	0.240	0.0	0.00	0.150	0.001	0.7	538.0	28.00	8.20	5.0	2120	172.0
EAST SALT CREEK ABOVE CANAL (I)	7/8/1987	1.00	8.40	8.60	19.0	4900	4800	30.0	0.0	0.40	1.0	5.0	0.300	6.0	0.00	0.075	0.006	0.8	384.0	38.00	7.60	5.0	1770	147.0
EAST SALT CREEK ABOVE CANAL (I)	9/1/1987	1.70	8.40	8.30	16.5	4370	5200	380.0	0.0	0.08	0.2	5.0	0.180	0.0	0.00	0.667	0.004	0.5	255.0	17.00	7.70	5.0	2020	134.0
EAST SALT CREEK ABOVE CANAL (I)	6/14/1988	4.60	8.20	8.10	19.0	3850	3900	100.0	0.0	0.65	0.8	3.0	0.320	0.0	0.00	0.395	0.002	0.0	426.0	0.00	4.80	3.0	965	110.0
EAST SALT CREEK ABOVE CANAL (I)	9/14/1988	1.44	8.00	7.50	12.0	3600	4700	400.0	0.0	0.00	9.4	0.0	0.260	2.0	0.00	0.575	0.000	0.8	358.0	0.00	40.00	7.0	1490	173.0
EAST SALT CREEK ABOVE CANAL (I)	5/23/1989	0.42	8.00	7.30	20.0	7200	8000	37.5	0.0	0.36	0.6	0.0	0.460	9.0	0.00	0.880	0.003	0.0	456.0	0.00	7.50	0.0	1910	160.0
EAST SALT CREEK ABOVE CANAL (I)	8/30/1989	1.62	7.70	7.05	22.0	1600	2000	125.0	0.0	0.03	0.0	0.0	0.500	2.0	0.00	0.667	0.000	0.0	196.0	0.00	10.00	0.0	727	293.0
EAST SALT CREEK ABOVE CANAL (I)	6/21/1990	2.19	7.90	8.30	20.0	1000	1200	525.0	0.0	0.00	0.0	0.0	0.200	0.0	0.11	1.100	0.000	0.5	163.0	0.00	6.40	0.0	345	86.0
EAST SALT CREEK ABOVE CANAL (I)	9/17/1990	1.84	7.80	7.80	25.0	2230	2200	500.0	0.0	0.01	0.2	0.0	0.370	4.0	0.00	1.530	0.004	0.2	186.0	0.00	12.30	25.0	806	200.0
EAST SALT CREEK ABOVE CANAL (I)	6/25/1991	1.42	7.80	7.80	23.0	1020	900	230.0	0.0	0.00	0.2	0.0	0.220	1.0	0.10	0.228	0.010	0.3	154.0	0.00	4.10	6.0	284	67.0
EAST SALT CREEK ABOVE CANAL (I)	9/5/1991	0.25	7.60	7.20	18.0	3700	4100	18.0	0.0	0.00	0.2	0.0	0.410	0.0	0.00	0.820	0.000	0.0	336.0	0.00	13.70	7.0	1530	280.0
EAST SALT CREEK ABOVE CANAL (I)	5/22/1992	3.50	8.15	7.40	26.0	3780	3950	450.0	0.0	0.27	0.0	0.0	0.510	0.0	0.00	0.920	0.000	0.0	421.0	0.00	10.10	30.0	1020	107.0
EAST SALT CREEK ABOVE CANAL (I)	9/4/1992	0.40	7.70		17.0	6000	12000	5.0	0.0	0.20	0.8	0.0	0.300	0.0	0.00	0.867	0.000	0.0	577.0	0.00	12.30	0.0	4550	322.0
EAST SALT CREEK ABOVE CANAL (I)	7/28/1993	1.50	8.10	8.25	18.0	6000	6700	15.0	0.0	0.00	1.0	0.0	0.420	55.0	0.00	0.570	0.000	0.0	361.0	0.00	6.60	0.0	2320	236.0
EAST SALT CREEK ABOVE CANAL (I)	9/28/1993	1.89	7.80	7.80	19.0	1800	2200	85.0	0.0	1.21	0.2	0.0	0.360	1.0	0.00	0.630	0.000	0.0	234.0	0.00	14.90	15.0	1100	161.0
EAST SALT CREEK ABOVE CANAL (I)	5/26/1994	5.10	8.50	8.10	25.0	5000	5380	0.9	0.0	0.04	0.2	0.0	0.450	0.0	0.00	0.840	0.002	0.2	433.0	18.80	11.60	1.0	1467	185.0
EAST SALT CREEK ABOVE CANAL (I)	8/30/1994	1.50	7.60	7.65	23.0	3000	3650	30.0	0.0	0.05	0.0	0.0	0.280	0.0	0.14	0.560	0.009	0.0	253.0	0.00	13.20	5.0	1060	171.0
EAST SALT CREEK ABOVE CANAL (I)	7/17/1995	4.90	8.40	8.25	26.0	3750	3940	290.0	0.0	0.00	0.0	0.0	0.450	0.0	0.00	1.010	0.000	0.0	332.0	34.40	6.20	5.0	749	91.0
EAST SALT CREEK ABOVE CANAL (I)	9/11/1995	0.64	8.00	7.80	23.0	4100	4430	220.0	0.0	0.00	0.0	0.0	0.470	0.0	0.00	0.750	0.000	0.0	332.0	0.00	15.60	5.0	1200	208.0
EAST SALT CREEK ABOVE CANAL (I) averages		**4.2**	**8.0**	**7.9**	**20.9**	**3770**	**4446**	**202.4**	**0.0**	**0.15**	**0.6**	**0.8**	**0.346**	**3.7**	**0.02**	**0.647**	**0.002**	**0.2**	**325.3**	**7.1**	**11.2**	**6.5**	**1371**	**164.8**
EAST SALT CREEK AT 6&50 (I)	8/24/1981	13.90		8.20	23.0	2910		0.0	0.0	0.00	0.0	0.0	0.300	0.0	0.00	3.200	0.000	0.0	0.0	0.00	6.50	0.0	1200	280.0
EAST SALT CREEK AT 6&50 (I)	6/29/1982	8.60		8.60	24.0	2610		45.0	0.0	0.00	0.0	4.0	0.130	1.0	0.00	1.750	0.000	0.0	188.0	0.00	7.63	5.0	1112	232.0
EAST SALT CREEK AT 6&50 (I)	9/3/1982	15.50		8.30	19.0	2400		160.0	0.0	0.00	0.0	0.0	0.250	0.0	0.00	3.470	0.000	0.0	261.0	0.00	6.80	0.0	1154	252.0
EAST SALT CREEK AT 6&50 (I)	5/5/1983	63.90		8.60	10.0	1220		640.0	0.0	0.00	0.0	0.0	0.297	0.0	0.00	0.190	0.000	0.0	311.0	12.00	8.11	0.0	575	89.3
EAST SALT CREEK AT 6&50 (I)	8/24/1983	21.40		8.20	16.5	2020		4.0	0.0	0.00	0.2	1.0	0.200	0.0	0.00	0.780	0.000	0.0	284.0	0.00	3.96	2.0		191.0
EAST SALT CREEK AT 6&50 (I)	9/23/1983	14.00		8.50	11.0	2580		12.0	0.0	0.00	0.2	0.0	0.270	3.0	0.00	0.950	0.000	0.0	267.0	0.00	6.93	2.0		252.0
EAST SALT CREEK AT 6&50 (I)	3/9/1984	12.00	7.80	8.30	4.0	2200	3500	120.0	1.0	0.00	0.7	1.0	0.244	1.0	0.18	0.550	0.006	0.0	391.0	0.00	4.67	0.0		160.0
EAST SALT CREEK AT 6&50 (I) averages		**21.33**	**7.8**	**8.4**	**15.4**	**2277**	**3500**	**140.1**	**0.1**	**0.00**	**0.2**	**0.9**	**0.242**	**0.7**	**0.03**	**1.556**	**0.001**	**0.0**	**243.1**	**1.71**	**6.37**	**1.3**	**1010**	**208.0**
SALT CREEK AT I-70 (H) averages	8/24/1981	127.00	8.10	8.20	23.0	1770	2050						0.300			1.800					5.20		570	190.0
SALT CREEK AT I-70 (H) averages	6/29/1982	112.50		8.50	22.0	1250		87.0	0.0	0.00	0.0	27.0	0.180	1.0	0.00	1.200	0.000	0.00	188.0	0.00	4.25	0.00	566	136.0
SALT CREEK AT I-70 (H) averages	5/5/1983	185.50	8.00	8.40	16.0	1250	1480	250.0	0.0	0.00	0.0	0.0	0.300	0.0	0.00	0.210	0.000	0.00	154.0	4.85	5.27	0.00	464	104.0
SALT CREEK AT I-70 (H) averages	8/2/1993	98.90	8.20	8.20	23.0	1500	1700	700.0	0.0	0.00	0.1	0.0	0.310	0.0	0.00	1.110	0.002	0.00	208.0	0.00	4.50	5.00	818	208.0
SALT CREEK AT I-70 (H) averages	9/28/1993	150.00	7.95	7.90	16.0	1330	1865	67.0	0.0	1.30	0.3	0.0	0.350	0.0	0.00	0.960	0.000	0.00	209.0	0.00	6.20	1.00	744	190.0
SALT CREEK AT I-70 (H) averages		**134.78**	**8.06**	**8.24**	**20.00**	**1420**	**1774**	**276.0**	**0.0**	**0.33**	**0.1**	**6.8**	**0.288**	**0.3**	**0.00**	**1.056**	**0.001**	**0.00**	**189.8**	**1.21**	**5.08**	**1.50**	**632**	**165.6**

BLM Water Quality Data

NAME	DATE	Q cfs	PH_L SU	PH_F SU	TEMP C.	COND_F µS/cm	COND_L µS/cm	TURBIDITY NTU	ARSENIC µg/l	BARIUM mg/l	CADMIUM µg/l	CHROMIUM µg/l	FLUORIDE mg/l	LEAD µg/l	MERCURY µg/l	NITRATE mg/l	SELENIUM mg/l	SILVER µg/l	BICARBONAT mg/l	CARBONATE mg/l	POTASSIUM mg/l	COLOR Co/Pt	HARDNESS CaCO3 mg/l	CALCIUM mg/l
WEST SALT CREEK AT GAGE (J')	6/4/1986	6.60	8.10	8.40	24.0	5010	5250	1630	0.0	0.00	0.5		0.200	0.0	0.00	0.710	0.000	0.0	298.0	0.00	13.20	10.0	1850	225.0
WEST SALT CREEK AT GAGE (J')	9/9/1986	0.36	8.55	8.40	26.0	13800	12000	12.0	0.0	0.00	0.0	0.0	0.240	2.0	0.00	0.150	0.000	0.4	333.0	38.00	17.60	5.0	4550	395.0
WEST SALT CREEK AT GAGE (J')	7/8/1987	1.04	7.65	8.60	17.0	4000	6500	87.0	0.0	0.76	0.0	5.0	0.360	3.0	0.00	0.024	0.000	0.9	338.0	0.00	11.40	7.0	2720	267.0
WEST SALT CREEK AT GAGE (J')	9/1/1987	0.58	8.40	8.55	16.0	8200	13500	90.0	0.0	0.00	0.5	0.0	0.180	0.0	0.00	0.000	0.000	0.4	267.0	12.00	13.40	10.0	3480	342.0
WEST SALT CREEK AT GAGE (J')	6/14/1988	0.43	8.20	8.00	22.0	7950	7800	15.0	0.0	0.80	1.3	0.0	0.440	0.0	0.10	0.170	0.000	0.0	359.0	0.00	11.40	1.5	3160	316.0
WEST SALT CREEK AT GAGE (J')	9/1/1988	0.33	8.10	7.70	17.0	8000	9300	450.0	0.0	0.00	0.3	7.0	0.220	1.0	0.00	0.370	0.000	0.2	353.0	0.00	4.00	6.0	3430	345.0
WEST SALT CREEK AT GAGE (J')	5/23/1989	0.01	7.60	7.20	15.0	11000	22200	5.0	0.0	0.25	0.0	1.0	0.450	0.0	0.07	0.542	0.004	0.0	407.0	0.00	16.90	0.0	5040	406.0
WEST SALT CREEK AT GAGE (J')	8/30/1989	0.03	8.05	7.20	22.0	16000	16000	0.2	0.0	0.06	0.8	8.0	0.610	21.0	0.00	1.130	0.001	0.0	345.0	0.00	32.20	2.0	5630	451.0
WEST SALT CREEK AT GAGE (J')	6/21/1990	0.00																						
WEST SALT CREEK AT GAGE (J')	9/17/1990	0.41	7.70	7.80	26.0	2230	2050	100000	0.0	0.02	0.4	1.0	0.320	4.0	0.08	0.281	0.000	0.0	135.0	0.00	5.20	30.0	746	217.0
WEST SALT CREEK AT GAGE (J')	6/25/1991	0.00																						
WEST SALT CREEK AT GAGE (J')	9/5/1991	0.00																						
WEST SALT CREEK AT GAGE (J')	5/22/1992	0.02	8.00	7.60	30.0	8500	5600	11100	0.0	0.04	0.3	0.0	0.570	0.0	0.00	1.500	0.000	0.0	376.0	0.00	21.70	0.0	2390	271.0
WEST SALT CREEK AT GAGE (J')	9/4/1992	0.05	8.25		17.0	14500	14800	1.5	0.0	0.10	1.2	0.0	0.420	9.0	0.00	0.690	0.001	0.0	451.0	0.00	24.20	0.0	1910	293.0
WEST SALT CREEK AT GAGE (J')	7/28/1993	0.14	8.10	8.25	28.0	12000	13400	1.5	0.0	0.00	0.7	0.0	0.410	3.0	0.00	0.690	0.000	0.0	449.0	0.00	12.80	5.0	5430	420.0
WEST SALT CREEK AT GAGE (J')	9/28/1993	0.09	8.35	8.30	23.0	14500	20800	2.8	0.0	2.88	1.3	3.0	0.460	0.0	0.00	0.750	0.002	0.0	430.0	35.40	24.40	10.0	6010	476.0
WEST SALT CREEK AT GAGE (J')	7/17/1995	0.79	8.40	8.35	28.0	12000	16000	275.0	0.0	0.00	0.0	0.0	0.480	9.0	0.00	0.800	0.002	0.2	323.0	34.40	18.20	5.0	3150	311.0
WEST SALT CREEK AT GAGE (J')	9/11/1995	0.27	8.30	8.10	26.0	8000	7730	16100	0.0	0.00	0.3	2.0	0.480	2.0	0.00	2.030	0.000	0.0	342.0	0.00	18.80	17.0	2060	290.0
WEST SALT CREEK AT GAGE (J') averages		**0.62**	**8.1**	**8.0**	**19.9**	**9245**	**11569**	**286.2**	**0.0**	**0.23**	**2.0**	**3.0**	**0.338**	**3.4**	**0.02**	**0.387**	**0.001**	**0.2**	**337.5**	**6.25**	**15.01**	**5.2**	**3733**	**343.4**
WEST SALT CREEK NR 8 ROAD (J)	8/25/1981	24.60	8.20		16.0	1845							0.300			0.810					4.90		700	185.0
WEST SALT CREEK NR 8 ROAD (J)	6/29/1982	16.60		8.40	23.0	1420		210.0	0.0	0.00	0.0	2.0	0.130	0.0	0.00	0.640	0.000	0.0	192.0	0.00	6.58	0.0	642	170.0
WEST SALT CREEK NR 8 ROAD (J)	9/3/1982	40.70		8.10	15.0	1190		310.0	0.0	0.00	0.0	0.0	0.220	0.0	0.00	0.681	0.000	0.0	186.0	0.00	4.10	0.0	500	114.0
WEST SALT CREEK NR 8 ROAD (J)	5/5/1983	40.70	7.50	8.30	14.0	1500	1200	300.0	0.0	0.00	0.0	0.0	0.260	0.0	0.00	0.240	0.000	0.0	199.0	4.85	4.98	5.0	516	104.0
WEST SALT CREEK NR 8 ROAD (J)	8/24/1983	32.40		8.20	16.5	1200		3.0	0.0	0.00	0.0	1.0	0.175	0.0	0.00	0.455	0.000	0.0	84.0	72.40	2.80	2.0		134.0
WEST SALT CREEK NR 8 ROAD (J)	9/23/1983	33.70	7.90	8.50	12.5	1220		86.0	0.0	0.00	0.0	0.0	0.270	9.0	0.61	0.330	0.000	0.0	155.0	0.00	5.25	2.0		115.0
WEST SALT CREEK NR 8 ROAD (J)	3/9/1984	2.09	7.85	8.30	7.0	4350	6600	15.0	0.0	0.00	1.6	5.0	0.208	6.0	0.14	1.400	0.004	2.5	317.0	0.00	8.85	0.0		496.0
WEST SALT CREEK NR 8 ROAD (J)	8/15/1984	1.80	6.70		21.5	3900	5500	35000	0.0	0.00	0.2	0.0	0.420	1.0	0.00	0.361	0.000	0.0	189.0	0.00	23.30	30.0	2090	503.0
WEST SALT CREEK NR 8 ROAD (J)	6/14/1985	2.40	8.20	8.20	22.0	6100	5800	95.0	0.0	0.00	0.1	0.0	0.270	0.0	0.00	0.350	0.001	0.0	321.0	0.00	40.60	4.0	2670	302.0
WEST SALT CREEK NR 8 ROAD (J)	9/10/1985	0.79	8.20	8.20	19.0	8100	10800	51.0	0.0	0.00	0.0	0.0	0.360	2.0	0.00	0.000	0.001	0.0	352.0	0.00	11.00	5.0	3480	327.0
WEST SALT CREEK NR 8 ROAD (J) averages		**19.58**	**7.8**	**8.3**	**16.7**	**3082.5**	**5980.0**	**4007.8**	**0.0**	**0.00**	**0.2**	**0.9**	**0.261**	**2.0**	**0.08**	**0.527**	**0.001**	**0.3**	**221.7**	**8.58**	**11.24**	**5.3**	**1514**	**245.0**

BLM Water Quality Data

NAME	DATE	Q	MAGNESIUM	SODIUM	CHLORIDE	SULFATE	PHEN_ALK	TOT_ALK	DIS_SOLID	IRON	MANGANESE	COPPER	ZINC	MOLYBDENUM	AMMONIA	PHOSPHATE	BORON	ALUMINUM
		cfs	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	µg/l	mg/l	µg/l	µg/l	µg/l	mg/l	mg/l	mg/l	µg/l
BIG SALT WASH ABV DIVERSION (K)	8/25/1981	0.05	94.00	400.00	38.00	790.0		450.0	1630	20.0	0.010					0.010		
BIG SALT WASH ABV DIVERSION (K)	6/29/1982	1.85	55.40	139.00	8.00	326.0	0.00	290.0	798	0.0	0.023	0.0	1.0	12.0	0.000	0.000	0.130	
BIG SALT WASH ABV DIVERSION (K)	9/3/1982	0.90	51.70	135.00	10.00	233.0	22.00	278.0	678	434.0	0.019	0.0	0.0	11.0	0.000	0.015	0.180	
BIG SALT WASH ABV DIVERSION (K)	5/6/1983	28.60	47.10	60.00	6.00	135.0	0.00	259.0	456	0.0	0.003	0.0	29.0	12.0	0.040	0.040	0.110	
BIG SALT WASH ABV DIVERSION (K)	8/24/1983	1.72	83.00	146.00	8.80	540.0	84.40	257.0	980	0.0	0.018	0.0	6.0	20.0	0.660	0.000	0.135	
BIG SALT WASH ABV DIVERSION (K)	9/23/1983	0.67	81.30	139.00	9.20	300.0	7.50	335.0	972	0.0	0.001	0.0	5.0	20.0	0.120	0.010	0.179	
BIG SALT WASH ABV DIVERSION (K)	3/9/1984	4.34	60.00	265.00	12.00	600.0	0.00	351.0	1210	136.0	0.002	2.0	4.0	0.0	0.000	0.006	0.095	0.0
BIG SALT WASH ABV DIVERSION (K)	8/14/1984	4.03	83.90	194.00	4.00	375.0	0.00	307.0	1110	35.0	0.002	2.0	3.0	0.0	0.320	0.109	0.070	20.0
BIG SALT WASH ABV DIVERSION (K)	6/13/1985	11.60	77.60	185.00	3.20	619.0	0.00	317.0	966	253.0	0.004	0.0	5.0	12.0	0.000	0.030	0.070	
BIG SALT WASH ABV DIVERSION (K)	9/10/1985	1.70	28.40	254.00	4.40	442.0	0.00	310.0	1420	70.0	0.000	0.0	27.0	15.0	0.090	0.000	0.180	
BIG SALT WASH ABV DIVERSION (K)	6/4/1986	13.40	88.00	156.00	10.00	550.0	12.70	312.0	1030	10.0	0.003	0.0	3.0	31.0	0.083	0.010	0.000	30.0
BIG SALT WASH ABV DIVERSION (K)	9/9/1986	2.10	102.00	267.00	17.00	888.0	30.00	314.0	1460	230.0	0.002	5.0	0.0	15.0	0.320	0.090	0.200	16.0
BIG SALT WASH ABV DIVERSION (K)	7/8/1987	2.20	75.00	240.00	9.00	730.0	0.00	279.0	1090	0.0	0.000	1.0	0.0	21.0	0.450	0.040	0.182	53.0
BIG SALT WASH ABV DIVERSION (K)	9/1/1987	0.70	94.00	325.00	17.00	725.0	22.00	339.0	1510	20.0	0.014	1.0	4.0	8.0	0.000	0.040	0.015	2.0
BIG SALT WASH ABV DIVERSION (K)	6/14/1988	2.40	75.00	159.00	14.00	363.0	0.00	294.0	1010	0.0	0.004	2.0	3.0	6.0	0.300	0.090	0.000	0.0
BIG SALT WASH ABV DIVERSION (K)	9/14/1988	0.62	79.00	300.00	23.00	653.0	25.60	324.0	1250	0.0	0.009	11.0	6.0	3.0	0.800	0.000	0.215	13.0
BIG SALT WASH ABV DIVERSION (K)	5/23/1989	1.32	74.00	380.00	10.00	781.0	0.00	302.0	1300	0.0	0.003	2.0	5.0	12.0	0.440	0.496	0.080	0.0
BIG SALT WASH ABV DIVERSION (K)	6/21/1990	0.00																
BIG SALT WASH ABV DIVERSION (K)	9/18/1990	0.00																
BIG SALT WASH ABV DIVERSION (K)	6/25/1991	0.80	60.00	167.00	10.00	300.0	30.50	340.0	945	0.0	0.002	12.0	3.0	20.0	0.080	0.050	0.277	9.0
BIG SALT WASH ABV DIVERSION (K)	5/22/1992	1.70	53.00	106.00	1.00	275.0	0.00	305.0	847	0.0	0.000	0.0	10.0	15.0	0.850	0.010	0.049	0.0
BIG SALT WASH ABV DIVERSION (K)	7/28/1993	2.50	86.00	72.00	5.00	365.0	4.50	298.0	964	0.0	0.001	6.0	11.0	15.0	0.000	0.000	0.060	0.0
BIG SALT WASH ABV DIVERSION (K)	9/28/1993	0.67	87.00	324.00	6.00	733.0	0.00	374.0	1670	100.0	0.028	0.0	6.0	8.0	0.000	0.010	0.015	0.0
BIG SALT WASH ABV DIVERSION (K)	5/26/1994	2.68	74.00	250.00	16.00	513.0	16.00	325.0	1271	70.0	0.001	2.0	5.0	12.0	0.000	0.040	0.067	2.0
BIG SALT WASH ABV DIVERSION (K)	7/17/1995	3.10	54.00	131.00	10.00	380.0	20.50	242.0	861	60.0	0.005	3.0	15.0	15.0	0.000	0.000	0.146	3.0
BIG SALT WASH ABV DIVERSION (K)	9/11/1995	0.69	58.00	226.00	32.00	531.0	36.90	295.0	1120	380.0	0.000	5.0	0.0	12.0	0.670	0.010	0.085	0.0
BIG SALT WASH ABV DIVERSION (K) averages		**3.47**	**71.7**	**209.2**	**11.8**	**506.1**	**13.59**	**312.4**	**1106**	**75.8**	**0.006**	**2.3**	**6.6**	**12.8**	**0.227**	**0.046**	**0.110**	**9.3**
EAST SALT CREEK ABOVE CANAL (I)	8/15/1984	5.30	217.00	615.00	94.00	2200.0	0.00	82.6	3390	70.0	0.005	5.0	7.0	0.0	0.100	0.152	0.000	0.0
EAST SALT CREEK ABOVE CANAL (I)	6/13/1985	18.60	131.00	414.00	34.00	1300.0	0.00	279.0	1840	360.0	0.013	0.0	9.0	13.0	0.260	0.030	0.035	0.0
EAST SALT CREEK ABOVE CANAL (I)	9/10/1985	2.50	236.00	832.00	48.00	3050.0	0.00	4640.0	0	0.0	0.058	0.0	4.0	0.0	0.155	0.000	0.265	0.0
EAST SALT CREEK ABOVE CANAL (I)	6/4/1986	34.20	126.00	385.00	33.00	1320.0	23.40	301.0	2060	65.0	0.015	0.0	73.0	17.0	0.100	0.000	0.200	84.0
EAST SALT CREEK ABOVE CANAL (I)	9/9/1986	0.92	368.00	1600.00	210.00	4870.0	23.00	492.0	6650	400.0	0.099	0.0	1.0	8.0	1.530	0.030	0.450	115.0
EAST SALT CREEK ABOVE CANAL (I)	7/8/1987	1.00	261.00	945.00	72.00	2630.0	32.00	381.0	4240	0.0	0.075	5.0	0.0	5.0	0.450	0.110	0.455	115.0
EAST SALT CREEK ABOVE CANAL (I)	9/1/1987	1.70	315.00	908.00	126.00	3060.0	14.00	239.0	4200	110.0	0.130	3.0	0.0	5.0	0.000	0.150	0.100	0.0
EAST SALT CREEK ABOVE CANAL (I)	6/14/1988	4.60	161.00	682.00	91.00	1910.0	0.00	0.0		0.0	0.000	0.0	0.0	0.0	0.000	0.000	0.000	0.0
EAST SALT CREEK ABOVE CANAL (I)	9/14/1988	1.44	246.00	798.00	111.00	2750.0	0.00	296.0	4160	0.0	0.042	18.0	273.0	1.0	1.250	0.120	0.472	98.0
EAST SALT CREEK ABOVE CANAL (I)	5/23/1989	0.42	298.00	1670.00	260.00	4210.0	0.00	377.0	6670	0.0	0.060	0.0	8.0	4.0	0.695	0.070	0.030	24.0
EAST SALT CREEK ABOVE CANAL (I)	8/30/1989	1.62	2.00	185.00	240.00	568.0	0.00	162.0	1470	60.0	0.057	4.0	12.0	10.0	0.063	0.530	0.282	0.0
EAST SALT CREEK ABOVE CANAL (I)	6/21/1990	2.19	32.00	56.50	76.00	265.0	0.00	135.0	719	420.0	0.016	1.0	5.0	0.0	0.020	0.060	0.000	0.0
EAST SALT CREEK ABOVE CANAL (I)	9/17/1990	1.84	75.00	277.00	141.00	1080.0	0.00	154.0	1780	0.0	0.052	9.0	20.0	8.0	1.280	0.090	0.000	0.0
EAST SALT CREEK ABOVE CANAL (I)	6/25/1991	1.42	29.00	124.00	62.00	350.0	0.00	127.0	790	10.0	0.016	33.0	8.0	2.0	0.070	0.110	0.130	3.0
EAST SALT CREEK ABOVE CANAL (I)	9/5/1991	0.25	202.00	365.00	158.00	1830.0	0.00	278.0	2870	70.0	0.386	0.0	49.0	8.0	0.080	0.050	0.300	5.0
EAST SALT CREEK ABOVE CANAL (I)	5/22/1992	3.50	183.00	294.00	81.00	1300.0	0.00	348.0	2400	0.0	0.000	0.0	16.0	10.0	0.800	0.000	0.105	8.0
EAST SALT CREEK ABOVE CANAL (I)	9/4/1992	0.40	911.00	745.00	118.00	5500.0	0.00	477.0	8200	10.0	0.443	2.0	0.0	2.0	0.630	0.000	0.163	0.0
EAST SALT CREEK ABOVE CANAL (I)	7/28/1993	1.50	422.00	394.00	46.00	2950.0	0.00	298.0	4420	0.0	0.054	163.0	69.0	2.0	0.000	0.000	0.110	2.0
EAST SALT CREEK ABOVE CANAL (I)	9/28/1993	1.89	170.00	68.30	156.00	763.0	0.00	193.0	1570	100.0	0.015	0.0	52.0	2.0	0.000	0.250	0.060	0.0
EAST SALT CREEK ABOVE CANAL (I)	5/26/1994	5.10	253.00	665.00	133.00	2500.0	15.70	389.0	4060	90.0	0.069	0.0	4.0	10.0	0.000	0.030	0.243	3.0
EAST SALT CREEK ABOVE CANAL (I)	8/30/1994	1.50	155.00	438.00	22.00	1875.0	0.00	209.0	2930	100.0	0.182	6.0	3.0	7.0	0.130	0.080	0.000	25.0
EAST SALT CREEK ABOVE CANAL (I)	7/17/1995	4.90	127.00	578.00	76.00	1430.0	28.70	332.0	2830	0.0	0.031	1.0	5.0	2.0	0.900	0.190	0.175	1.0
EAST SALT CREEK ABOVE CANAL (I)	9/11/1995	0.64	166.00	740.00	188.00	2040.0	0.00	274.0	3400	90.0	0.183	0.0	0.0	6.0	1.250	0.080	0.183	0.0
EAST SALT CREEK ABOVE CANAL (I) averages		**4.2**	**221.1**	**599.1**	**112.0**	**2163.1**	**5.9**	**454.9**	**3211.3**	**85.0**	**0.087**	**10.9**	**26.9**	**5.3**	**0.424**	**0.093**	**0.163**	**21.0**
EAST SALT CREEK AT 6&50 (I)	8/24/1981	13.90	130.00	290.00	220.00	1300.0	0.00	200.0	2370	40.0	0.040	0.0	0.0	0.0	0.000	0.020	0.000	0.0
EAST SALT CREEK AT 6&50 (I)	6/29/1982	8.60	136.00	279.00	116.00	1250.0	0.00	155.0	1900	0.0	0.038	2.0	5.0	0.0	0.080	0.000	0.280	0.0
EAST SALT CREEK AT 6&50 (I)	9/3/1982	15.50	126.00	225.00	153.00	1125.0	0.00	216.0	2518	770.0	0.210	0.0	9.0	6.0	0.190	0.030	0.420	0.0
EAST SALT CREEK AT 6&50 (I)	5/5/1983	63.90	84.10	194.00	22.00	750.0	10.00	277.0	1282	50.0	0.002	0.0	3.0	15.0	10.600	0.040	0.140	0.0
EAST SALT CREEK AT 6&50 (I)	8/24/1983	21.40	115.00	215.00	107.00	900.0	0.00	235.0	2204	0.0	0.038	0.0	6.0	14.0	0.780	0.000	0.180	0.0
EAST SALT CREEK AT 6&50 (I)	9/23/1983	14.00	162.00	192.00	160.00	1275.0	0.00	221.0	2948	0.0	0.001	1.0	9.0	11.0	0.000	0.010	0.257	0.0
EAST SALT CREEK AT 6&50 (I)	3/9/1984	12.00	181.00	530.00	74.00	1650.0	0.00	323.0	2136	173.0	0.000	4.0	7.0	15.0	0.125	0.060	0.205	20.0
EAST SALT CREEK AT 6&50 (I) averages		**21.33**	**133.4**	**275.0**	**121.7**	**1178.6**	**1.43**	**232.4**	**2194**	**147.6**	**0.047**	**1.0**	**5.6**	**8.7**	**1.682**	**0.023**	**0.212**	**2.9**
SALT CREEK AT I-70 (H) averages	8/24/1981	127.00	67.00	170.00	180.00	690.0		180.0	1430	10.0	0.011					1.000		
SALT CREEK AT I-70 (H) averages	6/29/1982	112.50	48.10	91.10	68.00	508.0	0.00	155.0	930	0.0	0.049	4.0	49.0	0.0	0.130	0.000		
SALT CREEK AT I-70 (H) averages	5/5/1983	185.50	48.20	135.00	100.00	425.0	4.04	135.0	1048	50.0	0.007	0.0	13.0	26.0	1.000	0.005	0.150	
SALT CREEK AT I-70 (H) averages	8/2/1993	98.90	73.00	92.50	87.00	696.0	0.00	172.0	1370	0.0	0.008	7.0	5.0	2.0	0.000	0.000	0.070	2.0
SALT CREEK AT I-70 (H) averages	9/28/1993	150.00	66.00	125.00	140.00	613.0	0.00	173.0	1350	340.0	0.029	0.0	12.0	5.0	0.000	0.000	0.040	0.0
SALT CREEK AT I-70 (H) averages		**134.78**	**60.46**	**122.72**	**115.00**	**586.4**	**1.01**	**163.0**	**1226**	**80.0**	**0.021**	**2.8**	**19.8**	**8.3**	**0.283**	**0.201**	**0.087**	**1.0**

BLM Water Quality Data

NAME	DATE	Q cfs	MAGNESIUM mg/l	SODIUM mg/l	CHLORIDE mg/l	SULFATE mg/l	PHEN_ALK mg/l	TOT_ALK mg/l	DIS_SOLID mg/l	IRON µg/l	MANGANESE mg/l	COPPER µg/l	ZINC µg/l	MOLYBDENUM µg/l	AMMONIA mg/l	PHOSPHATE mg/l	BORON mg/l	ALUMINUM µg/l
WEST SALT CREEK AT GAGE (J')	6/4/1986	6.60	322.00	843.00	46.00	3650.0	0.00	246.0	4920	30.0	0.026	0.0	9.0	9.0	0.039	0.000	0.131	42.0
WEST SALT CREEK AT GAGE (J')	9/9/1986	0.36	737.00	2840.00	168.00	9940.0	32.00	339.0	11200	350.0	0.071	0.0	4.0	0.0	7.250	0.040	0.295	15.0
WEST SALT CREEK AT GAGE (J')	7/8/1987	1.04	426.00	1760.00	76.00	6350.0	0.00	279.0	8030	30.0	0.308	4.0	4.0	3.0	1.650	0.120	0.245	10.5
WEST SALT CREEK AT GAGE (J')	9/1/1987	0.58	647.00	1790.00	108.00	6500.0	10.00	241.0	9920	30.0	0.357	2.0	4.0	0.0	0.000	0.160	0.210	
WEST SALT CREEK AT GAGE (J')	6/14/1988	0.43	576.00	1470.00	224.00	5000.0	0.00	297.0	6300	0.0	0.039	4.0	9.0	5.0	0.940	0.075	0.127	0.0
WEST SALT CREEK AT GAGE (J')	9/1/1988	0.33	575.00	1600.00	112.00	2560.0	0.00	292.0	6820	0.0	0.246	14.0	9.0	1.0	1.000	0.050	0.700	20.0
WEST SALT CREEK AT GAGE (J')	5/23/1989	0.01	1050.00	2920.00	162.00	10500.0	0.00	336.0	15000	40.0	0.617	0.0	9.0	3.0	0.450	0.620	0.330	24.0
WEST SALT CREEK AT GAGE (J')	8/30/1989	0.03	1100.00	3240.00	285.00	11800.0	0.00	267.0	14500	0.0	0.006	33.0	16.0	1.0	0.027	0.290	0.628	0.0
WEST SALT CREEK AT GAGE (J')	6/21/1990	0.00																
WEST SALT CREEK AT GAGE (J')	9/17/1990	0.41	50.00	265.00	31.00	1160.0	0.00	111.0	1620	30.0	0.026	14.0	17.0	0.0	2.120	0.000	0.000	0.0
WEST SALT CREEK AT GAGE (J')	6/25/1991	0.00																
WEST SALT CREEK AT GAGE (J')	9/5/1991	0.00																
WEST SALT CREEK AT GAGE (J')	5/22/1992	0.02	417.00	102.00	102.00	2330.0	0.00	311.0	3620	0.0	0.059	0.0	41.0	1.0	0.480	0.010	0.280	20.0
WEST SALT CREEK AT GAGE (J')	9/4/1992	0.05	286.00	2660.00	85.00	7030.0	0.00	373.0	10800	0.0	0.012	2.0	38.0	1.0	2.800	0.000	0.313	0.0
WEST SALT CREEK AT GAGE (J')	7/28/1993	0.14	1070.00	892.00	92.00	7000.0	0.00	371.0	9940	10.0	0.043	0.0	16.0	0.0	0.000	0.000	0.286	0.0
WEST SALT CREEK AT GAGE (J')	9/28/1993	0.09	1180.00	2580.00	134.00	10000.0	29.50	414.0	14900	250.0	0.207	0.0	3.0	1.0	0.830	0.010	0.300	0.0
WEST SALT CREEK AT GAGE (J')	7/17/1995	0.79	579.00	1800.00	146.00	6000.0	28.70	324.0	10900	0.0	0.080	0.0	49.0	3.0	0.000	0.010	0.217	5.0
WEST SALT CREEK AT GAGE (J')	9/11/1995	0.27	325.00	1520.00	80.00	5090.0	0.00	283.0	6340	80.0	0.030	0.0	188.0	3.0	4.250	0.180	0.148	0.0
WEST SALT CREEK AT GAGE (J') averages		**0.62**	**679.1**	**2057.9**	**147.6**	**7037.5**	**5.25**	**287.1**	**9586**	**60.0**	**0.209**	**7.1**	**8.0**	**2.8**	**1.420**	**0.169**	**0.333**	**15.9**
WEST SALT CREEK NR 8 ROAD (J)	8/25/1981	24.60	57.00	170.00	190.00	620.0		180.0	1350	10.0	0.013					0.010		
WEST SALT CREEK NR 8 ROAD (J)	6/29/1982	16.60	51.20	82.20	64.00	608.0	0.00	159.0	1200	0.0	0.061	2.0	12.0	3.0	0.090	0.000	0.120	0.0
WEST SALT CREEK NR 8 ROAD (J)	9/3/1982	40.70	37.70	117.00	126.00	325.0	0.00	154.0	988	2.5	0.230	4.0	21.0	2.0	0.180	0.015	0.170	
WEST SALT CREEK NR 8 ROAD (J)	5/5/1983	40.70	62.00	194.00	173.00	456.0	40.40	172.0	1102	50.0	0.009	0.0	12.0	21.0	1.410	0.050	0.155	
WEST SALT CREEK NR 8 ROAD (J)	8/24/1983	32.40	50.30	100.00	100.00	375.0	60.30	190.0	1088	0.0	0.013	0.0	1.0	13.0	0.460	0.000	0.155	
WEST SALT CREEK NR 8 ROAD (J)	9/23/1983	33.70	67.97	117.00	162.00	496.0	0.00	128.0	1432	0.0	0.003	1.0	15.0	13.0	0.020	0.045	0.178	
WEST SALT CREEK NR 8 ROAD (J)	3/9/1984	2.09	405.00	982.00	233.00	4000.0	0.00	262.0	6500	245.0	0.135	5.0	7.0	23.0	0.040	0.000	0.315	10.0
WEST SALT CREEK NR 8 ROAD (J)	8/15/1984	1.80	187.00	554.00	42.00	2800.0	0.00	156.0	4300	0.0	0.294	28.0	21.0	0.0	2.160	0.810	0.000	11.0
WEST SALT CREEK NR 8 ROAD (J)	6/14/1985	2.40	460.00	380.00	67.60	3090.0	0.00	265.0	4210	190.0	0.033	5.0	29.0	9.0	0.700	0.030	0.250	
WEST SALT CREEK NR 8 ROAD (J)	9/10/1985	0.79	639.00	1640.00	6.80	7000.0	0.00	292.0	10400	28.0	0.001	0.0	16.0	3.0	0.060	0.000	0.162	
WEST SALT CREEK NR 8 ROAD (J) averages		**19.58**	**201.7**	**433.6**	**116.4**	**1977.0**	**11.19**	**195.8**	**3257**	**52.6**	**0.079**	**5.0**	**14.9**	**9.7**	**0.569**	**0.096**	**0.167**	**7.0**

USGS Surface Water Analytical Data

USGS Station -
Salt Ck nr Mack
Station Number 9163490

Date	Temperature ºC	Discharge cfs	pH	Specific conductance mS/cm at 25ºC	Turbidity severity code	Fluoride mg/l	Selenium µg/L	Bicarbonate mg/L	Hardness mg/L as CaCO3	Sodium mg/L	Sulfate mg/L	Suspended sediment concentration mg/L
4/4/1973	11											
4/12/1973	15											
4/20/1973	8											
5/2/1973	10											
6/5/1973	16.5											
7/6/1973	20											
8/3/1973	23											
8/8/1973	17.5	122				0.5			820	140	780	
11/28/1973	1	18				0.4			2300	420	2500	
2/20/1974	0	10				0.5			2200	480	2600	
3/8/1974	3	21				0.4			1400	350	1800	
5/29/1974	16	109				0.3			650	110	610	
8/13/1974	18.5	148				0.3			730	130	660	
12/10/1974	0	16				0.2			1700	410	2900	
3/5/1975	3.5					0.3			1900	460	2300	
5/22/1975	13					0.3			450	100	390	
8/5/1975	22.5					0.3			760	130	720	
11/4/1975	10.5					0.3			2200	380	2400	
12/15/1975	0	16				0.3			2300	420	2600	
1/14/1976	0					0.4			2300	450	2700	
2/6/1976	3					0.3			1800	400	2100	
3/9/1976	11.5					0.4			2000	530	2500	
4/6/1976	14					0.3			2300	550	2900	
5/4/1976	16.5	67				0.3			640	170	640	
6/8/1976	20.5					0.2			570	100	500	
7/2/1976	23					0.4			850	130	810	
8/6/1976	21.5					0.3			810	140	660	
9/7/1976	20					0.3			790	170	670	
10/6/1976	12.5					0.3			650	160	550	
11/30/1976	0.5					0.2			2200	400	2400	
12/16/1976	0.5					0.3			2300	440	2500	
1/18/1977	0.5	9.9				0.3			2300	420	2500	
2/2/1977	3					0.2			2200	430	2500	
3/8/1977	7					0.2			2300	450	2500	
4/8/1977	16					0.3			610	220	560	
7/8/1977	22					0.3			730	180	640	
10/19/1977	11.5					0.3			580	170	510	
2/14/1978	5					0.3			2500	440	2700	
4/5/1978	8.5					0.2			1700	400	1900	
7/11/1978	17					0.3			800	140	730	
11/14/1978	8					0.3			2100	420	2300	
3/13/1979	1	91				0.2			870	230	1100	
5/9/1979	8					0.3			560	160	580	
7/23/1979	18.5					0.3			740	120	700	
11/7/1979	7					0.3			2100	420	2200	
1/29/1980	1					0.3			2000	460	2400	
4/23/1980	14					0.3			400	130	380	
7/17/1980	18					0.4			610	120	570	
10/7/1980	12					0.3			850	190	740	
2/18/1981	2		8	5410		0.3			2100	630	2800	
5/14/1981	13.5		7.7	1630		0.2			550	150	470	
7/23/1981	22		8.1	2970		0.3			820	160	710	
12/3/1981	2.5		7.9	5090		0.3			2500	480	2900	
3/24/1982	10		7.8	4700		0.3			2200	550	2800	
6/15/1982	21		8.2	1710		0.3			610	110	620	
10/14/1982	10		7.9	1490		0.3			510	130	450	
1/6/1983	0		8	4870		0.3			2400	490	2800	
5/3/1983	12		8.3	1870		0.3			630	160	650	
8/10/1983	20.5		8.3	2780		0.3			850	160	1200	
9/7/1983	19.5		8.1	1830		0.3			590	120	700	
3/20/1991	5		7.8	4970		0.4			2200	500	3300	
6/25/1991	14.5											
8/27/1991	19		8.1	1670		0.3			620	130	570	
2/4/1992	0		7.8	4540		0.4			2100	420	2400	
3/24/1992	13											
4/27/1992	13.5		7.8	1330								
6/8/1992	17		8.1	1020								
7/15/1992	18.5		8	1280								
8/10/1992	21											
12/15/1994	0		7.6	4750		0.3			2200	470	2500	
1/20/1995	0		7.7	4760		0.3			2200	460	2600	
2/13/1995	3.9		8.1	4930		0.3			2000	540	2500	
3/13/1995	10.6		7.8	3610		0.3			1300	410	1700	
4/24/1995	14		8	1350		0.3			370	130	280	

USGS Station -
Salt Ck nr Mack
Station Number 9163490

Date	Temperature ºC	Discharge cfs	pH	Specific conductance mS/cm at 25ºC	Turbidity severity code	Fluoride mg/l	Selenium µg/L	Bicarbonate mg/L	Hardness mg/L as CaCO3	Sodium mg/L	Sulfate mg/L	Suspended sediment concentration mg/L
5/25/1995	12.4		8	1130		0.3			380	98	300	
6/27/1995	15.1		7.7	1280		0.2			490	99	480	
7/24/1995	16.8		7.7	884		0.2	7		340	59	280	
8/22/1995	19.8		7.8	1070		0.3			380	76	300	
9/27/1995	12.3		8	1390		0.2	9		460	120	360	
10/24/1995	6.3		8.1	1630		0.3			540	140	470	
11/20/1995	6.3		7.4	4170		0.2			1800	380	2100	
12/15/1995	3.8		7.7	4670		0.3			2100	480	2500	
1/16/1996	0		7.4	4960		0.3			2300	530	2700	
2/12/1996	0.9		7.7	4790		0.3			2100	530	2400	
3/11/1996	3.8		7.7	4870		0.3			1900	560	2600	
4/9/1996	9.4		8	1090		0.3			340	100	290	
5/14/1996	13.7		8	1240		0.3			430	110	420	
6/27/1996	15.8		7.9	1050		0.3			450	64	350	
7/24/1996	17.9		7.9	1190		0.3			470	81	370	
8/26/1996	18.8		7.9	1580		0.3	12		560	130	470	
9/19/1996	15.8		8.1	1260		0.3			400	110	310	
10/18/1996	9.3		8	1390		0.3			410	120	330	
11/13/1996	3.3		7.7	4260		0.3			2100	380	2200	
1/6/1997	0		7.7	4110		0.3			1900	350	2100	
3/10/1997	5.7		7.7	3940		0.3	26		1400	470	2100	
5/13/1997	16		8	1430		0.28			500	120	480	
7/9/1997	17		8	1180		0.24			480	66.6	411	
8/13/1997	17		8.1	1160		0.26	11		410	87.1	337	
5/13/1998	14.5		8.2	1040	2	0.3		220	380	89.3	299	3790

USGS Station -
East Salt Ck near Mack
Station Number 9163310

Date	Temperature ºC	Discharge cfs	pH	Specific conductance mS/cm at 25ºC	Turbidity severity code	Fluoride mg/l	Selenium µg/L	Bicarbonate mg/L	Hardness mg/L as CaCO3	Sodium mg/L	Sulfate mg/L	Suspended sediment concentration mg/L
7/2/1973	28											
7/19/1973	17											
7/24/1973	18											
8/8/1973	23	0.18				0.5		521	2200	660	2700	
8/8/1973	23											
9/11/1973	18											
9/27/1973	12											
11/27/1973	5	0.3				0.4		472	2200	850	3300	
2/20/1974	2	0.15				0.6		605	2400	990	3700	
3/8/1974	6.5	2.6				0.5		355	730	360	1300	
5/29/1974	14	1.7				0.5		297	820	120	920	
8/13/1974	14.5	0.55				0.4		530	1900	600	2400	
12/10/1974	3					0.3		523	1800	650	2500	
3/4/1975	4.5					0.2		256	560	270	780	
5/22/1975	9.5					0.4		309	340	94	250	
8/5/1975	23					0.4		414	1300	290	1400	
11/4/1975	12					0.3		565	2100	640	2500	
12/15/1975	2					0.4		593	2400	770	3100	
1/13/1976	3					0.4		599	2300	900	3400	
2/6/1976	1.5					0.4		255	610	330	1000	
3/9/1976	12.5					0.5		469	850	490	1400	
4/6/1976	11.5					0.5		595	2000	1100	3400	
5/4/1976	16					0.4		440	830	430	1200	
6/8/1976	24					0.3		447	850	450	1300	
7/2/1976	23.5					0.6		369	990	240	980	
8/6/1976	20.5					0.4		404	1300	320	1300	
9/7/1976	20					0.4		425	1500	380	1600	
10/4/1976	17					0.3		488	1900	510	2200	
11/30/1976	4.5					0.3		568	2200	720	3000	
12/16/1976	1					0.4		580	2300	800	3100	
1/18/1977	1.5					0.4		573	2300	870	3400	
2/2/1977	5					0.3		585	2400	910	3100	
3/8/1977	8					0.3		587	2500	960	3500	
4/8/1977	19.5					0.4		520	2200	880	3300	
7/8/1977	19					0.4		430	1700	360	1700	
10/19/1977	8					0.4		430	2100	570	2300	
2/14/1978	4.5					0.4		460	2500	740	3200	
4/1/1978	12					0.4		220	630	210	810	
7/14/1978	16.5					0.3		230	640	180	670	
11/15/1978	6					0.3		530	2000	630	2700	
3/13/1979	1					0.3			680	330	970	
5/9/1979	9					0.3			240	160	310	
7/23/1979	21					0.3			1900	590	2600	
11/6/1979	11					0.4			2300	830	3200	
1/29/1980	4					0.4			2100	810	2900	
4/22/1980	12					0.4			450	160	540	
7/16/1980	16.5					0.6			1200	640	2000	
10/7/1980	12					0.4			1600	660	2200	
2/18/1981	4.5		8.3	7320		0.4			2100	1200	3600	
5/12/1981	14		8.1	9150		0.4			2400	1600	4500	
7/23/1981	19.5		8.1	3180		0.3			1100	380	1300	
12/3/1981	2.5		7.9	7640		0.4			2700	1400	4700	
3/24/1982	1		8.4	5200		0.4			1600	800	2600	
6/15/1982	15		7.9	3220		0.3			1000	450	1500	
5/2/1991	11		8.1	7050		0.5	8		2000	1200	3900	
2/4/1992	0		7.8	6860		0.6	21		2300	1000	3600	

USGS Station -
Big Salt Wash at Fruita
Station Number 9153270

Date	Temperature ºC	Discharge cfs	pH	Specific conductance mS/cm at 25ºC	Turbidity severity code	Fluoride mg/l	Selenium µg/L	Bicarbonate mg/L	Hardness mg/L as CaCO3	Sodium mg/L	Sulfate mg/L	Suspended sediment concentration mg/L
3/7/1973	6											
4/11/1973	12											
5/2/1973	11.5											
6/4/1973	9											
6/19/1973	10											
6/20/1973	9											
8/2/1973	7											
8/7/1973	21	106				0.3			660	130	640	
11/27/1973	7	18				0.3			1800	280	1800	
2/19/1974	4.5	9.5				0.5			1600	270	1500	
3/8/1974	10	16				0.5			1400	260	1400	
5/28/1974	17.5	94				0.5			550	78	450	
8/12/1974	19	92				0.3			750	140	670	
12/10/1974	1.5					0.3			1700	260	1600	
3/4/1975	5.5					0.3			1100	220	1000	
5/22/1975	10					0.3			410	70	330	
8/5/1975	16.5					0.4			780	130	690	
11/4/1975	8.5					0.3			1800	250	1600	
12/15/1975	2					0.3			1600	250	1600	
1/13/1976	5					0.3			1700	260	1700	
2/5/1976	7					0.4			1600	250	1500	
3/9/1976	5					0.4			800	200	850	
4/6/1976	5					0.4			920	250	1000	
5/3/1976	17					0.3			630	120	540	
6/8/1976	14.5					0.3			590	83	490	
7/1/1976	22.5					0.4			800	110	720	
8/4/1976	22					0.4			870	150	680	
9/3/1976	20					0.4			910	170	760	
10/4/1976	12.5					0.3			630	140	490	
11/30/1976	3	17				0.3			1700	240	1500	
12/15/1976	6					0.3			1600	250	1600	
1/18/1977	1.5					0.3			1700	250	1600	
2/2/1977	5					0.4			1700	250	1500	
3/8/1977	4					0.5			1600	260	1500	
4/8/1977	9					0.4			520	180	420	
7/6/1977	18.5					0.3			820	180	730	
3/20/1991	7.5		7.7	3350		0.3			1500	290	1500	
6/25/1991	15											
8/27/1991	20.5		8	1870		0.3			730	130	660	
2/5/1992	1.5		7.8	3390		0.3			1500	270	1500	
4/27/1992	15		7.9	1330								
6/8/1992	18		8	1560								
11/20/1995	6.6		7.2	3300		0.2			1600	220	1500	
12/15/1995	5.2		7.5	3050		0.3			1500	220	1200	
2/12/1996	7		7.6	3300		0.3			1600	270	1400	
3/11/1996	7.7		7.6	3360		0.3			1600	270	1500	
4/9/1996	11.8		7.9	931		0.3			310	73	240	
5/13/1996	15.3		7.9	1290		0.3			530	77	450	
6/27/1996	15.5		7.8	1290		0.3			590	71	450	
7/24/1996	18.4		7.8	1780		0.3			780	110	640	
8/26/1996	18.3		7.8	1850		0.3	20		720	140	610	
9/6/1996	18.2		7.7	1680		0.3	12		610	130	500	
9/6/1996	18.2		7.7	1690		0.3	13		610	130	520	
9/19/1996	11.7		7.9	1720		0.3			680	130	550	
10/18/1996	8.3		7.9	1810		0.3			660	130	550	
11/11/1996	5.7		7.8	2380		0.3			1100	180	890	
12/3/1996	4.1		7.5	3300		0.3			1700	230	1500	
1/6/1997	5		7.5	3350		0.3			1600	260	1500	
3/10/1997	3		7.6	2400		0.3	12		800	250	960	
4/15/1997	7.5		8.1	1300		0.29	7		400	122	324	
5/13/1997	11.5		7.8	1070		0.22			420	61.7	330	
6/16/1997	14		7.8	1040		0.2			490	59.4	361	
7/9/1997	17		7.9	1490		0.27			640	82.7	529	
8/13/1997	18.5		8	1250		0.28	12		490	84.2	385	
5/13/1998	11		8	1060	2	0.3		228	420	71.2	317	1570
11/19/1998	7		7.6	3190		0.23			1500	211	1440	
12/17/1998	4.5		7.7	3170		0.24			1700	232	1420	
1/20/1999	6		7.6	3180		0.27			1500	227	1430	
3/8/1999	8		7.6	3150		0.27			1600	230	1420	

USGS Station -
Mack Wash near Mack
Station Number 9163340

Date	Temperature ºC	Discharge cfs	pH	Specific conductance mS/cm at 25ºC	Turbidity severity code	Fluoride mg/l	Selenium µg/L	Bicarbonate mg/L	Hardness mg/L as CaCO3	Sodium mg/L	Sulfate mg/L	Suspended sediment concentration mg/L
7/27/1973	21											
8/8/1973	19	7.8				0.7		227	1600	200	1700	
9/14/1973	19											
10/10/1973	12											
11/27/1973	10	2.4				0.3		262	1900	240	1900	
11/28/1973	10.5											
1/8/1974	3											
1/22/1974	9											
2/20/1974	7	2.2				0.5		250	1900	230	1900	
2/20/1974	8											
3/6/1974	11											
3/21/1974	12.5											
4/11/1974	9.5											
4/23/1974	13											
5/14/1974	13											
5/28/1974	18.5	32				0.3		163	440	110	380	
6/11/1974	17											
6/25/1974	12											
7/16/1974	17											
8/12/1974	21.5	33				0.3		135	440	100	410	
8/15/1974	21											
9/9/1974	24.5											
12/10/1974	7.5					0.2		271	2000	230	2000	
3/4/1975	11					0.3		253	1900	230	1900	
5/22/1975	14					0.3		168	370	100	260	
8/5/1975	21					0.3		161	630	100	600	
11/4/1975	11.5					0.2		272	1900	240	1800	
12/15/1975	8.5					0.3		269	1900	210	1900	
1/13/1976	9					0.3		259	1900	230	1900	
2/5/1976	10.5					0.4		253	1900	220	1900	
3/9/1976	13.5					0.3		248	1800	210	1800	
4/6/1976	9.5					0.3		252	1900	220	1900	
5/4/1976	11					0.3		245	1800	220	1900	
6/8/1976	20					0.2		145	310	72	230	
7/2/1976	17.5							227	1400	180	1400	
8/6/1976	22					0.3		157	530	99	450	
9/7/1976	22					0.3		152	470	110	390	
10/4/1976	16					0.3		165	360	120	270	
11/30/1976	10					0.3		268	1900	220	2000	
12/16/1976	8					0.3		265	1900	220	1900	
1/18/1977	9					0.3		258	1900	220	1900	
2/2/1977	9.5					0.3		262	1900	210	1800	
3/8/1977	10					0.2		250	1900	210	1800	
4/8/1977	11.5					0.3		180	440	170	370	
7/8/1977	22					0.3		160	440	150	360	
10/18/1977	14					0.4		170	330	150	240	
2/14/1978	9.5					0.3		260	2000	240	1900	
4/3/1978	13.5					0.2		260	1900	230	1900	
7/14/1978	14					0.3		270	1800	240	1800	
11/15/1978	12					0.3		280	1900	240	1900	
3/13/1979	15					0.3			1800	240	1800	
5/10/1979	13					0.2			290	83	200	
7/23/1979	18					0.3			1900	53	1400	
11/6/1979	11					0.3			1900	230	1900	
1/29/1980	9					0.3			1900	220	1900	
4/22/1980	15					0.3			350	120	250	
7/16/1980	22					0.4			360	73	300	
10/7/1980	16.5		7.8	2570		0.3			1300	280	1200	
2/18/1981	9		7.6	3650		0.3			1900	250	1900	
5/12/1981	16		7.9	1380		0.2			620	300	340	
7/23/1981	22		8.1	1600		0.2			580	130	500	
12/3/1981	8		7.7	3960		0.3			1900	240	2100	
3/24/1982	8.5		7.8	3400		0.3			1900	240	1900	
6/15/1982	20.5		7.6	1700		0.3			690	110	610	

USGS Station -
West Salt Ck nr Mack
Station Number 9153400

Date	Temperature ºC	Discharge cfs	pH	Specific conductance mS/cm at 25ºC	Turbidity severity code	Fluoride mg/l	Selenium µg/L	Bicarbonate mg/L	Hardness mg/L as CaCO3	Sodium mg/L	Sulfate mg/L	Suspended sediment concentration mg/L
9/12/1973	29	0.97				0.5		142	670	310	1200	
9/26/1973	10	0.06				0.9		90	2600	510	3500	
9/12/1976	13.5					0.3			510	190	490	
10/3/1976	16					0.3		180	320	97	380	
9/11/1977						0.2		45	890	27	900	
10/7/1977						0.4		220	590	86	590	
3/3/1978	4					0.6		97	1300	200	1500	
4/1/1978	11					0.4		220	480	300	890	
1/22/1979	2					0.1			540	40	490	
3/13/1979	9					0.2			650	120	780	
4/11/1979	10					0.5			1800	890	3400	
2/19/1980	7					0.5			2500	530	3500	
4/21/1980	25					0.5			740	340	4300	
8/25/1980	24					0.4			2400	360	3000	
7/17/1981			7.2	2070		0.4			1300	72	1100	130000
7/17/1981			7.1	9910		0.4			5100	2000	6900	
8/12/1981												318000
8/13/1981	26.5		7.3	7070		0.4			2600	1100	4500	
8/14/1981	25					0.2			1000	290	1400	
9/14/1981	25.5		8.4	11200		0.4			5100	1600	8200	
10/5/1981	12		7.2	1980		0.3			950	120	1100	
2/24/1983	13.5											
2/28/1983	6.5											
3/14/1983	10											
3/15/1983	9											
4/13/1983	10											
5/3/1983	9											
5/17/1983	8											
5/24/1983	26											
6/7/1983	15											
6/13/1983	12											
7/6/1983	32											
7/26/1983	21											
8/9/1983	33											
9/7/1983	17.1											
12/4/1995	2.8		8	11700		0.2			4200	2000	7400	
3/13/1997	2.5		7.7	1820		0.1	3		500	210	810	6980

Red Cliff Mine Surface Water Analytical Data

Bowie Resources, LLC
Bowie No. 2 Mine
2006 Annual Hydrology Report

Ground Water

Red Cliff Mine
Surface Water SW-1

TC-03-01 East (R)
Terror Creek - Monitoring Well
Elevation - 7118'
Depth - 871'

Easting 1063946
Northing 572835

Date								6/30/2007	4/30/2007	8/30/2006	10/24/2006
		Summary Information									
Field		Baseline			Operation						
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max				
Static Water Level	Feet	0	---	0							
Water Elevation	Feet	0.0	---	0.0							
FieldComment											
ph	su	0	---	0							
Conductivity	umhos/cm	0	---	0							
Temperature	Celsius	0	---	0							
Lab Parameters	UNITS										
pH	mg/L	7.89	7.89	7.89							7.89
Conductivity	mg/L	1780.2	1780.16	1780.16							1780.16
Total Dissolved Solids	mg/L	<MDL	1364	1364							1364
Total Suspended Solids	mg/L	595	595	595							595
Total Alkalinity	umhos/cm	48.85	48.85	48.85							48.85
Bicarbonate	mg/L	48.85	48.85	48.85							48.85
Carbonate	mg/L	2	2	2							2
Hydroxide	mg/L	0	0	0							0
Sulfate	su	901.69	901.69	901.69							901.69
Calcium	mg/L	<MDL	193.8	193.8							193.8
Magnesium	mg/L	44.5	44.5	44.5							44.5
SAR in water	mg/L	0.783	0.783	0.783							0.783
Ammonia	mg/L	0	---	0							
Hardness	mg/L	667.17	667.17	667.17							667.17
Chloride	mg/L	<MDL	0.5	0.5							0.5
Sodium	mg/L	46.5	46.5	46.5							46.5
Potassium	mg/L	9.04	9.04	9.04							9.04
Aluminum	mg/L	13.7	13.7	13.7							13.7
Nitrate	mg/L	<MDL	---	0							
Nitrite	mg/L	0	---	0							
Nitrate-Nitrite											
Phosphate	mg/L	0	---	0							
Arsenic - Dissolved	mg/L	<MDL	0.039	0.039							0.039
Boron	mg/L	<MDL	0.263	0.263							0.263
Copper	mg/L	<MDL	0.015	0.015							0.015
Cadmium - Dissolved	mg/L	<MDL	---	0							
Iron - Dissolved	mg/L	1.39	1.39	1.39							1.39
Iron - Total Recoverable	mg/L	0	---	0							
Lead	mg/L	0.03	0.03	0.03							0.03
Manganese (Dissolved)	mg/L	0.06	0.06	0.06							0.06
Manganese (Total)	mg/L	0	---	0							
Mercury - Dissolved	mg/L	0	---	0							
Selenium - Dissolved	mg/L	0.019	0.019	0.019							0.019
Zinc - Dissolved	mg/L	0	---	0							

Baseline Information Collection initiated on 9/27/03 and not yet considered complete.

Bowie Resources, LLC
Bowie No. 2 Mine
2006 Annual Hydrology Report

Ground Water

Red Cliff Mine
Surface Water SW-2

TC-03-01 East (R)
Terror Creek - Monitoring Well
Elevation - 7118'
Depth - 871'

Easting 1068149
Northing 570094

Date								6/30/2007	4/30/2007	8/30/2006	10/24/2006
		Summary Information									
Field		Baseline			Operation						
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max				
Static Water Level	Feet	0	---	0							
Water Elevation	Feet	0.0	---	0.0							
FieldComment											
ph	su	0	---	0							
Conductivity	umhos/cm	0	---	0							
Temperature	Celsius	0	---	0							
Lab Parameters	UNITS										
pH	mg/L	7.92	7.92	7.92							7.92
Conductivity	mg/L	1171	1170.95	1170.95							1170.95
Total Dissolved Solids	mg/L	<MDL	967	967							967
Total Suspended Solids	mg/L	249	249	249							249
Total Alkalinity	umhos/cm	91.5	91.5	91.5							91.5
Bicarbonate	mg/L	91.5	91.5	91.5							91.5
Carbonate	mg/L	2	2	2							2
Hydroxide	mg/L	0	0	0							0
Sulfate	su	67.8	67.8	67.8							67.8
Calcium	mg/L	124.8	124.8	124.8							124.8
Magnesium	mg/L	37.1	37.1	37.1							37.1
SAR in water	mg/L	0.279	0.279	0.279							0.279
Hardness	mg/L	464.4	464.4	464.4							464.4
Chloride	mg/L	0.5	0.5	0.5							0.5
Ammonia	mg/L	0.5	0.5	0.5							0.5
Phosphorous	mg/L	0	---	0							
Hardness	mg/L	0	---	0							
Chloride	mg/L	<MDL	---	0							
Sodium	mg/L	13.85	13.85	13.85							13.85
Potassium	mg/L	4.36	4.36	4.36							4.36
Nitrate-Nitrite	mg/L	0	---	0							
Aluminum	mg/L	0.055	0.055	0.055							0.055
Nitrate	mg/L	<MDL	---	0							
Nitrite	mg/L	0	---	0							
Nitrate-Nitrite	mg/L	0	---	0							
Phosphate	mg/L	0	---	0							
Arsenic - Dissolved	mg/L	<MDL	0.012	0.012							0.012
Boron	mg/L	<MDL	0.261	0.261							0.261
Copper	mg/L	<MDL	0.01	0.01							0.01
Cadmium - Dissolved	mg/L	<MDL	---	0							
Iron - Dissolved	mg/L	0.09	0.09	0.09							0.09
Lead	mg/L	0.07	0.07	0.07							0.07
Iron - Total Recoverable	mg/L	0	---	0							
Lead	mg/L	0	---	0							
Manganese (Dissolved)	mg/L	0	---	0							
Manganese (Total)	mg/L	0.01	0.01	0.01							0.01
Mercury - Dissolved	mg/L	0	---	0							
Selenium - Dissolved	mg/L	0.01	0.01	0.01							0.01
Zinc - Dissolved	mg/L	0	---	0							

Baseline Information Collection initiated on 9/27/03 and not yet considered complete.

Bowie Resources, LLC
Bowie No. 2 Mine
2006 Annual Hydrology Report

Ground Water

Red Cliff Mine
Surface Water SW-3

TC-03-01 East (R)
Terror Creek - Monitoring Well
Elevation - 7118'
Depth - 871'

Easting 1076754
Northing 574609

Date								6/30/2007	4/30/2007	8/30/2006	10/24/2006
		Summary Information									
Field		Baseline			Operation						
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max				
Static Water Level	Feet	0	---	0							
Water Elevation	Feet	0.0	---	0.0							
FieldComment											
ph	su	0	---	0							
Conductivity	umhos/cm	0	---	0							
Temperature	Celsius	0	---	0							
Lab Parameters	UNITS										
pH	mg/L	7.95	7.95	7.95							7.95
Conductivity	mg/L	28200	28200	28200							28200
Total Dissolved Solids	mg/L	<MDL	26024	26024							26024
Total Suspended Solids	mg/L	260	260	260							260
Total Alkalinity	umhos/cm	355.34	355.34	355.34							355.34
Bicarbonate	mg/L	355.34	355.34	355.34							355.34
Carbonate	mg/L	2	2	2							2
Hydroxide	mg/L	0	0	0							0
Sulfate	su	16193	16193.4	16193.4							16193.38
Calcium	mg/L	398.6	398.6	398.6							398.6
Magnesium	mg/L	1797	1797	1797							1797
SAR in water	mg/L	1.25	1.25	1.25							1.25
Hardness	mg/L	8395.4	8395.35	8395.35							8395.35
Chloride	mg/L	45.02	45.02	45.02							45.02
Ammonia	mg/L	0	---	0							
Phosphorous	mg/L	0	---	0							
Hardness	mg/L	0	---	0							
Chloride	mg/L	<MDL	---	0							
Sodium	mg/L	263.5	263.5	263.5							263.5
Potassium	mg/L	47.3	47.3	47.3							47.3
Nitrate-Nitrite	mg/L	0	---	0							
Aluminum	mg/L	0.054	0.054	0.054							0.054
Nitrate	mg/L	<MDL	---	0							
Nitrite	mg/L	0	---	0							
Nitrate-Nitrite	mg/L	0	---	0							
Phosphate	mg/L	0	---	0							
Arsenic - Dissolved	mg/L	<MDL	0.216	0.216							0.216
Boron	mg/L	<MDL	0.261	0.261							0.261
Copper	mg/L	<MDL	0.072	0.072							0.072
Cadmium - Dissolved	mg/L	<MDL	---	0							
Iron - Dissolved	mg/L	0.15	0.15	0.15							0.15
Lead	mg/L	0.73	0.73	0.73							0.73
Iron - Total Recoverable	mg/L	0	---	0							
Lead	mg/L	0	---	0							
Manganese (Dissolved)	mg/L	0.75	0.75	0.75							0.75
Manganese (Total)	mg/L	0	---	0							
Mercury - Dissolved	mg/L	0	---	0							
Selenium - Dissolved	mg/L	0.361	0.361	0.361							0.361
Zinc - Dissolved	mg/L	0	---	0							

Baseline Information Collection initiated on 9/27/03 and not yet considered complete.

Bowie Resources, LLC
Bowie No. 2 Mine
2006 Annual Hydrology Report

Ground Water

Red Cliff Mine
Pond P-6

TC-03-01 East (R)
Terror Creek - Monitoring Well
Elevation - 7118'
Depth - 871'

Easting 1073163
Northing 573998

Date								6/30/2007	4/30/2007	8/30/2006	10/24/2006
		Summary Information									
Field		Baseline			Operation						
Parameters	UNITS	Min	Ave	Max	Min	Ave	Max				
Static Water Level	Feet	0	---	0							
Water Elevation	Feet	0.0	---	0.0							
FieldComment											
ph	su	9.6	9.6	9.6							9.6
Conductivity	umhos/cm	800	800	800							800
Temperature	Celsius	13.2	13.2	13.2							13.2
Lab Parameters	UNITS										
pH	mg/L	9.17	9.17	9.17							9.17
Conductivity	mg/L	725.93	725.93	725.93							725.93
Total Dissolved Solids	mg/L	<MDL	518	518							518
Total Suspended Solids	mg/L	0.5	0.5	0.5							0.5
Total Alkalinity	umhos/cm	75.77	75.77	75.77							75.77
Bicarbonate	mg/L	75.77	75.77	75.77							75.77
Carbonate	mg/L	0	0	0							0
Hydroxide	mg/L	0	0	0							0
Sulfate	su	281.95	281.95	281.95							281.95
Calcium	mg/L	57.8	57.8	57.8							57.8
Magnesium	mg/L	41.5	41.5	41.5							41.5
SAR in water	mg/L	1.41	1.41	1.41							1.41
Hardness	mg/L	315.22	315.22	315.22							315.22
Chloride	mg/L	0.5	0.5	0.5							0.5
Ammonia	mg/L	0	---	0							
Phosphorous	mg/L	0	---	0							
Hardness	mg/L	0	---	0							
Chloride	mg/L	<MDL	---	0							
Sodium	mg/L	57.4	57.4	57.4							57.4
Potassium	mg/L	6.23	6.23	6.23							6.23
Nitrate-Nitrite	mg/L	0	---	0							
Aluminum	mg/L	0.066	0.066	0.066							0.066
Nitrate	mg/L	<MDL	---	0							
Nitrite	mg/L	0	---	0							
Nitrate-Nitrite	mg/L	0	---	0							
Phosphate	mg/L	0	---	0							
Arsenic - Dissolved	mg/L	<MDL	0.036	0.036							0.036
Boron	mg/L	<MDL	0.261	0.261							0.261
Copper	mg/L	<MDL	0.01	0.01							0.01
Cadmium - Dissolved	mg/L	<MDL	---	0							
Iron - Dissolved	mg/L	0.15	0.15	0.15							0.15
Lead	mg/L	0.05	0.05	0.05							0.05
Iron - Total Recoverable	mg/L	0	---	0							
Lead	mg/L	0	---	0							
Manganese (Dissolved)	mg/L	0.02	0.02	0.02							0.02
Manganese (Total)	mg/L	0	---	0							
Mercury - Dissolved	mg/L	0	---	0							
Selenium - Dissolved	mg/L	0.953	0.953	0.953							0.953
Zinc - Dissolved	mg/L	0	---	0							

Baseline Information Collection initiated on 9/27/03 and not yet considered complete.

Water Rights Data

Table G-1
PERMITTED WELLS WITHIN THE PROJECT AREA

Permit Number	Use	Principal Meridian (PM)	Township	Range	Section	Q160	Q40
15498	Irrigation	6th PM South	7 S	102 W	36	NE	SE
223206	Domestic	6th PM South	7 S	102 W	36	NE	SE
223205	Domestic	6th PM South	7 S	102 W	36	NE	SE
32752	Industrial	6th PM South	7 S	102 W	21	NE	SW
256861	Domestic	6th PM South	8 S	103 W	24	NE	SW
189882	Stock	6th PM South	8 S	102 W	26	NW	NE
270165	Monitoring Well	6th PM South	8 S	102 W	9	NE	SE
270164	Monitoring Well	6th PM South	8 S	102 W	16	NE	NW
277300	Domestic	6th PM South	8 S	102 W	34	NW	SE
8	Geothermal	6th PM South	9 S	102 W	2	SE	NW
35524	Monitoring Well	6th PM South	9 S	103 W	34	SE	SE
28	Geothermal	6th PM South	9 S	103 W	33	SE	NW
53	Geothermal	6th PM South	9 S	103 W	33	NW	SE
162328	Stock	Ute	2 N	3 W	34	NE	NW
13139	Domestic	Ute	2 N	3 W	35	SE	SE
16219	Irrigation	Ute	2 N	3 W	19	SW	SW
30149	Monitoring Well	Ute	2 N	3 W	19	SW	SW
208755	Monitoring Well	Ute	2 N	3 W	19	SW	SE
208752	Monitoring Well	Ute	2 N	3 W	19	SW	SE
208751	Monitoring Well	Ute	2 N	3 W	19	SW	SE
208753	Monitoring Well	Ute	2 N	3 W	19	SW	SE
208754	Monitoring Well	Ute	2 N	3 W	19	SW	SE
32983	Monitoring Well	Ute	2 N	3 W	19	SW	SW
35212	Monitoring Well	Ute	2 N	3 W	19	SW	SW
35721	Monitoring Well	Ute	2 N	3 W	34	SW	NE
216478	Monitoring Well	Ute	2 N	3 W	19	SW	SW
215189	Domestic	Ute	2 N	3 W	34	SW	NE
217304	Monitoring Well	Ute	2 N	3 W	34	NW	SW
217305	Monitoring Well	Ute	2 N	3 W	34	NW	SW
35929	Monitoring Well	Ute	2 N	3 W	34	NW	SW
247833	Domestic	Ute	9 S	102 W	15	SW	SE
43882	Monitoring Well	Ute	2 N	3 W	19	SW	SW

Source: Colorado Division of Water Resources 2008

Table G-2
WATER RIGHTS WITHIN THE PROJECT AREA BOUNDARY

Structure ID	Structure Name	Q10	Q40	Q160	Section	Township	Range	PM	Water Source	Type	Currently In Use	Decreed Rate Abs (CFS)	Decreed Rate Cond (CFS)	Decreed Rate Apex Abs (CFS)	Decreed Rate Apex Cond (CFS)	Decreed Rate Total (CFS)	Decreed Volume Abs (Acft)	Decreed Volume Cond (Acft)	Decreed Volume Apex Abs (Acft)	Decreed Volume Apex Cond (Acft)	Decreed Volume Total (Acft)
513	ARBUCKLE WASTE WATER		NE	NE	24	2N	3W	U	COLORADO RIVER	Ditch	A	1.4	0	0	0	1.4	0	0	0	0	0
556	BUENA VISTA DITCH		SE	SE	11	9S	103W	S	EAST SALT CREEK	Ditch	I	0	0	0	0	0	0	0	0	0	0
560	BURKETT RANCH DITCH	SE	SW	SE	6	1N	2W	U	BIG SALT WASH	Ditch	A	0.24	0	0	0	0.24	0	0	0	0	0
606	EAST CANON DITCH	NW	NE	NE	22	7S	101W	S	BIG SALT WASH	Ditch	A	0.6	0	0	0	0.6	0	0	0	0	0
608	EAST GULCH DITCH	NW	SE	SE	15	7S	101W	S	BIG SALT WASH	Ditch	A	0.6	0	0	0	0.6	0	0	0	0	0
629	GAVIN CANAL DITCH	NW	NW	NW	13	8S	102W	S	BIG SALT WASH	Ditch	A	1.44	0	0	0	1.44	0	0	0	0	0
639	WOOD DIVERSION REED WASH	NE	SW	NE	34	2N	3W	U	REED WASH	Ditch	A	0.2	0	0	0	0.2	0	0	0	0	0
664	HARPER DITCH	NE	SE	NW	35	2N	3W	U	REED WASH	Ditch	A	2.13	0.75	0	0	2.88	0	0	0	0	0
688	HERRON DITCH A	NE	NE	SE	27	9S	103W	S	COLORADO RIVER	Ditch	I	0.5	0	0	0	0.5	0	0	0	0	0
689	HERRON DITCH B	NE	NE	SE	27	9S	103W	S	COLORADO RIVER	Ditch	I	0.5	0	0	0	0.5	0	0	0	0	0
690	HERRON DITCH C	SE	NE	SE	27	9S	103W	S	COLORADO RIVER	Ditch	I	0.5	0	0	0	0.5	0	0	0	0	0
705	HOWARD SALT RIVER	NW	NE	NW	6	8S	102W	S	EAST SALT CREEK	Ditch	A	3	0	0	0	3	0	0	0	0	0
740	WILSON PUMP - REED WASH	NE	NE	NE	19	2N	2W	U	REED WASH	Pump	A	0.134	0	0	0	0.134	0	0	0	0	0
788	MIDDLECAMP NO 1 DITCH	SW	NW	SW	31	7S	101W	S	BIG SALT WASH	Ditch	H	0	0	0	0	0	0	0	0	0	0
789	MIDDLECAMP NO 2 DITCH	SW	NW	SW	31	7S	101W	S	BIG SALT WASH	Ditch	A	0.7	0	0	0	0.7	0	0	0	0	0
795	MITCHELL DALE DITCH	SE	NE	SW	8	7S	102W	S	EAST SALT CREEK	Ditch	A	0.9	0	0	0	0.9	0	0	0	0	0
802	MOUNT ZION DITCH	NE	NE	NE	28	2N	3W	U	COLORADO RIVER	Ditch	H	0	0	0	0	0	0	0	0	0	0
843	RAYMOND DITCH	SE	NE	SE	24	2N	3W	U	REED WASH	Ditch	A	3.5	0	0	0	3.5	0	0	0	0	0
844	W G RAYMOND DITCH	NE	NE	NW	25	2N	3W	U	REED WASH	Ditch	A	2	0	0	0	2	0	0	0	0	0
860	RUBY AND LEE DITCH	NE	SW	SW	12	8S	102W	S	BIG SALT WASH	Ditch	A	9	0	0	0	9	0	0	0	0	0
913	ROOTS DIVERSION NO 1	SE	SW	NW	20	2N	3W	U	MACK WASH	Ditch	A	0	4	0	0	4	0	0	0	0	0
916	UNFRED DITCH	NE	SW	NW	35	2N	3W	U	COLORADO RIVER	Ditch	I	2.5	0	0	0	2.5	0	0	0	0	0
919		NW	NW	NE	23	8S	102W	S	BIG SALT WASH	Ditch	A	2.57	0	0	0	2.57	0	0	0	0	0
930	WARNER DITCH	SW	SE	SE	15	7S	101W	S	BIG SALT WASH	Ditch	A	1	0	0	0	1	0	0	0	0	0
941	WILLIAMS IRRIGATING D	NW	SE	SW	23	8S	102W	S	BIG SALT WASH	Ditch	A	1.71	0	0	0	1.71	0	0	0	0	0
961	RALEY PUMP	SW	NW	SW	35	2N	3W	U	REED WASH	Pump	I	0	0	0	0	0	0	0	0	0	0
962	RALEY TAILWATER DITCH	SW	NW	SW	35	2N	3W	U	REED WASH	Ditch	I	0	0	0	0	0	0	0	0	0	0
974	ROOTS DIVERSION NO 2	SE	SW	NW	20	2N	3W	U	MACK WASH	Pump	I	0	0	0	0	0	0	0	0	0	0
985	16 ROAD DRAINLINE	NW	SW	NW	19	2N	2W	U	COLORADO RIVER	Ditch	U	10	0	0	0	10	0	0	0	0	0
986	JOHN HART W W DITCH NO 1	NE	NE	NE	19	2N	2W	U	COLORADO RIVER	Ditch	A	1	0	0	0	1	0	0	0	0	0
998	BARLOW DITCH NO 1	SE	NE	SE	10	9S	103W	S	EAST SALT CREEK	Ditch	A	1	0	0	0	1	0	0	0	0	0
999	BARLOW PUMP AND PL	NE	NW	NE	15	9S	103W	S	EAST SALT CREEK	Ditch	A	1	0	0	0	1	0	0	0	0	0
1000	BARLOW SPRING NO 1 DITCH	NE	NW	NW	15	9S	103W	S	COLORADO RIVER	Ditch	A	1	0	0	0	1	0	0	0	0	0
1001	BARLOW SPRING NO 2 DITCH	SW	NE	NW	15	9S	103W	S	COLORADO RIVER	Ditch	A	1	0	0	0	1	0	0	0	0	0
1003	BARR WASH DITCH	SW	NW	NE	18	2N	3W	U	COLORADO RIVER	Ditch	A	2	10	0	0	12	0	0	0	0	0
1013	BITTLE SPRING NO 1		SE	SW	3	1N	3W	U	COLORADO RIVER	Spring	A	0.02	0	0	0	0.02	0	0	0	0	0
1014	BITTLE SPRING NO 2		SW	SE	3	1N	3W	U	COLORADO RIVER	Spring	A	2	0	0	0	2	0	0	0	0	0
1015	BITTLE SPRING NO 3		SW	SE	3	1N	3W	U	COLORADO RIVER	Spring	A	0.02	0	0	0	0.02	0	0	0	0	0
1024	BRACH PUMP	SW	SE	NW	27	2N	3W	U	COLORADO RIVER	Pump	A	4	0	0	0	4	0	0	0	0	0
1042	DANIELS PUMP AND PL	NW	SE	SW	15	9S	103W	S	EAST SALT CREEK	Pump	A	2.8	0	0	0	2.8	0	0	0	0	0
1063	DISHMAN BARNES PUMP	SW	SW	NE	5	1N	2W	U	COLORADO RIVER	Pump	A	0.225	0	0	0	0.225	0	0	0	0	0
1065	DON WEIMER DITCH	SW	NE	NW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	2.7	0	0	0	2.7	0	0	0	0	0
1066	DONOHO PUMP AND PIPELINE	NE	NE	NW	2	1N	3W	U	REED WASH	Pump	A	0.17	0	0	0	0.17	0	0	0	0	0
1073	EAST SALT CREEK DITCH	NW	SE	NW	22	9S	103W	S	EAST SALT CREEK	Ditch	I	0	0	0	0	0	0	0	0	0	0
1088	GAMMILL SPRING	SE	NE	NW	5	1N	2W	U	COLORADO RIVER	Spring	U	0.25	0	0	0	0.25	0	0	0	0	0
1092	GAY PIPELINE A & B	NW	SE	NE	17	2N	3W	U	COLORADO RIVER	Pipeline	A	3	0	0	0	3	0	0	0	0	0
1107	H F MCCLAIN DITCH	SW	NW	SW	21	7S	102W	S	EAST SALT CREEK	Ditch	A	3.32	0	0	0	3.32	0	0	0	0	0
1111	HARRIS PUMP AND PIPELINE	SE	SW	SE	8	2N	2W	U	COLORADO RIVER	Pump	A	0	4	0	0	4	0	0	0	0	0

Table G-2
WATER RIGHTS WITHIN THE PROJECT AREA BOUNDARY

Structure ID	Structure Name	Q10	Q40	Q160	Section	Township	Range	PM	Water Source	Type	Currently In Use	Decreed Rate Abs (CFS)	Decreed Rate Cond (CFS)	Decreed Rate Apex Abs (CFS)	Decreed Rate Apex Cond (CFS)	Decreed Rate Total (CFS)	Decreed Volume Abs (Acft)	Decreed Volume Cond (Acft)	Decreed Volume Apex Abs (Acft)	Decreed Volume Apex Cond (Acft)	Decreed Volume Total (Acft)
1126	HOELSCHER BASIN NO 1	NE	NE	SE	8	2N	3W	U	COLORADO RIVER	Ditch	I	0	0	0	0	0	0	0	0	0	0
1127	HOELSCHER D NO 1 DIVR 1	NE	SE	NE	8	2N	3W	U	COLORADO RIVER	Pipeline	A	3	0	0	0	3	0	0	0	0	0
1135	KOVENE DITCH	SE	SE	SE	27	9S	103W	S	LITTLE SALT WASH	Ditch	A	1.5	0	0	0	1.5	0	0	0	0	0
1137	L H GLASSIER PIPELINE	SW	SW	NE	35	2N	3W	U	COLORADO RIVER	Pipeline	A	0.18	0	0	0	0.18	0	0	0	0	0
1140	KIPP PUMP AND PIPELINE	NE	NE	SE	13	2N	3W	U	REED WASH	Pump	N	0	0	0	0	0	0	0	0	0	0
1143	LEE PUMP AND PIPELINE	NE	NE	SW	28	9S	103W	S	LITTLE SALT WASH	Pump	A	4.16	0	0	0	4.16	0	0	0	0	0
1155	MARCHUN HIGHPOINT SPG 1	NW	NE	NE	5	1N	2W	U	LITTLE SALT WASH	Spring	U	0.03	0	0	0	0.03	0	0	0	0	0
1158	MCGRANAHAN PUMP	NE	SW	NE	5	1N	2W	U	COLORADO RIVER	Pump	U	0.165	0	0	0	0.165	0	0	0	0	0
1159	MCINTYRE PIPELINE NO 1	NE	SE	NE	6	1N	2W	U	BIG SALT WASH	Pipeline	I	0	0	0	0	0	0	0	0	0	0
1160	MCINTYRE PIPELINE NO 2	NE	SW	NE	6	1N	2W	U	BIG SALT WASH	Pipeline	U	0.5	0	0	0	0.5	0	0	0	0	0
1161	MCINTYRE PIPELINE NO 3	NE	SE	SE	31	2N	2W	U	BIG SALT WASH	Pipeline	U	1	0	0	0	1	0	0	0	0	0
1162	MCINTYRE PIPELINE NO 4	NE	SE	NE	31	2N	2W	U	BIG SALT WASH	Pipeline	U	0.75	0	0	0	0.75	0	0	0	0	0
1170	MINT SPRING NO 1	NE	NE	NW	5	1N	2W	U	BIG SALT WASH	Spring	U	0.06	0	0	0	0.06	0	0	0	0	0
1171	MINT SPRING NO 2	SE	NE	NW	5	1N	2W	U	BIG SALT WASH	Spring	U	0.01	0	0	0	0.01	0	0	0	0	0
1180	NIEHUES PUMP & PIPELINE	NW	SE	NW	8	2N	3W	U	COLORADO RIVER	Pump	I	0	0	0	0	0	0	0	0	0	0
1186	PELLEY DITCH	SE	NE	NE	28	2N	3W	U	REED WASH	Ditch	A	3	0	0	0	3	0	0	0	0	0
1187	PINYON MESA E PUMP STATN	NW	NE	NE	21	9S	103W	S	EAST SALT CREEK	Pump	A	2.5	0	0	0	2.5	0	0	0	0	0
1188	PINYON MESA W PUMP STATN	SW	SW	NE	21	9S	103W	S	WEST SALT CREEK	Pump	A	2.5	0	0	0	2.5	0	0	0	0	0
1198	ROSELLI PUMP NO 1	SE	NW	NE	5	1N	2W	U	BIG SALT WASH	Pump	U	0.2	0	0	0	0.2	0	0	0	0	0
1199	ROSYS DITCH	SE	SE	SW	25	2N	3W	U	COLORADO RIVER	Ditch	U	0.576	0	0	0	0.576	0	0	0	0	0
1214	SILVER OPEN DITCH	SW	SE	NE	34	9S	103W	S	COLORADO RIVER	Ditch	U	0.36	0.4	0	0	0.76	0	0	0	0	0
1223	STILLION-MCMILLAN PUMP	NE	SW	NE	5	1N	2W	U	COLORADO RIVER	Pump	U	0.165	0	0	0	0.165	0	0	0	0	0
1232	T J B PUMPS PIPELINES D	NE	NE	NW	6	2N	3W	U	EAST SALT CREEK	Ditch	A	2.02	1.59	0	0	3.61	0	0	0	0	0
1236	VER MEULEN DITCH	SE	SW	NW	19	2N	3W	U	COLORADO RIVER	Ditch	A	2	0	0	0	2	0	0	0	0	0
1256	AMERICAN GILSONITE D & P	NE	SE	SE	11	1N	3W	U	COLORADO RIVER	Pump	A	5.1	0	0	0	5.1	0	0	0	0	0
1258	ANDERSON BIG WASH PMPLT1	SW	NE	NW	32	2N	2W	U	BIG SALT WASH	Pump	A	0.75	0	0	0	0.75	0	0	0	0	0
1269	GVIC 13 ROAD DRAIN LINE	NW	NW	SW	15	2N	3W	U	REED WASH	Ditch	A	0	5	0	0	5	0	0	0	0	0
1276	DOUBLE D LAKE INLET	SE	NE	SW	20	2N	2W	U	BIG SALT WASH	Pump	A	1	1	0	0	2	0	0	0	0	0
1286	L AND M PIPELINE NO 1	NW	NW	NE	7	2N	3W	U	EAST SALT CREEK	Pipeline	A	0.2	0	0	0	0.2	0	0	0	0	0
1287	L AND M PIPELINE NO 1 AP	NW	SW	NE	7	2N	3W	U	EAST SALT CREEK	Pipeline	A	0	0	0.2	0	0.2	0	0	0	0	0
1290	TOMLINSON WW DITCH HGT 1	SE	NW	SW	28	9S	103W	S	WEST SALT CREEK	Ditch	I	0	0	0	0	0	0	0	0	0	0
1295	TOMLINSON PMPG PLT NO 2	NW	SW	NW	33	9S	103W	S	WEST SALT CREEK	Pump	I	0	0	0	0	0	0	0	0	0	0
1296	TOMLINSON PMPG PLT NO 2B	NE	SW	NW	33	9S	103W	S	WEST SALT CREEK	Pump	I	0	0	0	0	0	0	0	0	0	0
1297	TOMLINSON PMPG PLT NO 2C	NE	NW	NW	33	9S	103W	S	WEST SALT CREEK	Pump	I	0	0	0	0	0	0	0	0	0	0
1304	A L H DIVERSION PT NO 1	SW	NE	SW	34	9S	103W	S	LITTLE SALT WASH	Ditch	A	0	0	0	0	0	0	0	0	0	0
1305	A L H DIVERSION PT NO 2	NW	SE	SW	34	9S	103W	S	LITTLE SALT WASH	Ditch	A	0	0	0	0	0	0	0	0	0	0
1308	STEVE CHAFFIN IRR PUMP	SE	SE	SW	10	9S	103W	S	EAST SALT CREEK	Pump	A	3	0	0	0	3	0	0	0	0	0
1314	ALBERTSON LIVESTOCK D	NE	SW	NE	8	2N	2W	U	BIG SALT WASH	Ditch	A	0.2	0	0	0	0.2	0	0	0	0	0
1333	LAGE PUMP	SE	SW	SE	8	1N	2W	U	LITTLE SALT WASH	Pump	A	0.18	0	0	0	0.18	0	0	0	0	0
1351	DEKRUGER DIV PIPE & PUMP	NE	NE	NW	16	2N	3W	U	COLORADO RIVER	Pump	I	0	0	0	0	0	0	0	0	0	0
1355	DORCHESTER COLOMINE PL 1	SE	NE	SW	29	2N	2W	U	BIG SALT WASH	Pipeline	A	0	20	0	0	20	0	0	0	0	0
1360	HOELSCHER D NO 1 DIVR 2	NW	SE	NE	8	2N	3W	U	COLORADO RIVER	Pump	A	0	0	3	0	3	0	0	0	0	0
1373	KEMNITZ DITCH	NE	SE	NW	8	1N	2W	U	COLORADO RIVER	Ditch	A	0.22	0	0	0	0.22	0	0	0	0	0
1378	PAULL DITCH NO 1	SE	NE	SW	17	2N	3W	U	LITTLE SALT WASH	Ditch	U	0.625	1.75	0	0	2.375	0	0	0	0	0
1379	PAULL DITCH NO 2	NE	SE	SW	17	2N	3W	U	LITTLE SALT WASH	Ditch	U	0.75	0	0	0	0.75	0	0	0	0	0
1382	REED WASH PMP PLT AND PL	NE	SE	SW	2	1N	3W	U	REED WASH	Pump	I	0	0	0	0	0	0	0	0	0	0
1384	REID WASTE DITCH	SE	NW	NW	24	2N	3W	U	COLORADO RIVER	Ditch	A	3	0	0	0	3	0	0	0	0	0
1385	SCMC PUMP NO 1	NW	SE	SE	33	9S	103W	S	MACK WASH	Pump	A	3	0	0	0	3	0	0	0	0	0

Table G-2
WATER RIGHTS WITHIN THE PROJECT AREA BOUNDARY

Structure ID	Structure Name	Q10	Q40	Q160	Section	Township	Range	PM	Water Source	Type	Currently In Use	Decreed Rate Abs (CFS)	Decreed Rate Cond (CFS)	Decreed Rate Apex Abs (CFS)	Decreed Rate Apex Cond (CFS)	Decreed Rate Total (CFS)	Decreed Volume Abs (Acft)	Decreed Volume Cond (Acft)	Decreed Volume Apex Abs (Acft)	Decreed Volume Apex Cond (Acft)	Decreed Volume Total (Acft)
1407	MILLER PUMP	SE	NE	SE	34	2N	3W	U	REED WASH	Pump	A	0	0.1	0	0	0.1	0	0	0	0	0
1408	DANS SOURCE	SW	NW	NE	32	2N	2W	U	BIG SALT WASH	Pipeline	A	0.3	0	0	0	0.3	0	0	0	0	0
1409	HARTMAN DIVERSION	NW	NE	NW	7	2N	3W	U	EAST SALT CREEK	Pump	A	0.72	0	0	0	0.72	0	0	0	0	0
1426	GARY WEST BOT WASH PL	NW	NW	NW	11	1N	3W	U	REED WASH	Pipeline	A	0	0	10	0	10	0	0	0	0	0
1427	YOUNG DIVERSION POINT #1	SE	SW	NW	24	8S	103W	S	EAST SALT CREEK	Ditch	A	5	0	0	0	5	0	0	0	0	0
1436	BRAY DITCH	NW	NW	NE	2	1N	3W	U	REED WASH	Ditch	A	0	0.2	0	0	0.2	0	0	0	0	0
1445	COAL GULCH DITCH	SE	NW	NW	24	8S	102W	S	BIG SALT WASH	Ditch	I	0	0	0	0	0	0	0	0	0	0
1455	RAYMOND DITCH NO 1 HGT 1	SE	NE	SE	24	2N	3W	U	REED WASH	Ditch	A	2	0	0	0	2	0	0	0	0	0
1456	RAYMOND DITCH NO 1 HGT 2	NE	SE	SE	24	2N	3W	U	COLORADO RIVER	Ditch	A	2	0	0	0	2	0	0	0	0	0
1471	ANDERSON BIG WASH PMPLT2	SE	NE	NW	32	2N	2W	U	BIG SALT WASH	Pump	A	0.2	0	0	0	0.2	0	0	0	0	0
1472	EAST SALT CREEK PUMP NO1	NW	NE	NE	10	9S	103W	S	EAST SALT CREEK	Pump	I	0	0	0	0	0	0	0	0	0	0
1473	EAST SALT CREEK PUMP NO2	NW	SW	NE	10	9S	103W	S	EAST SALT CREEK	Pump	A	0	1	0	0	1	0	0	0	0	0
1474	EAST SALT CREEK PUMP NO3	NE	NE	SW	10	9S	103W	S	EAST SALT CREEK	Pump	I	0	0	0	0	0	0	0	0	0	0
1490	HARRIS PUMP AND PL AP	SW	SW	SE	17	2N	2W	U	BIG SALT WASH	Pump	A	0	0	0	4	4	0	0	0	0	0
1491	LEE DITCH	NE	SW	SE	21	9S	103W	S	LITTLE SALT WASH	Ditch	A	0	0	4.16	0	4.16	0	0	0	0	0
1492	LOMA POWER PLANT PUMP AP	NE	NE	SE	11	1N	3W	U	COLORADO RIVER	Power Plant	I	0	0	0	0	0	0	0	0	0	0
1493	MACK PUMPING PIPELINE AP	NE	SE	SE	11	1N	3W	U	COLORADO RIVER	Pump	I	0	0	150	0	150	0	0	0	0	0
1507	ROSYS DITCH	SW	SE	SW	25	2N	3W	U	REED WASH	Ditch	U	0	0	0.576	0	0.576	0	0	0	0	0
1597	LOMA DRAIN	NE	SE	SE	33	2N	3W	U	COLORADO RIVER	Pump	I	0	0	0	0	0	0	0	0	0	0
1601	ERNI SPRING NO 1	NW	NW	SW	18	2N	3W	U	SALT CREEK(GRAND VALLEY)	Spring	I	0	0	0	0	0	0	0	0	0	0
1602	ERNI SPRING NO 2	SW	NW	SW	18	2N	3W	U	SALT CREEK(GRAND VALLEY)	Spring	I	0	0	0	0	0	0	0	0	0	0
1621	SHAFFER WASTE DITCH	SW	SE	NE	26	2N	3W	U	REED WASH	Ditch	A	1	0	0	0	1	0	0	0	0	0
1632	BROKEN ARROW SALT CR PL	NW	NE	NW	22	9S	103W	S	EAST SALT CREEK	Pump	A	0	0.35	0	0	0.35	0	0	0	0	0
1633	DEATON FDR DITCH ALT. #1	SE	NW	NE	22	9S	103W	S	EAST SALT CREEK	Pump	A	0	0.75	0	0	0.75	0	0	0	0	0
1634	DEATON FDR DITCH ALT. #2	SW	SW	NE	22	9S	103W	S	EAST SALT CREEK	Pump	A	0	0.75	0	0	0.75	0	0	0	0	0
1641	JD NO. 1 PUMP	SW	NW	SE	15	9S	103W	S	EAST SALT CREEK	Pump	A	0.5	0	0	0	0.5	0	0	0	0	0
1642	JD NO. 2 PUMP	SW	NW	SE	15	9S	103W	S	EAST SALT CREEK	Pump	I	0	0	0	0	0	0	0	0	0	0
1644	ADOLF DITCH NO. 1	SW	NW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1645	ADOLF DITCH NO. 2	SW	NW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1646	ADOLF DITCH NO. 3	SW	NW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1647	ADOLF DITCH NO. 4	SW	NW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1648	ADOLF DITCH NO. 5	SE	NW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1649	ADOLF DITCH NO. 6	NW	SW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1650	ADOLF DITCH NO. 7	NW	SW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1651	ADOLF DITCH NO. 8	SW	SW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1652	ADOLF DITCH NO. 9	SW	SW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1653	ADOLF DITCH NO. 10	SW	SW	SW	7	2N	3W	U	EAST SALT CREEK	Ditch	A	1.3	0	0	0	1.3	0	0	0	0	0
1654	13 ROAD DRAINLINE	SW	SW	NW	15	2N	3W	U	COLORADO RIVER	Ditch	A	5	0	0	0	5	0	0	0	0	0
1655	BOUCHARD PUMP	NW	NW	NW	23	2N	3W	U	COLORADO RIVER	Pump	A	0.033	0	0	0	0.033	0	0	0	0	0
1661	HORSEWATER DIVR PT NO. 1	SW	NW	SE	1	1N	3W	U	COLORADO RIVER	Ditch	A	2.5	0	0	0	2.5	0	0	0	0	0
1662	HORSEWATER DIVR PT NO. 2	NW	SE	SW	1	1N	3W	U	COLORADO RIVER	Ditch	A	2.5	0	0	0	2.5	0	0	0	0	0
1667	SEEP WATER DIVR PT NO. 1	SE	SE	NE	1	1N	3W	U	COLORADO RIVER	Ditch	A	0.022	0	0	0	0.022	0	0	0	0	0
1668	SEEP WATER DIVR PT NO. 2	SE	SE	NE	1	1N	3W	U	COLORADO RIVER	Ditch	A	0.022	0	0	0	0.022	0	0	0	0	0
1672	ALBERTSON LIVESTOCK D AP	NW	NW	SW	1	9S	102W	S	BIG SALT WASH	Ditch	A	0	0	0.2	0	0.2	0	0	0	0	0
1674	MSB DITCH	NW	SW	NW	6	2N	3W	U	COLORADO RIVER	Ditch	A	0.5	0	0	0	0.5	0	0	0	0	0

Table G-2
WATER RIGHTS WITHIN THE PROJECT AREA BOUNDARY

Structure ID	Structure Name	Q10	Q40	Q160	Section	Township	Range	PM	Water Source	Type	Currently In Use	Decreed Rate Abs (CFS)	Decreed Rate Cond (CFS)	Decreed Rate Apex Abs (CFS)	Decreed Rate Apex Cond (CFS)	Decreed Rate Total (CFS)	Decreed Volume Abs (Acft)	Decreed Volume Cond (Acft)	Decreed Volume Apex Abs (Acft)	Decreed Volume Apex Cond (Acft)	Decreed Volume Total (Acft)
1675	WILLOW TANK	SW	NW	SE	8	1N	2W	U	LITTLE SALT WASH	Ditch	A	0.25	0	0	0	0.25	0	0	0	0	0
1677	JOHNSON DITCH	NW	NW	SW	35	2N	3W	U	REED WASH	Ditch	A	0.111	0.139	0	0	0.25	0	0	0	0	0
1680	BIG SALT DIVERSION	NW	NW	SW	1	9S	102W	S	BIG SALT WASH	Ditch	A	0	0.25	0	0	0.25	0	0	0	0	0
1688	MARSHALL PUMP	SW	NW	SW	9	2N	3W	U	REED WASH	Pump	A	0	0.25	0	0	0.25	0	0	0	0	0
1692	GOLD LAKE FEEDER PL		SE	NW	27	2N	3W	U	REED WASH	Pipeline	A	0	4	0	0	4	0	0	0	0	0
1693	BURKETT RANCH DIT. HDGT2		SW	SE	6	1N	2W	U	BIG SALT WASH	Ditch	A	1.76	2	0	0	3.76	0	0	0	0	0
1695	DANIELS PUMP SITE # 1	SE	SE	SW	15	9S	103W	S	EAST SALT CREEK	Pump	A	0.075	0	0	0	0.075	0	0	0	0	0
1696	DANIELS PUMPSITE #3	SE	NW	SW	15	9S	103W	S	EAST SALT CREEK	Pump	A	0.125	0	0	0	0.125	0	0	0	0	0
1698	SPENDRUP CANAL AND PUMP	NE	SE	SE	11	1N	3W	U	COLORADO RIVER	Ditch	A	10	0	0	0	10	0	0	0	0	0
1703	ALKALI ACRES PUMP	NW	SW	NE	5	1N	2W	U	BIG SALT WASH	Pump	A	0.1	0	0	0	0.1	0	0	0	0	0
1705	ATCHEE DITCH	NE	SW	SW	19	2N	3W	U	COLORADO RIVER	Ditch	A	0.1	0	0	0	0.1	0	0	0	0	0
1705	ATCHEE DITCH	NE	SW	SW	19	2N	3W	U	COLORADO RIVER	Ditch	A	0.1	0	0	0	0.1	0	0	0	0	0
1714	WOOTTEN PUMPING SYSTEM	NE	SE	SW	15	9S	103W	S	EAST SALT CREEK	Pipeline	A	0.075	0.15	0	0	0.225	0	0	0	0	0
1715	LONNIE SPRING	SE	SE	SW	15	9S	103W	S	EAST SALT CREEK	Spring	A	0	0	0.225	0	0.225	0	0	0	0	0
1716	DEL'S DITCH	SE	NE	NE	27	9S	103W	S	MACK WASH	Ditch	A	0	0.787	0	0	0.787	0	0	0	0	0
1717	HAMPTON PUMP SITE NO. 1	NW	NE	NW	22	9S	103W	S	EAST SALT CREEK	Pump	A	0.1	0	0	0	0.1	0	0	0	0	0
1718	HAMPTON PUMP SITE NO. 2	NW	NE	NW	22	9S	103W	S	EAST SALT CREEK	Pump	A	0	0.14	0	0	0.14	0	0	0	0	0
1735	PORTER PUMP & PIPELINE		SE	SW	17	2N	2W	U	REED WASH	Pump	A	0	0.125	0	0	0.125	0	0	0	0	0
1736	FOX DIVERSION	SE	SE	SE	13	2N	3W	U	REED WASH	Ditch	A	0.1	0	0	0	0.1	0	0	0	0	0
1737	KIEFER DIVERSION	NE	SE	NW	19	2N	3W	U	MACK WASH	Ditch	A	0	3.5	0	0	3.5	0	0	0	0	0
1739	BOREN DIVERSION NO 1	NE	NE	NE	15	9S	103W	S	EAST SALT CREEK	Ditch	A	0.4	0	0	0	0.4	0	0	0	0	0
1740	BOREN DIVERSION NO 2	NE	NE	NE	15	9S	103W	S	EAST SALT CREEK	Ditch	A	0	0.75	0	0	0.75	0	0	0	0	0
1741	BOREN DIVERSION NO 3	NE	NE	NE	15	9S	103W	S	EAST SALT CREEK	Ditch	A	0	0.75	0	0	0.75	0	0	0	0	0
1742	BOREN DIVERSION NO 4	NE	SW	SW	15	9S	103W	S	EAST SALT CREEK	Ditch	A	0	0.5	0	0	0.5	0	0	0	0	0
1743	BOREN DIVERSION NO 1AP	NW	NW	NW	14	9S	103W	S	EAST SALT CREEK	Ditch	A	0	0	0.4	0	0.4	0	0	0	0	0
1744	BOREN DIVERSION NO 2AP	SW	SE	SE	10	9S	103W	S	EAST SALT CREEK	Ditch	A	0	0	0	0.75	0.75	0	0	0	0	0
1753	HARTMAN DIVERSION-WEBB	NE	NE	NW	7	2N	3W	U	EAST SALT CREEK	Pump	A	0.2	0	0	0	0.2	0	0	0	0	0
3500	DEATON WILDLIFE POND #1	NW	NW	SE	22	9S	103W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	0	1.75	0	0	1.75
3501	DEATON WILDLIFE POND #2	NW	NW	SE	22	9S	103W	S	EAST SALT CREEK	Reservoir	A										
3502	YOUNG STOCK POND NO. 1	NE	NE	NE	29	7S	102W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	2.1	0	0	0	2.1
3503	YOUNG STOCK POND NO. 2	NE	SW	NE	29	7S	102W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	2.25	0	0	0	2.25
3504	YOUNG STOCK POND NO. 3	NE	SW	SE	29	7S	102W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	3.12	0	0	0	3.12
3512	BROWN POND E SALT CR	NE	NE	NW	6	8S	102W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	18	0	0	0	18
3513	TWIN HILL POND NO. 1	NE	NW	SE	6	8S	102W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	6	0	0	0	6
3514	TWIN HILL POND NO. 2	NW	NE	SE	6	8S	102W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	2.88	0	0	0	2.88
3515	BEARD POND NO. 2	SE	NE	NE	13	8S	103W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	1.64	0	0	0	1.64
3526	LOWER ROOTS RESERVOIR	SW	SW	NE	19	2N	3W	U	MACK WASH	Reservoir	A	0	0	0	0	0	25	0	0	0	25
3530	BIG SALT RESERVOIR		NW	SW	1	9S	102W	S	BIG SALT WASH	Reservoir	A	0	0	0	0	0	0	0.88	0	0	0.88
3534	HORSETHIEF WLDLF POND #2	SW	SW	SW	11	1N	3W	U	COLORADO RIVER	Well	A	0	0	0	0	0	3.37	0	0	0	3.37
3549	SPENDRUP POND	NE	NE	SE	11	1N	3W	U	COLORADO RIVER	Reservoir	A	0	0	0	0	0	7	0	0	0	7
3711	SALT CREEK RESERVOIR (WEST SALT CR)	SE	NE	NE	28	9S	103W	S	COLORADO RIVER	Reservoir	A	0	0	0	0	0	3	0	0	0	3
3716	OVER POND	NE	SE	NE	7	2N	3W	U	MACK WASH	Reservoir	A	0	0	0	0	0	0	2.5	0	0	2.5
3721	KIEFER POND	NE	SE	NW	19	2N	3W	U	MACK WASH	Reservoir	A	0	0	0	0	0	0	2.3	0	0	2.3
3724	BOREN POND NO 1	NE	SW	SW	14	9S	103W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	0.5	0	0	0	0.5
3725	BOREN POND NO 2	NW	NE	NE	14	9S	103W	S	EAST SALT CREEK	Reservoir	A	0	0	0	0	0	0	2.5	0	0	2.5
3755	GOLD LAKE		SE	NW	27	2N	3W	U	REED WASH	Reservoir	A	0	0	0	0	0	0	30	0	0	30
3758	WOOD POND	SE	SW	NE	34	2N	3W	U	REED WASH	Reservoir	A	0	0	0	0	0	4	0	0	0	4

Table G-2
WATER RIGHTS WITHIN THE PROJECT AREA BOUNDARY

Structure ID	Structure Name	Q10	Q40	Q160	Section	Township	Range	PM	Water Source	Type	Currently In Use	Decreed Rate Abs (CFS)	Decreed Rate Cond (CFS)	Decreed Rate Apex Abs (CFS)	Decreed Rate Apex Cond (CFS)	Decreed Rate Total (CFS)	Decreed Volume Abs (Acft)	Decreed Volume Cond (Acft)	Decreed Volume Apex Abs (Acft)	Decreed Volume Apex Cond (Acft)	Decreed Volume Total (Acft)
3771	CUDDY RESERVOIR	SE	SE	SE	35	8S	102W	S	BIG SALT WASH	Reservoir	U	0	0	0	0	0	0.7	0	0	0	0.7
3777	DAM NO 9 RESERVOIR	NW	SW	NE	8	9S	102W	S	WEST SALT CREEK	Reservoir	U	0	0	0	0	0	15.4	0	0	0	15.4
3836	DOUBLE D LAKE	SE	NE	SW	20	2N	2W	U	BIG SALT WASH	Reservoir	A	0	0	0	0	0	5	0	0	0	5
3921	RUBY LEE RESERVOIR	NE	NE	NW	23	8S	102W	S	BIG SALT WASH	Reservoir	A	0	0	0	0	0	367	0	0	0	367
3947	REID RESERVOIR	SE	SW	NW	20	2N	3W	U	COLORADO RIVER	Reservoir	A	0	0	0	0	0	20	0	0	0	20
3957	HIGHLINE RESERVOIR	NW	SE	SW	5	2N	3W	U	MACK WASH	Reservoir	A	0	0	0	0	0	3400.42	2350	0	0	5750.42
3965	SALT CREEK RESERVOIR	SE	NE	SW	33	9S	103W	S	SALT CREEK (GRAND VALLEY)	Reservoir	A	0	0	0	0	0	0	3000	0	0	3000
4019	ROOTS RESERVOIR	SW	SW	NE	19	2N	3W	U	MACK WASH	Reservoir	A	0	0	0	0	0	150.41	75	0	0	225.41
4063	COLEMAN POND	NE	NE	NW	5	1N	2W	U	BIG SALT WASH	Reservoir	A	0	0	0	0	0	4	0	0	0	4
4070	GOLDEN HILL RESERVOIR	SW	SW	SW	27	2N	3W	U	REED WASH	Reservoir	I	0	0	0	0	0	0	0	0	0	0
4075	KOVENE RESERVOIR	SE	NE	SE	27	9S	103W	S	LITTLE SALT WASH	Reservoir	A	0	0	0	0	0	0	2	0	0	2
4077	MACK MESA RESERVOIR	SW	NE	SW	13	9S	103W	S	MACK WASH	Reservoir	A	0	0	0	0	0	130.9	275	0	0	405.9
4127	WILLY'S POND	SW	SW	NE	34	2N	3W	U	COLORADO RIVER	Reservoir	C										
5083	ERICS SPRING	NW	NW	NW	7	2N	3W	U	EAST SALT CREEK	Well	A	0.4	0	0	0	0.4	0	0	0	0	0
5084	M J SPRING	SE	SE	SW	6	2N	3W	U	EAST SALT CREEK	Spring	U	0.2	0	0	0	0.2	0	0	0	0	0
5091	PEPE SPRING NO 1	NW	SE	SE	1	1N	3W	U	COLORADO RIVER	Spring	U	0.05	0	0	0	0.05	0	0	0	0	0
5098	EAST DESERT WELL	NW	SE	NE	14	8S	102W	S	BIG SALT WASH	Well	A	0.033	0	0	0	0.033	0	0	0	0	0
5171	CLUSTER SPRING	SW	NE	NE	12	7S	102W	S	EAST SALT CREEK	Spring	U	0.001	0	0	0	0.001	0	0	0	0	0
5185	SHERIDAN SPRING	SW	NW	NE	18	2N	3W	U	MACK WASH	Spring	A	0.033	0	0	0	0.033	0	0	0	0	0
5188	SALTLICK SEEP		NE	NE	2	8S	101W	S	BIG SALT WASH	Spring	U	0	0	0	0	0	0	0	0	0	0
5189	FINALLY SPRING		SW	SE	12	7S	102W	S	EAST SALT CREEK	Spring	U	0.002	0	0	0	0.002	0	0	0	0	0
5303	LAPAN SPRING NO 1		SW	NE	8	7S	101W	S	BIG SALT WASH	Spring	U	0.01	0	0	0	0.01	0	0	0	0	0
5304	LAPHAM SPRING NO 2		SE	NE	8	7S	101W	S	BIG SALT WASH	Spring	U	0.01	0	0	0	0.01	0	0	0	0	0
5410	ALSTATT SPRING NO. 1	SE	SE	SE	11	9S	103W	S	EAST SALT CREEK	Spring	A	0.09	0	0	0	0.09	0	0	0	0	0
5411	ALSTATT SPRING NO. 2	SE	NW	NW	6	2N	3W	U	EAST SALT CREEK	Spring	A	0.17	0	0	0	0.17	0	0	0	0	0
5454	KIEFER SPRING	NW	NE	NW	19	2N	3W	U	MACK WASH	Spring	A	0	0	0	3.5	3.5	0	0	0	0	0

Source: Colorado Division of Water Resources 2008
Notes:
PM = Principal Meridian
S = 6th Principal Meridian South
U = Ute Principal Meridian
CFS = cubic feet per second
ACFT = acre-feet
Under Currently In Use column:
A = Active Structure with contemporary diversion records
U = Active structure but diversion records are not maintained
H = Historical structure only – no longer exists or has records, but has historical data
I = Inactive structure which physically exist, but no diversion records are maintained

References: Colorado Division of Water Resources. 2008. “Colorado's Decision Support Systems.” http://cdss.state.co.us/DNN/default.aspx. Accessed August 8, 2008.