TITAN Environmental

Hydrogeologic Evaluation of White Mesa Uranium Mill

Prepared For:

Energy Fuels Nuclear, Inc.
One Tabor Center, Suite 2500
1200 Seventeenth Street
Denver, CO 80202

July 1994

By:

TITAN Environmental Corporation
5690 DTC Boulevard, Suite 260
Englewood, CO 80111

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HYDROGEOLOGIC EVALUATION OF WHITE MESA URANIUM MILL

1.0 INTRODUCTION

This report presents a hydrogeologic evaluation for the White Mesa Uranium Mill. The evaluation focuses on description and definition of the site hydrostratigraphy, and occurrence of ground water as it relates to the natural and manmade safeguards which protect ground water resources from potential leakage of tailings cells at the site.

The findings of this evaluation indicate that the tailings located in the existing disposal cells are not impacting ground water at the site. In addition, it does not appear that future impacts to ground water would be expected as a result of continuing operations. These conclusions are based on chemical and hydrogeologic data which show that:

1. The chemistry of perched ground water encountered below the site does not show concentrations or increasing trends in concentrations of constituents that would indicate seepage from the existing disposal cells;

2. The useable aquifer at the site is separated from the facility by about 1,200 feet of unsaturated, low-permeability rock;

3. The useable aquifer is under artesian pressure and, therefore, has an upward pressure gradient which would preclude downward migration of constituents into the aquifer; and

4. The facility has operated for a period of 15 years and has caused no discernible impacts to ground water during this period.

Continued and expanded monitoring of subsurface conditions at the site will be performed to verify that past, current and future operations will not impact ground water.

Numerous technical studies were used in the preparation of this document. Regional geologic and geohydrologic data were obtained primarily from U.S. Geological Survey and State of Utah publications. Site-specific information was obtained from the 1978 Environmental Report

prepared by Dames and Moore, the 1988 Reclamation Plan submitted by Umetco, a 1992 ground water study report submitted by Umetco, and a 1991 ground water hydrology report on White Mesa prepared by Hydro-Engineering. Additional references consulted during preparation of this report include site-specific reports by D'Appolonia (1981, 1982 and 1984).

1.1 Site Description

The White Mesa Uranium Mill is located in southeastern Utah, approximately 6 miles south of the town of Blanding. It is situated on White Mesa, a flat area bounded on the east by Corral Canyon, to the west by Westwater Creek, and to the south by Cottonwood Canyon. The site consists of the uranium processing mill, and four engineered lined tailings disposal cells.

1.2 Geologic Setting

The White Mesa Uranium Mill site is located near the western edge of the Blanding Basin within the Canyon lands section of the Colorado Plateau physiographic province (Figure 1.1). The Canyon lands have undergone broad, fairly horizontal uplift and subsequent erosion which have produced the region's characteristic topography represented by high plateaus, mesas, buttes and deep canyons incised into relatively flat lying sedimentary rocks of pre-Tertiary age. Elevations range from approximately 3,000 feet in the bottoms of the deep canyons along the southwestern margins of the region to more than 11,000 feet in the Henry, Abajo and La Sal mountains located to the northwest and northeast of the facility. With the exception of the deep canyons and isolated mountain peaks, an average elevation slightly in excess of 5,000 feet persists over most of the Canyon lands. The average elevation at the White Mesa Uranium Mill is 5,600 feet mean sea level (MSL).

1.2.1 Stratigraphy

Rocks of Upper Jurassic and Cretaceous age are exposed in the canyon walls in the vicinity of the White Mesa Uranium Mill site. These rock units (Figure 1.2) include, in descending order, the following: Eolian sand of Quaternary Age and varying thickness overlies the Dakota

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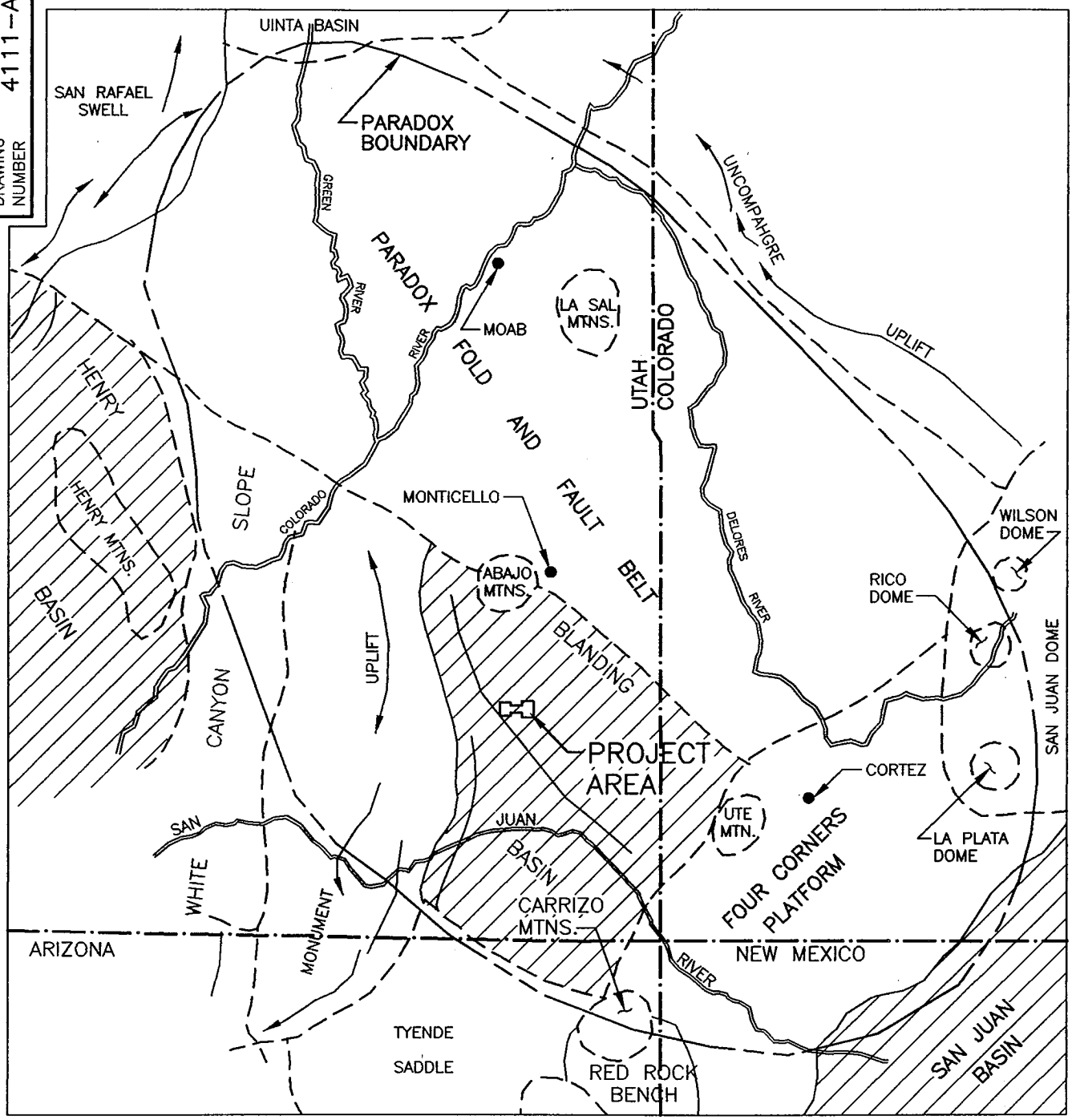

COLORADO PLATEAU GEOLOGIC MAP

PREPARED FOR

ENERGY FUELS NUCLEAR
DENVER, COLORADO

REFERENCE:
AFTER SHOEMAKER, 1956; KELLEY, 1958)

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No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY	DATE: 7-20-94 SCALE: N.T.S.	FIGURE 1.1	DRAWING NUMBER 4111-A4
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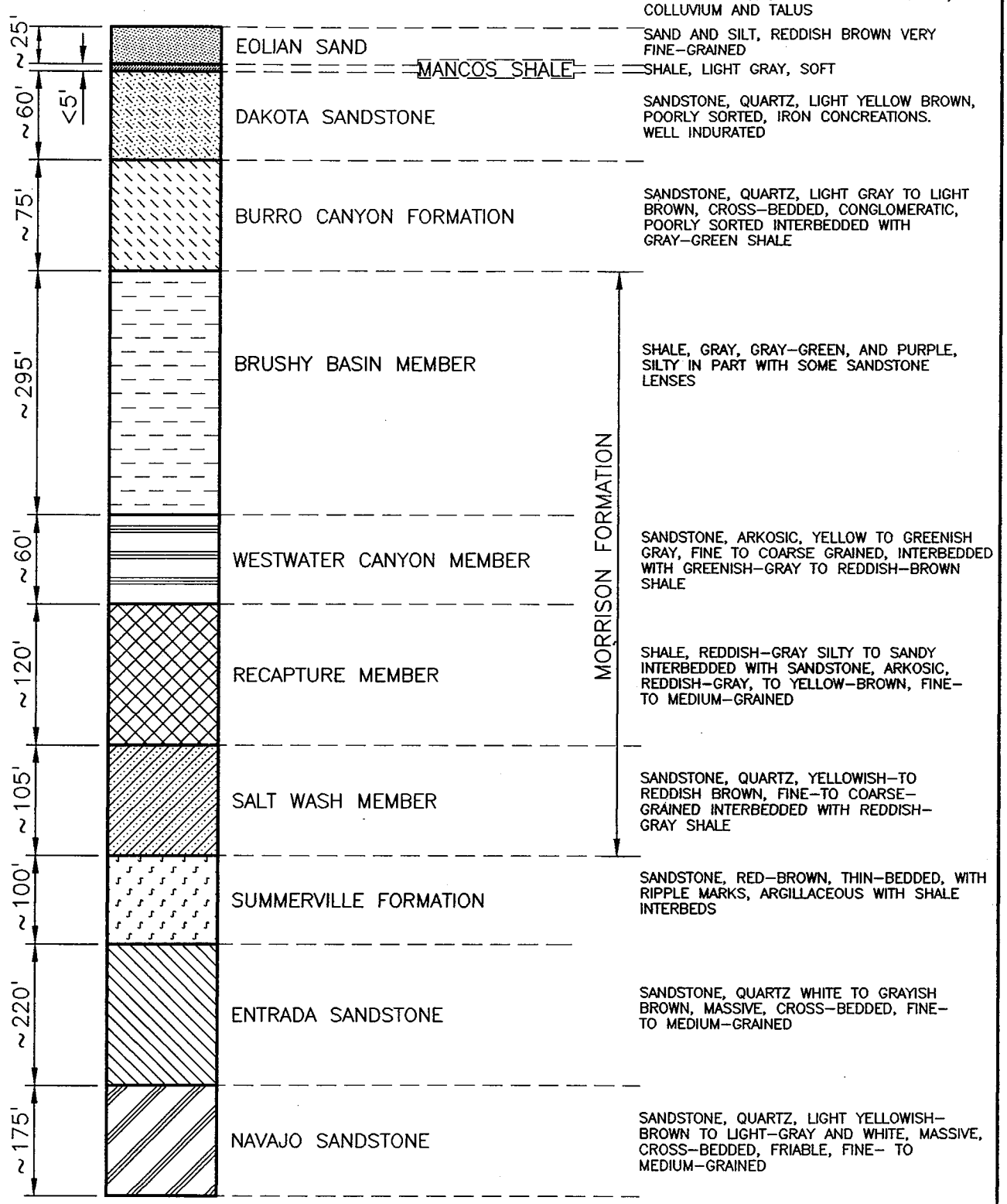

NOTE:

1. THIS DRAWING IS NOT TO SCALE.
2. ALL THICKNESSES ARE APPROXIMATE.

REFERENCE:
DAMES & MOORE 1978

STRATIGRAPHY OF WHITE MESA

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FIGURE 1.2

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sandstone and Mancos shale on the mesa. A thin deposit of talus derived from rock falls of Dakota sandstone and Burro Canyon Formation mantles the lower valley flanks. Underlying these units are the Cretaceous Age erosional remnants of Mancos shale, Dakota Sandstone, and Burro Canyon Formation. Erosional remnants of Mancos shale are only found north of the Mill site. The Brushy Basin, Westwater Canyon, Recapture and Salt Wash Members of the upper Jurassic Age Morrison Formation are encountered below the Burro Canyon Formation. The Summerville Formation, Entrada Sandstone and Navajo Sandstone are the deepest units of concern encountered at the site.

1.2.2 Local Geologic Structure

In general, the rock formations of the region are flat-lying with dips of 1 to 3 degrees. The rock formations are incised by streams that have formed canyons between intervening areas of broad mesas and buttes. An intricate system of deep canyons along and across hog-backs and cuestas has resulted from faulting, upwarping and dislocation of rocks around the intrusive rock masses, such as the Abajo Mountains. Thus the region is divided up into numerous hydrological areas controlled by structural features.

The strata underlying White Mesa have a regional dip of 1/2 to 1 degrees to the south; however, local dips of 5 degrees have been measured. Haynes, et al (1972) includes a map showing the structure at the base of the Dakota Formation. Approximately 25 miles to the north, the Abajo Mountains, formed by igneous intrusions, have caused local faulting, upwarping, and displacement of the sedimentary section. However, no faults have been mapped in the immediate vicinity of White Mesa.

1.3 Hydrogeologic Setting

On a regional basis, the formations that are recognized as aquifers are: Cretaceous-age Dakota Sandstone and the upper part of the Morrison Formation of late Jurassic age; the Entrada Sandstone, and the Navajo Sandstone of Jurassic age; the Wingate Sandstone and the Shinarump

Member of the Chinle Formation of Triassic age; and the DeChelle Member of the Cutler Formation of Permian age.

Recharge to aquifers in the region occurs by infiltration of precipitation into the aquifers along the flanks of the Abajo, Henry and La Sal Mountains and along the flanks of folds, such as Comb Ridge Monocline and the San Rafael Swell, where the permeable formations are exposed at the surface (Figure 1.1).

Seventy-four ground water appropriation applications, within a five-mile radius of the Mill site, are on file with the Utah State Engineer's office. A summary of the applications is presented in Table 1.1 and shown on Figure 1.3. The majority of the applications is by private individuals and for wells drawing small, intermittent quantities of water, less than 8 gallons per minute (gpm), from the Burro Canyon Formation. For the most part, these wells are located upgradient (north) of the White Mesa Uranium Mill site. Stockwatering and irrigation are listed as primary uses of the majority of the wells. It is important to note that no wells exist downgradient of the site within the 5-mile radius.

The productivity of the Burro Canyon Formation within the White Mesa site is substantially different from the productivity of this formation upgradient of the site. For the most part, the documented pumping rates from on-site wells completed in the Burro Canyon Formation are less than 0.5 gpm. Even at this low rate, the on-site wells are typically pumped dry within a couple of hours. This low productivity stems from the fact that the White Mesa Uranium Mill is located over a peripheral fringe of perched water; saturated thickness decreases under the site and permeability of the formation is very low.

These observations have been verified by studies performed for the U.S. Department of Energy's disposal site at Slick Rock which noted that the Dakota Sandstone, Burro Canyon Formation and upper claystone of the Brushy Basin Member are not considered aquifers due to the low permeability, discontinuous nature and limited thickness of these units (DOE, 1993).

Table 1.1

Wells Located Within A 5-Mile Radius of The White Mesa Uranium Mill

Map Numbers	Water Right	SEC	TWP	RNG	CFS	USE	Depth (ft.)
1	Nielson, Norman and Richard C.	11	37S	22E	0.015	IDS	150-200
2	Guymon, Willard M.	10	37S	22E	0.015	S	82
3	Nielson, J. Rex	10	37S	22E	0.015	IDS	160
4	Nielson, J. Rex	10	37S	22E	0.013	S	165
5	Lyman, Fred S.	10	37S	22E	0.022	IDS	120
6	Plateau Resources	15	37S	22E	0.015	O	740
7	Plateau Resources	15	37S	22E	0.015	O	135
8	Nielson, Norman and Richard C.	14	37S	22E	0.015	IS	150-200
9	Lyman, George F.	15	37S	22E	0.015	S	135
10	Holt, N.E., McLaws, W.	15	37S	22E	0.007	S	195
11	Perkins, Dorothy	21	37S	22E	0.015	S	150
12	Energy Fuels Nuclear, Inc.	21	37S	22E	0.6	O	1600
13	Energy Fuels Nuclear, Inc.	22	37S	22E	1.11	O	1820
14	Utah Launch Complex	27	37S	22E	0.015	D	650
15	Energy Fuels Nuclear, Inc.	28	37S	22E	1.11	O	1885
16	Energy Fuels Nuclear, Inc.	28	37S	22E	1.11	O	1850
17	Energy Fuels Nuclear, Inc.	28	37S	22E	0.015	DSO	1800
18	Energy Fuels Nuclear, Inc.	28	37S	22E	0.6	O	1600
19	Jones, Alma U.	33	37S	22E	0.015	S	200
20	Energy Fuels Nuclear, Inc.	33	37S	22E	0.6	O	1600
21	BLM	8	37S	22E	0.01	S	170
22	Halliday, Fred L.	11	37S	22E	0.015	IS	180
23	Perking, Paul	2	37S	22E	0.015	ID	180
24	Redd, James D.	2	37S	22E	0.1	ID	200
25	Brown, Aroe G.	1	37S	22E	0.015	IS	210
26	Brown, George	1	37S	22E	0.015	IDS	140
27	Brown, Llo M.	1	37S	22E	0.004	IDS	141
28	Rentz, Alyce M.	1	37S	22E	0.015	ID	180
29	Rogers, Clarence	2	37S	22E	0.015	S	142
30	Perkins, Dorothy	2	37S	22E	0.015	S	100-200
31	Brandt J.R. & C.J.	1	37S	22E	0.015	IDS	160
32	Montella, Frank A.	3	37S	22E	0.015	IDO	190
33	Snyder, Bertha	1	37S	22E	0.1	IDS	196
34	Martineau, Stanley D.	1	37S	22E	0.015	ID	160
35	Kirk, Ronald D. & Catherine A.	1	37S	22E	0.015	IDS	160
36	Palmer, Ned J. and Marilyn	1	37S	22E	0.015	IDS	0
37	Grover, Jess M.	1	37S	22E	0.015	S	160
38	Monson, Larry	1	37S	22E	0.015	IDS	140
39	Neilson, Norman and Richard	1	37S	22E	0.015	IS	132
40	Watkins, Henry Clyde	1	37S	22E	0.015	IS	150
41	Shumway, Glen & Eve	15	37S	22E	0.015	IS	60
42	Energy Fuels Nuclear, Inc. (not drilled)	21	37S	22E	0.600	O	1600

Table 1.1

Wells Located Within A 5-Mile Radius of The White Mesa Uranium Mill
(Continued)

Map Numbers	Water Right	SEC	TWP	RNG	CFS	USE	Depth (ft.)
43	Energy Fuels Nuclear, Inc. (#1)	28	37S	22E	1.100	O	1860
44	Watkins, Ivan R.	1	37S	22E	0.200	S	185
45	Waukesha of Utah	3	37S	22E	0.015	D	226
46	Simpson, William	3	37S	22E	0.030	ID	180
47	Guyman, Willard M.	2	37S	22E	0.030	S	164
48	Harrieson, Lynda	2	37S	22E	0.012	IDS	---
49	Hurst, Reed	2	37S	22E	0.015	D	100-300
50	Kaer, Alvin	2	37S	22E	0.015	IDS	100-300
51	Heiner, Gerald B.	2	37S	22E	0.015	ID	75
52	Laws, James A.	2	37S	22E	0.015	IDS	100-300
53	Laws, J. Parley	2	37S	22E	0.015	IDS	
54	Anderson, Dennis & Edith	2	37S	22E	0.015	IDS	160
55	Guymon, Eugene	2	37S	22E	0.100	IDS	130
56	Guymon, Eugene	2	37S	22E	0.015	S	130
57	Guymon, Dennis & Doris	2	37S	22E	0.030	IDS	210
58	Guymon, Eugene	2	37S	22E	0.115	IDS	100-200
59	Guymon, Eugene	2	37S	22E	0.115	IDS	100-200
60	Perkins, Dorothy	2	37S	22E	0.015	IDS	140
61	Watkins, Ivan R.	1	37S	22E	0.015	IDS	145
62	Roper, Lloyd	34	36S	22E	0.015	ID	180
63	Smith, Lee & Marylynn	34	36S	22E	0.060	IDS	170
64	McDonald, Kenneth P.	34	36S	22E	0.015	IDS	734
65	Brake, John	34	36S	22E	0.015	ID	250
66	Brake, John	34	36S	22E	0.015	IS	150
67	Redd, Parley V. & Reva V.	34	36S	22E	0.015	IS	200
68	C & C Construction	34	26S	22E	0.015	IS	190
69	Guymon, Dean W.	3	37S	22E	0.015	IDS	180
70	Phillips, Elizabeth Ann Hurst	34	36S	22E	0.015	I	165
71	Howe, Leonard R.	3	37S	22E	0.015	O	160
72	Shumway, Mark Eugene	3	37S	22E	0.015	ID	
73	Shumway, Mark Eugene	3	37S	22E	0.015	IDS	150
74	Lyman, Henry M.	3	37S	22E	0.100	IDS	200

Notes:

D - Domestic
I - Irrigation
S- Stockwatering
O - Industrial

SEC - Section
TWP - Township
RNG - Range
CFS - Cubic Feet Per Second

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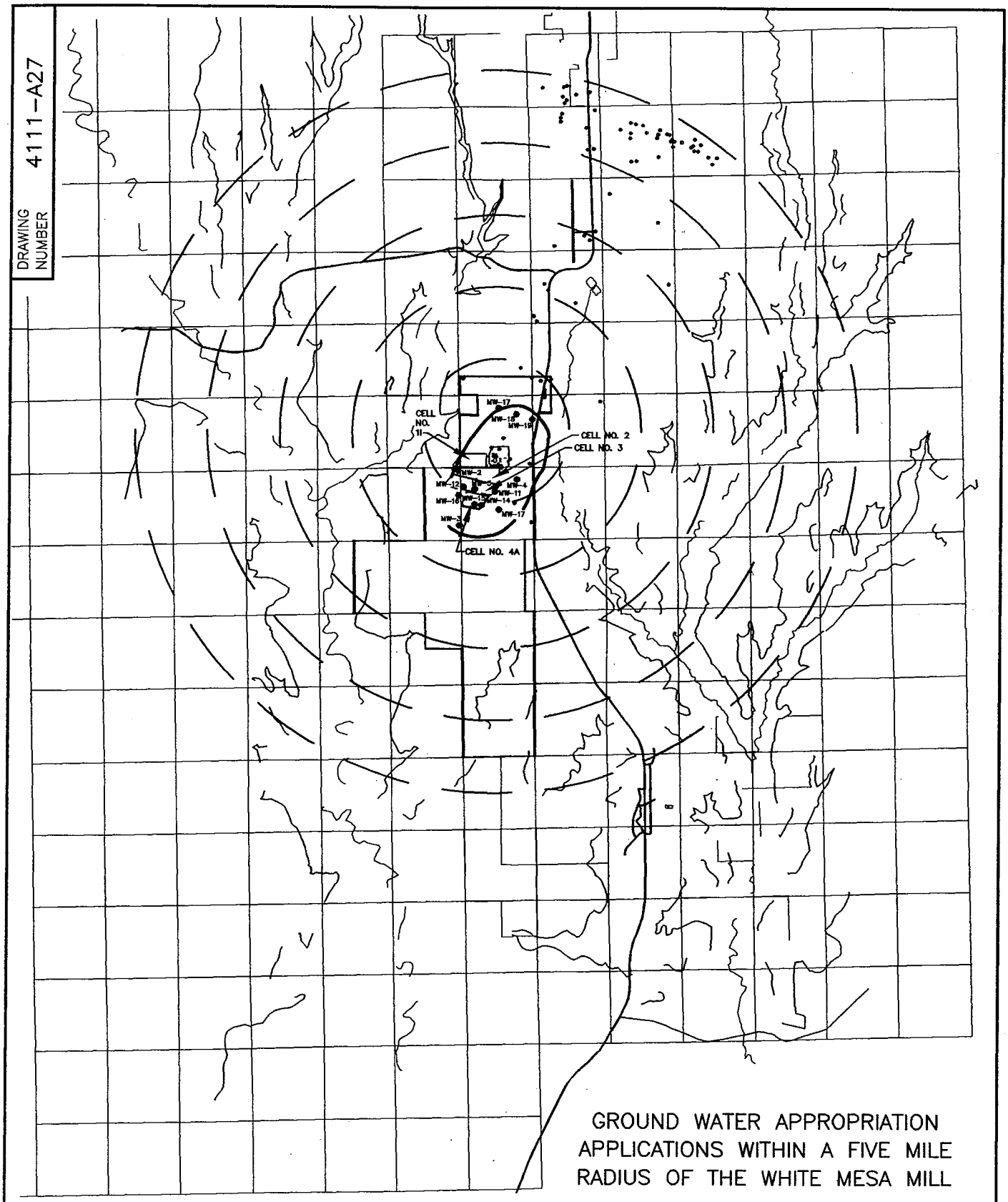

GROUND WATER APPROPRIATION APPLICATIONS WITHIN A FIVE MILE RADIUS OF THE WHITE MESA MILL

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SCALE

2000 0 2000 FEET

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FIGURE 1.3

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Two water wells exist approximately 4.5 miles southeast of the site on the Ute Indian Reservation. These wells supply domestic water for the village on the mesa along Highway 191. Both wells are completed in the Entrada sandstone which is 1,200 feet below the ground surface.

1.4 Climatological Setting

The climate of southeastern Utah is classified as dry to arid continental. The region is generally typified by warm summer and cold winter temperatures, with precipitation averaging less than 11.8 inches annually and evapotranspiration in the range of 61.5 inches annually (Dames and Moore, 1978).

Precipitation in southeastern Utah is characterized by wide variations in seasonal and annual rainfall and by long periods of no rainfall. Short duration summer storms furnish rain in small areas of a few square miles and this is frequently the total rainfall for an entire month within a given area. The average annual precipitation in the region ranges from less than 8 inches at Bluff to more than 16 inches on the eastern flank of the Abajo Mountains, as recorded at Monticello. The mountain peaks in the Henry, La Sal and Abajo Mountains may receive more than 30 inches of precipitation, but these areas are very small in comparison to the vast area of much lower precipitation in the region.

2.0 EVALUATION OF GROUND WATER OCCURRENCE

The site stratigraphy is briefly described in Section 1.2.1. The detailed site stratigraphic column with descriptions of each geologic unit is provided on Figure 1.2. The following discussion focuses on those geologic units at or in the vicinity of the site which have or may have ground water present.

2.1 Hydrostratigraphy

The presence of ground water within and in proximity to the site has been documented in three strata: the Dakota Sandstone, the Burro Canyon Formation, and the Entrada/Navajo Sandstone. The Burro Canyon Formation hosts perched ground water over the Brushy Basin Member of the Morrison Formation at the site.

The Entrada/Navajo Sandstones form one of the most permeable aquifers in the region. This aquifer is separated from the Burro Canyon Formation by the Morrison Formation and Summerville Formation. Water in this aquifer is under artesian pressure and is used by the site's operator for industrial needs and consumption. The artesian conditions present in this aquifer are discussed in Section 3.4.1.

Geologic cross sections which illustrate the stratigraphic position of the Entrada/Navajo Sandstone aquifer and intervening strata are shown on Figures 2.1, 2.2, and 2.3. The summary of the borehole information supporting the site's stratigraphy, description of the drilling information and boring logs are presented in Appendix A. With the exception of six deep water supply wells installed at various locations around the site and completed in Entrada/Navajo Sandstone, all of the boring data are from wells drilled through the Dakota/Burro Canyon Sandstones and terminated in the Brushy Basin Member. The drilling and logging data indicate that the physical characteristics of the bedrock vary considerably, both vertically and laterally. The following sections discuss the relevance of those strata and their physical characteristics to the site's hydrogeology.

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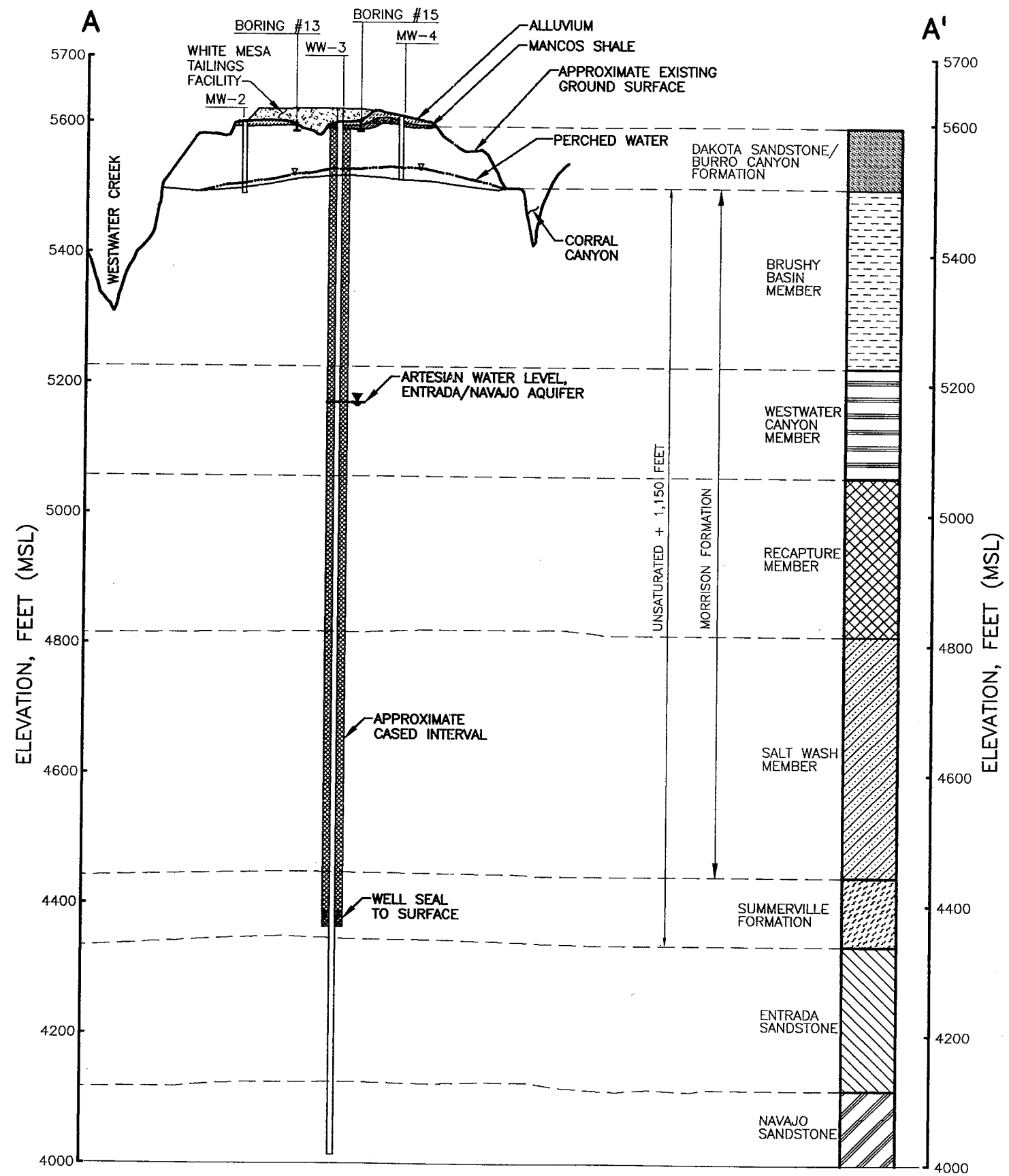

VERTICAL SCALE

200 0 200 FEET

NOTES:

1. CONTACTS ARE APPROXIMATE BASED ON DRILLERS LOGS.
2. BORINGS HAVE BEEN PROJECTED.

CROSS SECTION A–A'
WEST TO EAST THROUGH WHITE MESA
WESTWATER CREEK
TO CORRAL CANYON

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

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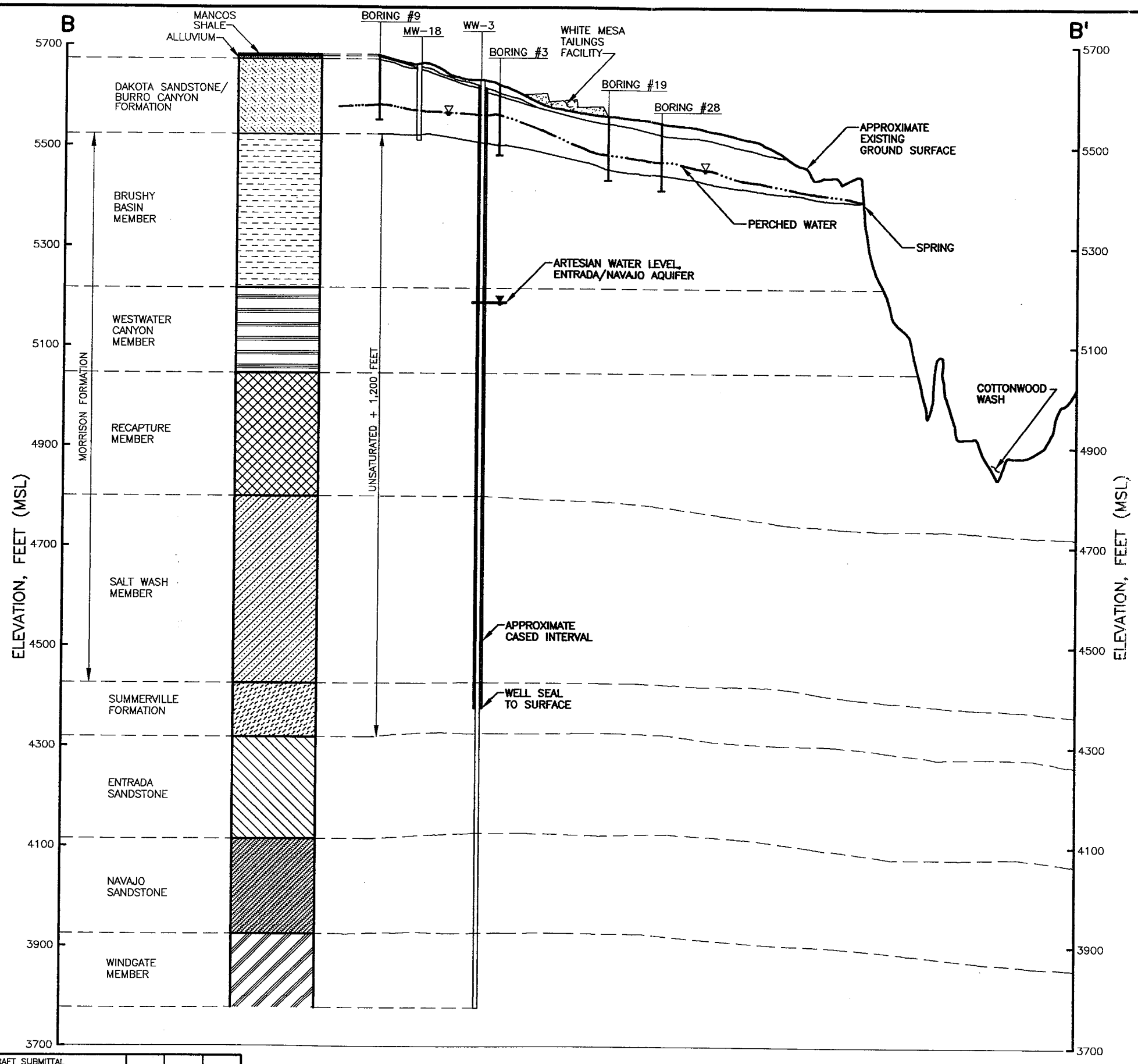
DATE: 7–18–94	FIGURE 2.2	DRAWING NUMBER 4111–B2
SCALE: AS SHOWN		

DRAWING NUMBER 4111-B1



NOTES:

1. CONTACTS ARE APPROXIMATE BASED ON DRILLERS LOGS.
2. BORINGS HAVE BEEN PROJECTED.

VERTICAL SCALE

200 0 200 FEET

CROSS SECTION B–B'
NORTH TO SOUTH THROUGH WHITE MESA
NORTH OF FACILITY
TO COTTONWOOD WASH

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DATE: 7–18–94 SCALE: AS SHOWN	FIGURE 2.3	DRAWING NUMBER 4111–B1

2.1.1 Dakota Sandstone

The Dakota Sandstone is a low- to moderately-permeable formation that produces acceptable quality water at low production rates. Water from this formation is typically used for stock water and/or irrigation.

The Dakota Sandstone is the uppermost strata in which the tailings disposal cells are sited. At the ground surface, the Dakota Sandstone is overlain by a veneer of reddish-brown clayey or sandy silts with a thickness of up to 10 feet and extends to depths of 43 to 66 feet below the surface (D'Appolonia, 1982). The Dakota Sandstone at this site is typically composed of moderately hard to hard sandstones with random discontinuous shale (claystone) and siltstone layers. The sandstones are moderately cemented (upper part of formation) to well cemented with kaolinitic clays. The claystones and siltstones are typically 2 to 3 feet thick, although boring WMMW-19 encountered a siltstone layer having a thickness of 8 feet at 33 to 41 feet below the ground surface.

Porosity of the Dakota Sandstone is predominately intergranular. Laboratory tests performed (see Table 2.1) show the total porosity of the sandstone varies from 13.4 to 26.0 percent with an average value of 19.9 percent. The formation is very dry to dry with volumetric water contents varying from 0.6 to 7.1 percent with an average value of 3.0 percent. Saturation values for the Dakota Sandstone vary from 3.7 to 27.2 percent. The hydraulic conductivity values as determined from packer tests range from 9.12E-04 centimeters per second (cm/sec) to 2.71E-06 cm/sec with a geometric mean of 3.89E-05 cm/sec (Dames & Moore, 1978; Umetco, 1992). A summary of hydraulic properties of the Dakota Sandstone is presented in Table 2.2.

2.1.2 Burro Canyon Sandstone

Directly below the Dakota Sandstone, the borings encountered sandstones and random discontinuous shale layers of the Burro Canyon Formation to depths of 91 to 141 feet below the site. The importance of this stratum to the site's hydrogeology is that it hosts perched water beneath the site. The composition of the Brushy Basin Member is of variegated bentonitic

Table 2.1

Properties of the Dakota/Burro Canyon Formations
White Mesa Uranium Mill

Formation	Well No. and Sample Interval		Moisture Content (Percent)	Moisture Content Volumetric	Dry Unit Weight (lbs/cu ft)	Porosity (Percent)	Particle Sp. Gr.	Saturation (Percent)	Retained Moisture (Percent)	Liquid Limit (Percent)	Plastic Limit (Percent)	Plasticity Index (Percent)	Rock Type
Dakota	WMMW-16	26.4' - 38.4'	1.5	3.3	135.2	17.9	2.64	18.2	5.1				Sandstone
	WMMW-16	37.8' - 38.4'	0.4	0.8	127.4	22.4	2.63	3.7	6.3				Sandstone
	WMMW-17	27.0' - 27.5'	0.3	0.6	138.8	13.4	2.57	4.8	5.1				Sandstone
	WMMW-17	49.0' - 49.5	3.6	7.1	121.9	26.0	2.64	27.2	9.6				Sandstone
Burro Canyon	WMMW-16	45.0' - 45.5'	5.6	12.6	140.9	16.4	2.70	77.2		29.6	15.4	14.2	Sandy Mudstone
	WMMW-16	47.5' - 48.0'	2.6	5.9	142.8	12.0	2.60	48.9	4.4				Sandstone
	WMMW-16	53.5' - 54.1'	0.7	1.4	129.0	19.9	2.58	7.1	6.4				Sandstone
	WMMW-16	60.5' - 61.0'	0.1	0.2	117.9	27.3	2.61	0.8	9.9				Sandstone
	WMMW-16	65.5' - 66.0'	2.6	5.5	131.5	19.3	2.62	28.2	7.1				Sandstone
	WMMW-16	73.0' - 73.5'	0.1	0.3	130.3	20.6	2.63	1.3	5.5				Sandstone
	WMMW-16	82.0' - 82.4'	0.1	0.1	134.3	18.5	2.64	0.6	4.8				Sandstone
	WMMW-16	90.0' - 90.7	0.1	0.3	161.5	2.0	2.64	12.8	0.9				Sandstone
	WMMW-16	91.1' - 91.4'	5.2	9.8	118.1	29.1	2.67	33.8		33.7	16.2	17.5	Claystone
	WMMW-17	104.0' - 104.5'	0.2	0.4	161.4	1.7	2.67	26.6	0.8				Sandstone
Average:			**1.65**	**3.4**	**135**	**17.6**	**2.63**	**21**	**5.5**				

Table 2.2

Summary of Hydraulic Properties
White Mesa Uranium Mill

Boring/Well Location	Test Type	Interval (ft-ft)	Document Referenced		Hydraulic Conductivity (ft/yr)	Hydraulic Conductivity (cm/sec)
Soils						
6	Laboratory Test	9	D&M		1.2E+01	1.2E-05
7	Laboratory Test	4.5	D&M		1.0E+01	1.0E-05
10	Laboratory Test	4	D&M		1.2E+01	1.2E-05
12	Laboratory Test	9	D&M		1.4E+02	1.4E-04
16	Laboratory Test	4.5	D&M		2.2E+01	2.1E-05
17	Laboratory Test	4.5	D&M		9.3E+01	9.0E-05
19	Laboratory Test	4	D&M		7.0E+01	6.8E-05
22	Laboratory Test	4	D&M		3.9E+00	3.8E-06
			Geometric Mean		2.45E+01	2.37E-05
Dakota Sandstone						
No. 3	Injection Test	28-33	D&M	(1)	5.68E+02	5.49E-04
No. 3	Injection Test	33-42.5	D&M		2.80E+00	2.71E-06
No. 12	Injection Test	16-22.5	D&M		5.10E+00	4.93E-06
No. 12	Injection Test	22.5-37.5	D&M		7.92E+01	7.66E-05
No. 19	Injection Test	26-37.5	D&M		7.00E+00	6.77E-06
No. 19	Injection Test	37.5-52.5	D&M		9.44E+02	9.12E-04
			Geometric Mean		4.03E+01	3.89E-05
Burro Canyon Formation						
No. 3	Injection Test	42.5-52.5	D&M		5.80E+00	5.61E-06
No. 3	Injection Test	52.5-63	D&M		1.62E+01	1.57E-05
No. 3	Injection Test	63-72.5	D&M		5.30E+00	5.13E-06
No. 3	Injection Test	72.5-92.5	D&M		3.20E+00	3.09E-06
No. 3	Injection Test	92.5-107.5	D&M		4.90E+00	4.74E-06
No. 3	Injection Test	122.5-142	D&M		6.00E-01	5.80E-07
No. 9	Injection Test	27.5-42.5	D&M		2.70E+00	2.61E-06
No. 9	Injection Test	42.5-59	D&M		2.00E+00	1.93E-06
No. 9	Injection Test	59-82.5	D&M		7.00E-01	6.77E-07
No. 9	Injection Test	82.5-107.5	D&M		1.10E+00	1.06E-06
No. 9	Injection Test	107.5-132	D&M		3.00E-01	2.90E-07
No. 12	Injection Test	37.5-57.5	D&M		9.01E-01	8.70E-07
No. 12	Injection Test	57.5-82.5	D&M		1.40E+00	1.35E-06
No. 12	Injection Test	82.5-102.5	D&M		1.07E+01	1.03E-05
No. 28	Injection Test	76-87.5	D&M		4.30E+00	4.16E-06
No. 28	Injection Test	87.5-107.5	D&M		3.00E-01	2.90E-07
No. 28	Injection Test	107.5-132.5	D&M		2.00E-01	1.93E-07
WMMW1	(7) Recovery	92-112	Peel	(2)	3.00E+00	2.90E-06
WMMW3	(7) Recovery	67-87	Peel		2.97E+00	2.87E-06
WMMW5	(7) Recovery	95.5-133.5	H-E		1.31E+01	1.27E-05
WMMW5	(7) Recovery	95.5-133.5	Peel		2.10E+01	2.03E-05
WMMW11	(7) Recovery	90.7-130.4	H-E	(3)	1.23E+03	1.19E-03
WMMW11	(7) Single well drawdown	90.7-130.4	Peel		1.63E+03	1.58E-03
WMMW12	(7) Recovery	84-124	H-E		6.84E+01	6.61E-05
WMMW12	(7) Recovery	84-124	Peel		6.84E+01	6.61E-05
WMMW14	Single well drawdown	90-120 (5)	H-E		1.21E+03	1.16E-03
WMMW14	Single well drawdown	90-120 (6)	H-E		4.02E+02	3.88E-04
WMMW15	Single well drawdown	99-129	H-E		3.65E+01	3.53E-05
WMMW15	(7) Recovery	99-129	Peel		2.58E+01	2.49E-05

Table 2.2

Summary of Hydraulic Properties
White Mesa Uranium Mill
(Continued)

Boring/Well Location	Test Type	Interval (ft-ft)	Document Referenced	Hydraulic Conductivity (ft/yr)	Hydraulic Conductivity (cm/sec)
WMMW16	Injection Test	28.5-31.5	Peel	9.42E+02	9.10E-04
WMMW16	Injection Test	45.5-51.5	Peel	5.28E+01	5.10E-05
WMMW16	Injection Test	65.5-71.5	Peel	8.07E+01	7.80E-05
WMMW16	Injection Test	85.5-91.5	Peel	3.00E+01	2.90E-05
WMMW17	Injection Test	45-50	Peel	3.10E+00	3.00E-06
WMMW17	Injection Test	90-95	Peel	3.62E+00	3.50E-06
WMMW17	Injection Test	100-105	Peel	5.69E+00	5.50E-06
WMMW18	Injection Test	27-32	Peel	1.14E+02	1.10E-04
WMMW18	Injection Test	85-90	Peel	2.59E+01	2.50E-05
WMMW18	Injection Test	85-90	Peel	2.69E+01	2.60E-05
WMMW18	Injection Test	120-125	Peel	4.66E+00	4.50E-06
WMMW19	Injection Test	55-60	Peel	8.69E+00	8.40E-06
WMMW19	Injection Test	95-100	Peel	1.45E+00	1.40E-06
			Geometric mean	1.05E+01	1.01E-05
Entrada/Navajo Sandstones					
WW-1	Recovery		D'Appolonia (4)	3.80E+02	3.67E-04
WW-1	Multi-well drawdown		D'Appolonia	4.66E+02	4.50E-04
WW-1,2,3	Multi-well drawdown		D'Appolonia	4.24E+02	4.10E-04
			Geometric Mean	4.22E+02	4.08E-04

Notes:
(1) D&M = Dames & Moore, Environmental Report, White Mesa Uranium Project, January, 1978.
(2) Peel = Peel Environmental Services, UMETCO Minerals Corp., Ground Water Study, White Mesa Facility, June, 1994.
(3) H-E = Hydro-Engineering, Ground-Water Hydrology at the White Mesa Tailings Facility, July, 1991.
(4) D'Appolonia, Assessment of the Water Supply System, White Mesa Project,Feb. 1981
(5) Early test data.
(6) Late test data.
(7) Test data reanalyzed by TEC.

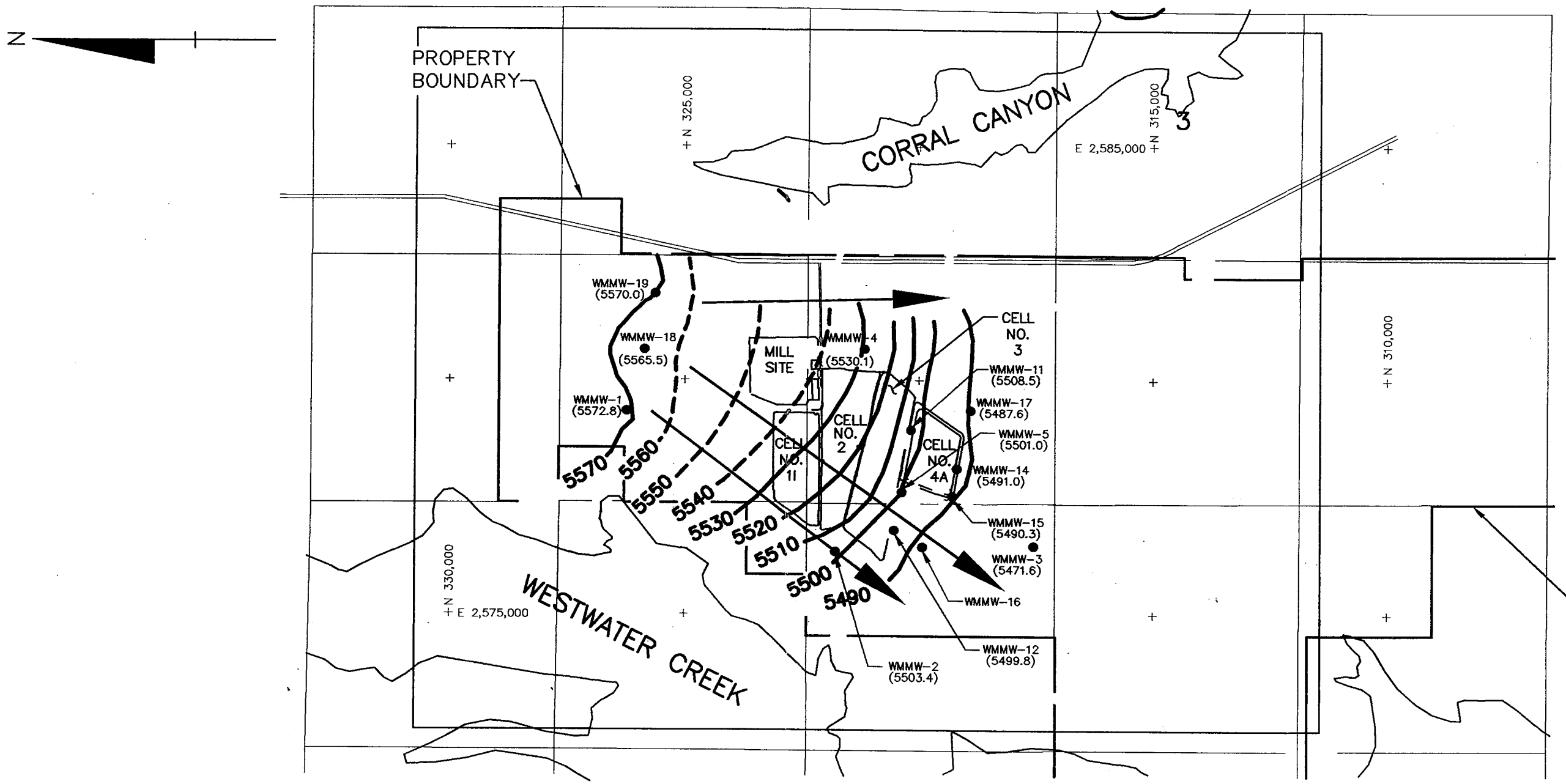
mudstone and siltstone; its permeability is lower than the overlying Burro Canyon Formation and prevents downward percolation of ground water (Haynes, et al, 1972). Observed plasticity of claystones (Umetco, 1992) forming the Brushy Basin Member indicates low potential for open fractures which could increase permeability.

Previous investigators have seldom made a distinction between the Dakota and Burro Canyon Sandstones. However, examination of borehole cuttings, cores and geophysical logging methods has allowed separation of the two formations. Although similar to the Dakota, the Burro Canyon Formation varies from a very fine- to coarse-grained sandstone. The sand grains are generally poorly sorted. The coarse-grained layers also tend to be conglomeratic. The grains are cemented with both silica and kaolin, but silica-cemented sandstones are dominant. The formation becomes argillaceous near the contact with the Brushy Basin Member.

The saturated thickness in the Burro Canyon Formation varies across the project area from 55 feet in the northern section to less than 5 feet in the southern area. Saturation ceases or is marginal along the western and southern section of the project. The extent toward the east is not defined, but its maximum extent is certainly not beyond the walls of Westwater Creek and Corral Canyons where the Burro Canyon Formation crops out. Perched ground water elevations and saturated thickness of this formation are shown on Figures 2.4 and 2.5, respectively.

Hydraulic properties of this stratum have been determined from 12 single, well-pumping/recovery tests and from 30 packer tests. A summary of the hydraulic properties is given in Table 2.2. These tests indicate the hydraulic conductivity geometric mean to be 1.0E-05 cm/sec. The physical properties of the Burro Canyon Sandstone are summarized in Table 2.1. Based on the core samples tested, the sandstones of the Burro Canyon Formation vary in total porosity from 1.7 to 27.6 percent, the average being 16.0 percent. Volumetric water content in these sandstones ranges from 0.1 to 7.1 percent, averaging 2.2 percent, with the fine-grained materials having the higher moisture content. Porosities in the claystone layers vary from 16.4 to 29.1 percent with saturation values ranging from 33.8 to 77.2 percent.

DRAWING NUMBER 4111-B9



SCALE

2000 0 2000 4000 FEET

LEGEND:

5550 CONTOUR IN FEET ABOVE MEAN SEA LEVEL

GROUND WATER FLOW DIRECTION

PERCHED GROUND WATER LEVELS
FALL 1992
WHITE MESA MILL
BLANDING, UTAH

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

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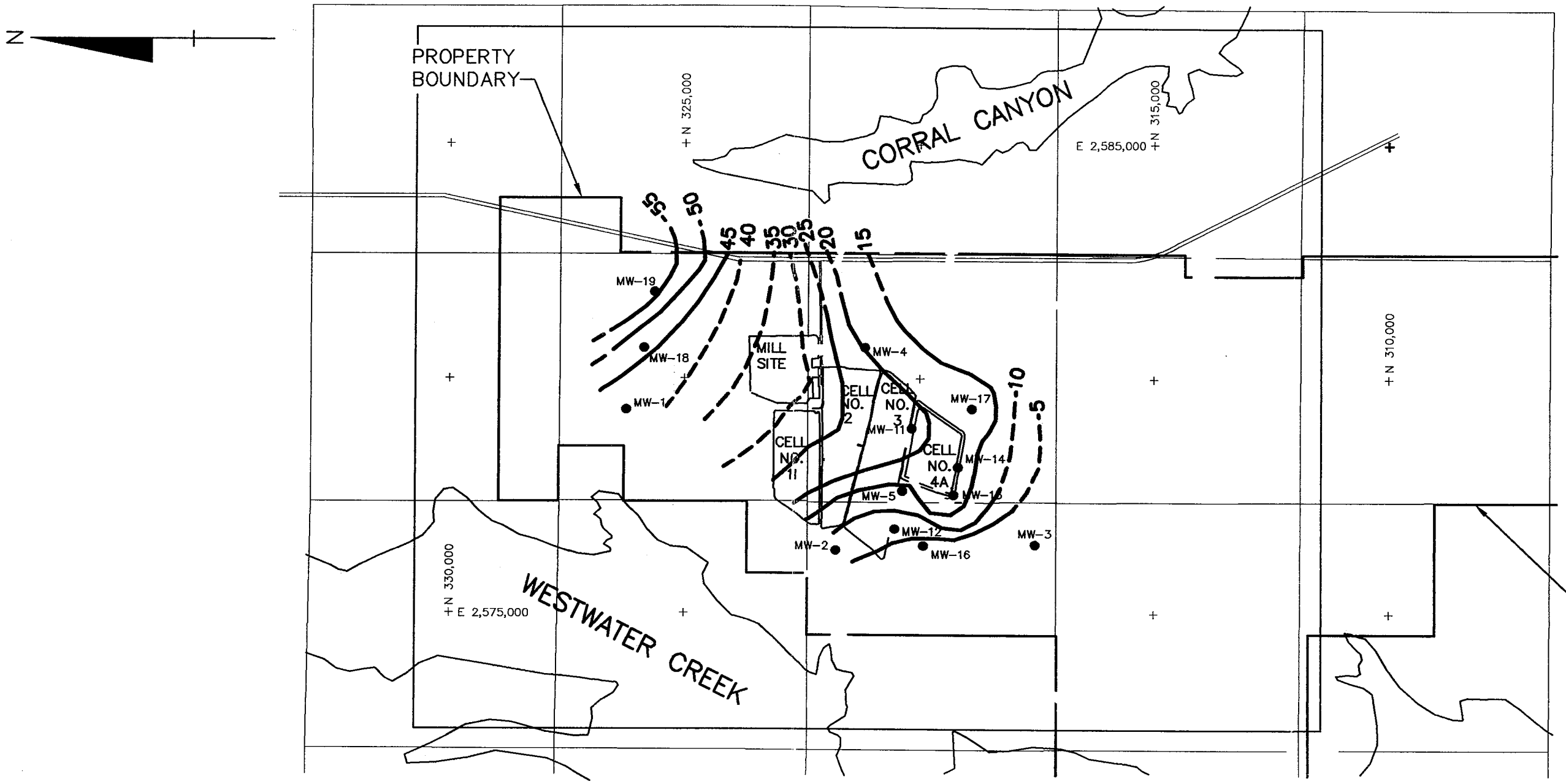
FIGURE 2.4

DRAWING NUMBER 4111-B9

DRAWING NUMBER 4111-B8



SCALE

2000 0 2000 4000 FEET

LEGEND:

-5 SATURATED THICKNESS IN FEET

SATURATED THICKNESS FALL 1992
BURRO CANYON FORMATION
WHITE MESA MILL
BLANDING, UTAH

PREPARED FOR

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DATE: 7-18-94	FIGURE 2.5	DRAWING NUMBER 4111-B8
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2.1.3 Brushy Basin Member

The Brushy Basin Member of the Morrison Formation is the first aquitard isolating perched water in the Burro Canyon Formation from the productive Entrada/Navajo Sandstones. The Brushy Basin Member, in contrast to the overlying Dakota Sandstone, is composed of bentonitic mudstone and claystone. Site-specific hydraulic property data are not available for the Brushy Basin Member.

The thickness of the Brushy Basin Member in this region reportedly varies from 200-450 feet (Dames & Moore, 1978). This stratum was penetrated by six water supply wells (see Figure 2.1 and Appendix A) and its thickness was estimated at 275 feet. During the site investigation, borings which terminated in the Brushy Basin Member, encountered moderately plastic dark green to dark reddish-brown mudstones. Plastic bentonitic mudstone is not prone to develop fracturing. Hence, competency of this strata, as on aquitard, is very likely.

2.1.4 Entrada/Navajo Aquifer

Within and in proximity to the site, the Entrada/Navajo Sandstones are both prolific aquifers. Since site water wells are screened in both aquifers, they are, from a hydrogeologic standpoint, treated as a single aquifer. The Entrada/Navajo Sandstone is the first useable aquifer of significance documented within the project area. This aquifer is present at depths between 1200 and 1800 feet below the surface and is capable of delivering from 150 to 225 gpm of water per well (D'Appolonia, 1981).

Water is present under artesian pressure and is documented to rise by about 800 to 900 feet above the top of Entrada/Navajo Sandstone contact with the overlying Summerville Formation. The static water level is about 400 to 500 feet below the surface (Figures 2.2 and 2.3). Section 3.4.1 provides a more detailed discussion regarding the artesian conditions of this formation.

The thickness of the strata separating this aquifer from water present in the Burro Canyon Formation is about 1,200 feet. This confining layer is competent enough to maintain pressure

of 900 feet of water or 390 pounds per square inch (psi) within the Entrada/Navajo Aquifer. The positioning of this aquifer and its hydraulic head versus other strata is shown on Figures 2.2 and 2.3. In-situ hydraulic pressure of ground water in the Entrada/Navajo Aquifer is strong evidence of the "aquitard" properties of the overlying sedimentary section. Due to the presence of significant artesian pressure in this aquifer, any future hydraulic communication between perched water in the Burro Canyon Formation and the Entrada/Navajo Aquifer is unlikely.

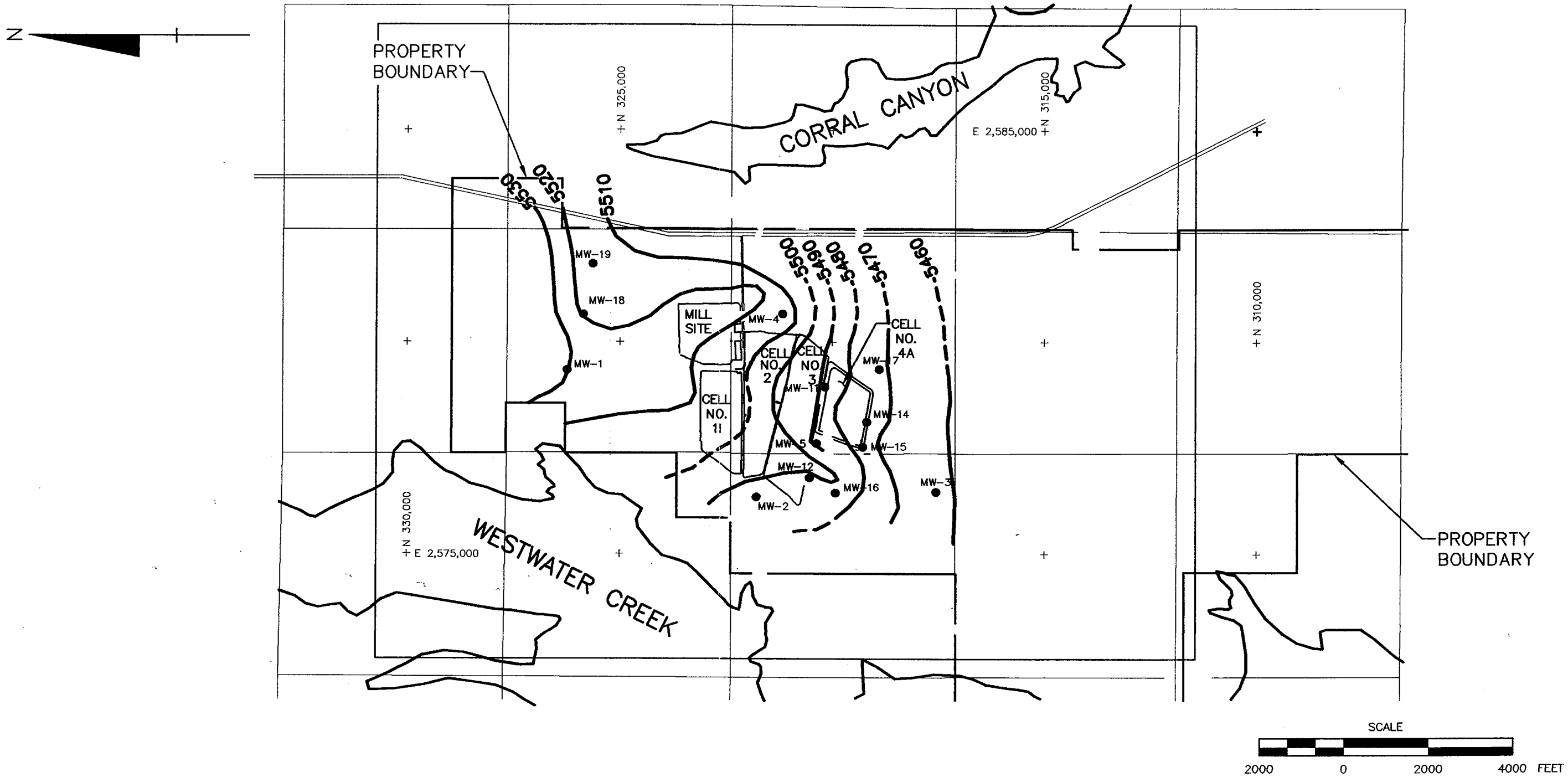
2.2 Perched Ground Water Characteristics

The perched water in the Burro Canyon Formation originates in the areas north of the site as shown by the direction of ground water flow from north to south (see Figure 2.4). The thickness of saturation is greatest in the northern and central sections of the site and reduces toward the south. The configuration of the perched water table and map of saturated thicknesses are provided on Figures 2.4 and 2.5, respectively. The topography of the Brushy Basin Member which defines the bottom of the perched water is shown on Figure 2.6.

The ground water from the Burro Canyon Formation discharges into the adjacent canyons (Westwater Creek and Corral Canyon) as evidenced by springs and productive vegetation patterns. Some part of the ground water flow may enter the Brushy Basin Member via relief fractures which occur in close proximity to the canyons. The location of the canyons which bound the White Mesa on the west, east and south are shown on Figure 2.1.

The geometric mean of the hydraulic conductivity of the saturated part of Burro Canyon Formation is 1.0E-05 cm/sec. The water yield per well is very low, as documented by 9 pumping tests, and is typically below 0.5 gpm. In contrast to the very low pumping rates observed in 8 wells, Well WMMW-11 produced a higher yield on the order of 2 gpm. This higher yield may be attributable to the presence of localized high-permeability material, such as a lense of coarser material acting as a drainage gallery. Localized fracturing could also cause a similar effect, but few fractures have been documented during drilling of this or other wells (Umetco, 1992; Dames & Moore, 1978).

DRAWING NUMBER 4111-B7



LEGEND:

5520 CONTOUR IN FEET ABOVE MEAN SEA LEVEL

ELEVATION OF
TOP OF BRUSHY BASIN
WHITE MESA MILL
BLANDING, UTAH

PREPARED FOR

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DATE: 7-18-94	FIGURE 2.6	DRAWING NUMBER 4111-B7
SCALE: AS SHOWN		

2.2.1 Perched Water Quality

Ground water monitoring of the Burro Canyon Formation saturated zone has been conducted at the White Mesa facility since 1979. Table 2.3 provides a list of wells that have been constructed for monitoring purposes at the facility. Figure 2.1 indicates the locations of these wells. The water quality data obtained from these wells are provided both in tabular and graphical form in Appendix B.

Examination of the spatial distribution and temporal trends (or lack thereof) in concentrations of analyzed constituents provides three significant conclusions:

1. The quality of perched water throughout the site shows no discernible pattern in variation,

2. The water quality is generally of poor quality [moderately high values of chloride, sulfate, and totally dissolved solids (TDS)], and

3. Analytical results show that operations at the White Mesa Uranium Mill have not impacted the quality of the perched water of the Burro Canyon Formation.

To arrive a these conclusions, comparisons of the water chemistries from the various wells were analyzed by graphical techniques. The purpose of the comparisons was to determine if trends in chloride, which would be associated with water from the tailings ponds, were increasing in the perched water of the Burro Canyon Formation. The trilinear plot and the Stiff diagram were used to conduct a preliminary evaluation of differences or similarities in water quality data between wells.

2.2.1.1 Temporal and Spatial Variations

Figure 2.7 is a trilinear plot for the water sampled in wells in the immediate vicinity of the Mill site during the fall of 1992. Figures 2.8 through 2.10 are Stiff diagrams presenting the same data. These plots show that the water from all wells is of the sulfate (anion) type. The cation

Table 2.3

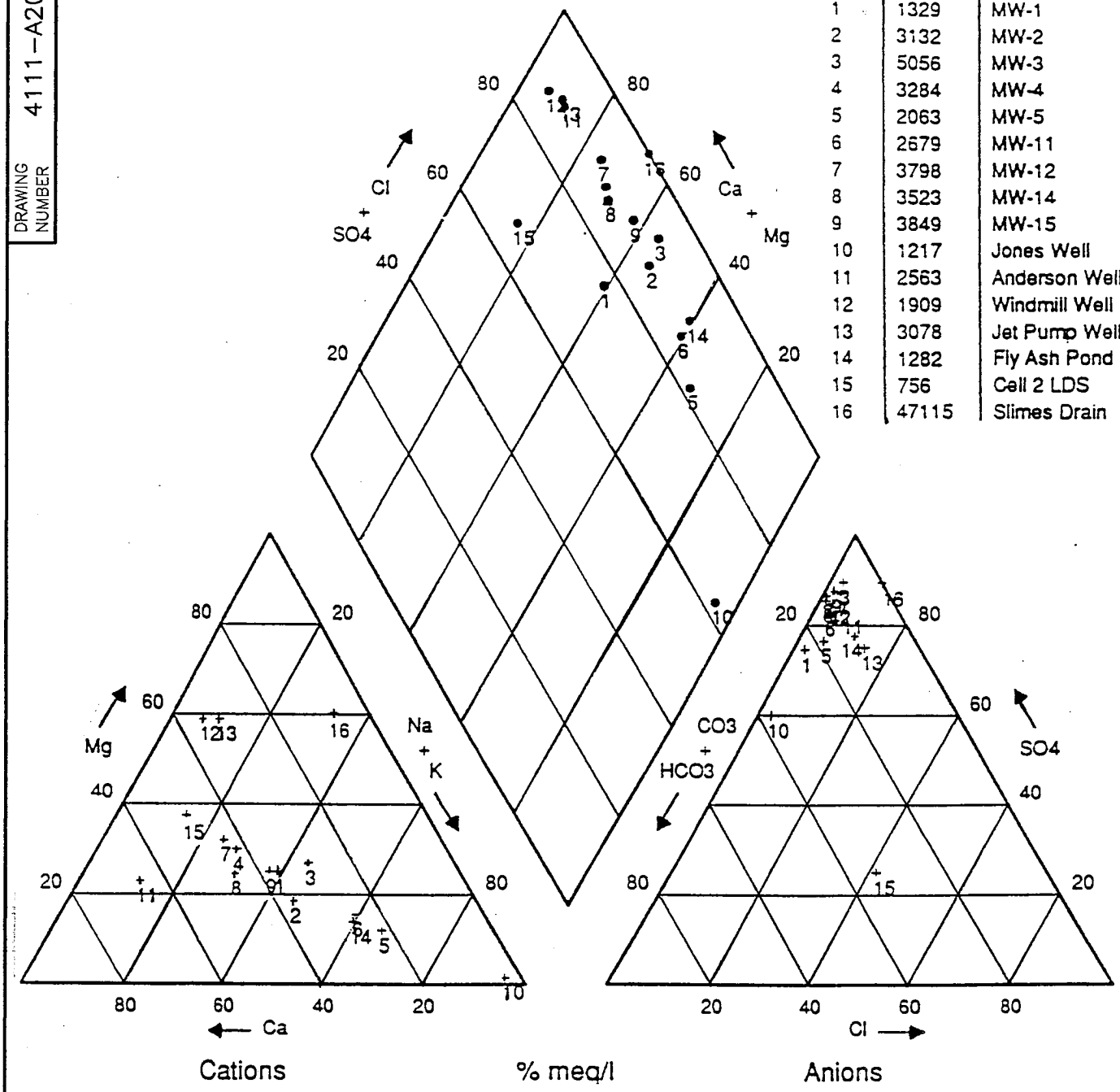
Monitoring Well and Ground Water Elevation Data
White Mesa Uranium Mill

Well Name	Date Installed	Total Depth	Perforations	Water Level			Measuring Point	
				Date	Depth (ft)	Elevation (ft-MSL)	Above LDS (ft)	Elevation (ft-MSL)
WMMW-1	Sep-79	117'	92'-112'	11/19/92	75.45	5572.77	2.0	5648.22
WMMW-2	Sep-79	128.8'	85'-125'	11/19/92	110.06	5503.43	1.8	5613.49
WMMW-3	Sep-79	98'	67'-87'	11/19/92	83.74	5471.58	2.0	5555.32
WMMW-4	Sep-79	123.6'	92'-12'	11/19/92	92.42	5530.15	1.6	5622.57
WMMW-5	May-80	136'	95.5'-133-5'	11/19/92	108.32		0.6	5609.33
WMMW-6	May-80	This well was destroyed in March 1993 during construction of Cell 3.						
WMMW-7	May-80	This well was destroyed in March 1993 during construction of Cell 3.						
WMMW-8	May-80	This well was destroyed in March 1993 during construction of Cell 3.						
WMMW-11	Oct-82	135'	90.7-130.4'	11/19/92	102.53	5508.55	2.4	5611.08
WMMW-12	Oct-82	130.3'	84'-124'	11/19/92	109.68	5499.77	0.9	5609.45
WMMW-13	Oct-82	118.5'	This well was destroyed during construction of Cell 4A					
WMMW-14	Sep-89	129.1'	90'-120'	11/19/92	105.34	5491.05	0.0	5596.39
WMMW-15	Sep-89	138'	99'-129'	11/19/92	108.28	5490.34	0.8	5598.62
WMMW-16	Dec-92	91.5'	78.5'-88.5'	7/12/92	Dry		1.5	
WMMW-17	Dec-92	110'	90'-100'	11/30/92	87.56		1.5	
WMMW-18	Dec-92	148.5'	103.5'-133.5'	11/30/92	92.11		1.5	
WMMW-19	Dec-92	149'	101'-131'	10/12/92	85.00		1.5	
#9-1	May-80	33.5'	10'-30'	3/4/91	Dry		1.8	5622.83
#9-2	May-80	62.7'	39.7''-59.7''	3/4/91	Dry		2	5622.58
#10-2	May-80	33.5'	11.3'-31.3'	3/4/91	Dry		2	5633.58
#10-2	May-80	62.2'	39.2'-59.2'	3/4/91	Dry		2.1	5633.39

Notes:
1. Well locations provided on Figure 2.1.
2. LDS = leak detection system
3. ft.-MSL = feet - mean sea level

DRAWING NUMBER 4111-A20

No.	TDS	Well Name
1	1329	MW-1
2	3132	MW-2
3	5056	MW-3
4	3284	MW-4
5	2063	MW-5
6	2679	MW-11
7	3798	MW-12
8	3523	MW-14
9	3849	MW-15
10	1217	Jones Well
11	2563	Anderson Well
12	1909	Windmill Well
13	3078	Jet Pump Well
14	1282	Fly Ash Pond
15	756	Cell 2 LDS
16	47115	Slimes Drain



TRILINEAR PLOT OF WATER FROM WHITE MESA MILL MONITOR WELLS, FLY ASH POND, SLIMES DRAIN AND SURROUNDING STOCK WELLS

PREPARED FOR

ENERGY FUELS NUCLEAR
DENVER, COLORADO

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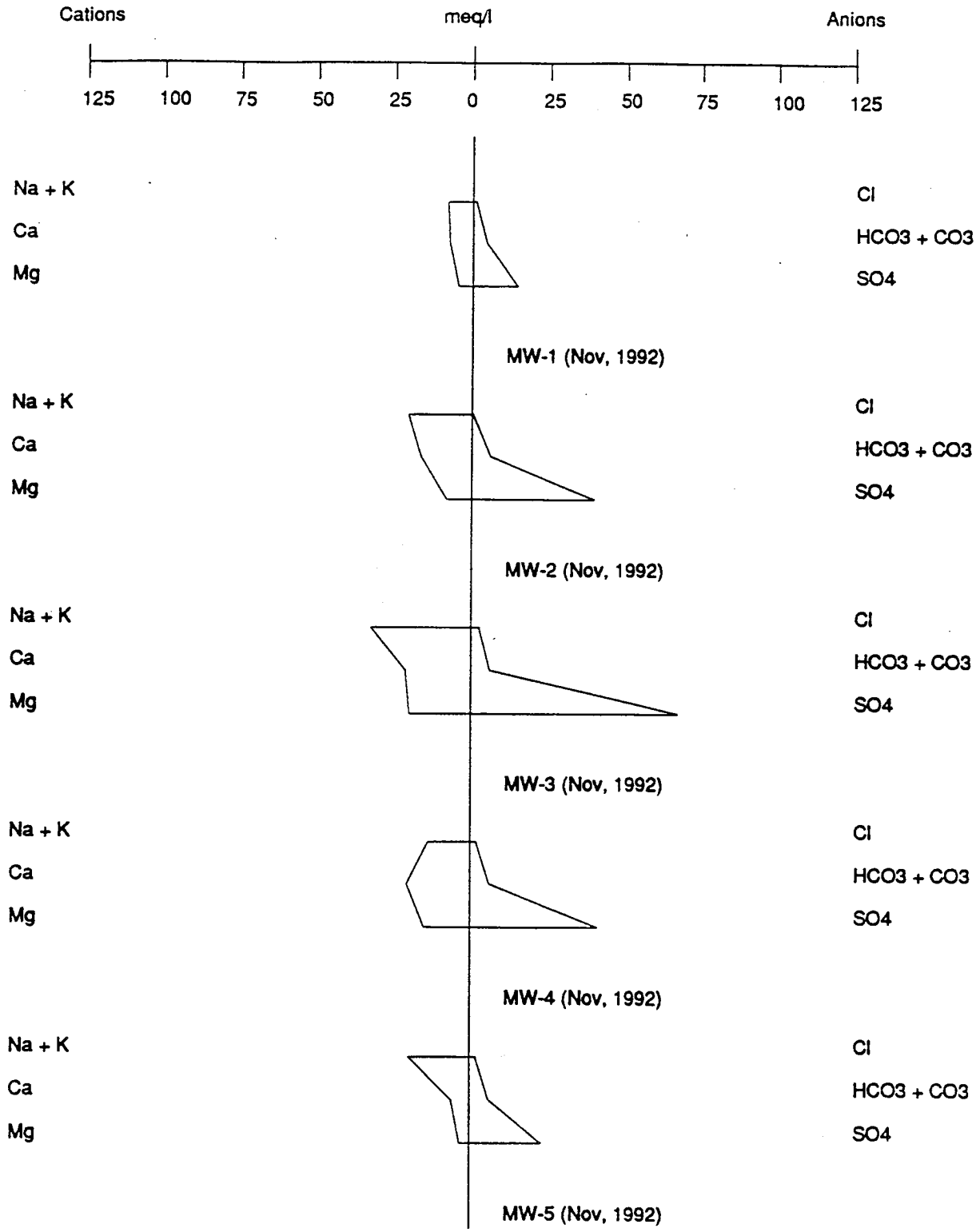
FIGURE 2.7

DRAWING NUMBER 4111-A20

1

DRAWING NUMBER 4111-A14



STIFF DIAGRAMS OF WATER FROM MONITOR WELLS

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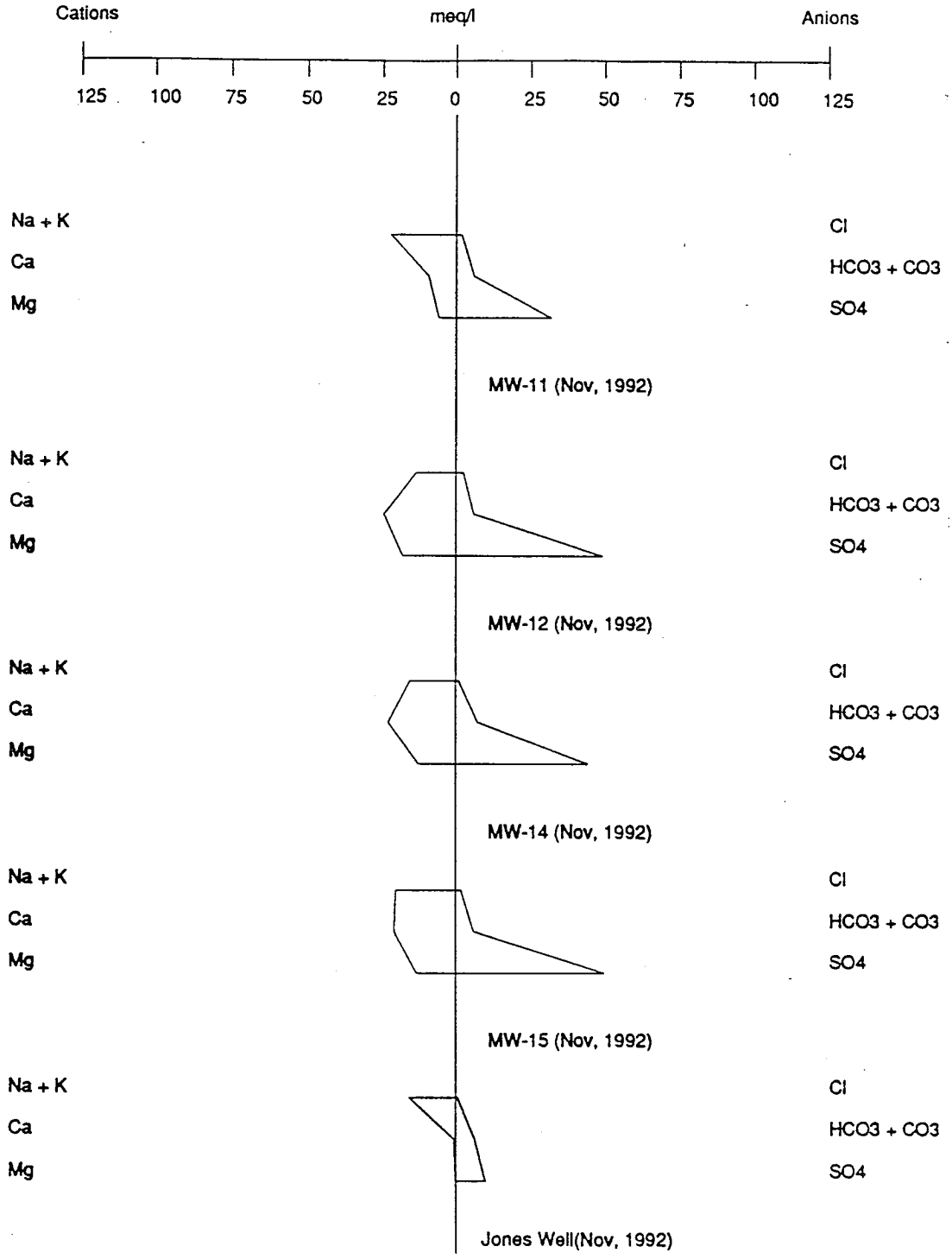
DATE: 7-19-94
SCALE: N.T.S.

FIGURE 2.8

DRAWING NUMBER 4111-A14

1

DRAWING NUMBER 4111-A15



STIFF DIAGRAMS OF
WATER FROM MONITOR WELLS
AND STOCK WELL

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FIGURE 2.9

DRAWING NUMBER 4111-A15

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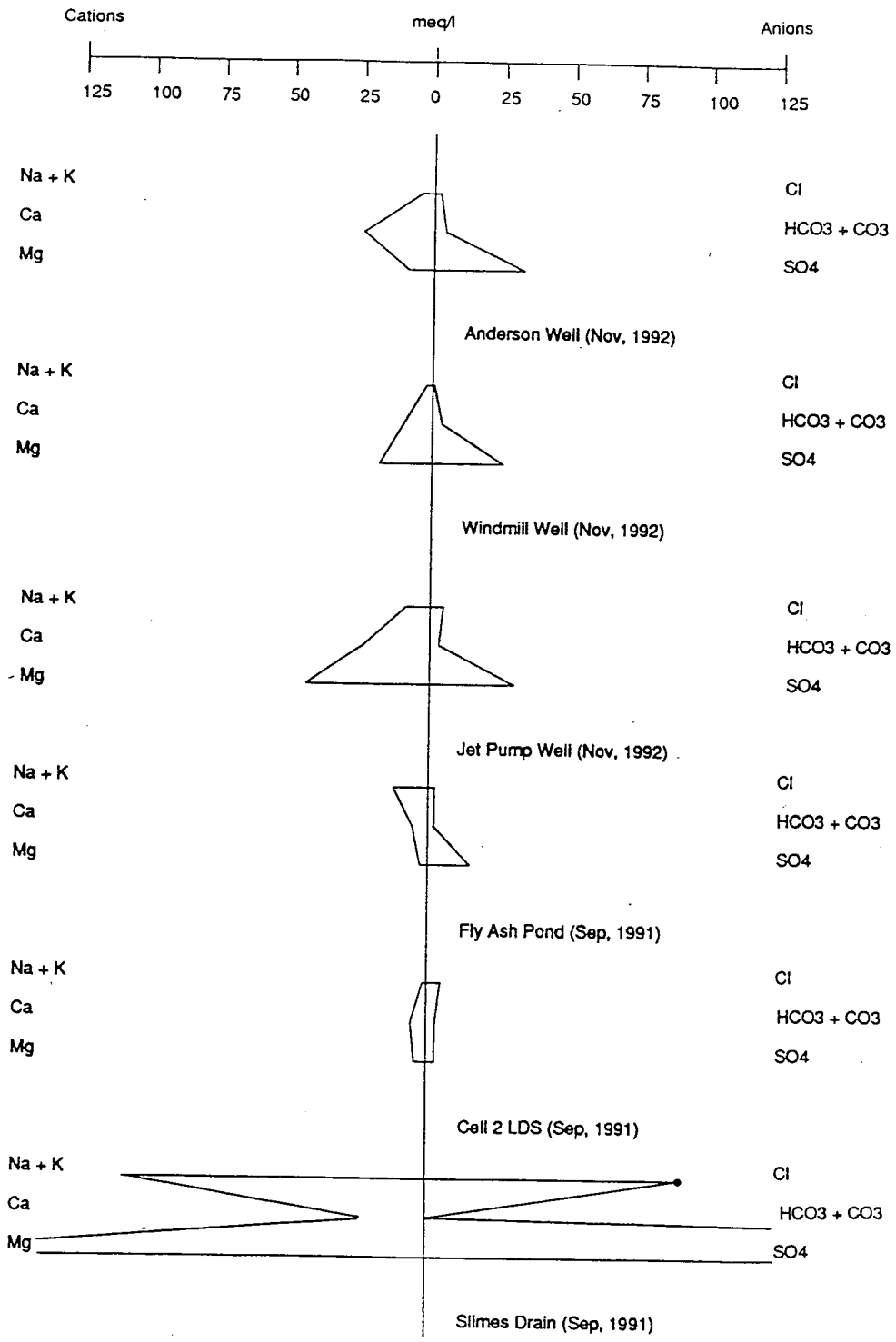
DRAWING NUMBER 4111-A16



STIFF DIAGRAMS OF SLIMES DRAIN, FLY ASH POND AND SURROUNDING STOCK WELLS

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No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY	DATE: 7-19-94 SCALE: N.T.S.	FIGURE 2.10	DRAWING NUMBER 4111-A16
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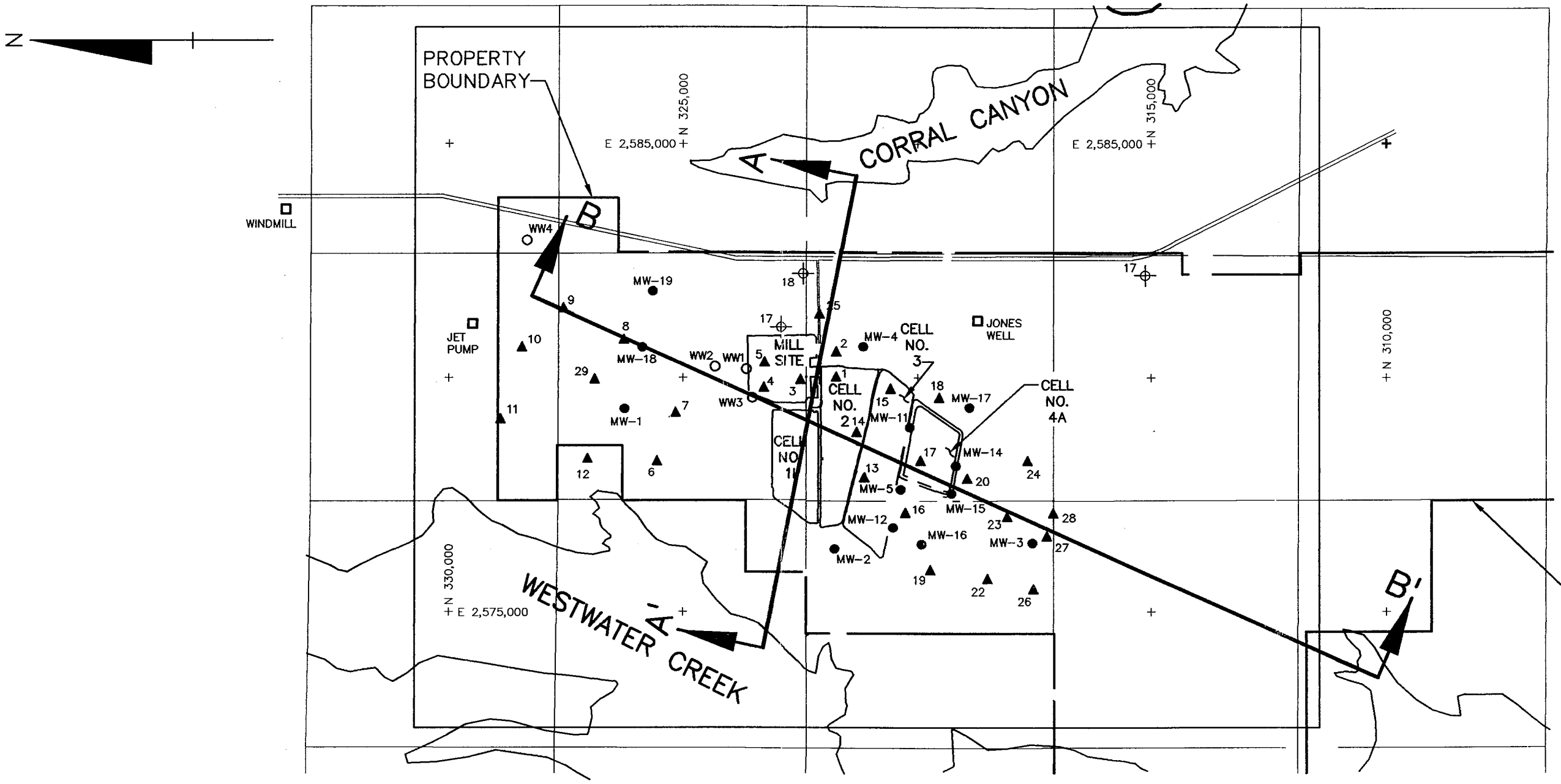
DRAWING NUMBER 4111-B5



LEGEND:

- ▲12 DAMES AND MOORE 1978 BORINGS
- WW4 WATER SUPPLY WELLS D'APPOLONIA (1981)
- MW-2 EXISTING MONITORING WELLS
- 9 EXISTING WATER SUPPLY WELLS
- 17 EXISTING WATER SUPPLY WELLS
- STOCK WELLS
- B CROSS SECTION LOCATIONS

SCALE

2000 0 2000 4000 FEET

SITE PLAN MAP
WHITE MESA MILL
BLANDING, UTAH

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DATE: 7-18-94	FIGURE 2.1	DRAWING NUMBER 4111-B5
SCALE: AS SHOWN		

definition of the water type is variable. Of the 13 wells analyzed for water chemistry, 4 fall in the calcium-sulfate type category, 4 fall in the (sodium plus potassium)-sulfate type, 2 samples classify as the magnesium-sulfate type. Five samples have no dominant cation type. However, these 5 samples tend to classify more closely to the (sodium plus potassium)-sulfate and calcium-sulfate types.

A temporal change of water chemistries may be suggested from four sampling periods for wells WMMW-1, WMMW-3 and WMMW-4 using the trilinear plotting technique shown on Figures 2.11 through 2.13. These figures suggest changes in water chemistries from October, 1979 through February 1991.

The spatial variability of water quality data within the Burro Canyon Formation is illustrated on Figures 2.7 through 2.13 and the data presented in Appendix B. Upgradient Monitoring Wells WMMW-1, WMMW-18, and WMMW-19 varied in sulfate concentrations from 676 to 1736 milligrams per liter (mg/l). Likewise, chloride concentrations in these wells varied from 12 to 92 mg/l. Across the site, sulfate and chloride concentrations vary with no discernible pattern to the variations. Details regarding chemistry of the Burro Canyon Formation water can be found in Appendix B, including the results of 1993 sampling for Wells WMMW-17, 18 and 19.

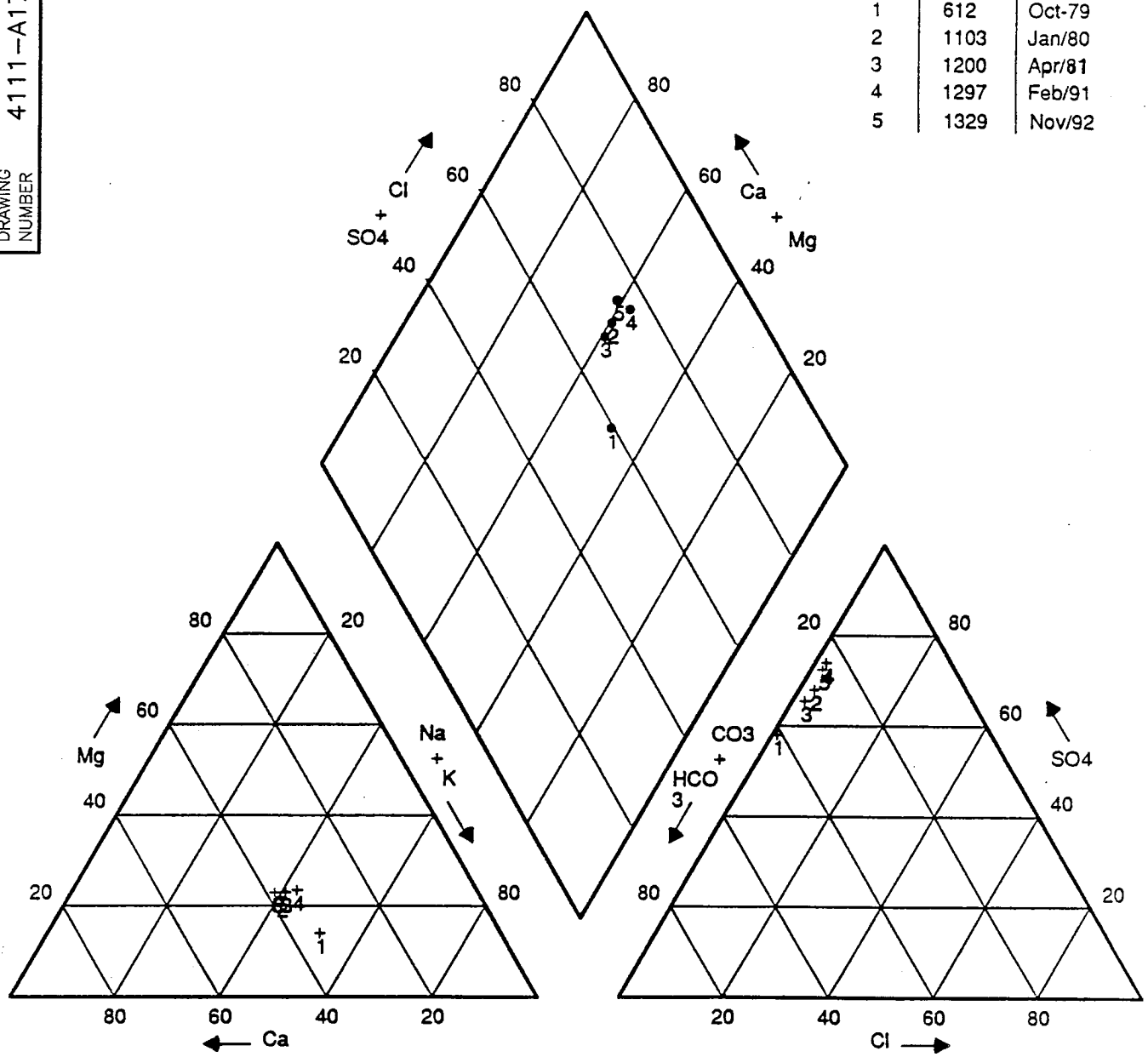
Variability of water within the Burro Canyon Formation is the result of slow moving to nearly stagnant ground water flow beneath the site. These conditions are likely leading to dissolution of minerals from the Brushy Basin Member and the formation of sulfate-dominated waters.

2.2.1.2 Statistical Analysis

Because of the variable ground water chemistry in the Burro Canyon Formation baseline data, comparison of individual well ground water chemistries to a single background ground water well may not be an appropriate method of monitoring potential disposal cell leakage or ground water impacts. Water quality baseline and comparisons to that baseline established on a well-by-well basis may be required to provide a meaningful representation of changes in ground water chemistry. Using this concept, the statistical "t" test was performed on samples from chloride

DRAWING NUMBER 4111-A17

No.	TDS	Sample Date
1	612	Oct-79
2	1103	Jan/80
3	1200	Apr/81
4	1297	Feb/91
5	1329	Nov/92



Ref: Umetco, 1982.

TIME-SEQUENCE
TRILINEAR PLOT OF WMMW-1

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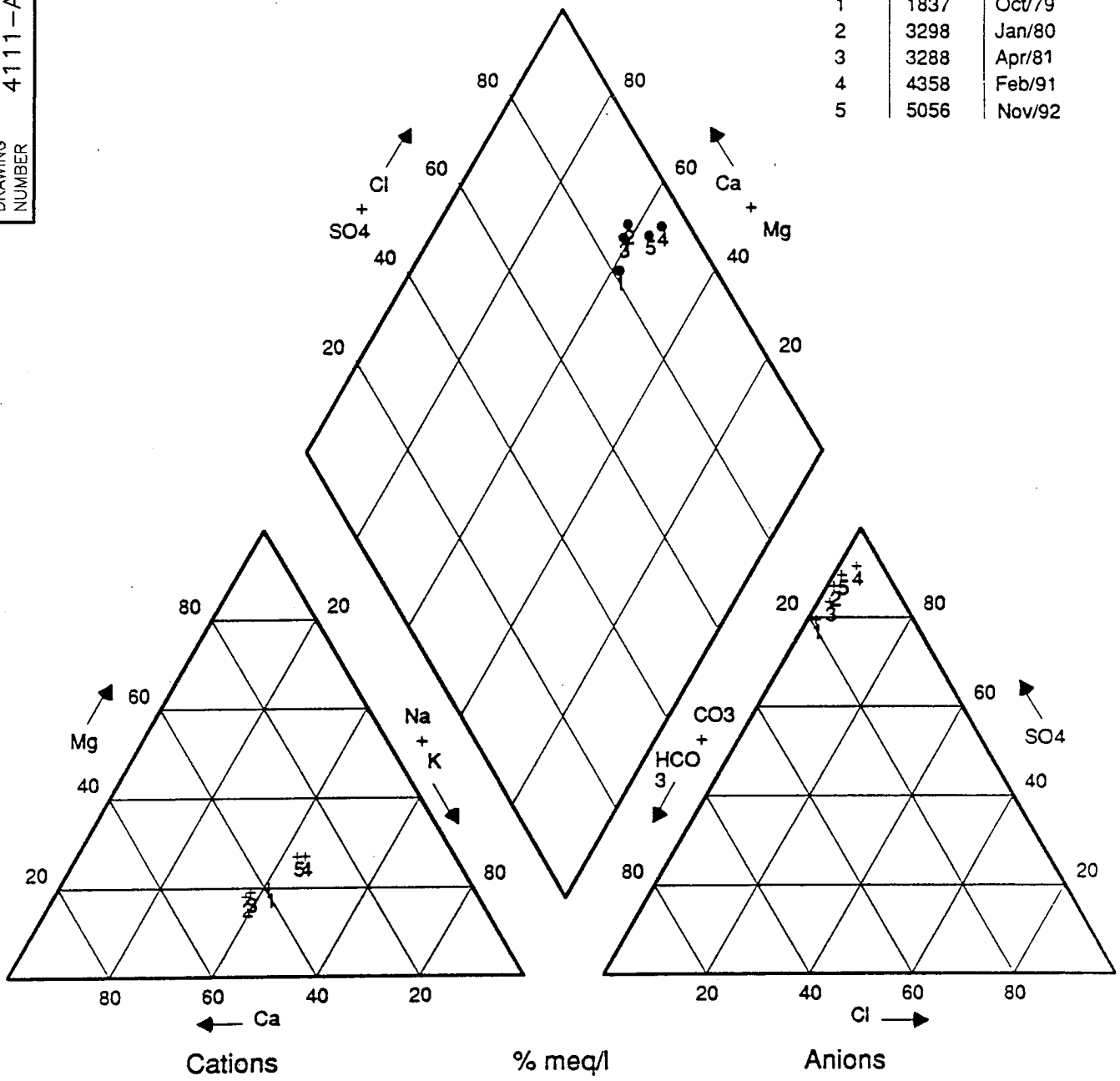
FIGURE 2.11

DRAWING NUMBER 4111-A17

1

DRAWING NUMBER 4111-A18

No.	TDS	Sample Date
1	1837	Oct/79
2	3298	Jan/80
3	3288	Apr/81
4	4358	Feb/91
5	5056	Nov/92



TIME-SEQUENCE
TRILINEAR PLOT OF WMMW-3

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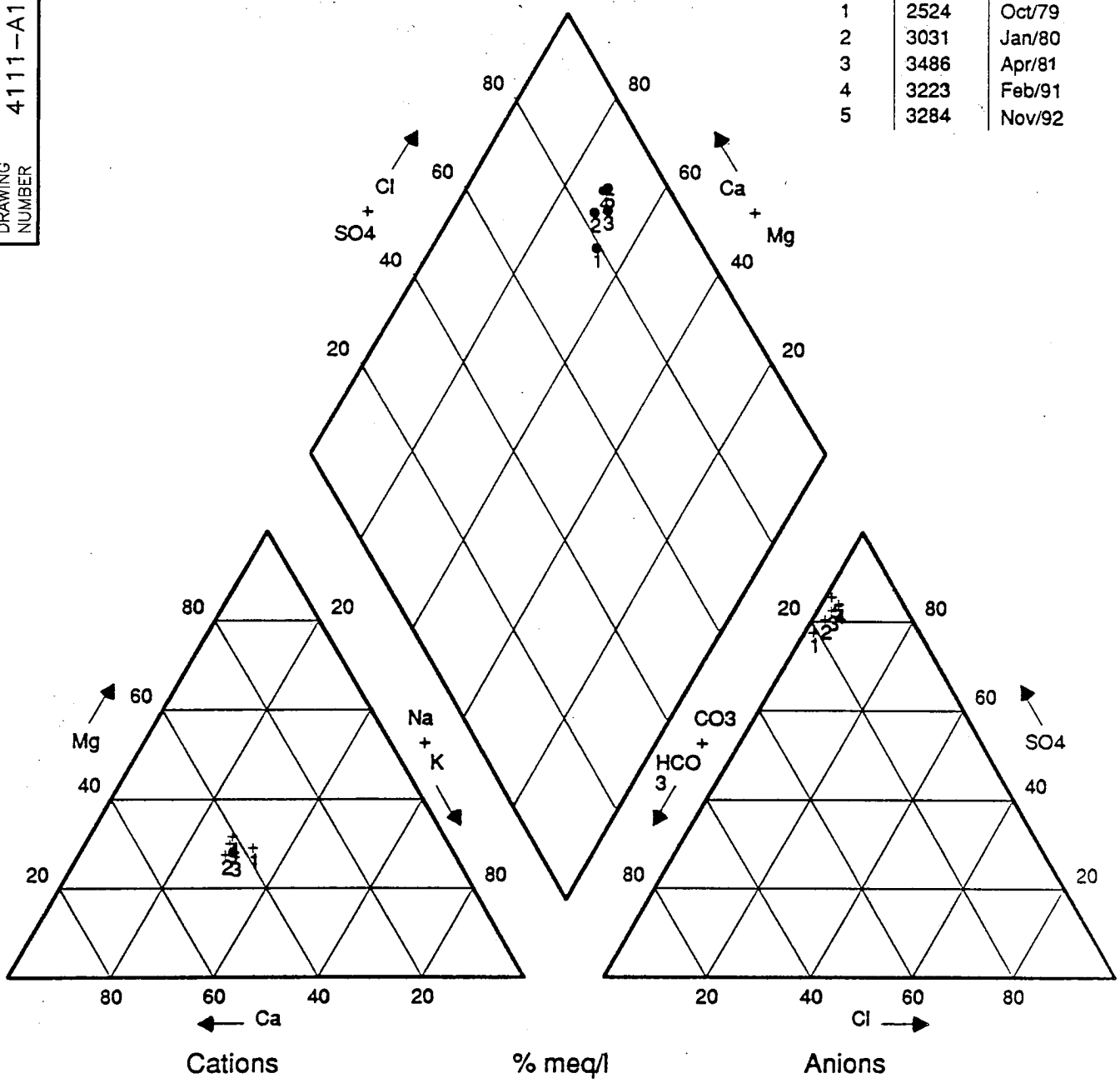
FIGURE 2.12

DRAWING NUMBER 4111-A18

1

DRAWING NUMBER 4111-A19

No.	TDS	Sample Date
1	2524	Oct/79
2	3031	Jan/80
3	3486	Apr/81
4	3223	Feb/91
5	3284	Nov/92



TIME SEQUENCE
TRILINEAR PLOT OF WMMW-4

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DENVER, COLORADO

REFERENCE:
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FIGURE 2.13

DRAWING NUMBER 4111-A19

1

populations within specific wells over time (see Appendix B). Because chlorides are a conservative species and are concentrated in the tailings solutions, this or other similar mobile constituents may be selected as an initial method of detecting impacts to the ground water.

Disposal Cell No. 2 leak detection system (LDS) water chemistry provides a useful picture of the water chemistry directly below Disposal Cell No. 2. The water analyzed in the Disposal Cell No. 2 LDS contains the lowest TDS content (756 mg/l) of any water sampled in the area (Appendix B) with the exception of the Jones well. The Jones well also contains the highest percentage of carbonate and bicarbonate when compared to the other monitoring wells. The slimes drain contains a TDS value of 47,115 mg/l and no carbonates due to its extremely low pH (typically 1.5 to 3). Any significant leakage of tailings solution into the LDS would react with the carbonates and raise the TDS levels. This has not occurred to date.

Well WMMW-1 (installed September 1979) was originally considered as a potential background well for the site. Chlorides in this well have been relatively low (varying from 11 to 53.2 mg/l) since 1980. A "t" test was performed on sample populations from 1980-81 and 1990-92 for Well WMMW-1. The test indicates that there is a significant difference in the mean of the populations at the 0.05 level of significance. The analysis indicates chloride levels decreased significantly. Tests performed on a sulfate population from the period 1980-81 to a population from 1990-92 show the sulfates in this well have increased significantly. Such changes in water chemistry in this potential background well suggest that water chemistry in the Brushy Basin Member is variable.

Well WMMW-3 (installed September 1979) was originally constructed to serve as the point of compliance well. Statistical testing ("t" test) on a chloride population from 1980-81 compared to a chloride population from 1990-92 shows that there is no significant difference in the two chloride populations. Sulfate samples taken 1980-81 compared to samples taken 1988-91 show there is a significant increase in sulfates.

For Well WMMW-5 (installed May 1980), the statistical "t" test performed on a sample from the chloride population of 1981-83 to a sample from a chloride population of 1990-92 shows there

is a significant difference in the means of the chloride populations and that the chloride content has decreased.

For Well WMMW-12 (installed October 1982), the statistical "t" test performed on a sample from the chloride population from 1982-85 compared to the chloride population from 1990-91 shows there is a significant difference in the means of the chloride populations of these two sampling periods and that the chloride content has decreased.

Wells WMMW-14 and 15 (installed September 1989) were installed in the south embankment of Disposal Cell No. 4A in 1989. Wells WMMW-14 and 15 have a similar water chemistry to Monitor Well WMMW-12 which was installed in 1982. A statistical "t" test chloride value indicates the mean chloride value in Well WMMW-15 is significantly higher than Well WMMW-14. Statistical tests also show that the chloride values are decreasing in both wells. Similar testing on Well WMMW-12 likewise shows a decrease in chlorides. Any contamination from the tailings solution would probably show an increase in the chloride values in these wells over time, which has not happened.

Considering the apparent variability of chemical composition of perched water and the absence of any impact from operations, it may be appropriate to determine background concentrations for a number of selected wells.

3.0 OPERATIONAL EFFECTS

This section addresses the potential operational effects of the tailings disposal cells on the vadose zone, perched ground water, and the Entrada/Navajo Aquifer. It is important to note that in the 15 years of operation, no operational effects to the vadose zone, perched ground water, or the underlying aquifers have been documented, as demonstrated by the water chemistry discussions in Section 2.2.

3.1 Infiltration Evaluation

Operational effects of the tailings disposal cells are concerned with the potential for liquids from the cells to migrate into and through the vadose zone at the site.

The EPA Hydrologic Evaluation of Landfill Performance (HELP) Model Version 2.0 (Schroeder, et al, 1989) was used to estimate the potential seepage from the tailings disposal cells. The HELP model uses water balance methods to quantify water movement out of the bottom of the disposal cells. The model accounts for the combined effects of hydrologic processes including precipitation, surface disposal, runoff, infiltration, percolation, evapotranspiration, changes in soil moisture, and lateral drainage.

The HELP model uses site-specific climatological, cover/liner material, and design data. Climatological data include: monthly temperature, precipitation, and solar radiation values. Cover/liner property data include: soil type, hydraulic conductivity, porosity, field capacity, and wilting point. Design data include: number of soil layers, thicknesses of layers, type of soil layer (barrier to flow, lateral drainage, or percolation layer), and drainage slopes. The specific input and output data used in the HELP model evaluation for the facility are presented in Appendix C. Properties of tailings, disposal cell design, and properties of disposal cell cover materials were obtained from the reclamation plan for the site (Umetco, 1988).

The tailings disposal cells at the White Mesa Uranium Mill store slurried tailings from the mill's operations. These cells are termed wet cells. Tailings imported from outside sources will be void of drainable liquid and will be placed in impoundments free of liquids. These cells are termed dry cells. Dry tailings disposal consists of placing low-moisture-content tailings in a lined, engineered disposal cell. Hence, dry tailings have no capacity to drain liquid into underlying strata. An engineered cap is placed over the tailings to limit precipitation infiltration.

Wet tailings disposal consists of placement of slurried tailings into a lined, engineered disposal cell. With this type of disposal, the tailings are completely saturated. Due to their wet condition, these tailings have the potential to release seepage into the vadose zone. Wet cells are also capped to limit precipitation infiltration.

Both the dry and wet tailings cells were evaluated using the HELP model. For this evaluation, climatological data from Blanding, Utah and Grand Junction, Colorado were utilized. The cells were conservatively evaluated assuming partially- and fully-leaking liners.

3.1.1 Dry Tailings Disposal Cell

A schematic for a typical dry tailings disposal cell is shown on Figure 3.1. As shown, the bottom of the cell has a 1-foot clay layer base which is overlain with a synthetic liner. Dry tailings are placed within the cell over the liner. The dry cell cap consists of a 4-foot-thick random-fill base layer overlain by 1 foot of clay, 1 foot of filter material (capillary break), 3.5 feet of random fill (protective layer), and 0.5 foot of vegetative cover.

The EPA HELP model was used to evaluate the infiltration that may occur through the typical dry tailings disposal cell configuration. The specific input and output data used for the HELP model evaluation for dry tailings disposal are presented in Appendix C. Based on site data, the HELP model evaluation for the dry tailings disposal cell configuration indicated that zero net infiltration is expected to reach the vadose zone through the operational life of the cell.

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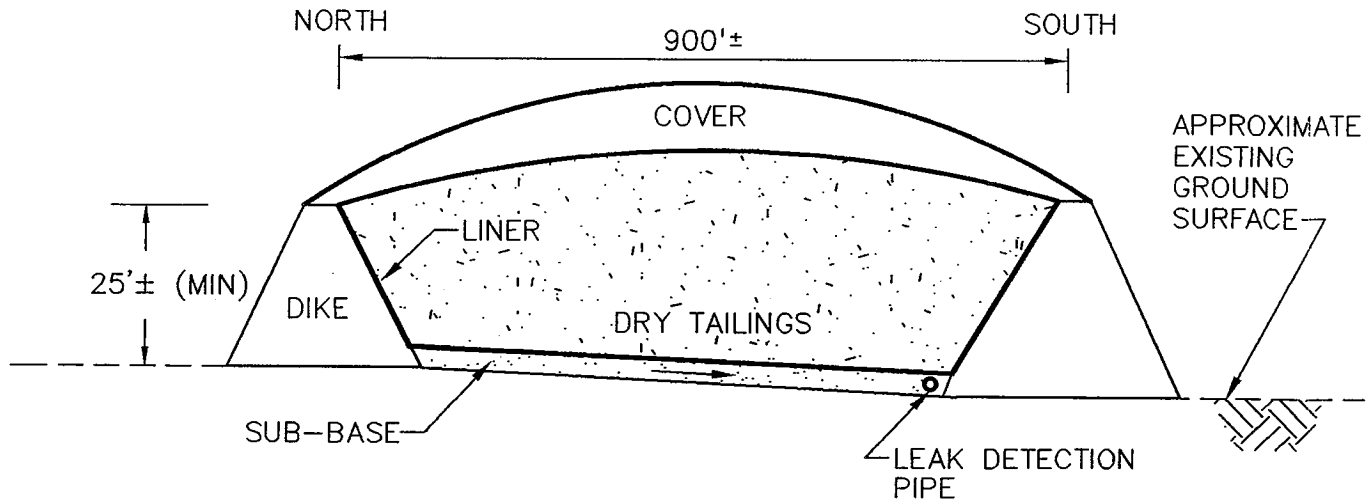
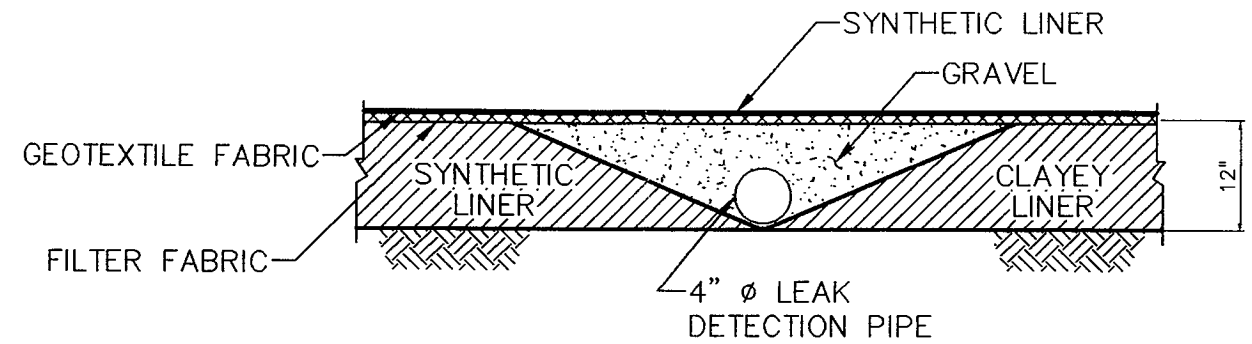
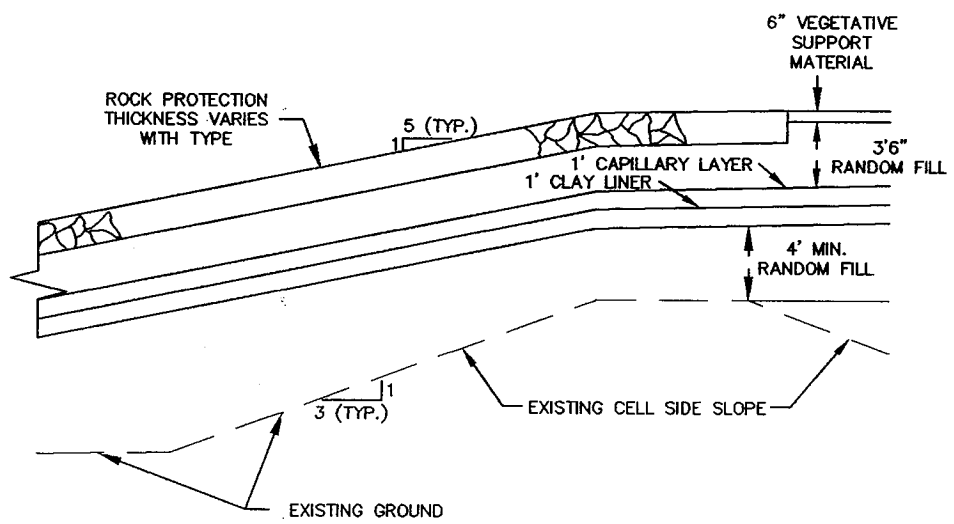


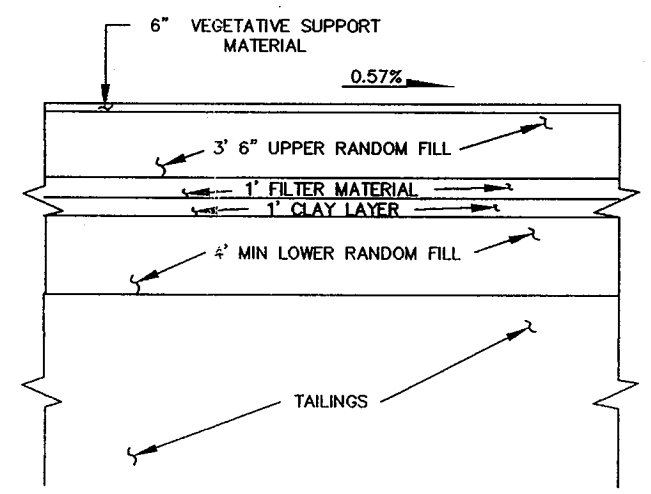
DRY TAILINGS CELL SCHEMATIC



LEAK DETECTION DETAIL



TYPICAL SIDE SLOPE RECLAMATION COVER



TYPICAL DRY CELL RECLAMATION COVER

DRY TAILINGS CELL SCHEMATIC

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DATE: 7-18-94	FIGURE 3.1	DRAWING NUMBER 4111-B12
SCALE: N.T.S.		

3.1.2 Wet Tailings Disposal Cell

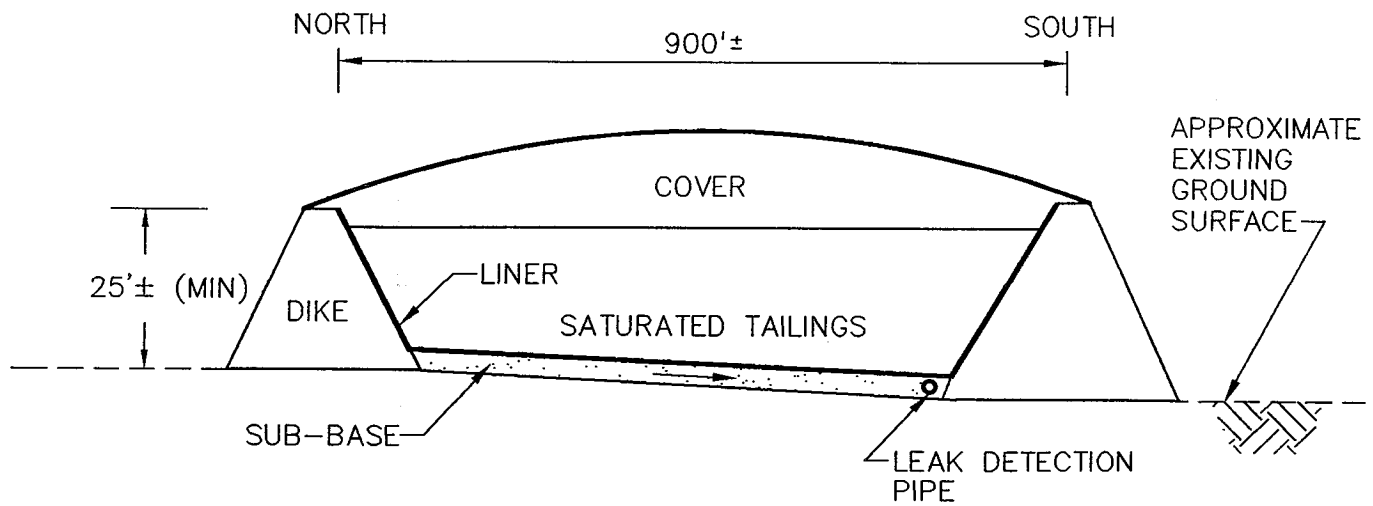
A schematic for a typical wet tailings disposal cell is shown on Figure 3.2. The wet tailings disposal cell has a six-inch base/drainage layer of crushed rock and sand overlain by a synthetic liner. Under operational conditions, the tailings are placed within the cell as a slurry; therefore, the tailings are completely saturated. The maximum depth of the tailings within the cell is three feet below the top of the cell dike (freeboard limit). The cap for the wet tailings disposal cell is identical to that for the dry tailings disposal cell.

The EPA HELP model was used to evaluate the infiltration that may occur through the typical wet tailings disposal cell configuration. The specific input and output data used for the HELP model evaluation are presented in Appendix C. Based on site data, the HELP model evaluation for the wet tailings disposal cell configuration indicates the potential for .04 to .12 feet per year of net infiltration into the vadose zone. The estimated infiltration for the wet tailings disposal cell is higher than for the dry tailings disposal cell because of: 1) the saturated condition of the tailings provides additional water for gravity drainage into the vadose zone; and 2) the conservative assumption that the bottom liner of the disposal cell would leak.

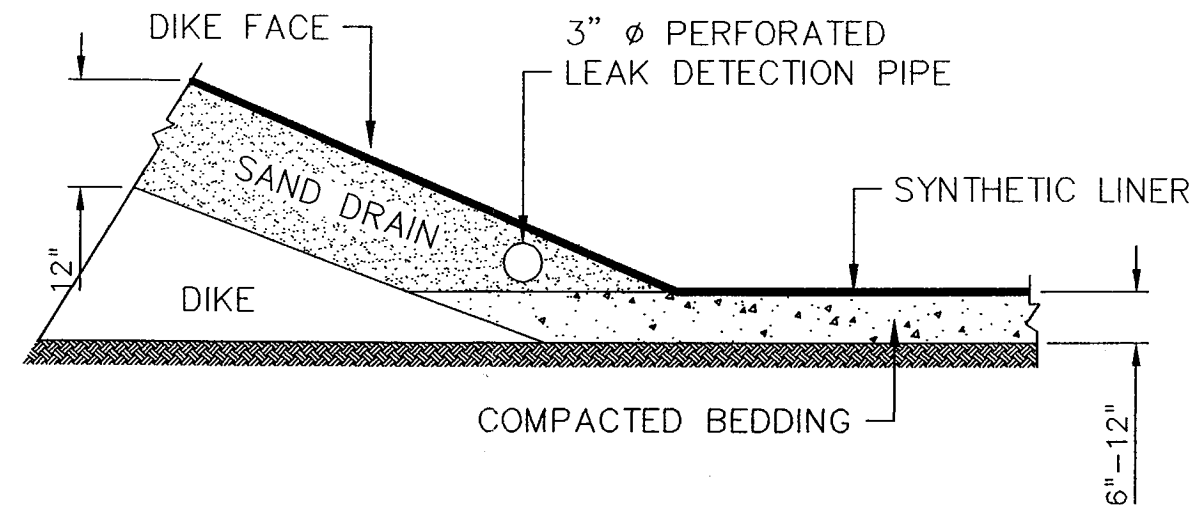
3.2 Potential Vadose Zone Impacts

Moisture infiltrating the vadose zone will first be taken up into storage within the formation until enough moisture is available to allow gravity drainage. This storage is referred to as residual moisture or moisture retention. Moisture retention tests on the Dakota and Burro Canyon Sandstones are summarized in Table 2.1. These data indicate that the unsaturated portions of the Dakota and Burro Canyon Sandstones, on the average, may retain up to 5.5 percent of moisture under gravity drainage conditions. Using an average unsaturated zone thickness of 109.5 feet, the available volume of "retained" moisture beneath a typical cell is approximately 18,902,000 cubic feet. Assuming continued infiltration from the wet tailings cell, it would take 50 years for a fully-leaking lined cell and 150 years for a partially-leaking lined cell to accumulate this volume. Therefore, migration of infiltrated moisture from the wet tailings disposal cell is

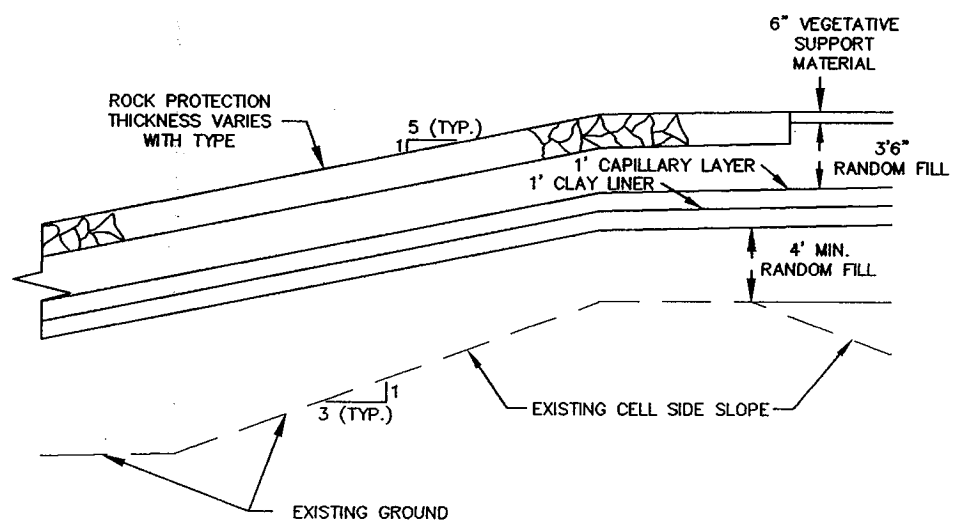
DRAWING NUMBER 4111-B13



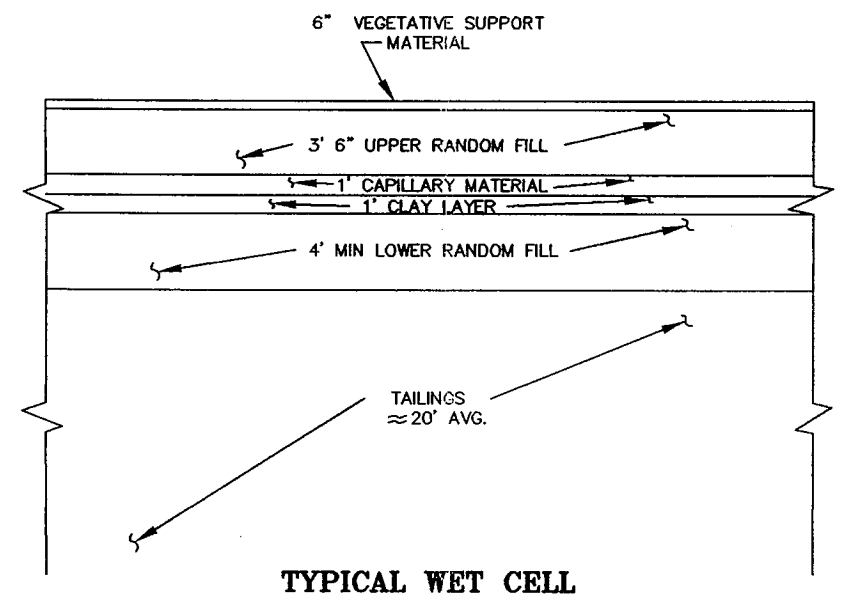
DRY TAILINGS CELL SCHEMATIC



LEAK DETECTION DETAIL
NTS



TYPICAL SIDE SLOPE RECLAMATION COVER



TYPICAL WET CELL RECLAMATION COVER

WET TAILINGS CELL SCHEMATIC

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DATE: 7-18-94	FIGURE 3.2	DRAWING NUMBER 4111-B13
SCALE: N.T.S.		

estimated to take 50 to 150 years to travel through the vadose zone at the site. This estimate is conservative as it assumes only vertical migration from the cells and does not account for lateral migration.

It could be postulated that a hypothetical fracture beneath a wet tailings disposal cell would reduce the time of infiltration through the vadose zone. However, no significant fractures/joints have been documented in the subsurface in the approximately 45 wells and borings at the site. In addition, Disposal Cell No. 2 has been in operation for over 14 years with no evidence of constituents migrating through the vadose zone.

3.3 Potential Perched Ground Water Zone Impacts

As discussed in Section 2.0, the perched ground water zone beneath the site thins toward the edges of the mesa. Both the Dakota and Burro Canyon Sandstones outcrop at the edge of the mesa, and this is also the discharge zone for the perched ground water. Discharge takes place at the rim along the contact between the Burro Canyon Formation and underlying Brushy Basin Member as evidenced by the springs and productive vegetative pattern. Part of the discharge may also enter the Brushy Basin Member along documented fractures at the canyon rim.

Constituents that may have entered the perched water zone via infiltration through the vadose zone would be expected to migrate southward within the perched water zone and ultimately be discharged at the edge of the mesa. Vertical migration to any significant depth is highly unlikely due to the low permeability and unsaturated thickness of the underlying strata.

The ground water seepage velocity in the saturated Burro Canyon Formation can be used to estimate the minimum travel time for constituents to migrate from under the site to the edge of the mesa. This is a conservative approach, as this method does not account for adsorption of the constituents which may retard migration and lengthen the transport time. Specific calculations of ground water travel time are presented in Appendix D.

The ground water seepage velocity may be estimated using Darcy's law. Seepage velocity is a function of hydraulic conductivity, hydraulic gradient, and effective porosity. The measured hydraulic conductivities for the Burro Canyon Sandstone via pump/recovery and injection tests are summarized in Table 2.2. The measured values range from 1.58E-03 to 1.93E-07 cm/sec with a geometric mean of the measured values of 1.01E-05 cm/sec (10.5 ft/yr).

An average hydraulic gradient from the site to the edge of the mesa can be estimated utilizing the perched water elevation map shown on Figure 2.4. The hydraulic gradient from the center of the site to the edge of the site is estimated to be 0.015 feet/foot. Using an average porosity of 17.6 percent for both the Dakota and Burro Canyon Sandstones (Table 2.1), the seepage velocity within the perched water zone is estimated at approximately 0.89 ft/yr.

The downgradient distance from the White Mesa Facility to the Dakota/Burro Canyon Sandstones outcrop on the southern rim of the mesa is approximately 8,000 feet. Using the ground water seepage velocity of 0.89 ft/yr, it would take a minimum of 8,900 years for a constituent entering the perched water zone to reach the discharge point at the rim of the canyon. Therefore, even if leakage did occur, the possibility of constituents entering the local surface drainage system via seepage from the Burro Canyon Formation is not likely.

3.4 Potential Entrada/Navajo Aquifer Impacts

This section addresses the natural hydraulic and physical barriers that are present at the site that protect the Entrada/Navajo Aquifer from operational effects of the facility. The primary barriers are the artesian conditions present in the Entrada/Navajo Aquifer and the presence of the Brushy Basin aquitard and other intervening low-permeability layers within the Morrison and Summerville Formations which separate the perched water from the Entrada/Navajo Aquifer. In the presence of both of these natural barriers, it is unlikely constituents present in the tailings disposal cells would migrate into the Entrada/Navajo Aquifer.

3.4.1 Artesian Conditions

As described in Section 2.1.4, the Entrada/Navajo Aquifer is regionally used for irrigation and domestic consumption (Dames and Moore, 1978). Figures 2.2 and 2.3 show the relative location of the Entrada/Navajo Aquifer with respect to the White Mesa Uranium Facility and the perched water in the Burro Canyon Sandstone. The elevation of the Entrada/Navajo Aquifer beneath White Mesa is approximately 4,340 feet MSL, or 1,200 feet below the mesa ground surface.

Well logs from four water supply wells completed at the facility indicate that the ground water levels in the Entrada/Navajo are at an average elevation of 5,180 feet MSL, or 450 feet below the mesa ground surface (D'Appolonia, 1981) (Appendix A). This is equivalent to 850 feet of artesian head. The artesian pressure heads measured in these wells are summarized in Table 3.1.

Artesian conditions in the Entrada/Navajo Aquifer were also noted in a water well drilled at the Hanksville ore-buying station 84 miles from the site (Dames and Moore, 1978). Therefore, the presence of artesian pressure in this aquifer is laterally extensive and can be assumed to be continuous throughout this site.

The artesian conditions in the Entrada/Navajo Aquifer can be explained by the topographic location of primary aquifer recharge. According to the Dames and Moore (1978) Environmental Report, recharge to the Entrada/Navajo Aquifer is from the outcrop area of these sandstones along the length of the north-south trending Comb Ridge Monocline located approximately 8 miles west of the site (Dames and Moore, 1978).

In terms of operational effects, the presence of artesian pressures in the Entrada/Navajo provides a positive safeguard against potential migration of constituents into the aquifer. In order for constituents to enter the aquifer, the pressure within the aquifer would have to be exceeded. Therefore, migration of constituents into the Entrada/Navajo Aquifer in the presence of artesian conditions is unlikely.

Table 3.1

Ground Water Levels in Entrada/Navajo Aquifer
White Mesa Uranium Mill

Well Designation	Estimated Ground Surface Elevation (ft-MSL)	Estimated Casing Elevation (ft-MSL)	Total Well Depth (ft)	Estimated Original Static Water Elevation (ft-MSL)	Estimated Top Elevation of Entrada Aquifer (ft-MSL)	Artesian Pressure Head (ft)	Completion Details
WW1	5622	4582	1860	5175	4326	849	Gravel pack and slotted casing installed at depth of 1700 ft. Well decommissioned.
WW2	5630	4380	1885	5180	4340	840	Barren below the casing. Casing not sealed at the bottom.
WW3	5622	4372	1820	5172	4322	850	Barren below the casing. Casing cemented at bottom.
WW4	5670	4420	1820	5210	4370	840	Barren below the casing.

Notes: ft-MSL = feet - mean sea level

3.4.2 Brushy Basin Aquitard

As shown on Figures 2.2 and 2.3, the Brushy Basin, Westwater Canyon, Recapture, and Salt Wash Members of the Morrison Formation are stratigraphically situated between the facility and Entrada/Navajo Aquifer. All of these members are unsaturated as indicated on drillers logs for wells that have penetrated the Morrison Formation (Appendix A) and are described as being low permeability. The Brushy Basin Member is described as consisting of bentonitic mudstones and siltstones and is generally considered impermeable (Dames and Moore, 1978).

Site-specific data on the hydraulic properties of the Brushy Basin or other members of the Morrison Formation are not available. However, the relative permeability of the Morrison Formation can be inferred from the presence of the high artesian pressures present in the Entrada/Navajo Aquifer. If this formation were moderately permeable, then leaky, confined conditions would exist and the overlying strata would be saturated to some degree. The absence of saturated conditions in the Morrison Formation implies layers of very low permeability.

The presence of low permeability, unsaturated strata between the Burro Canyon Formation and the Entrada/Navajo Aquifer provides a positive natural physical barrier that will protect the quality of the Entrada/Navajo Aquifer. In order to impact the quality of the Entrada/Navajo Aquifer, constituents generated from tailings storage would have to migrate through over 1,200 feet of unsaturated, low-permeability strata between the Burro Canyon Member and top of the Entrada/Navajo Aquifer. This, combined with the artesian pressures in the Entrada/Navajo Aquifer indicate migration of constituents from the facility to the aquifer is unlikely.

4.0 ADDITIONAL INVESTIGATIONS AND MONITORING

4.1 Additional Investigations

This section presents proposed additional investigations to comply with the requirements of the U.S. Nuclear Regulatory Commission (NRC). Proposed investigations include the following tasks:

- Investigate subsurface joint sets,
- Verify the hydraulic properties of the Brushy Basin Member, and
- Define the extent of the perched ground water zone.

The proposed investigations will be conducted in the following phases: 1) subsurface joint identification program, 2) Brushy Basin Member investigations, and 3) extent of the perched ground water zone.

4.2 Subsurface Joint Sets

Observational data presented in the Environmental Report (Dames and Moore, 1978) indicate that jointing is common in the exposed Dakota/Burro Canyon Formations along the mesa's rim with primary joints parallel to the cliff faces and secondary joints almost perpendicular to the primary joints. Umetco (1992) also mapped surface fractures along the canyon rim and found a primary joint vector with a strike of N11E, and a secondary joint vector with a strike of N47W.

Investigations are proposed to determine whether or not the surficially mapped joint sets are present in the subsurface Dakota/Burro Canyon Formations beneath Tailings Disposal Cells No. 3 and No. 4A at the site and whether or not their presence, if any, is causing an increase in the rock mass permeability.

The scope of investigations to identify subsurface joint sets consists of advancing four angled borings into the Dakota/Burro Canyon Formations and at least 25 feet into the Brushy Basin

Member beneath Tailings Disposal Cells No. 3 and No. 4A. Figure 4.1 presents the proposed locations of the angled borings. At each location shown on Figure 4.1, one angled boring will be advanced parallel to the strike of the primary joints mapped on the surface. A second boring will be advanced perpendicular to the strike of the primary joints. This method should intersect the maximum number of potential subsurface fractures, if present. Each boring will be fully cored with an NX or NWQL double-core barrel. Cores will be logged with particular attention given to fractures, specifically, their orientation, spacing, aperture, and any evidence of flow (e.g., staining, mineral redeposition or presence of clay).

Permeability pressure (packer) tests will be conducted in each borehole in five- or ten-foot increments throughout the entire length of the borehole. Upon completion, borings will be grouted with cement/bentonite grout from the bottom up.

4.3 Brushy Basin Member Investigations

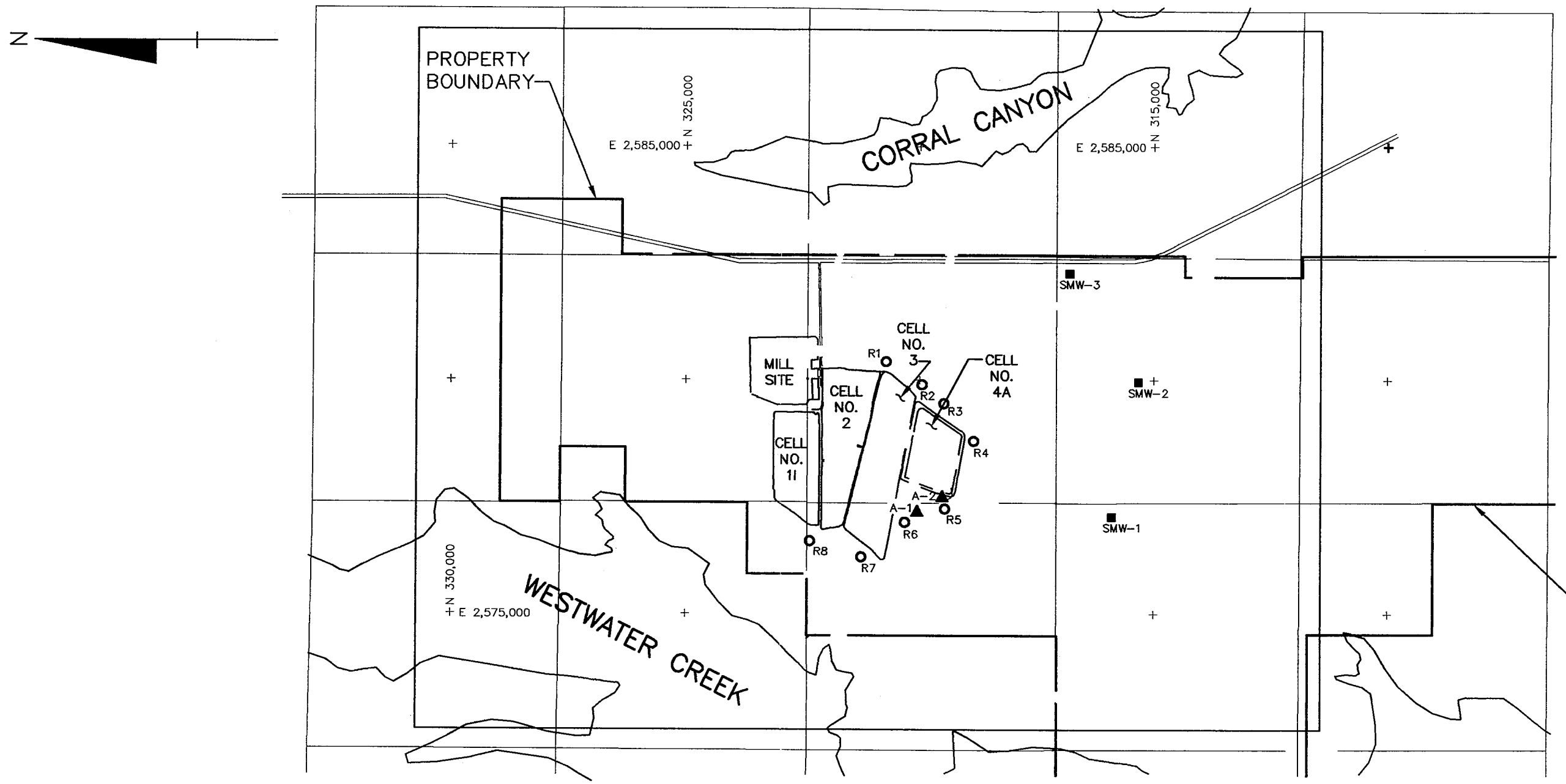
The primary objective of the Brushy Basin Member investigation is to quantify the hydraulic properties of the unit and evaluate its effectiveness as an aquitard. For the sake of expediting the investigations, borings from which the hydraulic information is obtained will be converted into observation wells to further define the extent of saturation in the Burro Canyon Formation.

The proposed Brushy Basin Member investigation includes:

- Drilling three exploratory borings into the Brushy Basin Member. Each boring will penetrate 20 feet into the unit. The boring data will also be used to define the Brushy Basin-Burro Canyon Member contact. The proposed locations of the borings are presented on Figure 4.1.

- From each boring, collecting two 5-foot sections of the core from the Brushy Basin Member.

DRAWING NUMBER 4111-B10



SCALE

2000 0 2000 4000 FEET

PROPOSED LOCATIONS FOR ADDITIONAL BORINGS AND MONITORING WELLS
WHITE MESA MILL
BLANDING, UTAH

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

NOTE:

1. ALL LOCATIONS ARE APPROXIMATE.

LEGEND:

A-1 ▲ NESTED ANGLE BORINGS

SMW-1 ■ SHALLOW MONITORING WELL AND BRUSHY BASIN TEST HOLE

R4 ○ RESISTIVITY SURVEY POINT

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1		ISSUED FOR DRAFT SUBMITTAL	T.M.G.		

TITAN Environmental

DATE: 7-18-94	FIGURE 4.1	DRAWING NUMBER 4111-B10
SCALE: AS SHOWN		

- Conducting packer permeability tests in each boring within the section of the hole in the Brushy Basin Member.

- Conducting laboratory liquid permeability tests on vertically-oriented cores from the Brushy Basin Member. These tests will be necessary to quantify the vertical permeability which is expected to be orders of magnitude lower than the horizontal permeabilities from the field packer tests (horizontal permeability will be calculated from packer tests).

All borings advanced within the Brushy Basin Member will be converted into the observation wells screened in the Burro Canyon Formation.

4.4 Perched Ground Water Zone Extent

Based on the available site data, the perched ground water zone thickness in the Dakota/Burro Canyon sandstones thins southward and the water discharges along the rim of White Mesa. The lateral extent and saturated thickness of the perched ground water zone between the site and the edge of the mesa are currently unknown. It is known, however, that the extent of perched ground water does not extend beyond the canyon walls, as the Dakota/Burro Canyon sandstones outcrop along the rim of the canyon.

To further define the extent of the perched ground water zone between the site and the edge of the mesa, three shallow observation wells will be completed in the borings advanced for the investigation of the Brushy Basin Member. The proposed locations of these wells are presented on Figure 4.1. Each well will be fully screened within the Burro Canyon Formation. Well construction will be the same as that for Well WMMW-16, as shown in Appendix A.

4.5 Vadose Zone Monitoring

Energy Fuels believes that the existing monitoring wells which are completed in the perched water zone above the Brushy Basin Formation are suitable for the timely detection of leaks from the tailings disposal cells at the site when considering that the first aquifer to protect is in the

Entrada/Navajo Sandstones and that about 1,200 feet of unsaturated, tight formations separate this aquifer from perched water. The NRC, however, has asked that other methods be investigated that would provide an earlier warning that excursions are taking place from the tailings disposal cells.

To be responsive to NRC requests, Energy Fuels has investigated several methods of monitoring existing tailings disposal cells and has evaluated their potential application at the White Mesa Uranium Mill. The methods reviewed are presented in Appendix E. A summary of the proposed monitoring method is provided in the following paragraphs.

Energy Fuels wishes to stress that the TEM method will not allow for collection of alleged seepage samples for laboratory analysis. Therefore, information obtained by this method will be of a qualitative nature only. It appears possible that elevated moisture from atmospheric infiltration and likely dissolution of salts known to be present in Mancos Shale overlying the Dakota Sandstone may cause readings similar to those expected to be caused by leakage from cells. Therefore, Energy Fuels will exercise utmost care in collection and interpretation of TEM surveys.

4.5.1 Proposed Vadose Zone Monitoring Plan

Energy Fuels proposes to perform Transient Electromagnetic (TEM) geophysical surveys from approximately eight locations around the tailings cell as shown in Figure 4.1. Precise locations will depend on field-specific conditions prior to field implementation, and may vary slightly from those shown in Figure 4.1.

Initial survey information will be evaluated to establish baseline moisture conditions with depth from readings taken at specific locations. Two initial surveys will be performed at 6-month intervals, with annual surveys performed thereafter. The survey information will be evaluated to determine if a wetting front exists downgradient of the tailings ponds and to evaluate potential movement of this front downward through the unsaturated zone. The data and yearly evaluation

will be presented in the Annual Technical Evaluation of the White Mesa Mill Tailings Management System.

4.5.1.1 General Description

Based on current usage in the field of geophysics, the TEM survey is the preferred method of choice in the industry for detection and monitoring of plumes. The method, using a survey pattern similar to that being proposed in this section for the White Mesa Mill, is now being employed at Kennecott's Bingham Pit. Much of the recent work has included saltwater encroachment in the southeast.

The underlying premise for using geophysics is that the property being evaluated has substantially different properties from those of the host rock. The physical properties that are generally of most interest are magnetic susceptibility, resistivity, and induced polarization effect.

TEM surveys are conducted using a large transmitter (T_x) loop on the ground, and a small loop connected to a receiver. The transmitter loop will vary from 100 feet on side to several thousand feet on a side. Equipment for TEM surveys is built by several manufacturers, Geonics, Crone, UTEM, and Zonge Engineering.

4.5.1.2 Basic Operation

To collect data, the transmitter loop is connected to the transmitter, and a large current, typically 15-20 amps, is then transmitted for a short time, 17 milliseconds. When the current is turned off, eddy currents are generated in the ground which decay over time. The receiver, which is connected to the small coil, then makes many measurements starting at 0.089 milliseconds until 20 milliseconds. In most case three measurements are made at each station, vertical (z), north and east. North and east are often called X and Y to confuse the geologists.

4.5.1.3 General Description of Survey Procedures

Three types of set-ups are commonly used for TEM surveys. One of these will be applied for White Mesa Mill. They are fixed transmitter-moving receiver (profiling), in-loop (sounding), and slingram.

The fixed transmitter-moving receiver generally uses a large loop of wire, typically 1,000 feet by 1,500 feet. The loop is not moved during a survey, only the receiver is moved along the survey lines. The fixed transmitter-moving receiver method is the most common method used for exploration.

The in-loop method is the most common in environmental and engineering applications. A small transmitter loop, between 100-400 feet on a side, and the receiver are both moved for every reading. The receiver is in the center of the loop. The in-loop method is good for determining the depth to different layers, often for engineering surveys. Station separation between transmitter loops is dependant upon the target, for environmental monitoring this separation can vary between 0 and a thousand feet.

The slingram method is similar to the in-loop method. However, both the receiver and transmitter are moved for each reading, with the receiver always a fixed distance outside of the transmitter loop. Many of the initial TEM surveys in Canada used the slingram method, however, it is the least popular method.

Appendix E includes a description of the principals of TEM.

REFERENCES

REFERENCES

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Shoemaker, E.M., 1956, "Structural Features of the Colorado Plateau and Their Relation to Uranium Deposits," U.S. Geological Survey Professional Paper 300, p. 155-168.

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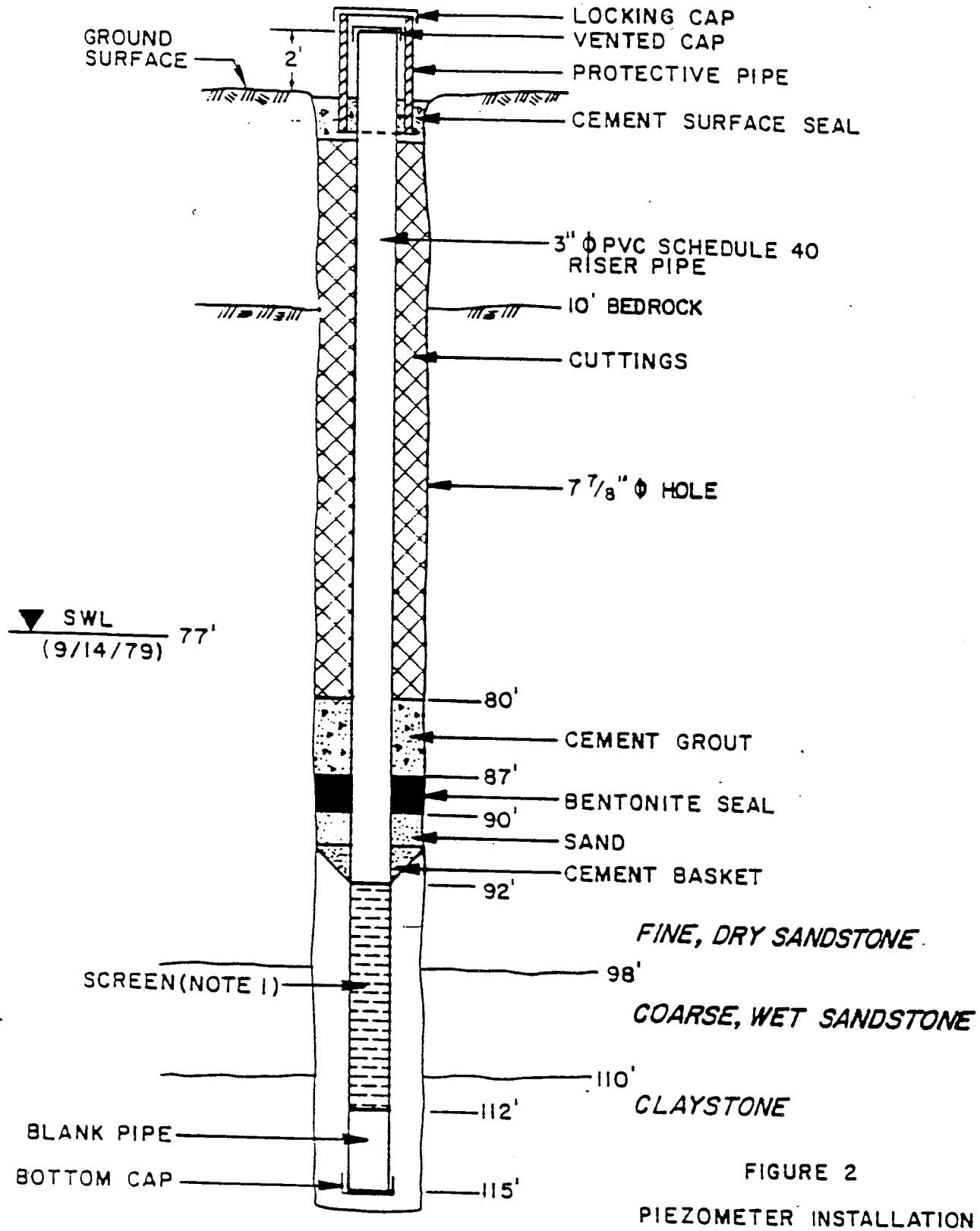
APPENDIX A

WELL/BORING LOGS



NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045" WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

FIGURE 2

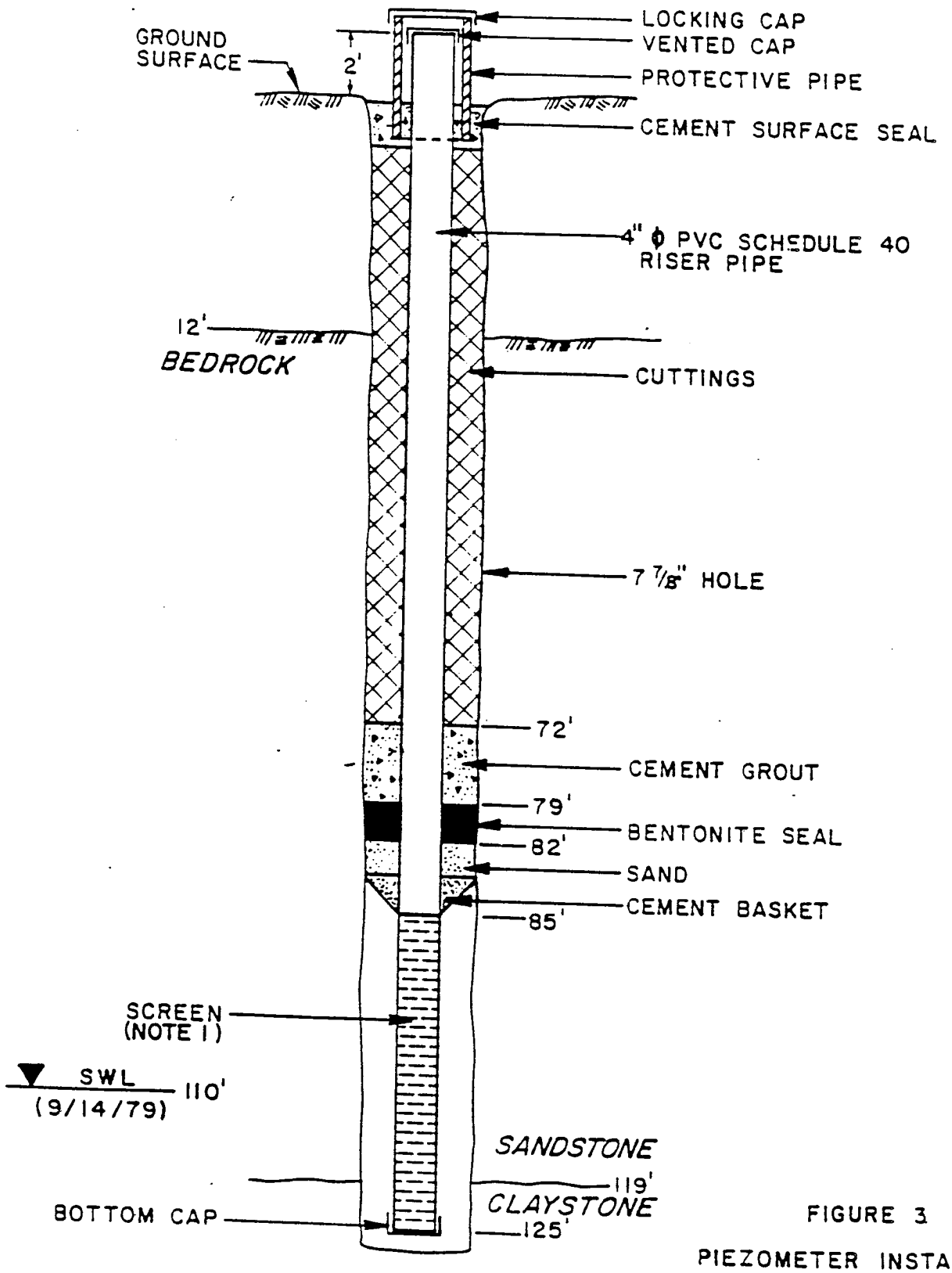
PIEZOMETER INSTALLATION
WELL NO. 1
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

REVISION:
△ REVISED 2-20-82 SED 2/23/82

BY	B.	CHECKED		DRAWING NUMBER	RN
	9-27-79	APPROVED BY	MJT	11/16/79	682



NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

FIGURE 3

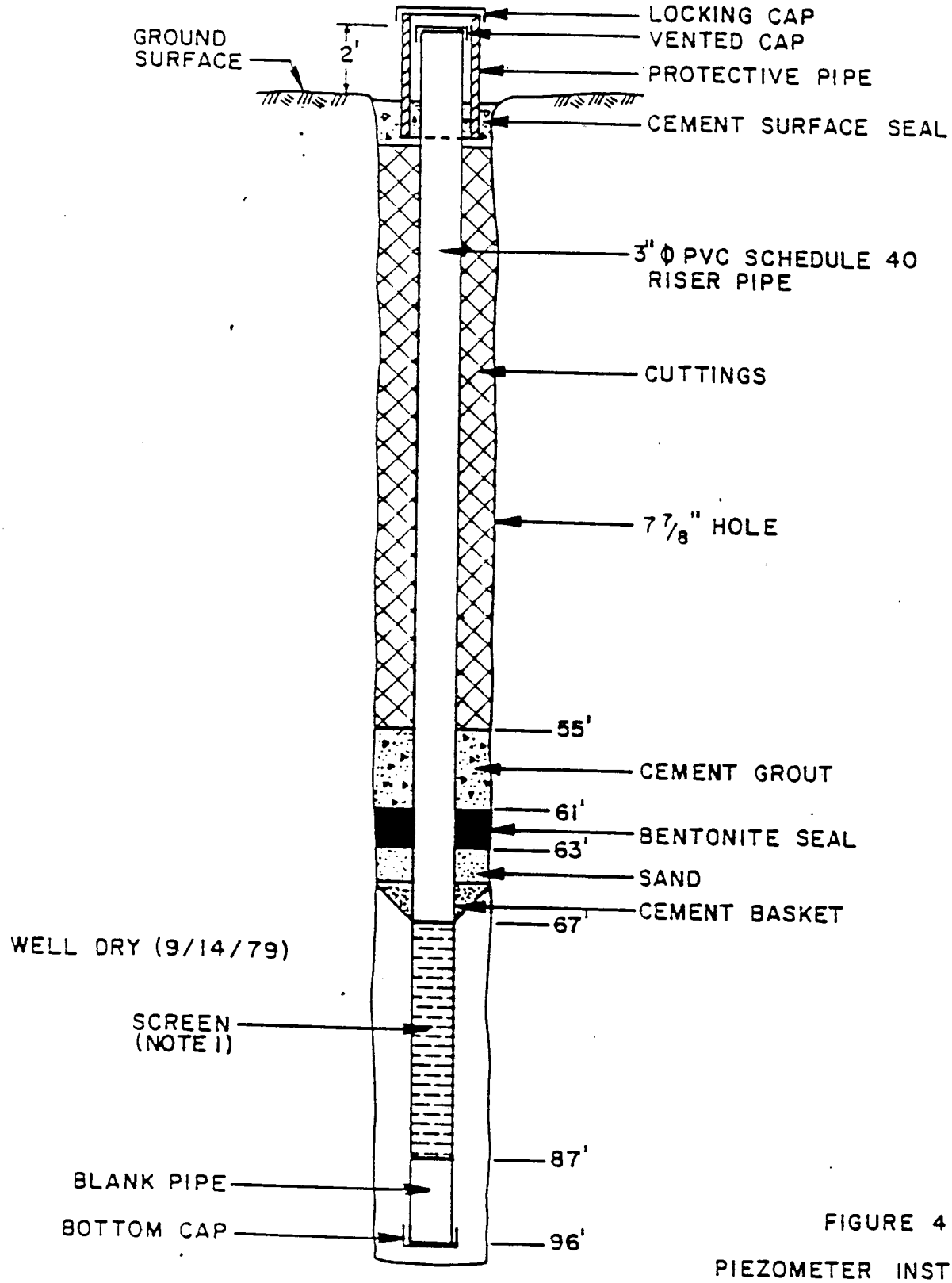
PIEZOMETER INSTALLATION
WELL NO. 2
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

BY B. 9-27-79 CI ED APPROVED BY CE MST 11/16/79 DF IG NUMBER RM10-682-A9

SION: REVISED -20-82 2/23/82



NOT TO SCALE

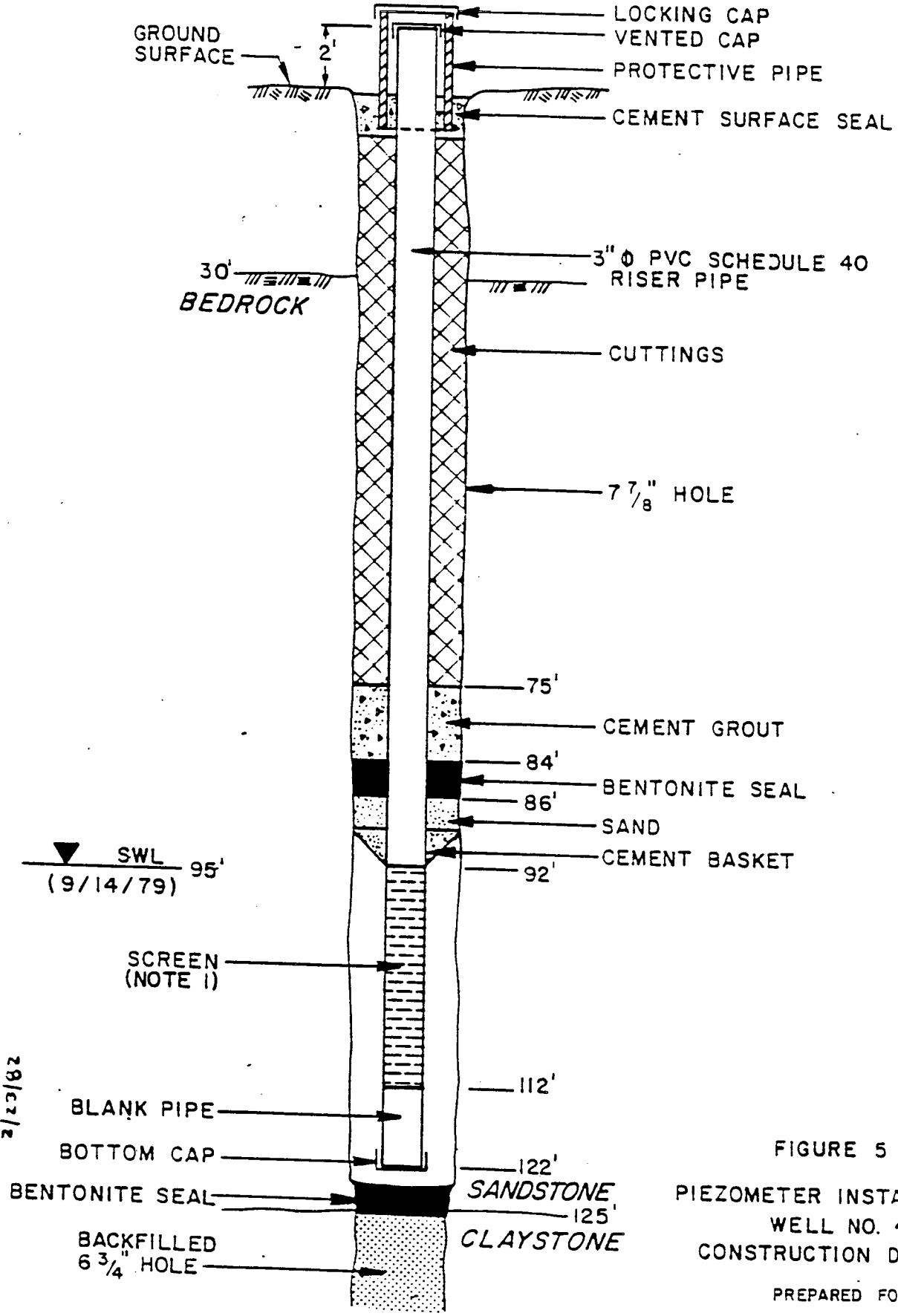
NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

FIGURE 4

PIEZOMETER INSTALLATION
WELL NO. 3
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO



NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

FIGURE 5

PIEZOMETER INSTALLATION
WELL NO. 4
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

D'APPOLONIA

DRAWN B.K.H. 9-28-79 | CHECKED BY CEO 10/29/79 | APPROVED BY MJ 11/1/79 | DRAWING NUMBER RA 682

REVISION: REVISED 2-20-82 CEO 2/23/82

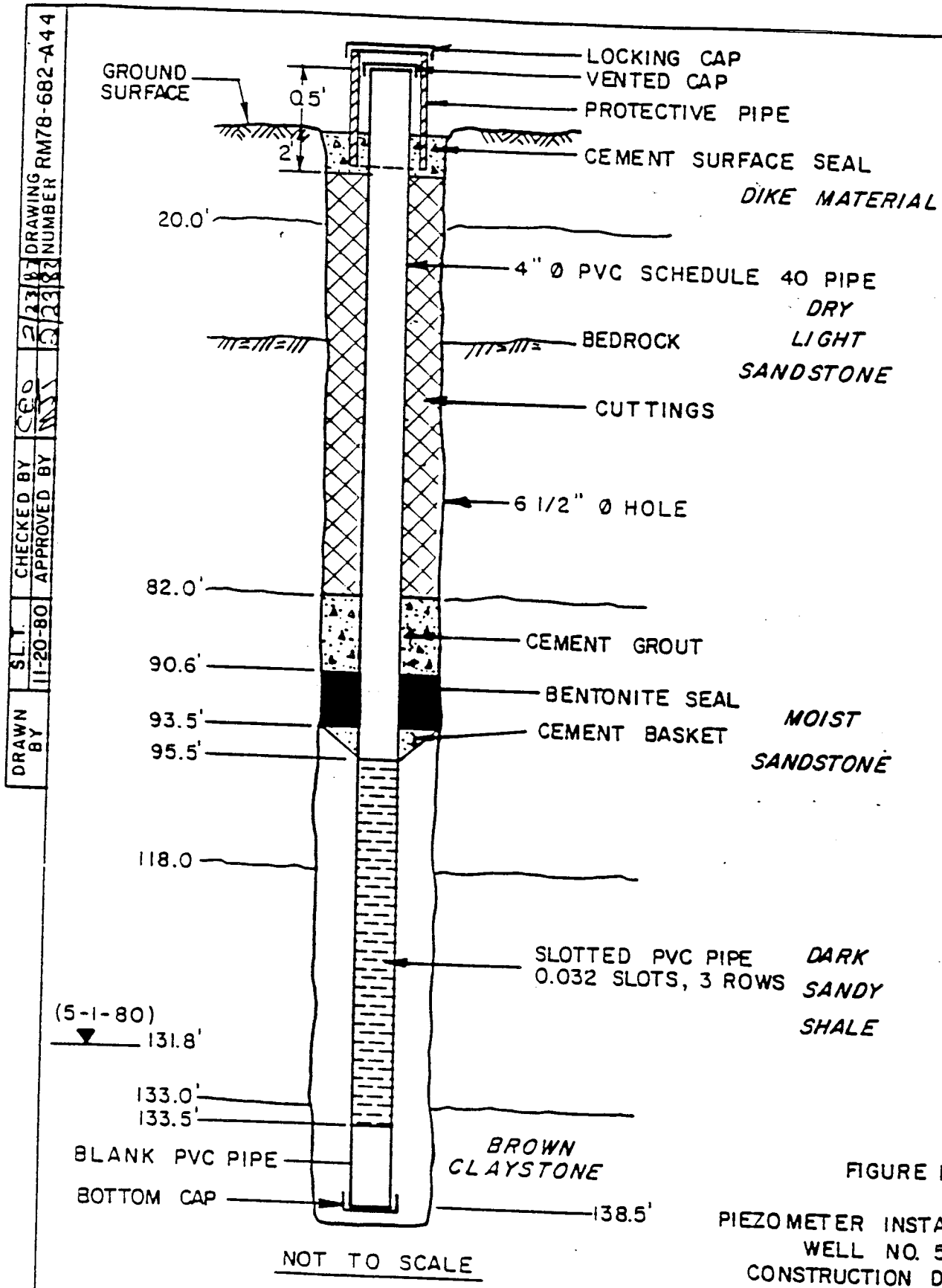


FIGURE 11

PIEZOMETER INSTALLATION
WELL NO. 5
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

D'APPOLONIA

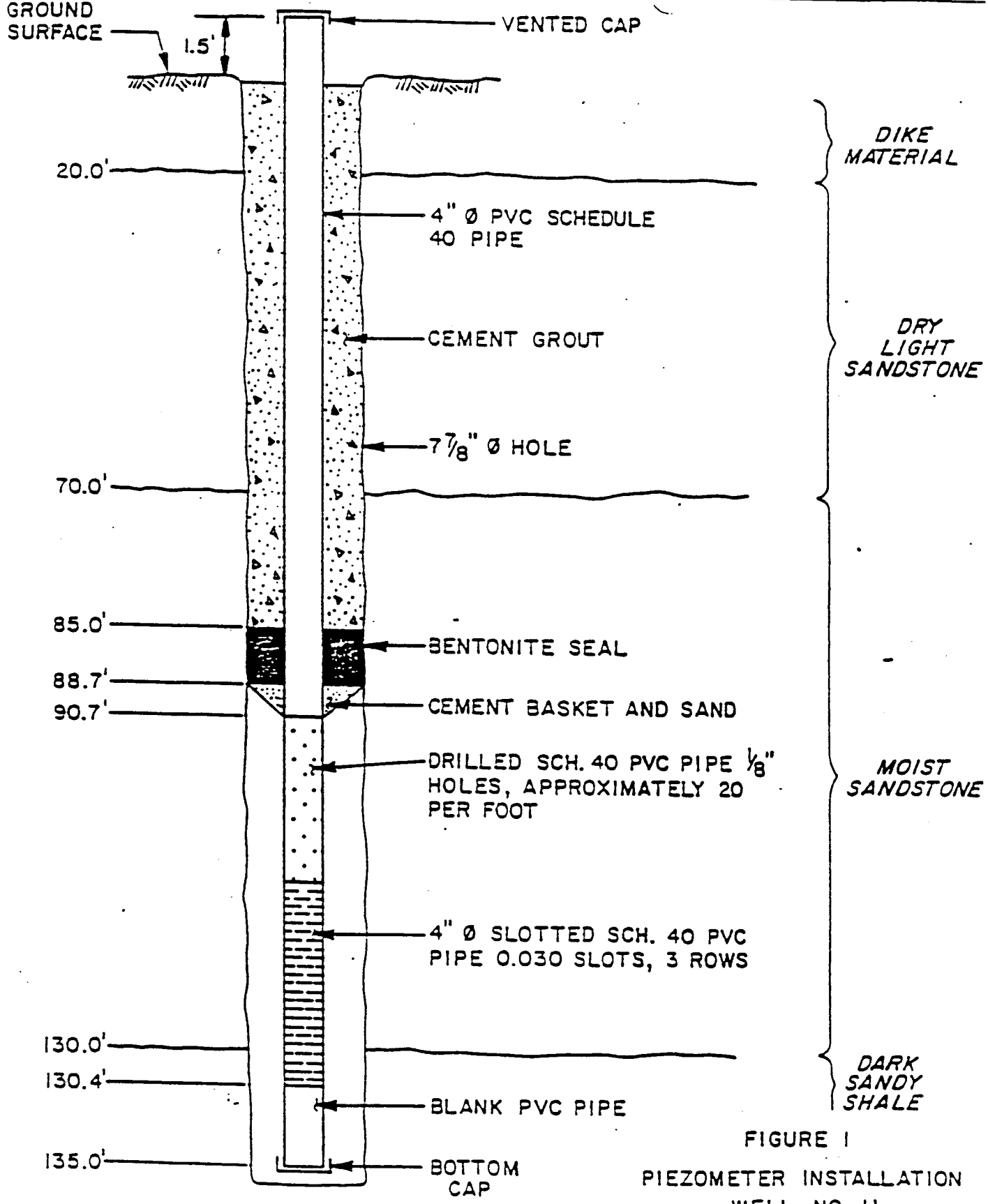


FIGURE 1

PIEZOMETER INSTALLATION
WELL NO. 11
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC
DENVER, COLORADO

2-2039-A1
DRAWING NUMBER
CHECKED BY
APPROVED BY
10-28-82

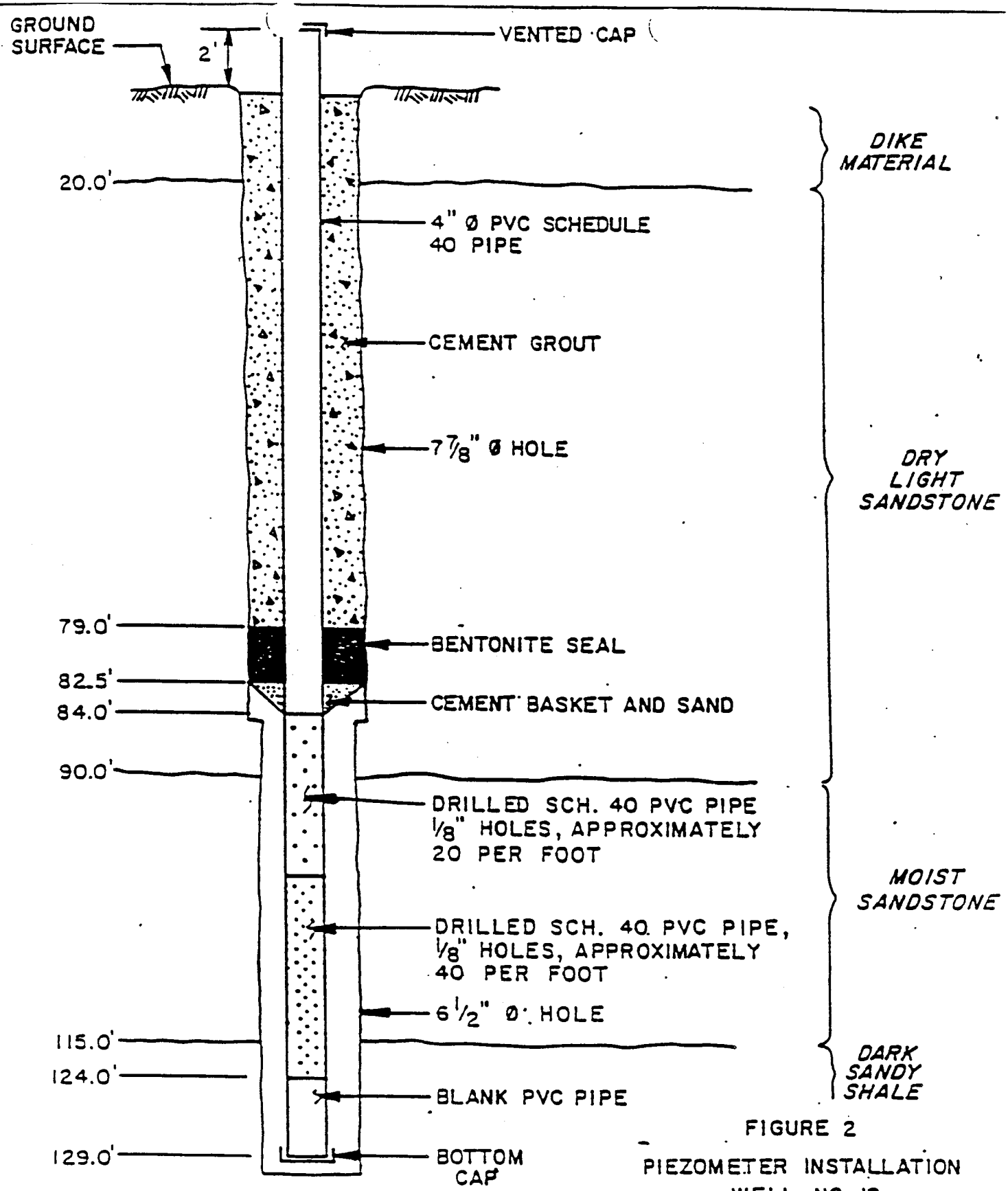


FIGURE 2

PIEZOMETER INSTALLATION
WELL NO. 12
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

NOT TO SCALE

D'APPOLONIA

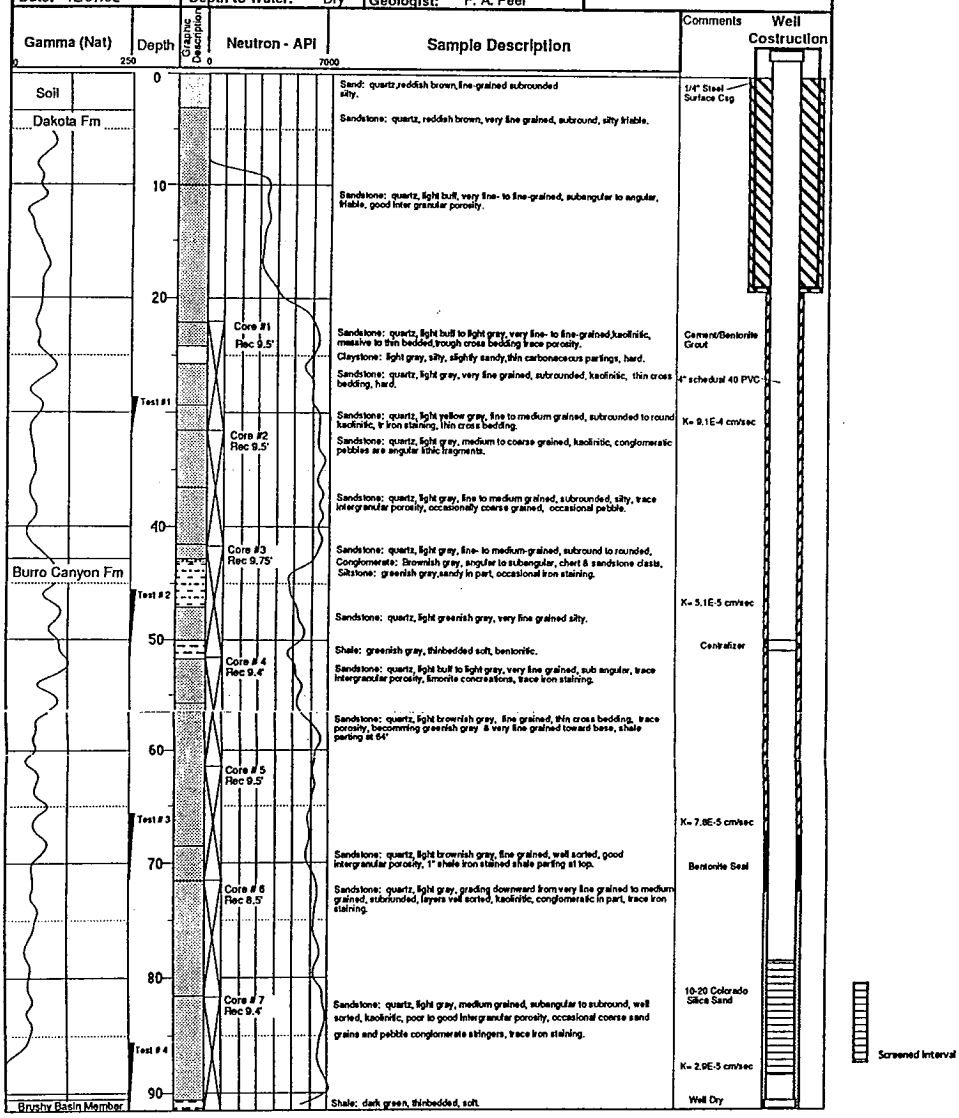
DRA NUMBER 2-2035-A3
DEC. BY
APPROVED BY
10-28-82

PEEL Environmental Services
Arvada, CO (303)422-5116

Bore Hole No. : WMMW-16

Project: White Mesa | Surface Elev. 5588.18 | T. D. = 91.5 | UMETCO Minerals Corporation

Date: 12/07/92 | Depth to Water: Dry | Geologist: F. A. Peel

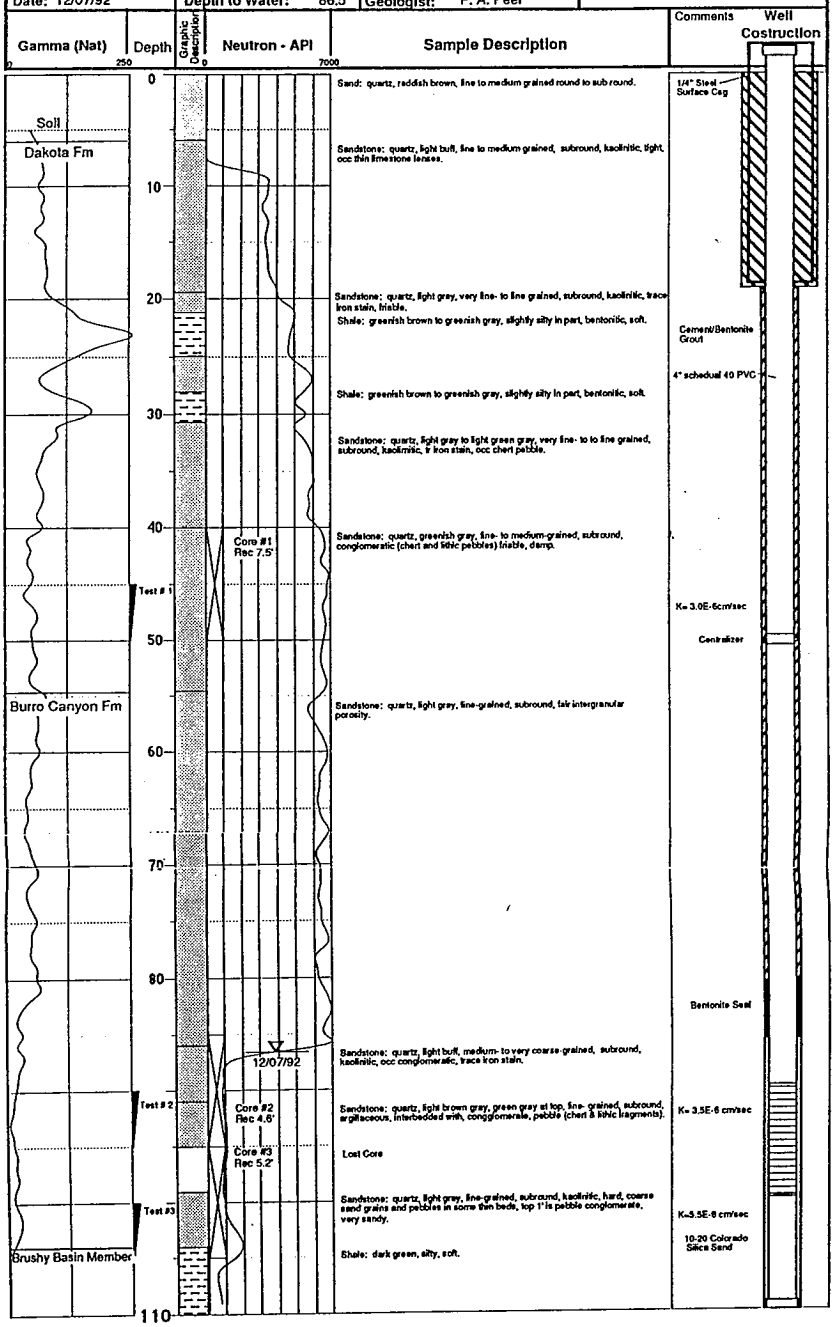


PEEL Environmental Services
Arvada, CO (303)422-5118

Bore Hole No. : WMMW-17

Project: White Mesa | Surface Elev. 5575.06 | T. D. = 110' | UMETCO Minerals Corporation

Date: 12/07/92 | Depth to Water: 86.5' | Geologist: F. A. Peel

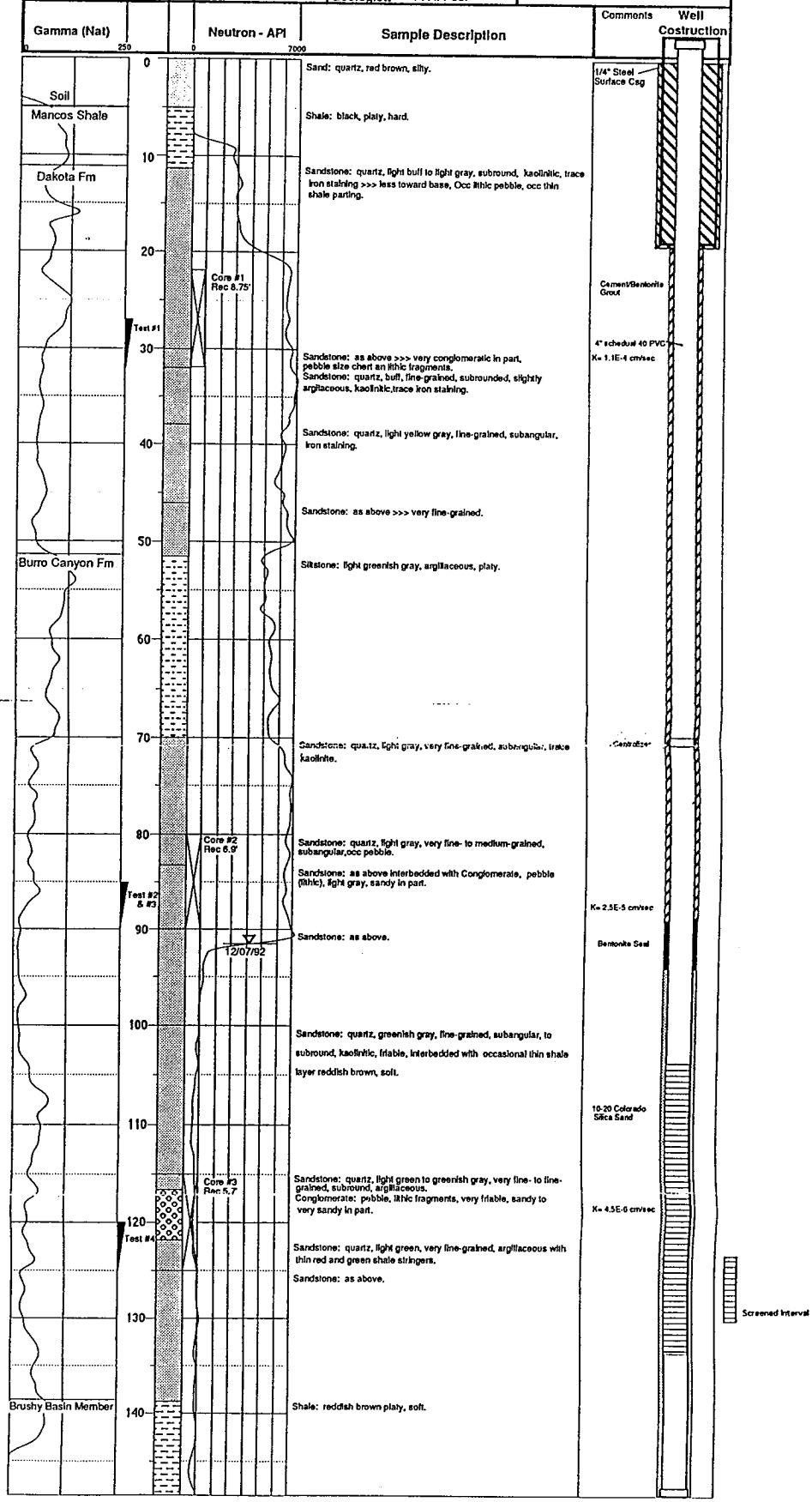


PEEL Environmental Services
Arvada, CO (303)422-5116

Bore Hole No. : WMMW-18

Project: White Mesa | Surface Elev. 5657.58 | T. D. = 148.5' | UMETCO Minerals Corporation

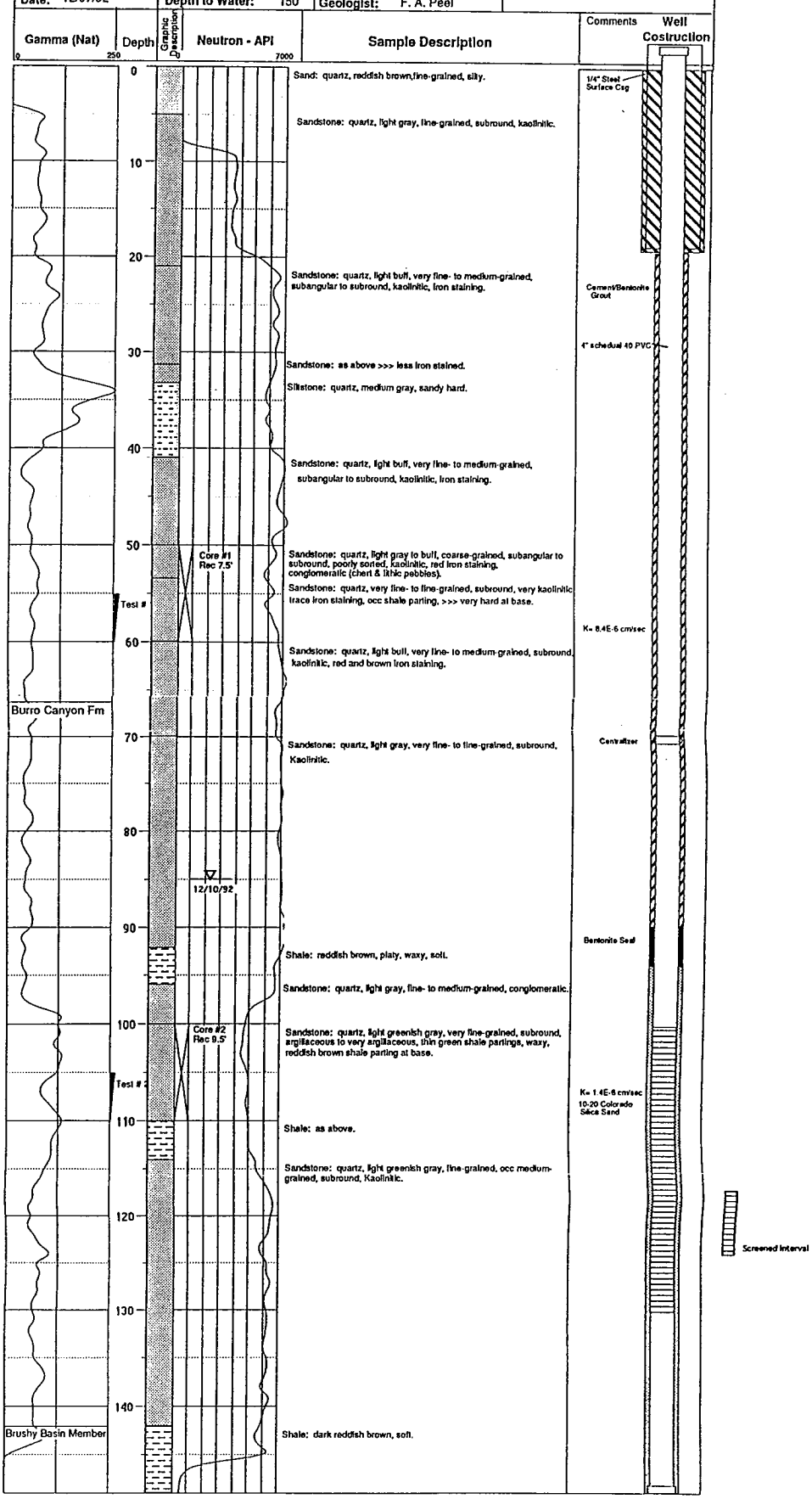
Date: 12/07/92 | Depth to Water: 92' | Geologist: F. A. Peel



PEEL Environmental Services
Arvada, CO (303)422-5116

Bore Hole No. : WMMW-19

Project: White Mesa	Surface Elev. 5655.05	T. D. = 149	UMETCO Minerals Corporation
Date: 12/07/92	Depth to Water: 150	Geologist: F. A. Peel	



Note: well was logged before the well recharged

WW 1

Form 113—5M—12-60

Examined _____

Recorded: B. C. _____ T. B. _____

Inspection Sheet _____

Closed _____

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. _____

Claim No. _____

Coordinate No. _____

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:
Name: Energy Fuels Nuclear, Inc.
Address: Blanding, Utah

(2) LOCATION OF WELL:
County: San Juan Ground Water Basin (leave blank): _____
North 1300 feet, South, East, West 2400 feet from SE Corner
of Section 28 T. 37 S. R. 22 E SLBM (strike out words not needed)

(3) NATURE OF WORK (check): New Well ☒
Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐
If abandonment, describe material and procedure: _____

(4) NATURE OF USE (check):
Domestic ☐ Industrial ☒ Municipal ☐ Stockwater ☐
Irrigation ☐ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check):
Rotary ☒ Dug ☐ Jetted ☐
Cable ☐ Driven ☐ Bored ☐

(6) CASING SCHEDULE: Threaded ☐ Welded ☐
10" Diam. from 0 feet to 1040 feet Gage .250
6" Diam. from 830 feet to 1700 feet Gage 180
" Diam. from _____ feet to _____ feet Gage _____
New ☐ Reject ☐ Used ☐

(7) PERFORATIONS: Perforated? Yes ☒ No ☐
Type of perforator used _____
Size of perforations 3/16 inches by 3 inches
7,140 perforations from 1030 feet to 1700 feet
perforations from _____ feet to _____ feet
perforations from _____ feet to _____ feet
perforations from _____ feet to _____ feet
perforations from _____ feet to _____ feet

(8) SCREENS: Well screen installed? Yes ☐ No ☒
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____
Diam. _____ Slot size _____ Set from _____ ft. to _____

(9) CONSTRUCTION:
Was well gravel packed? Yes ☐ No ☒ Size of gravel: _____
Gravel placed from _____ feet to _____ feet
Was a surface seal provided? Yes ☒ No ☐
To what depth? 120 feet
Material used in seal: Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water: _____ Depth of strata _____
Method of sealing strata off: _____

Was surface casing used? Yes ☐ No ☐
Was it cemented in place? Yes ☐ No ☐

(10) WATER LEVELS:
Static level 127 feet below land surface Date _____
Artesian pressure _____ feet above land surface Date _____

LOG RECEIVED:

(11) FLOWING WELL:
Controlled by (check) Valve ☐
Cap ☐ Plug ☐ No Control ☐
Does well leak around casing? Yes ☐
No ☐

(12) WELL TESTS: Drawdown is the distance in feet the water level is lowered below static level.
Was a pump test made? Yes ☒ No ☐ If so, by whom: Energy Fuels Nucle
Yield: 223 gal./min. with 353 feet drawdown after 1.6 hours
" _____ " _____ " _____ " _____
" _____ " _____ " _____ " _____
Bailer test _____ gal./min. with _____ feet drawdown after _____ hours
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? No ☐ Yes ☒

(13) WELL LOG: Diameter of well 12¼ inches
Depth drilled 1870 feet. Depth of completed well 1870 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other	REMARKS
0	8	x										Red
8	25										x	Sandstone Green
25	50										x	Yellow
50	78	x									x	White Clay Lenses
78	88											Shale Blue Gray
88	131											Mud Stone
131	360										x	Blue Gray
360	486											Lime
486	501		x								x	Gray Dark SS
501	580	x										Blue Gray
580	625	x										Red Mud Stone
625	705										x	White Sandstone
705	738	x										Red Shale
738	750											Brown
750	825	x									x	White SS/White Clay
825	857											Multi-color Shale
857	909	x										Shale Red
909	939		x									Silt Stone W/B
939	1038	x	x									Red
1038	1060	x									x	Red SS/B/W/R Clay
1060	1090	x										Mud Stone
1090	1200	x										Red Mud Stone
1200	1250	x										Red White Blue Mud Stone
1250	1296											Red Mud Stone
1296	1840	x									x	White SS / Clay Lenses
1840	1860	x										Red Shale

Work started August 3 1979 Completed September 26 1979

(14) PUMP:
Manufacturer's Name _____
Type: _____ H. P. _____
Depth to pump or bowls _____ feet

Well Driller's Statement:
This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.
Name GRIMSHAW DRILLING INC. (Person, firm, or corporation) (Type or print)
Address 4922 North 600 East - Cedar City, Utah 847
(Signed) [signature] (Well Driller)
License No. 240 Date _____, 19__

USE OTHER SIDE FOR ADDITIONAL REMARKS

Examined _____
Recorded: B. C. _____ T. B. _____
Inspection Sheet _____
Copied _____

WW#2

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. 47913 (22-2231)
Claim No. _____
Coordinate No. _____

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:
Name: Energy Fuels Nuclear
Address: Blanding, Utah

(2) LOCATION OF WELL:
County: San Juan Ground Water Basin (leave blank): _____
North 2100 feet, West 2200 feet from SE Corner of Section 28 T. 37 S. R. 22 E SLBM (strike out words not needed)

(3) NATURE OF WORK (check): New Well ☐
Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐
If abandonment, describe material and procedure: _____

(4) NATURE OF USE (check):
Domestic ☐ Industrial ☒ Municipal ☐ Stockwater ☐
Irrigation ☐ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check):
Rotary ☒ Dug ☐ Jetted ☐
Cable ☐ Driven ☐ Bored ☐

(6) CASING SCHEDULE: Threaded ☐ Welded ☐
10" Diam. from 0 feet to 1250 feet Gage 250
" Diam. from _____ feet to _____ feet Gage _____
" Diam. from _____ feet to _____ feet Gage _____
New ☒ Reject ☐ Used ☐

(7) PERFORATIONS: Perforated? Yes ☐ No ☐
Type of perforator used _____
Size of perforations _____ inches by _____ inches
_____ perforations from _____ feet to _____ feet
_____ perforations from _____ feet to _____ feet
_____ perforations from _____ feet to _____ feet
_____ perforations from _____ feet to _____ feet
_____ perforations from _____ feet to _____ feet

(8) SCREENS: Well screen installed? Yes ☐ No ☐
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____
Diam. _____ Slot size _____ Set from _____ ft. to _____

(9) CONSTRUCTION:
Was well gravel packed? Yes ☒ No ☐ Size of gravel 3/8 to 3/4
Gravel placed from 100 feet to 1250 feet
Was a surface seal provided? Yes ☒ No ☐
To what depth? 100 feet
Material used in seal: Cement
Did any strata contain unusable water? Yes ☐ No ☐
Type of water: _____ Depth of strata _____
Method of sealing strata off: _____

Was surface casing used? Yes ☐ No ☒
Was it cemented in place? Yes ☐ No ☐

(10) WATER LEVELS:
Static level 450 feet below land surface Date _____
Artesian pressure _____ feet above land surface Date _____

LOG RECEIVED:

(11) FLOWING WELL:
Controlled by (check) Valve ☐
Yes ☐ Flow ☐ No Control ☐
Does water leak around casing? Yes ☐
No ☐

(12) WELL TESTS: Drawdown is the distance in feet the water level is lowered below static level.
Was a pump test made? Yes ☐ No ☒ If so, by whom? _____
Yield: _____ gal./min. with _____ feet drawdown after _____ hours
" _____ " _____ " _____ "
" _____ " _____ " _____ "
Bailer test _____ gal./min. with _____ feet drawdown after _____ hours
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? No ☐ Yes ☐

(13) WELL LOG: Diameter of well 15 inches
Depth drilled 1885 feet. Depth of completed well 1885 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other Sandstone	REMARKS
0	25	X									X	Red & Green
25	80	X									X	White Grey-Blue Green
80	150	X									X	Mud Stone-Blue Grey
150	400										X	Blue Grey Sandstone
400	580	X									X	Blue Green Limestone/cl
580	650	X										
			5% Limestone-Shale - Red mudstone									
650	750	X									X	Blue Green Limestone
			Sandstone with Red Clay Lenses									
750	900										X	Mud Stone - Brown
900	1200	X									X	80% clay 15% Sandstone
			5% shale									
1200	1250	X									X	50% Red Clay-50% White Sandstone
1250	1290	X									X	Red Clay-Red Sandstone
1290	1885										X	White Sandstone
Note			0' to 1250' is 15 inch hole									
			Casing set to 1250'									
9-7/8		Open hole from 1250' to 1885'										

Work started Oct. 10, 19 79 Completed Feb. 18, 19 80

(14) PUMP:
Manufacturer's Name _____
Type: _____ H. P. 10 HP
Depth to pump or bowls _____ feet

Well Driller's Statement:
This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.

Name [illegible] Drilling Inc. (Person, firm, or corporation) (Type or print)
Address [illegible] Salt Lake City, Utah [illegible]
(Signed) [illegible] (Well Driller)
License No. [illegible] Date March [illegible], 19 [illegible]

USE OTHER SIDE FOR ADDITIONAL REMARKS

Form 113—SM—1260

Examined .....
Recorded: B. C. ..... T. B. .....
Inspection Sheet .....
Copied .....

WW3

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. 47243 (09-689)
Claim No. .....
Coordinate No. .....

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:
Name Energy Fuels Nuclear, Inc.
Address Blanding, UT 84511

(2) LOCATION OF WELL:
County San Juan Ground Water Basin ..... (leave blank)
North ~~XXX~~ 1400 feet, ~~XX~~ West 3000 feet from SE Corner of Section 28, T. 37 ~~X~~ S, R. 22 E SLBM ~~X NSM~~ (strike out words not needed)

(3) NATURE OF WORK (check): New Well ☒
Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐
If abandonment, describe material and procedure: .....

(4) NATURE OF USE (check):
Domestic ☐ Industrial ☒ Municipal ☐ Stockwater ☐
Irrigation ☐ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check):
Rotary ☒ Dug ☐ Jetted ☐
Cable ☐ Driven ☐ Bored ☐

(6) CASING SCHEDULE: Threaded ☐ Welded ☒
8 " Diam. from 10 feet to 1250 feet Gage 337
" Diam. from ..... feet to ..... feet Gage .....
" Diam. from ..... feet to ..... feet Gage .....
New ☐ Reject ☐ Used ☐

(7) PERFORATIONS: Perforated? Yes ☐ No ☒
Type of perforator used .....
Size of perforations ..... inches by ..... inches
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet

(8) SCREENS: Well screen installed? Yes ☐ No ☒
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... Set from ..... ft. to .....
Diam. ..... Slot size ..... Set from ..... ft. to .....

(9) CONSTRUCTION:
Was well gravel packed? Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... feet to ..... feet
Was a surface seal provided? Yes ☒ No ☐
To what depth? 1250 feet
Material used in seal: Cement
Did any strata contain unusable water? Yes ☐ No ☒
Type of water: ..... Depth of strata .....
Method of sealing strata off: .....

Was surface casing used? Yes ☐ No ☒
Was it cemented in place? Yes ☐ No ☐

(10) WATER LEVELS:
Static level 605 feet below land surface Date 8-3-80
Artesian pressure ..... feet above land surface Date .....

LOG RECEIVED:

(11) FLOWING WELL:
Controlled by (check) Valve ☐
Cap ☐ Plug ☐ No Control ☐
Does well leak around casing? Yes ☐
No ☒

(12) WELL TESTS: Drawdown is the distance in feet the water level is lowered below static level.
Was a pump test made? Yes ☒ No ☐ If so, by whom? Energy Fuels
Yield: 245 gal./min. with 315 feet drawdown after 2 hours
" " " " " "
Bailer test ..... gal./min. with ..... feet drawdown after ..... hours
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? No ☐ Yes ☐

(13) WELL LOG: Diameter of well 12¼" to 1250' & 6" to 1850' inches
Depth drilled 1850 feet. Depth of completed well 1850 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other	REMARKS
0	25	X										Brown Shale
25	70										X	Sandstone
70	100										X	Shale & Sandstone
100	350										X	Shale & Mudstone
350	470										X	Limestone
470	570		X									Gray Sandstone
570	600	X										Red Shale
600	710										X	Sandstone
710	750	X										Red Shale
750	830										X	Sandstone & Shale
830	920	X										Red & Gray Shale
920	1040										X	Red & White Sandstone
1040	1200	X										Red Mudstone
1200	1300										X	Red & Blue Shale
1300	1850										X	Red &White Sandstone

Work started June 24, 1980 Completed July 28, 1980

(14) PUMP:
Manufacturer's Name .....
Type: ..... H. P. .....
Depth to pump or bowles ..... feet

Well Driller's Statement:
This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.
Name Ormsbee Drilling Co., Inc. (Person, firm, or corporation) (Type or print)
Address 4261 Graham St., Boulder, CO 80303
(Signed) ..... (Well Driller)
License No. 624 (Colo) Date August 7, 1980

USE OTHER SIDE FOR ADDITIONAL REMARKS

WELL #4

WW4

Form 113—9M—12-60

Examined ..... Recorded: B. C. ..... T. B. ..... Inspection Sheet ..... Filed .....

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. A10906 (09-699)
Claim No. .....
Coordinate No. .....

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:
Name Energy Fuels Nuclear, Inc.
Address Blanding, UT 84511

(2) LOCATION OF WELL:
County San Juan Ground Water Basin ..... (leave blank)
North 1000 feet, East 650 feet from SW Corner NW
Section 22, T 37 S, R 22 E SLBM (strike out words not needed)

(3) NATURE OF WORK (check):
New Well ☒ Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐
If abandonment, describe material and procedure: .....

(4) NATURE OF USE (check):
Domestic ☐ Industrial ☒ Municipal ☐ Stockwater ☐
Irrigation ☐ Mining ☐ Other ☐ Test Well ☐

(5) TYPE OF CONSTRUCTION (check):
Rotary ☒ Dug ☐ Jetted ☐
Cable ☐ Driven ☐ Bored ☐

(6) CASING SCHEDULE:
Threaded ☐ Welded ☒
5 5/8" Diam. from 0 feet to 1250 feet Gage .337
..." Diam. from ..... feet to ..... feet Gage .....
..." Diam. from ..... feet to ..... feet Gage .....
New ☐ Reject ☐ Used ☐

(7) PERFORATIONS:
Perforated? Yes ☐ No ☒
Type of perforator used .....
Size of perforations ..... inches by ..... inches
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet
..... perforations from ..... feet to ..... feet

(8) SCREENS:
Well screen installed? Yes ☐ No ☒
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... Set from ..... ft. to .....
Diam. ..... Slot size ..... Set from ..... ft. to .....

(9) CONSTRUCTION:
Was well gravel packed? Yes ☐ No ☒ Size of gravel: .....
Gravel placed from ..... feet to ..... feet
Was a surface seal provided? Yes ☒ No ☐
To what depth? 125 feet
Material used in seal: Concrete
Did any strata contain unusable water? Yes ☐ No ☒
Type of water: ..... Depth of strata .....
Method of sealing strata off: .....

Was surface casing used? Yes ☐ No ☒
Was it cemented in place? Yes ☐ No ☐

(10) WATER LEVELS:
Static level 260 feet below land surface Date 11-3-80
Artesian flow ..... feet above land surface Date .....

LOG RECEIVED:

(11) FLOWING WELL:
Controlled by (check) Valve ☐ Cap ☐ Plug ☐ No Control ☐
Does well leak around casing? Yes ☐ No ☐

(12) WELL TESTS:
Drawdown is the distance in feet the water level is lowered below static level.
Was a pump test made? Yes ☒ No ☐ If so, by whom? Energy Fuels
Yield: 238 gal./min. with 890 feet drawdown after 48 hours
" ..... " ..... " ..... " .....
" ..... " ..... " ..... " .....
Bailer test ..... gal./min. with ..... feet drawdown after ..... hours
Artesian flow ..... g.p.m. Date .....
Temperature of water ..... Was a chemical analysis made? No ☐ Yes ☐

(13) WELL LOG:
Diameter of well 12 1/4" to 1250' & 6" to 1820' inches
Depth drilled 1820 feet. Depth of completed well 1820 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt STONE	Sand STONE	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	MUDSTONE	REMARKS
0	120			X								Dakota Formation
120	740		X								X	Brushy Basin
740	800			X							X	Brushy Basin & Silt Wash
800	940			X								Silt Wash
940	980										X	" "
980	1020		X	X								" "
1020	1050		X								X	" "
1050	1100			X								" "
1100	1240										X	" "
1240	1300		X									Summerville
1300	1480			X								Entrada
1480	1720			X								Navaho
1720	1820			X								Windgate

Work started Sept. 24, 1980 Completed Oct. 24, 1980

(14) PUMP:
Manufacturer's Name .....
Type: ..... H. P. .....
Depth to pump or bowles ..... feet

Well Driller's Statement:
This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.

Name Christensen Drilling Co., Inc. (Person, firm, or corporation) (Type or print)
Address 4251 Greenway Dr., Boulder, CO 80303
(Signed) [signature] (Well Driller)
License No. 355 Colo. Date Nov. 13, 1980

USE OTHER SIDE FOR ADDITIONAL REMARKS

Form 113—3M—12-60

Examined _____

Recorded: B. C. _____ T. B. _____

Inspection Sheet _____

Copied _____

WW5

REPORT OF WELL DRILLER
STATE OF UTAH

Application No. A 9198

Claim No. _____

Coordinate No. _____

GENERAL STATEMENT: Report of well driller is hereby made and filed with the State Engineer, in accordance with the laws of Utah. (This report shall be filed with the State Engineer within 30 days after the completion or abandonment of the well. Failure to file such reports constitutes a misdemeanor.)

(1) WELL OWNER:

Name Energy Fuels Ltd.

Address Denver, Colorado

(2) LOCATION OF WELL:

County San Juan Ground Water Basin (leave blank) _____ SECond

North 6040 feet, East 2000 feet from S W Corner

Of Section 27 T 37 N, R 22 E SLBM (strike out words not needed)

(3) NATURE OF WORK (check): New Well X

Replacement Well ☐ Deepening ☐ Repair ☐ Abandon ☐

If abandonment, describe material and procedure: _____

(4) NATURE OF USE (check):

Domestic ☐ Industrial X Municipal ☐ Stockwater ☐

Irrigation ☐ Mining ☐ Other ☐ Test Well X

(5) TYPE OF CONSTRUCTION (check):

Rotary X Dug ☐ Jetted ☐

Cable ☐ Driven ☐ Bored ☐

(6) CASING SCHEDULE: Threaded ☐ Welded ☐

6" Diam. from 0 feet to 1250 feet Gage ¼"

_____" Diam. from _____ feet to _____ feet Gage _____

_____" Diam. from _____ feet to _____ feet Gage _____

New ☐ Reject ☐ Used ☐

(7) PERFORATIONS: Perforated? Yes ☐ No X

Type of perforator used _____

Size of perforations _____ inches by _____ inches

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

_____ perforations from _____ feet to _____ feet

(8) SCREENS: Well screen installed? Yes ☐ No X

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ Set from _____ ft. to _____

Diam. _____ Slot size _____ Set from _____ ft. to _____

(9) CONSTRUCTION:

Was well gravel packed? Yes ☐ No X Size of gravel: _____

Gravel placed from _____ feet to _____ feet

Was a surface seal provided? Yes X No ☐

To what depth? 18' feet

Material used in seal: Concrete

Did any strata contain unusable water? Yes ☐ No X

Type of water: _____ Depth of strata _____

Method of sealing strata off: _____

Was surface casing used? Yes ☐ No X

Was it cemented in place? Yes ☐ No ☐

(10) WATER LEVELS:

Static level 387 feet below land surface Date 1-19-77

Artesian pressure _____ feet above land surface Date _____

LOG RECEIVED:

(11) FLOWING WELL:

Controlled by (check) Valve ☐

Cap ☐ Plug ☐ No Control ☐

Does well leak around casing? Yes ☐ No ☐

(12) WELL TESTS: Drawdown is the distance in feet the water level is lowered below static level.

Was a pump test made? Yes X No ☐ If so, by whom? W. E. Hoggard Jr.

Yield: 120 gal./min. with 377 feet drawdown after 1½ hours

" _____ " _____ " _____ "

" _____ " _____ " _____ "

Bailer test _____ gal./min. with _____ feet drawdown after _____ hours

Artesian flow _____ g.p.m. Date _____

Temperature of water 70 Was a chemical analysis made? No X Yes ☐

(13) WELL LOG: Diameter of well 8" to 260 6" to 1800' inches

Depth drilled 1800 feet. Depth of completed well 1800 feet.

NOTE: Place an "X" in the space or combination of spaces needed to designate the material or combination of materials encountered in each depth interval. Under REMARKS make any desirable notes as to occurrence of water and the color, size, nature, etc., of material encountered in each depth interval. Use additional sheet if needed.

DEPTH From	DEPTH To	Clay	Silt	Sand	Gravel	Cobbles	Boulders	Hardpan	Conglomerate	Bedrock	Other	REMARKS
0	5											Soil
6	27	X										Green Shale
28	230		X							X		Br. SS Dakota Formation
230	325	X										Green Shale with Lime
												very hard
326	760									X		Red & Green Shale with
												SS lenses med. hard
761	817		X									White SS Westwater Sand
												some water
818	890	X										Summerville shale& SS
891	910		X									Pink SS & Shale Curtis
												formation
911	1217		X									Red SS Entrada Formatio:
1218	1247		X									White SS top of NavajoS:
1250												Ser 6 5/8" OD casing to
												1250'
1251	1800		X									White SS. Navajo SS.
												(water)

Work started Dec. 6 1976 Completed Jan 19 1977

(14) PUMP:

Manufacturer's Name Reda

Type: Submergible H. P. 40

Depth to pump or bowles 790 feet

Well Driller's Statement:

This well was drilled under my supervision, and this report is true to the best of my knowledge and belief.

Name W. E. Hoggard Jr. (Person, firm, or corporation) (Type or print)

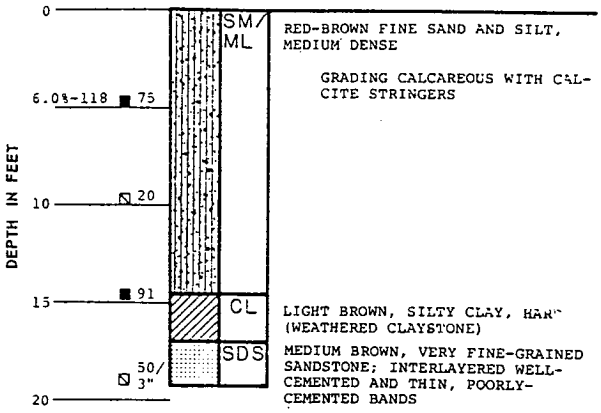
Address P.O. Box 373 Blanding, Utah 84511

(Signed) _____ (Well Driller)

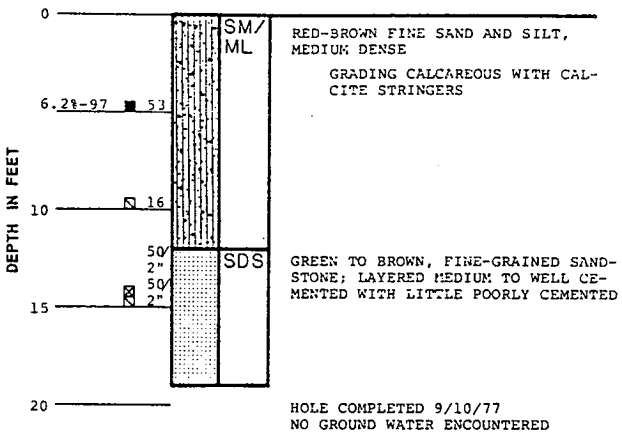
License No. 315 Date Feb. 23 1977

USE OTHER SIDE FOR ADDITIONAL REMARKS

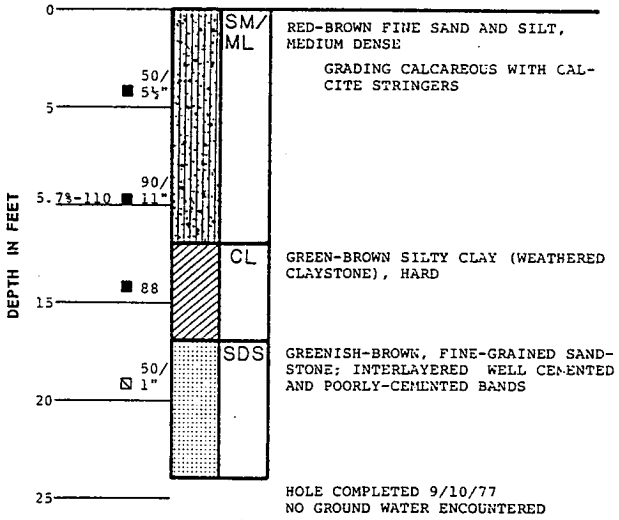
BORING NO. 1
EL. 5629.0 FT.



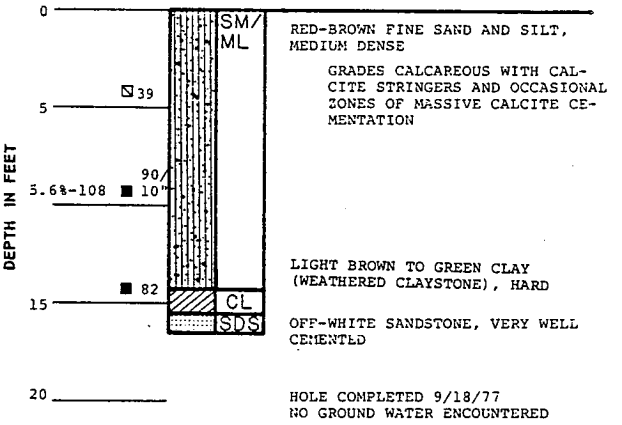
BORING NO. 5
EL. 5632.9 FT.



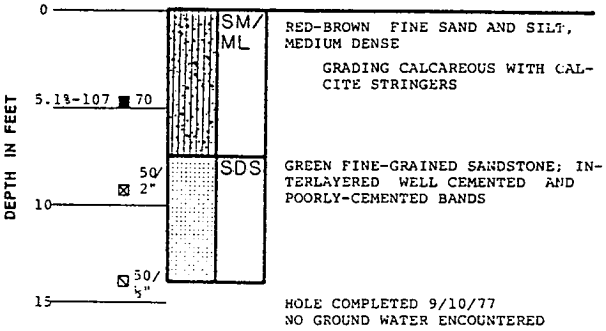
BORING NO. 2
EL. 5634.3 FT.



BORING NO. 6
EL. 5633.5 FT.



BORING NO. 4
EL. 5623.2 FT.



KEY

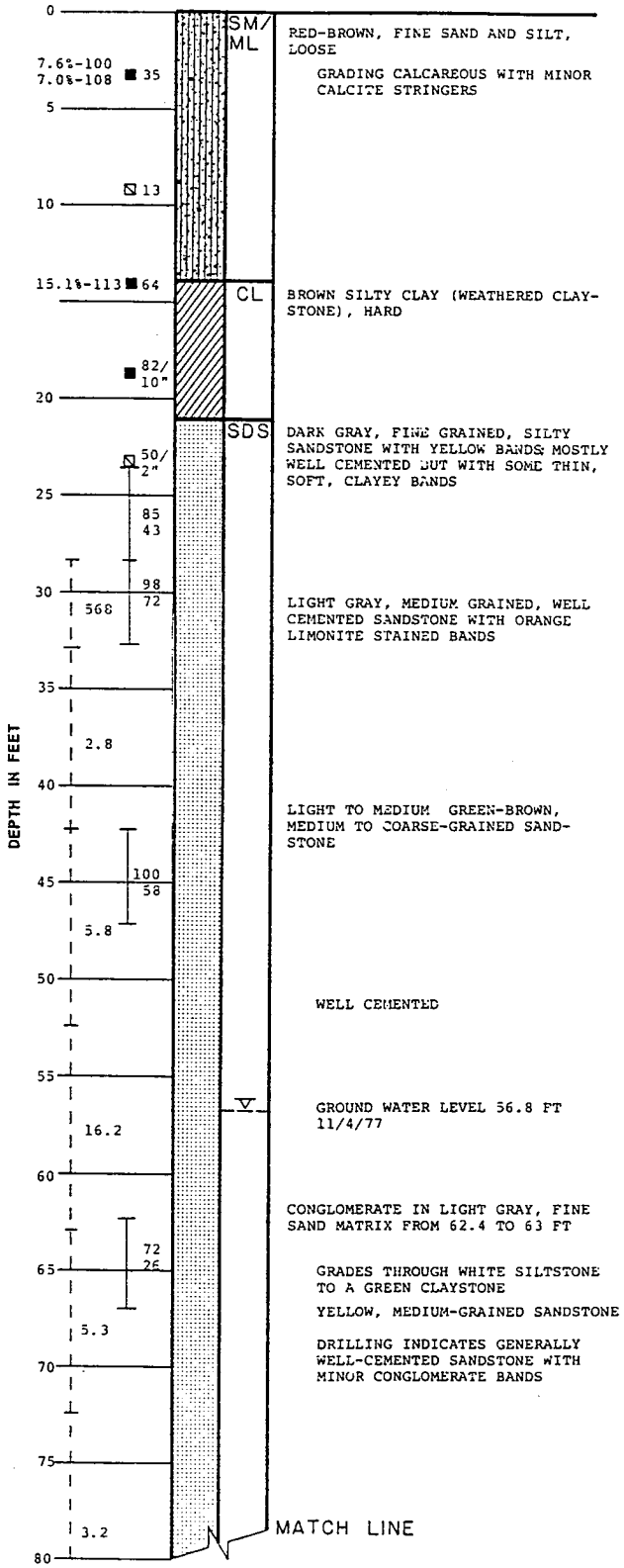
A-B ■ C	INDICATES DEPTH AT WHICH UNDISTURBED SAMPLE WAS EXTRACTED USING DAMES & MOORE SAMPLER
⊠ C	INDICATES DEPTH AT WHICH DISTURBED SAMPLE WAS EXTRACTED USING DAMES & MOORE SAMPLER
□ C	INDICATES SAMPLE ATTEMPT WITH NO RECOVERY
⊠ C	INDICATES DEPTH AT WHICH DISTURBED SAMPLE WAS EXTRACTED USING STANDARD PENETRATION TEST SAMPLER
A	FIELD MOISTURE EXPRESSED AS A PERCENTAGE OF THE DRY WEIGHT OF SOIL
B	DRY DENSITY EXPRESSED IN LBS/CU FT
C	BLOWS/FT OF PENETRATION USING A 140-LB HAMMER DROPPING 30 INCHES
D, E	INDICATES NC CORE RUN
D	PERCENT OF CORE RECOVERY
E	RQD*
F	INDICATES PACKER TEST SECTION
F	PERMEABILITY MEASURED BY SINGLE PACKER TEST IN FT/YR
NA	NOT APPLICABLE (USED FOR RQD IN CLAYS OR MECHANICALLY FRACTURED ZONES)
NOTE:	ELEVATIONS PROVIDED BY ENERGY FUELS NUCLEAR, INC.

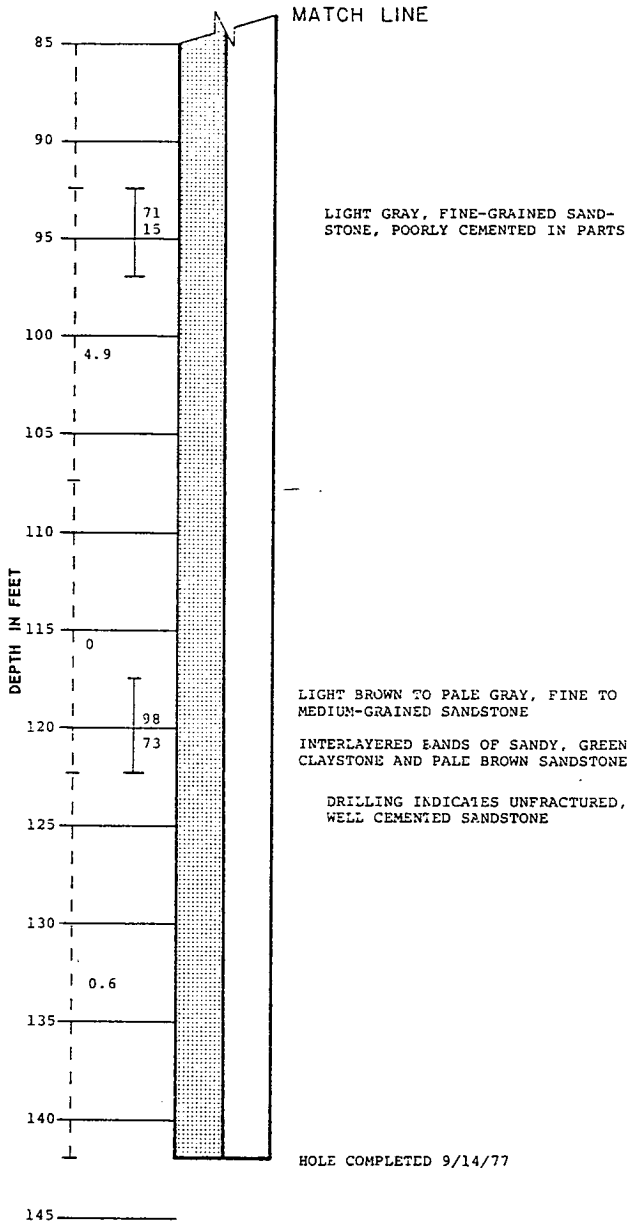
* ROCK QUALITY DESIGNATION -- PERCENTAGE OF CORE RECOVERED IN LENGTHS GREATER THAN 4 INCHES

LOG OF BORINGS

DAMES & MOORE

BORING NO. 3
EL. 5634.4 FT.

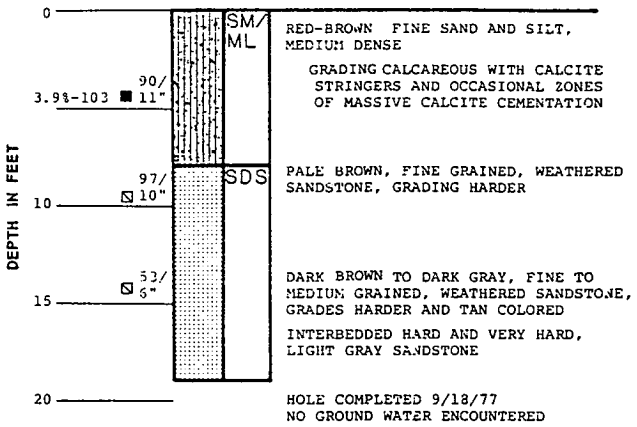




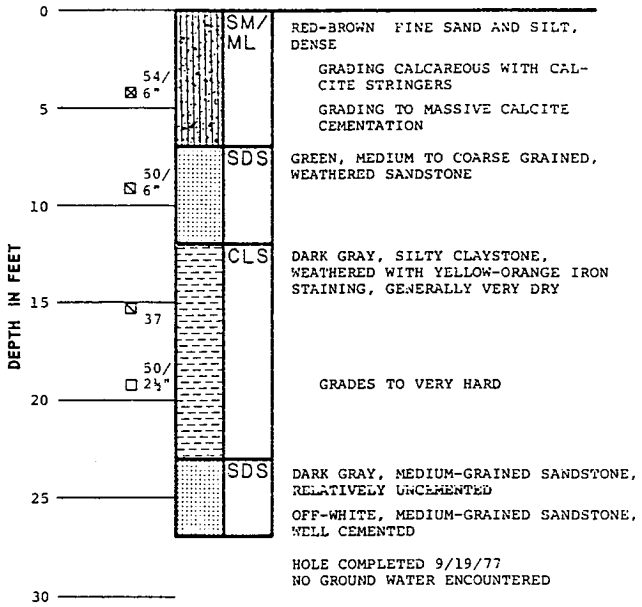
LOG OF BORINGS

DAMES & MOORE

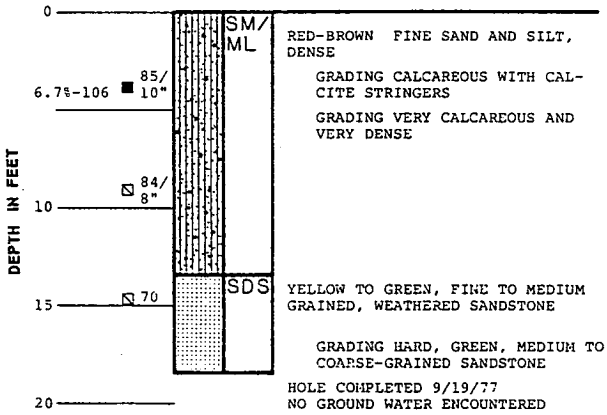
BORING NO. 7
EL. 5656.9 FT.



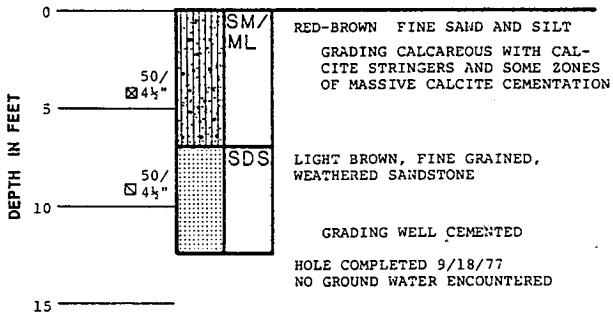
BORING NO. 8
EL. 5668.4 FT.



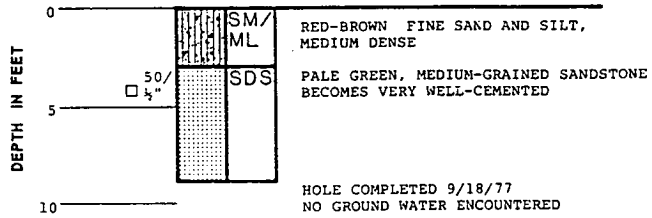
BORING NO. 10
EL. 5690.9 FT.



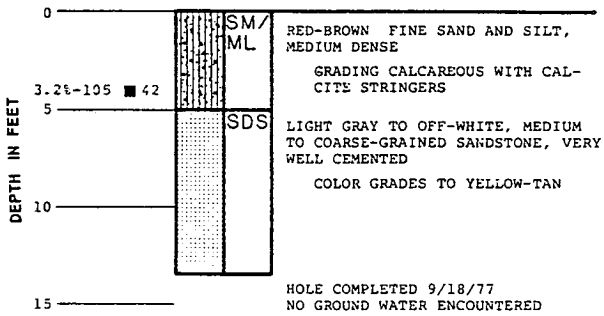
BORING NO. 11
EL. 5677.8 FT.



BORING NO. 13
EL. 5602.4 FT.



BORING NO. 14
EL. 5597.5 FT.

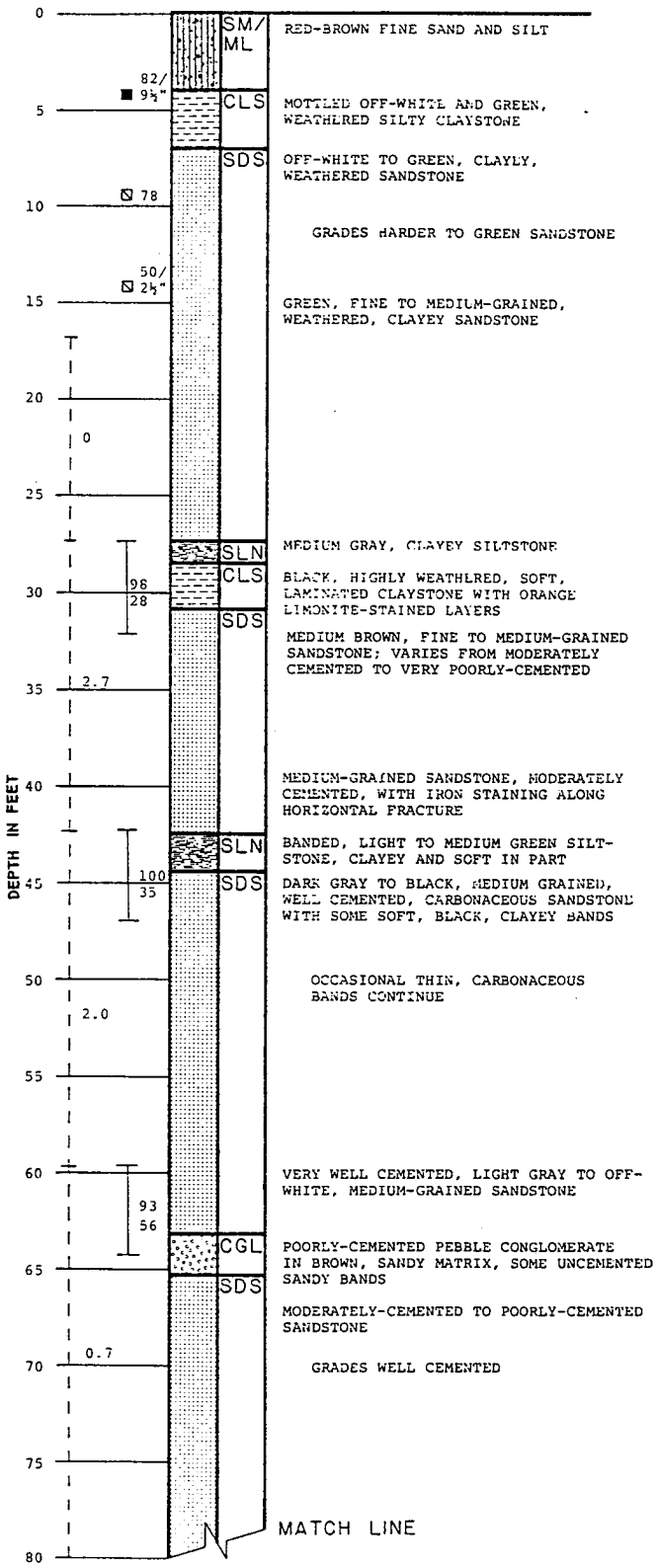


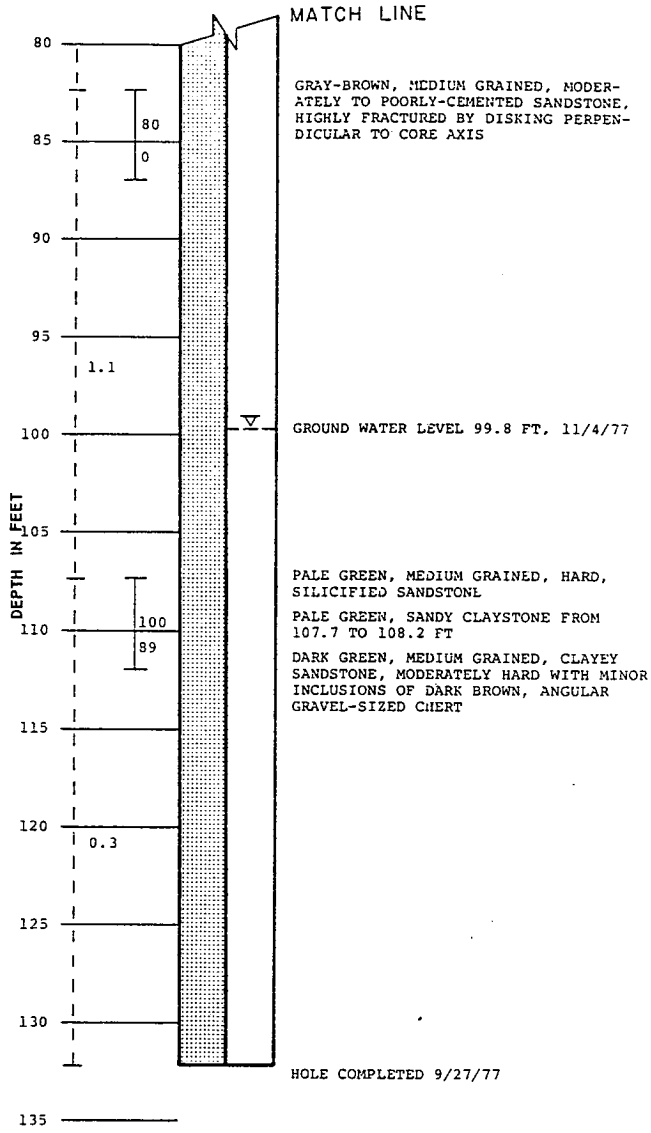
LOG OF BORINGS

DAMES & MOORE

BORING NO. 9

EL. 5679.3 FT.

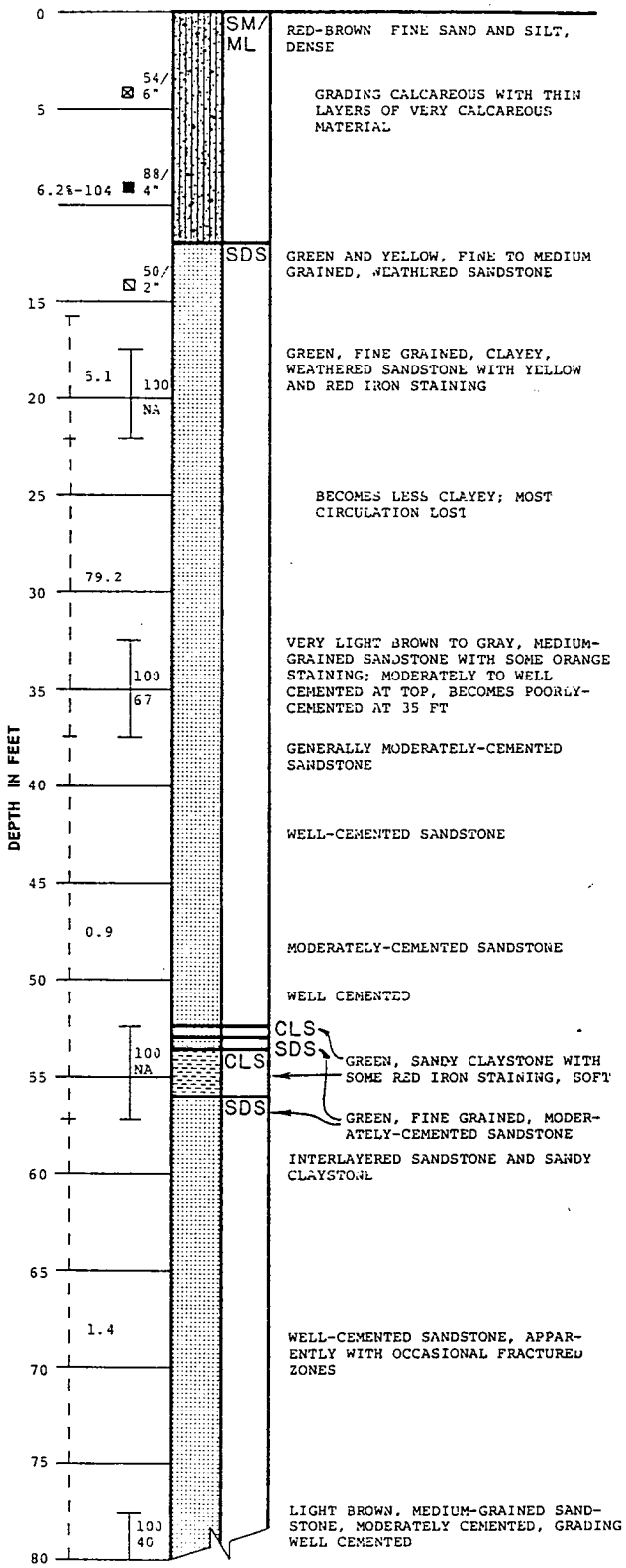


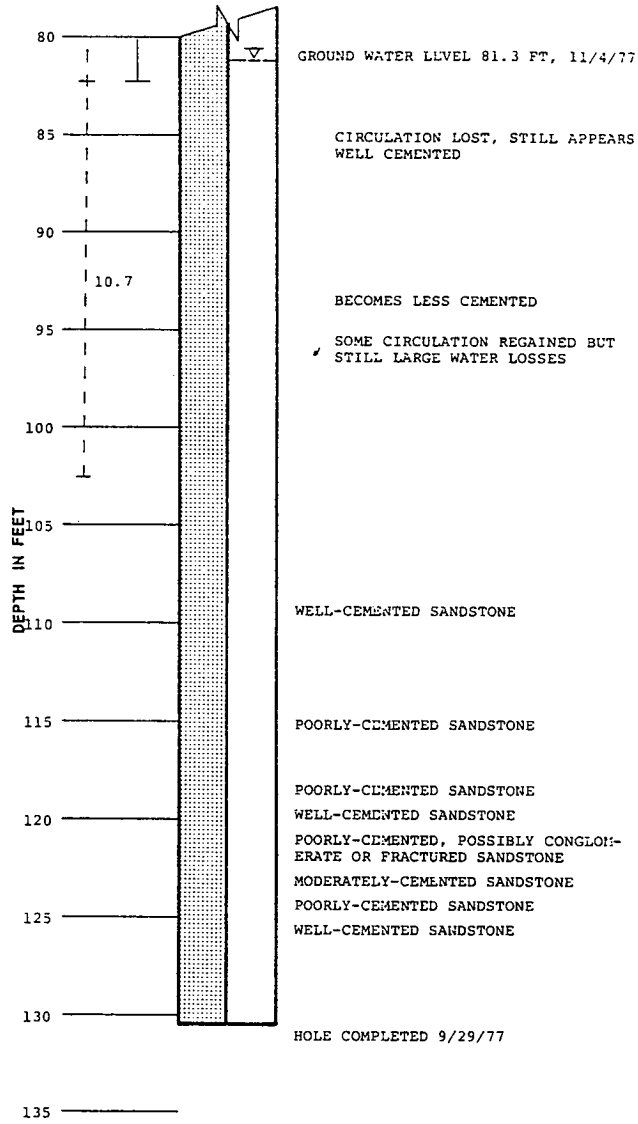


LOG OF BORINGS

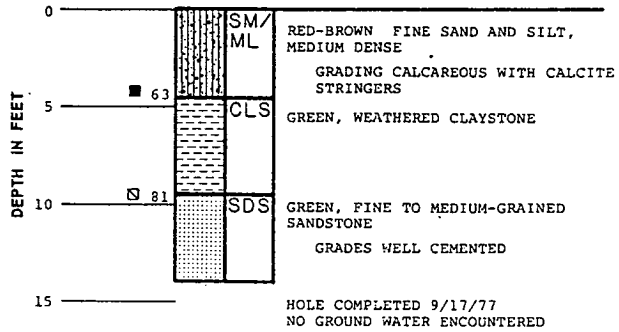
DAMES & MOORE

BORING NO. 12
EL. 5648.1 FT.



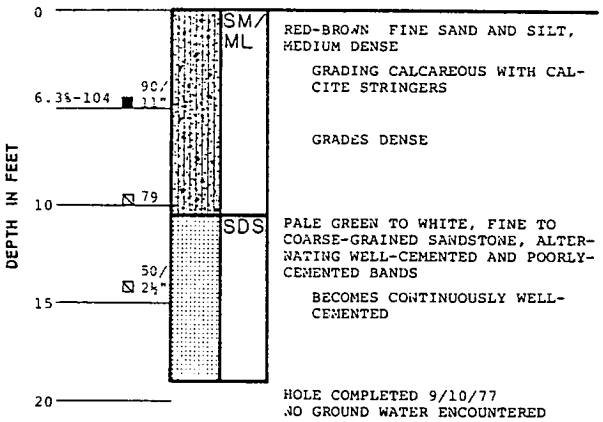


BORING NO. 15
EL. 5600.7 FT.



LOG OF BORINGS

BORING NO. 16
EL. 5597.5 FT.



RED-BROWN FINE SAND AND SILT, MEDIUM DENSE

GRADING CALCAREOUS WITH CALCITE STRINGERS

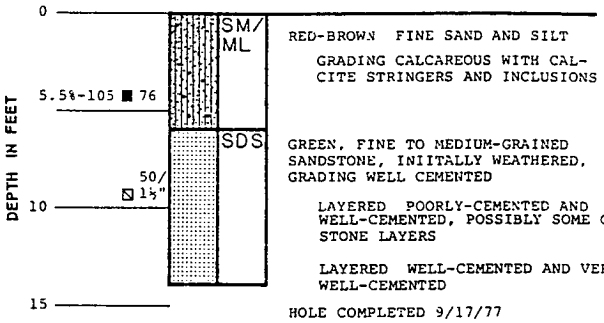
GRADES DENSE

PALE GREEN TO WHITE, FINE TO COARSE-GRAINED SANDSTONE, ALTERNATING WELL-CEMENTED AND POORLY-CEMENTED BANDS

BECOMES CONTINUOUSLY WELL-CEMENTED

HOLE COMPLETED 9/10/77
NO GROUND WATER ENCOUNTERED

BORING NO. 17
EL. 5582.0 FT.



RED-BROWN FINE SAND AND SILT

GRADING CALCAREOUS WITH CALCITE STRINGERS AND INCLUSIONS

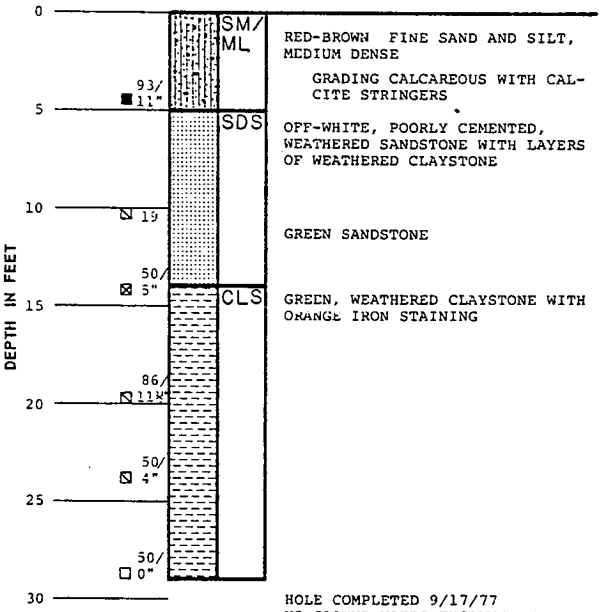
GREEN, FINE TO MEDIUM-GRAINED SANDSTONE, INITIALLY WEATHERED, GRADING WELL CEMENTED

LAYERED POORLY-CEMENTED AND WELL-CEMENTED, POSSIBLY SOME CLAYSTONE LAYERS

LAYERED WELL-CEMENTED AND VERY WELL-CEMENTED

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

BORING NO. 18
EL. 5608.5 FT.



RED-BROWN FINE SAND AND SILT, MEDIUM DENSE

GRADING CALCAREOUS WITH CALCITE STRINGERS

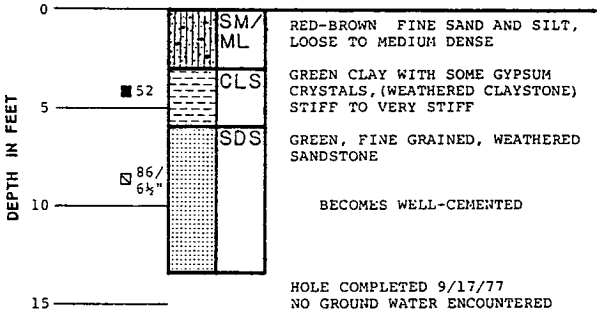
OFF-WHITE, POORLY CEMENTED, WEATHERED SANDSTONE WITH LAYERS OF WEATHERED CLAYSTONE

GREEN SANDSTONE

GREEN, WEATHERED CLAYSTONE WITH ORANGE IRON STAINING

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

BORING NO. 21
EL. 5584.5 FT.



RED-BROWN FINE SAND AND SILT, LOOSE TO MEDIUM DENSE

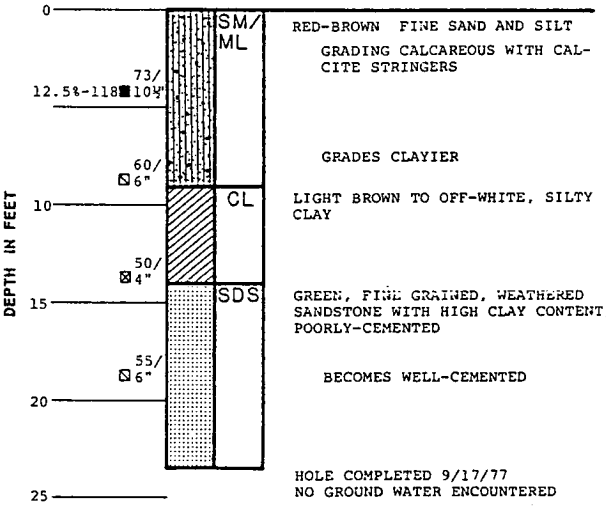
GREEN CLAY WITH SOME GYPSUM CRYSTALS, (WEATHERED CLAYSTONE) STIFF TO VERY STIFF

GREEN, FINE GRAINED, WEATHERED SANDSTONE

BECOMES WELL-CEMENTED

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

BORING NO. 22
EL. 5585.3 FT.



RED-BROWN FINE SAND AND SILT

GRADING CALCAREOUS WITH CALCITE STRINGERS

GRADES CLAYIER

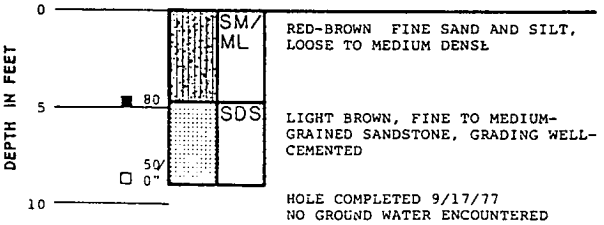
LIGHT BROWN TO OFF-WHITE, SILTY CLAY

GREEN, FINE GRAINED, WEATHERED SANDSTONE WITH HIGH CLAY CONTENT, POORLY-CEMENTED

BECOMES WELL-CEMENTED

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

BORING NO. 20
EL. 5570.4 FT.



RED-BROWN FINE SAND AND SILT, LOOSE TO MEDIUM DENSE

LIGHT BROWN, FINE TO MEDIUM-GRAINED SANDSTONE, GRADING WELL-CEMENTED

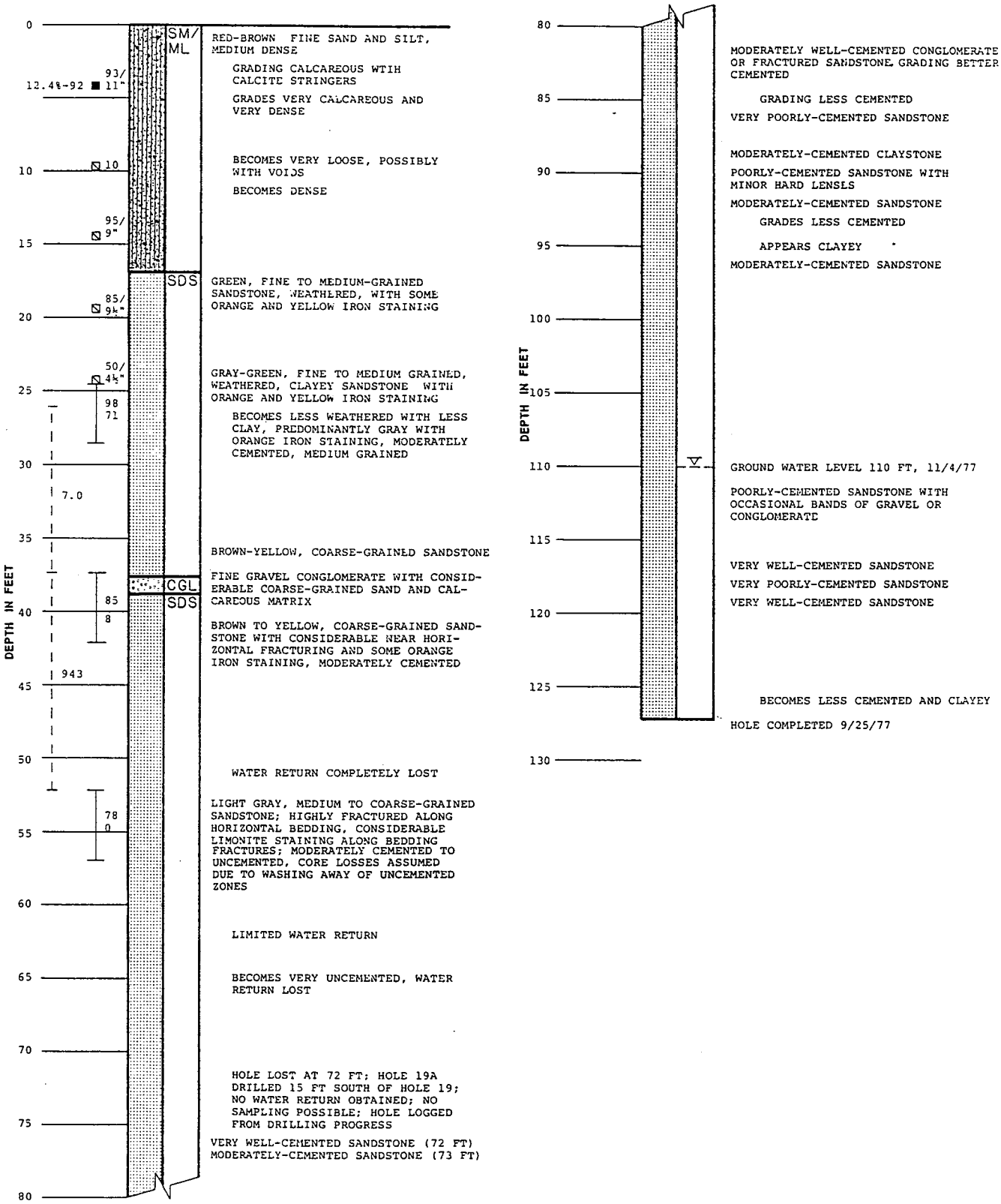
HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

LOG OF BORINGS

DAMES & MOORE

BORING NO. 19

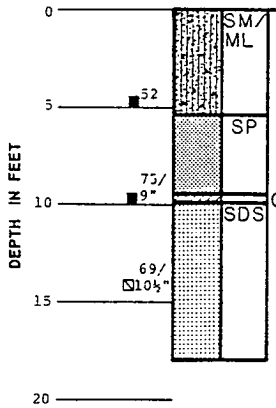
EL. 5600.3 FT.



LOG OF BORINGS

DAMES & MOORE

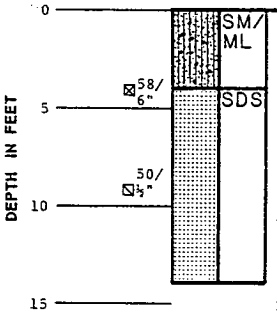
BORING NO. 23
EL. 5555.9 FT.



RED-BROWN FINE SAND AND SILT, LOOSE TO MEDIUM DENSE
GRADING CALCAREOUS WITH CALCITE STRINGERS
GRADES MEDIUM-GRAINED
MOTTLED COLORS FROM RED TO WHITE AND YELLOW
YELLOW TO LIGHT BROWN, MEDIUM TO COARSE-GRAINED SAND (WEATHERED SANDSTONE)
CL GREEN TO WHITE MOTTLED CLAY (WEATHERED CLAYSTONE)
OFF-WHITE TO YELLOW BROWN, MEDIUM TO COARSE-GRAINED, POORLY CEMENTED SANDSTONE, GRADES WELL CEMENTED

HOLE COMPLETED 9/10/77
NO GROUND WATER ENCOUNTERED

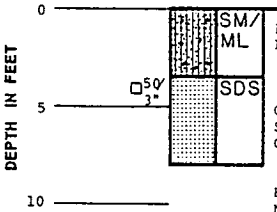
BORING NO. 24
EL. 5573.4 FT



RED-BROWN FINE SAND AND SILT, LOOSE TO MEDIUM DENSE
GRADING CALCAREOUS WITH CALCITE STRINGERS
OFF-WHITE, FINE GRAINED, WEATHERED SANDSTONE, GRADES WELL-CEMENTED
OFF-WHITE, FINE TO MEDIUM GRAINED, MODERATELY WELL-CEMENTED SANDSTONE
LIGHT BROWN, FINE TO MEDIUM GRAINED, WELL-CEMENTED SANDSTONE

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

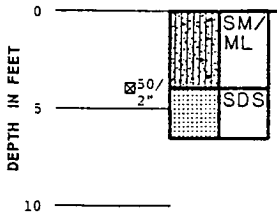
BORING NO. 26
EL. 5578.3 FT.



RED-BROWN FINE SAND AND SILT, LOOSE TO MEDIUM DENSE
GRADING CALCAREOUS WITH CALCITE STRINGERS
OFF-WHITE, FINE TO MEDIUM-GRAINED SANDSTONE, WEATHERED, GRADING WELL-CEMENTED
VERY WELL CEMENTED

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

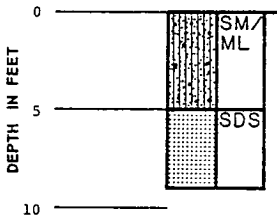
BORING NO. 27
EL. 5555.0 FT.



RED-BROWN FINE SAND AND SILT, LOOSE TO MEDIUM DENSE
GRADING CALCAREOUS WITH CALCITE STRINGERS
GREENISH, FINE TO MEDIUM-GRAINED SANDSTONE, VERY WELL-CEMENTED

HOLE COMPLETED 9/17/77
NO GROUND WATER ENCOUNTERED

BORING NO. 29
EL. 5655.0 FT. (APPROX)

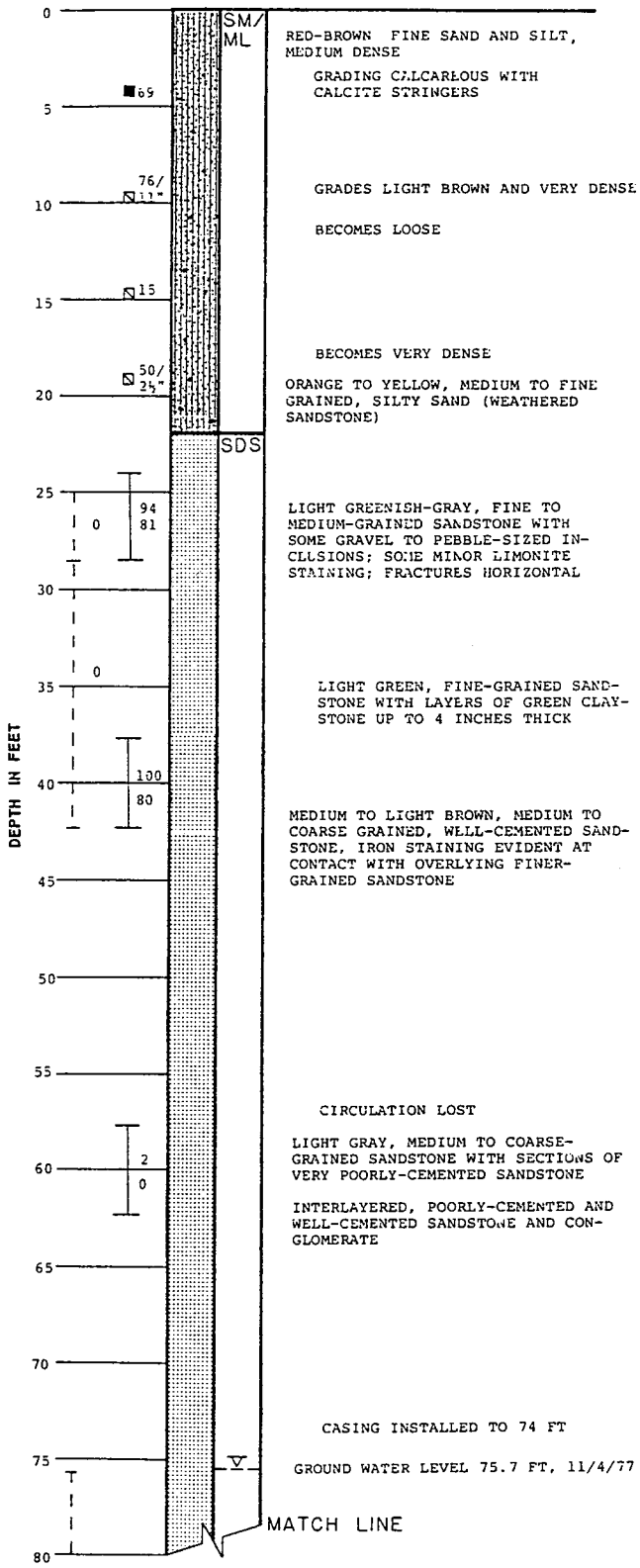


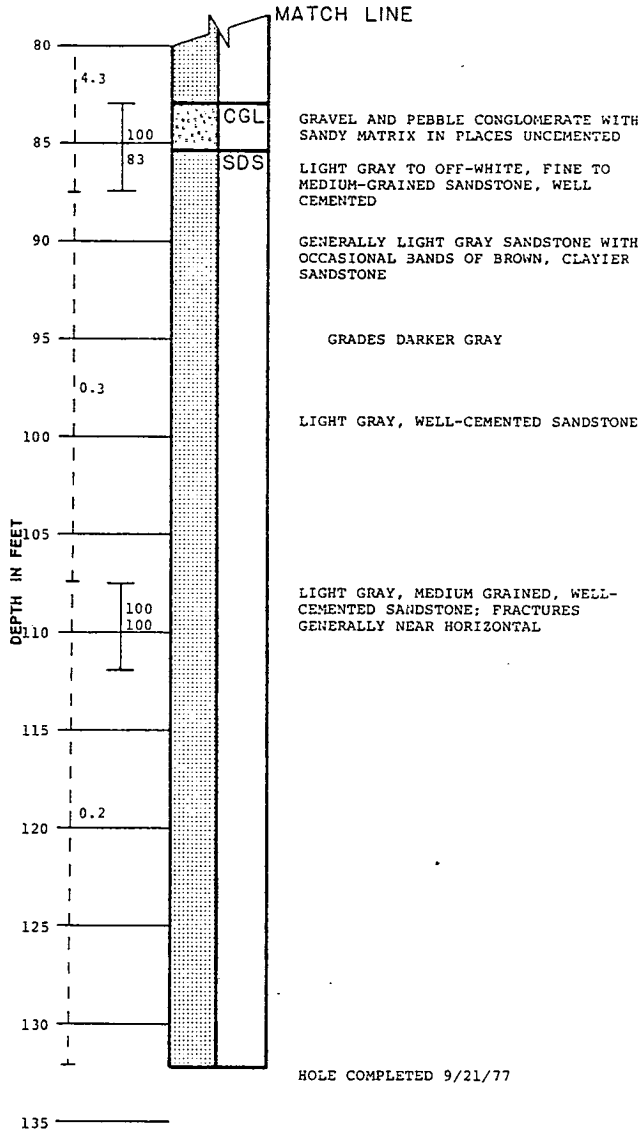
RED-BROWN FINE SAND AND SILT, LOOSE
GRADES MEDIUM DENSE
GRADING CALCAREOUS
WHITE TO SLIGHTLY TAN SANDSTONE
BECOMES WELL-CEMENTED

HOLE COMPLETED 9/30/77
NO GROUND WATER ENCOUNTERED

LOG OF BORINGS

BORING NO. 28
EL. 5547.6 FT.





LOG OF BORINGS

Umetco Minerals Corporation

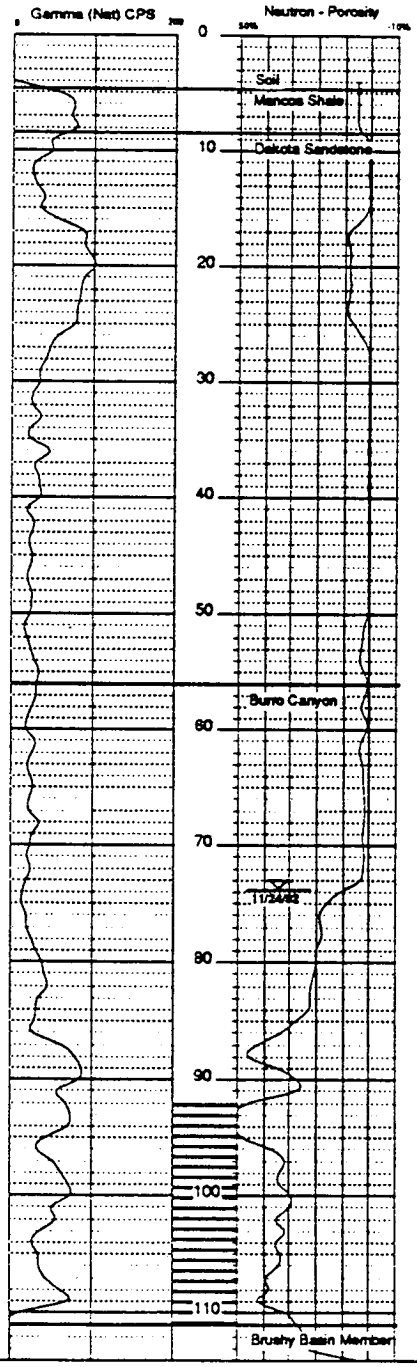
Location: San Juan County, Utah Date: 11/24/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5642.2

T.D. 114

WMMW-1



Umetco Minerals Corporation

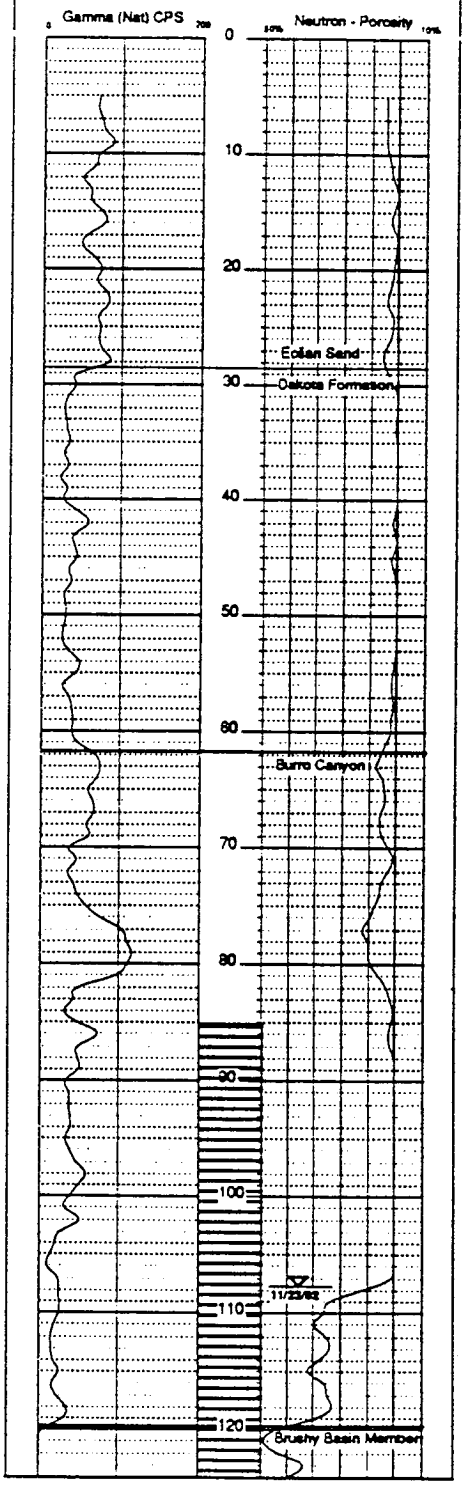
Location: Montrose County Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5611.6

T.D. 124

WMMW-2



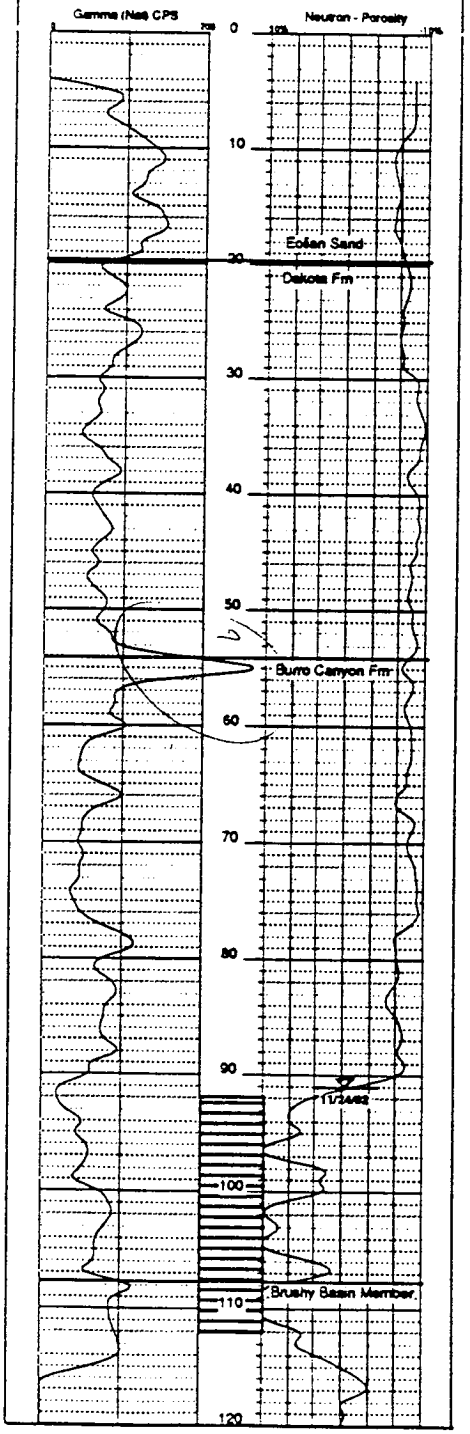
Umetco Minerals Corporation

Location: San Juan County, Utah Date: 11/24/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5421
T.D. 120

WMMW-4



Umetco Minerals Corporation

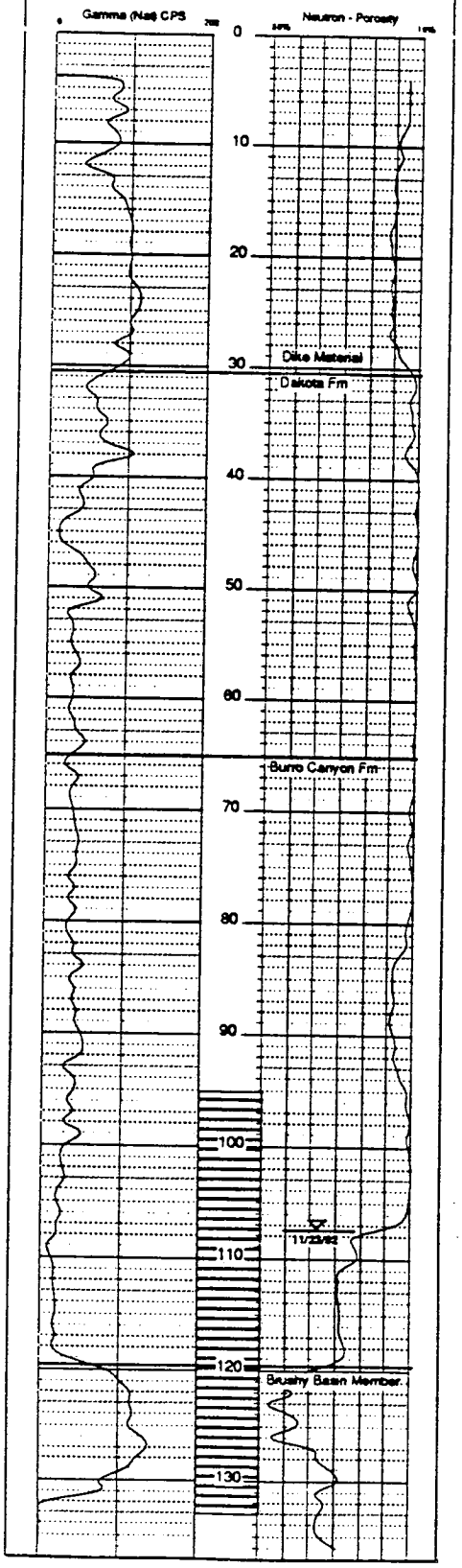
Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5608.9

T.D. 136

WMMW-5



Umetco Minerals Corporation

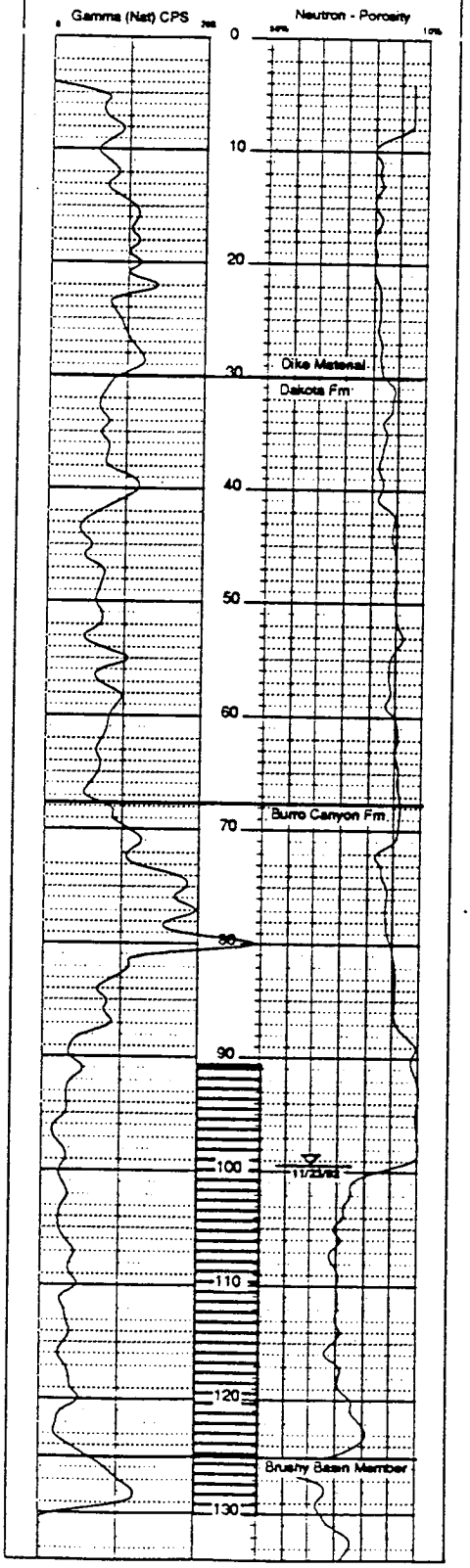
Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5606.8

T.D. 134

WMMW-11



Umetco Minerals Corporation

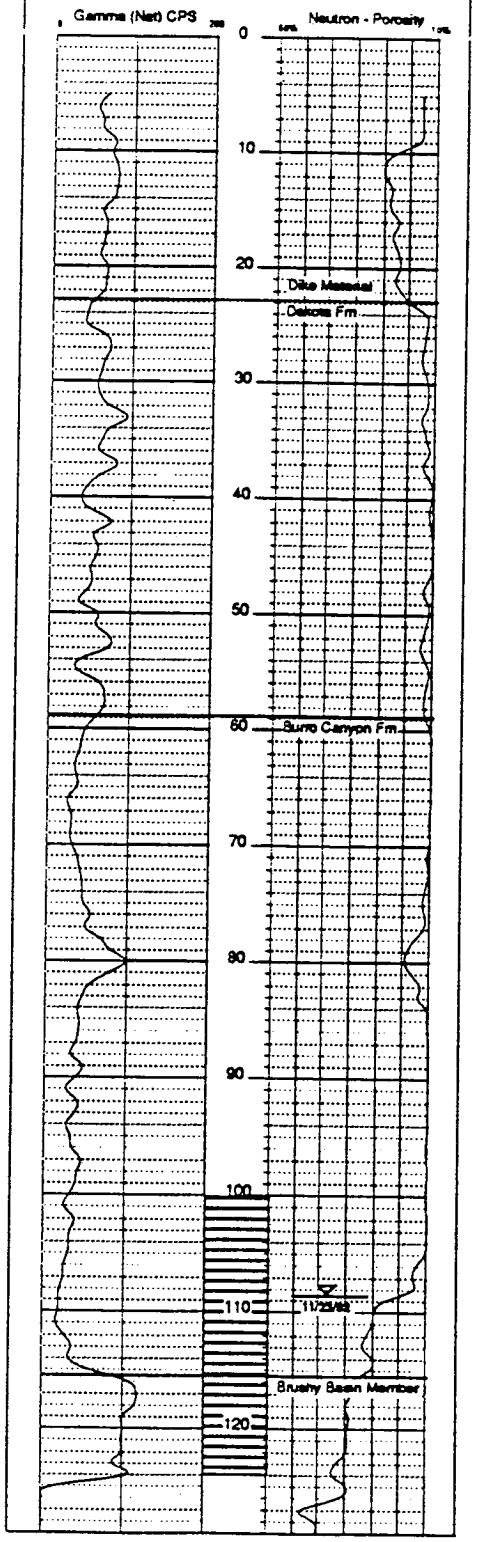
Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5408.5

T.D. 129

WMMW-12



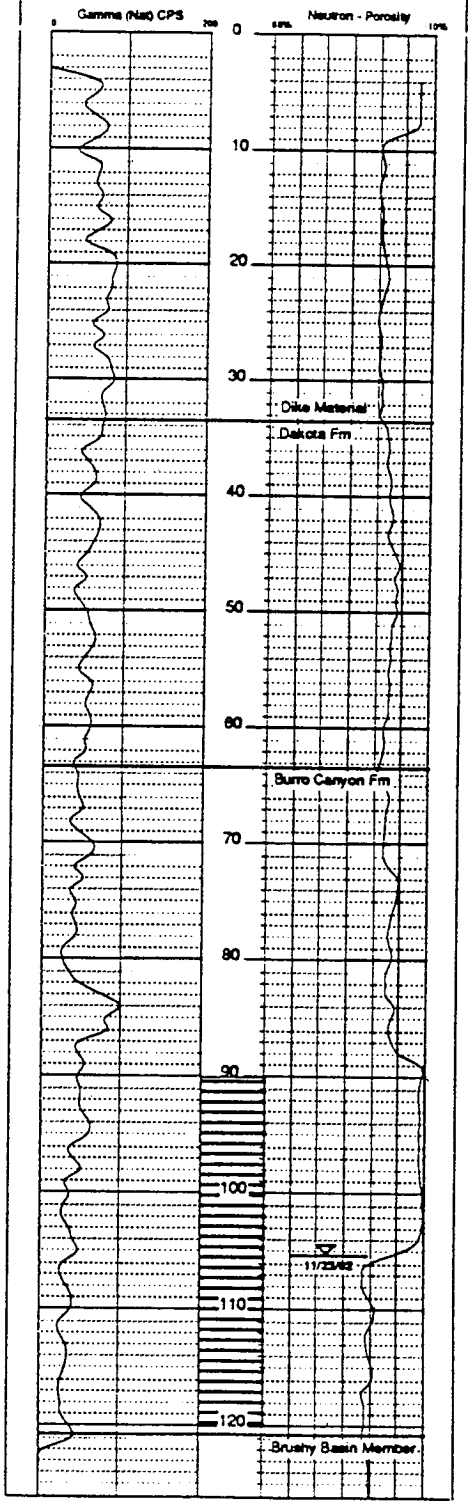
Umetco Minerals Corporation

Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5596
T.D. 127

WMMW-14



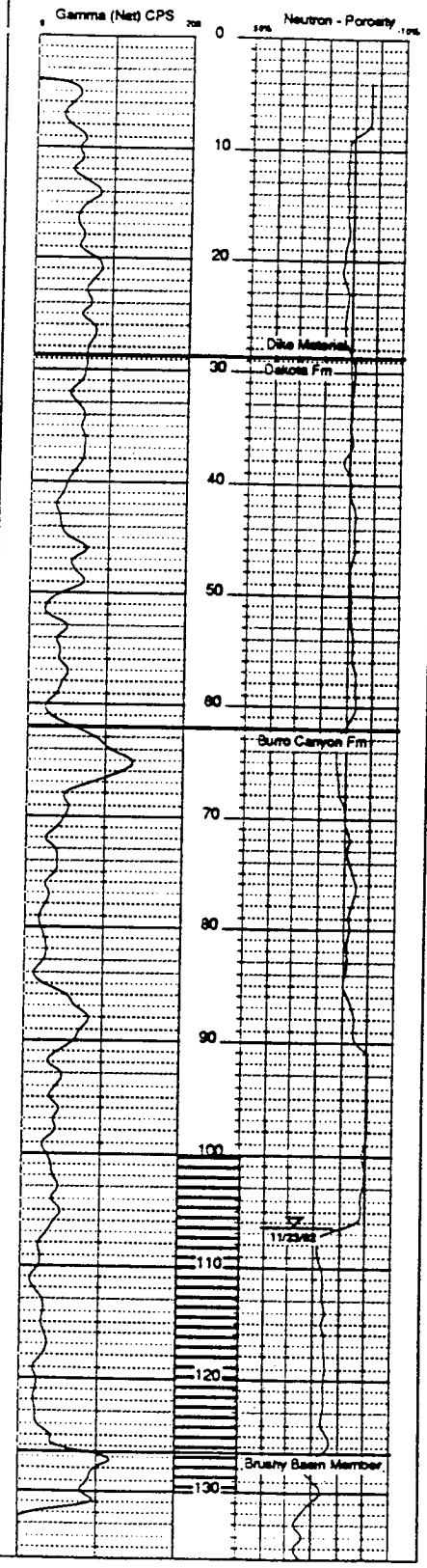
Umetco Minerals Corporation

Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Bev. 5598.8
T.D. 136

WMMW-15



APPENDIX B

WATER QUALITY DATA

Ground Water Quality Data

Water Depth	WM#1	WM#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#13	CULINARY	WM#14	WM#
06-Sep-79				93.0							
07-Sep-79				94.7							
10-Sep-79	108.5	115.2		94.6							
14-Sep-79	77.3	109.6		94.6							
25-Sep-79	76.6	110.1	83.4	94.7							
10-Oct-79	81.7	110.2	84.9	94.7							
10-Jan-80	76.0	109.5	83.2	93.9							
28-Feb-80	74.0	108.1	81.9	92.8							
20-Mar-80	74.0	107.9	80.8	92.4							
30-May-80	75.9	110.0	83.1	94.3	112.2						
17-Jun-80	75.4	110.0	83.7	94.3	108.0						
16-Jul-80	75.4	110.0	83.6	94.3	108.0						
19-Aug-80	75.1	110.0	83.6	94.2	108.0						
07-Sep-80	76.2	111.1	83.7	94.4	108.4						
11-Sep-80	74.3	110.5	83.7	94.3	108.5						
08-Oct-80	76.2	111.1	84.4								
27-Jan-82	75.3	110.0	83.6	94.3	108.6	104.0	118.7	78.0			
26-Sep-84	83.2	112.3	87.5	96.4	108.2	113.4	111.8	77.3			
05-Dec-84	76.0	110.4	84.0	94.0	108.0	104.0	109.6	73.0			
21-Feb-85	76.0	110.3	84.3	94.2	108.0	104.0	110.1	73.3			
25-Jun-85	76.2	110.5	84.5	94.0	108.2	103.9	109.8	73.2			
30-Sep-85	75.4	110.0	83.7	93.4	107.5	102.9	108.8	77.0			
31-Oct-85	75.0	110.8	83.0								
27-Nov-85	75.9	112.2									
15-Dec-85	75.5	110.3	83.7	93.5	108.1	103.7	109.7	77.5			
24-Jan-86	80.2	110.0	83.7								
28-Feb-86	75.8	110.1	83.8								
20-Mar-86	76.2	110.5	84.5	94.0	108.2	103.9	110.8	73.3			
27-Mar-86	75.8	110.3	84.0			103.0	110.0	77.0			
08-Apr-86	75.6	109.9	84.8								
19-Jun-86	75.7	109.8	83.4	93.4	107.9	102.8	109.3	77.2			
26-Jun-86	75.7	109.8	83.4	93.4	107.9	102.8	109.3	77.2			
04-Sep-86	75.9	110.1	83.8	93.5	107.9	103.0	109.3	77.1			
10-Dec-86	76.5	111.3	83.8	95.7	108.2	103.2	111.2	79.3			
20-Feb-87	76.8	111.3	83.8	95.7	108.2	103.2	110.2	79.3			
28-Apr-87	75.7	110.2	83.8	93.2	108.0	102.4	109.7	78.0			
14-Aug-87	76.3	111.1	83.3	93.3	108.3	102.6	108.5	78.0			
20-Nov-87	76.0	110.4	83.9	93.3	108.3	103.2	109.7	77.3			
27-Jan-88	75.9	110.4	83.8	93.6	108.3	102.8	109.7	77.2			
01-Jun-88	75.8	110.4	83.8	93.4	108.3	101.9	109.6	77.2			
23-Aug-88	75.2	110.1	83.4	93.1	110.5	102.0	109.1	77.4			
03-Nov-88	75.3	110.0	83.5	93.3	108.1	102.6	109.2	76.9			
09-Mar-89	73.0	110.1	83.8	93.8	108.7	102.5	109.5	77.4			
21-Jun-89	76.1	110.3	83.7	93.2	108.1	102.5	109.2				
01-Sep-89	75.6	110.0	85.7	93.3	108.2	102.6	109.4				
15-Nov-89	75.8	110.1	83.7	93.1	108.3	102.5	109.5			105.2	107.6
16-Feb-90	75.81	110.01	83.64	93.11	108.14	102.52	109.45			105.34	107.4
08-May-90	75.5	109.8	83.6	92.9	108.1	102.2	109.5			105.44	107.
07-Aug-90	75.0	110.0	83.9	92.9	108.2	102.6	109.4			105.47	107.5
13-Nov-90	75.8	109.8	84.2	92.8	109.0	102.5	109.0			105	107
27-Feb-91	75.6	110.1	83.7	92.5	108.1	102.1	109.2			105.37	108.
21-May-91	75.5	110.0	83.7	92.4	108.3	102.5	109.6			105.4	107.
24-Sep-91	75.0	110.3	84.0	92.6	108.5	102.6	109.7			105.46	107.6
03-Dec-91	75.7	110.4	83.9	92.5	108.5	102.5	109.7			105.6	107.
17-Mar-92	75.7	110.0	83.8	92.2	108.2	101.9	109.4			105.25	107.
11-Jun-92	75.7	110.2	83.7	92.5	108.5	102.3	109.5			105.29	107.5
03-Sep-92	75.2	110.1	83.7	92.4	108.4	102.2	109.5			105.43	107.
19-Nov-92	75.7	110.0	83.9	92.4	108.4	102.4	109.6			105.58	107.5

Ground Water Quality Data

Phreatic Elevation	WM#1 5648.22	WM#2 5613.49	WM#3 5555.32	WM#4 5622.57	WM#5 5609.33	WM#11 5609.45	WM#12 5611.08	WM#13 5570.35	CULINARY	WM#14 5596.39	#15 5598.62
06-Sep-79				5529.57							
07-Sep-79				5527.87							
10-Sep-79	5539.72	5498.29		5527.97							
14-Sep-79	5570.92	5503.89		5527.97							
25-Sep-79	5571.62	5503.39	5471.92	5527.87							
10-Oct-79	5566.52	5503.29	5470.42	5527.87							
10-Jan-80	5572.22	5503.99	5472.12	5528.67							
28-Feb-80	5574.22	5505.39	5473.42	5529.77							
20-Mar-80	5574.22	5505.59	5474.52	5530.17							
30-May-80	5572.32	5503.49	5472.22	5528.27	5497.13						
17-Jun-80	5572.82	5503.49	5471.62	5528.27	5501.33						
16-Jul-80	5572.82	5503.49	5471.72	5528.27	5501.33						
19-Aug-80	5573.12	5503.49	5471.72	5528.37	5501.33						
07-Sep-80	5572.02	5502.39	5471.62	5528.17	5500.93						
11-Sep-80	5573.92	5502.99	5471.62	5528.27	5500.83						
08-Oct-80	5572.02	5502.39	5470.92								
27-Jan-82	5572.92	5503.49	5471.72	5528.27	5500.73	5505.45	5502.41	5492.35			
26-Sep-84	5565.01	5501.20	5467.78	5526.13	5501.16	5506.08	5499.33	5493.06			
05-Dec-84	5572.22	5503.07	5471.32	5528.57	5501.33	5505.45	5501.50	5497.35			
21-Feb-85	5572.22	5503.16	5471.07	5528.40	5501.33	5505.45	5501.00	5497.10			
25-Jun-85	5572.05	5502.99	5470.82	5528.57	5501.16	5505.53	5501.25	5497.18			
30-Sep-85	5572.80	5503.49	5471.65	5529.15	5501.83	5506.53	5502.25	5493.35			
31-Oct-85	5573.22	5502.56	5472.32								
27-Nov-85	5572.30	5501.32									
15-Dec-85	5572.72	5503.16	5471.65	5529.07	5501.25	5505.78	5501.41	5492.85			
24-Jan-86	5568.05	5503.49	5471.65								
28-Feb-86	5572.39	5503.41	5471.57								
20-Mar-86	5572.05	5502.99	5470.82	5528.57	5501.16	5505.53	5500.28	5497.10			
27-Mar-86	5572.39	5503.16	5471.32			5506.45	5501.08	5493.35			
08-Apr-86	5572.64	5503.57	5470.57								
19-Jun-86	5572.55	5503.66	5471.90	5529.15	5501.41	5506.62	5501.83	5493.18			
26-Jun-86	5572.55	5503.66	5471.90	5529.15	5501.41	5506.62	5501.83	5493.18			
04-Sep-86	5572.30	5503.41	5471.49	5529.07	5501.41	5506.45	5501.83	5493.27			
10-Dec-86	5571.72	5502.19	5471.52	5526.87	5501.13	5506.25	5499.88	5491.05			
20-Feb-87	5571.47	5502.24	5471.57	5526.90	5501.16	5506.28	5500.91	5491.02			
28-Apr-87	5572.55	5503.32	5471.57	5529.40	5501.33	5507.03	5501.41	5492.35			
14-Aug-87	5571.89	5502.41	5471.99	5529.32	5501.00	5506.87	5502.58	5492.35			
20-Nov-87	5572.22	5503.07	5471.40	5529.24	5501.00	5506.28	5501.41	5493.10			
27-Jan-88	5572.30	5503.07	5471.49	5528.99	5501.00	5506.62	5501.41	5493.18			
01-Jun-88	5572.47	5503.12	5471.49	5529.15	5501.08	5507.55	5501.50	5493.18			
23-Aug-88	5573.05	5503.37	5471.90	5529.45	5498.83	5507.45	5502.00	5492.93			
03-Nov-88	5572.12	5503.19	5471.62	5529.34	5501.24	5506.96	5501.85	5570.35			
09-Mar-89	5575.22	5503.39	5471.52	5528.77	5500.63	5506.95	5501.58				
21-Jun-89	5572.12	5503.19	5471.62	5529.34	5501.24	5506.96	5501.85				
01-Sep-89	5572.67	5503.45	5469.59	5529.30	5501.18	5506.85	5501.72				
15-Nov-89	5572.43	5503.37	5471.60	5529.45	5501.08	5506.95	5501.63			5491.19	5490.95
16-Feb-90	5572.41	5503.48	5471.68	5529.46	5501.19	5506.93	5501.63			5491.05	5491.15
08-May-90	5572.71	5503.69	5471.68	5529.67	5501.20	5507.29	5501.55			5490.95	5491.22
07-Aug-90	5573.19	5503.48	5471.45	5529.64	5501.09	5506.89	5501.68			5490.92	5491.03
13-Nov-90	5572.42	5503.69	5471.12	5529.77	5500.33	5506.95	5502.08			5491.39	5490.92
27-Feb-91	5572.64	5503.42	5471.67	5530.10	5501.26	5507.39	5501.86			5491.02	5490.17
21-May-91	5572.77	5503.45	5471.58	5530.15	5501.03	5507.00	5501.52			5490.99	5491.06
24-Sep-91	5573.26	5503.19	5471.36	5529.97	5500.80	5506.89	5501.43			5490.93	5491.00
03-Dec-91	5572.52	5503.11	5471.42	5530.03	5500.84	5506.94	5501.36			5490.79	5490.86
17-Mar-92	5572.52	5503.47	5471.57	5530.37	5501.15	5507.53	5501.64			5491.14	5490.91
11-Jun-92	5572.52	5503.27	5471.64	5530.09	5500.86	5507.18	5501.55			5491.10	5491.10
03-Sep-92	5572.99	5503.40	5471.64	5530.14	5500.96	5507.27	5501.55			5490.96	5490.91
19-Nov-92	5572.55	5503.46	5471.46	5530.16	5500.89	5507.10	5501.44			5490.81	5491.04

Ground Water Quality Data

Conductance

	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Oct-79	948	1270	3260	3360							
30-May-80	1500	2413	3915	3205	2660						
30-Jun-80	1367	3031	4276	3196	2372						
31-Jul-80	1469	2500	4386	3264	2371						
31-Aug-80	1565	2712	4537	3223	2440						
30-Sep-80	1547	2791	4768	2791	2559						
31-Oct-80	1578	2930	4846	3268	2479						
30-Nov-80	1509	2668	4782	3289	2568						
31-Dec-80	1568	2730	4828	3254	2412						
31-Jan-81	1682	3190	5398	3435	2282						
28-Feb-81	1723	3089	5054	3370	2268						
31-Mar-81	1472		5153	3391	2638						
30-Apr-81	1425	3097	4893	3363	2589						
30-May-81	1543	2985	4918	3064	2422						
30-Jun-81	1303	2806	4433	3108	2699						
14-Aug-81	1716	3702	5632	3963	3077						
27-Jan-82	1450	3450	5100	3370	3050						
07-Apr-82	1635	3402	5489	3630	3275				459		
07-Jul-82	1570	3340	5170	3380	2790				573		
10-Dec-82	1320	2720	4390	3030	2220	2102	3280	3360	530		
25-Jan-83	1310	2680	4260	2910	2150	1630	3130	3290	439		
30-Apr-83	1320	2800	4820	3420	2490	2330	3400	3970	450		
07-Sep-83	1390	2810	4490	2970	2130	2260	3250	3160	412		
26-Oct-83	1680	3560	5550	3700	2840	2600	4000	4380	470		
20-Mar-84	1200	2380	4200	2340	2150	1500	3050	3200	312		
14-Jun-84	1200	2400	4500	2500	2300	1800	3200	3200	370		
05-Dec-84	1100	2275	3975	2325	2000	1900	3000	3050	238		
21-Feb-85	1300	2800	4000	2700	2100	1900	4000	3200	380		
25-Jun-85	1100	2600	4200	2800	2200	1850	3300	3150	300		
30-Sep-85	1500	2500	5000	3300	2800	2350	3800	3800	470		
15-Dec-85	3000	3200	4700	3000	2200	3100	2600	3600			
27-Mar-86	1350	2550	4000	2800	2300	1900	3100	3000	500		
26-Jun-86	1900	3800	5600	3600	3800	3400	5400	4400	700		
04-Sep-86	1800	3700	6000	4100	3250	2700	5500	5000	550		
10-Dec-86	2200	3200	4600	3400	2400	1500	3300	3600	800		
20-Feb-87	1800	3800	5600	3200	2800	3400	5500	4400	460		
29-Apr-87	1800	5000	5600	2600	3700	3250	4400	3900	500		
19-Aug-87	1500	3300	5400	3800	2700	2800	3300	4200	500		
20-Nov-87	1600	3400	5000	3700	2600	2300	3900	4000	600		
27-Jan-88	1300	2600	4500		1900	1800	3000	3050	265		
01-Jun-88	1350	2800	4500	2850	2100	2000	3250	3400	340		
23-Aug-88	1550	3400	4500	3100	2200	1800	3400	3350	310		
03-Nov-88	1250	2850	4400		2000	1950	3000	3300			
09-Mar-89	1300	2800	4200	2700	2100	2000	3200	3150			
21-Jun-89	1694	3660	5660	3690	2710	2520	4000		550		
01-Sep-89	1670	3670	5550	3670	2740	2560	4010		575	3860	456
15-Nov-89	1680	3620	5590	3640	2750	2510	4020		693	3880	445
20-Feb-90	1695	3630	5550	3630	2780	2750	3980		684	3830	430
08-May-90	1694	3630	5650	3650	2750	2550	4000		700	3880	439
07-Aug-90	1667	3560	5480	3550	2660	2530	3880		688	3710	42
13-Nov-90	1040	2060	4010	2070	2000	1090	3000		550	2080	30
27-Feb-91	1700	3720	5530	3730	2640	2680	4120		449	3960	43
21-May-91	1705	3680	5660	3670	2650	2620	4040		448	3880	440
24-Sep-91	1726	3660	5570	3660	2650	2690	4030		447	3840	431
03-Dec-91	1705	3650	5560	3610	2630	2610	4100		442	3900	42
17-Mar-92	1702	3600	5490	3670	2620	2630	4070		440	3890	432
11-Jun-92	1669	3640	5480	3620	2600	2600	4000		447	3850	43
03-Sep-92	1694	3620	5590	3610	2600	2630	4000		411	3810	420
19-Nov-92	1690	3660	5710	3650	2680	2630	4070		407	3850	427

Ground Water Quality Data

pH

	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Oct-79	8.6	7.2	7.3	7.1							
31-Jan-80	7.4	7.2	6.8	7.1							
30-May-80	7.3	7.4	7.2	7.2	7.6						
30-Jun-80	7.5	7.4	7.2	7.3	7.6						
31-Jul-80	7.4	7.5	7.2	7.3	7.7						
31-Aug-80	7.2	7.2	6.9	7.1	7.4						
30-Sep-80	7.6	7.6	7.6	7.7	7.7						
31-Oct-80	7.4	7.3	7.2	7.8	7.6						
30-Nov-80	7.5	7.4	7.1	7.3	7.7						
31-Dec-80	7.4	7.4	7.1	7.2	7.2						
31-Jan-81	7.2	7.2	7	7.1	7.4						
28-Feb-81	7.2	7.1	6.8	7	7.3						
31-Mar-81	7.5	7.15	7	7.7	7.7						
30-Apr-81	7.5	7.2	7.1	7.5	7.5						
30-May-81	7	7	6.5	6.8	7.2						
30-Jun-81	7.3	7.2	6.8	7.3	7.3						
31-Aug-81	7.4	7.4	6.9	7.2	7.8						
31-Dec-81	7.5	7.7	7.3	7.7	7.7						
31-Jan-82	7.3	7.2	6.7	7.1	7.35						
30-Apr-82	7.7	7.5	7.2	7.3	7.8						
31-Aug-82	7.8	7.7	7.5	7.8	8						
31-Dec-82	7.8	7.7	7.5	7.6	8	8.2	7.8	7.85			
31-Mar-83	7.6	7.5	7.2	7.3	8.05	7.4	6.7	7.4			
30-Jun-83	7.8	7.7	7.5	7.7	8.12	8	7.4	8			
31-Dec-83	7.6	7.55	7.4	7.55	7.7	7.2	7.2	7.6			
31-Mar-84	7.7	7.0	6.8	7.8	7.9	7.8	7.2	7.0	7.6		
30-Jun-84	7.6	7.2	7.4	7.8	7.8	7.2	7.8	7.5	8.2		
30-Sep-84	7.5	7.1	6.6	7.0	7.5	7.9	6.8	7.0	7.8		
31-Dec-84	7.7	7.1	6.8	6.8	7.8	7.9	6.7	7.1	8.3		
31-Mar-85	7.8	7.6	6.9	7.1	7.8	7.9	7.1	7.4	8.0		
30-Jun-85	7.6	7.0	6.8	6.7	7.9	8.0	6.8	7.2	7.8		
30-Sep-85	6.8	7.1	6.4	6.3	7.0	7.9	6.9	6.5	7.4		
31-Dec-85	7.3	7.3	6.8	6.9	8.1	7.1	7.7	7.1			
31-Mar-86	7.0	7.0	6.6	6.9	7.0	7.0	6.7	6.9	7.0		
30-Jun-86	7.5	7.0	6.7	7.0	7.5	7.9	6.7	6.9			
04-Sep-86	7.3	6.9	6.7	6.8	7.6	7.9	6.8	7.0	7.0		
10-Dec-86	7.7	6.9	6.5	7.0	7.1	7.9	7.1	7.1	7.6		
20-Feb-87	7.4	7.1	6.5	7.0	7.6	7.9	6.9	7.0	8.5		
29-Apr-87	7.6	6.7	6.5	6.9	7.6	7.8	6.9	7.0	7.6		
19-Aug-87	7.6	6.7	6.6	7.9	7.4	7.5	7.0	7.1	7.4		
20-Nov-87	7.8	7.4	7.2	7.2	8.0	7.8	7.3	7.4	7.4		
27-Jan-88	8.0	7.4	6.8		7.7	7.0	7.1	7.1	7.7		
01-Jun-88	8.1	7.2	7.0	7.1	7.6	7.9	7.1	7.3	8.2		
23-Aug-88	7.6	7.1	6.7	6.8	7.8	7.7	6.7	6.9	7.8		
03-Nov-88	7.5	7.2	6.7		7.5	8.0	6.6	7.0	7.8		
09-Mar-89	7.4	7.1	6.7	7.3	7.6	7.9	6.9	6.8			
21-Jun-89	8.0	7.1	6.7	6.9	7.4	7.8	6.8		7.7		
01-Sep-89	7.3	7.4	6.9	7.0	7.7	7.8	6.8		7.7		
15-Nov-89	7.5	7.0	6.5	6.8	7.8	7.8	7.1		7.6	6.9	6.9
20-Feb-90	7.8	7.5	6.8	7.0	8.0	8.1	7.2		8.0	6.87	7.46
08-May-90	7.5	7.1	6.6	7.0	7.6	7.8	6.8		7.9	6.8	7.07
07-Aug-90	7.5	7.0	6.8	7.7	7.7	7.4	7.0		7.8	6.87	7.18
13-Nov-90	7.9	7.5	6.6	7.7	8.0	8.0	7.5		8.2	6.47	7.06
27-Feb-91	7.9	7.5	6.6	7.7	8.0	8.0	7.5		8.2	6.47	7.06
21-May-91	7.4	7.1	6.3	6.8	7.4	7.9	7.0		7.1	6.82	7.06
24-Sep-91	7.7	7.0	6.7	7.0	7.4	8.0	6.8		7.3	6.69	6.94
03-Dec-91	7.6	7.3	6.8	6.9	7.7	7.9	6.9		7.8	6.8	7
17-Mar-92	6.7	7.2	5.8	6.9	7.6	7.9	7.0		7.1	7	7.21
11-Jun-92	7.1	6.9	6.1	6.7	7.2	7.4	6.6		7.7	6.6	7.33
03-Sep-92	8.1	7.9	6.7	7.0	7.6	7.9	7.4		7.6	6.89	7.03
19-Nov-92	7.5	7.8	7.1	6.9	7.8	6.2	8.1		7.7	6.83	7.16

Ground Water Quality Data

Sodium	mg/l										
	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Oct-79	106	154	282	342							
31-Jan-80	140	213	334	274							
30-May-80	165	346	575	346	478						
30-Jun-80	166	361	642	322	462						
31-Jul-80	160	418	442	335	435						
31-Aug-80	158	410	653	336	465						
30-Sep-80	156	468	586	371	500						
31-Oct-80	162	415	677	341	443						
30-Nov-80	166	419	567	309	428						
31-Dec-80	168	442	699	338	460						
31-Jan-81	170	467	756	335	467						
28-Feb-81	148	462	704	384	487						
31-Mar-81	175	470	745	338	473						
30-Apr-81	161	476	703	314	467						
30-May-81	160	472	718	350	459						
30-Jun-81	162	458	685	351	437						
31-Aug-81	161	460	688	323	426						
31-Dec-81	170	469	730	330	460						
31-Jan-82	170	483	757	340	490						
30-Apr-82	190	460	790	330	510						
31-Aug-82	160	470	750	340	470						
31-Dec-82	170	480	810	334	431	550	310	630	67		
30-Jun-83	170	470	770	330	458	480	310	640	27		
31-Dec-83	170	500	800	320	480	540	290	640			
30-Jun-84	170	500	780	310	470	530	320	650	5.6		
31-Dec-84	182	443	489	340	428	446	328	459	7.2		
30-Jun-85	20	540	790	370	540	610	330	660	7.3		
31-Dec-85	320	490	780	340	530	550	380	600	5.5		
19-Jun-86	262	543	937	326	514	580	430	659	23.6		
04-Sep-86	175	456	746	289	436	477	296	541	29.5		
10-Dec-86	210	529	784	335	501	250	324	562	68.0		
20-Feb-87	116	333	513	209	307	366	197	360	54.3		
29-Apr-87	134	362	518	232	360	378	235	389	7.0		
20-Nov-87	212	618	958	395	564	768	334	677	11.6		
27-Jan-88	185	507	776								
23-Aug-88	157	495	768	286	432	535	244	445	15.2		
03-Nov-88	172	460	659	289	410	486	280	510	17.4		
09-Mar-89	169	464	713	275	321	375	186	564	22.0		
01-Sep-89	163	466	713	287	411	489	269				
15-Nov-89	194	515	637	270	508	567	321		70.1	70.7	72.6
09-May-90	188	504	756	291	456	517	284		70.8	388.0	566.0
13-Nov-90	165	470	698	285	410	475	277		48.9	348.0	540.0
27-Feb-91	171	477	708	284	430	522	213		19.0	265.0	466.0
21-May-91	177	503	796	274	440	549	271		15.0	353.0	590.0
03-Dec-91	179	492	797	324	466	646	336		17.0	366.0	490.0
11-Jun-92	180	490	760	300	410	540	290		15.2	350.0	510.0
03-Sep-92	162	475	742	291	428	538	291		9.5	345	504
19-Nov-92	182	467	736	318	453	520	318		8.5	358.0	478.0

Ground Water Quality Data

Cl	mg/l MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Oct-79	2.5	5	12.5	20.1							
31-Jan-80	14	18	25	35							
30-May-80	20	18	50	44	50						
30-Jun-80	16	15	51	43	57						
31-Jul-80	20	20	62	48	60						
31-Aug-80	18	16	65	56	60						
30-Sep-80	13	15	62	43	51						
31-Oct-80	30	20	65	50	55						
30-Nov-80	12	8	64	38	49						
31-Dec-80	13	10	65	41	52						
31-Jan-81	15	11	71	48	53						
28-Feb-81	14	9	65	41	54						
31-Mar-81	14	10	66	40	55						
30-Apr-81	13	11	66	41	53						
30-May-81	14	13	110	41	53						
30-Jun-81	12	10	69	43	53						
31-Aug-81	14	7	67	32	52						
31-Dec-81	15	14	66	41	20						
31-Jan-82	13	8	64	42	51						
30-Apr-82	12	7	64	40	50						
31-Aug-82	12	6	67	43	43						
31-Dec-82	10.9	5.5	53	36	47.1	24.4	57.4	40.5	4.6		
25-Jan-83	16	11	71	46	57	32	70	53	6.4		
30-Jun-83	16.5	25	66.5	37.3	48.1	26.8	80.5	43.8	2.8		
31-Dec-83	13	8	63	36	54	32	65				
31-Mar-84	14.3	9.4	67.2	43.1	57.8	31.4	64.1	50.4	2.4		
30-Jun-84	12.0	7.0	63.0	43.0	54.0	32.0	65.0	49.0	3.0		
30-Sep-84	15.4	10.9	57.4	44.6	56.6	33.9	64.6	50.9	1.9		
31-Dec-84	14.2	7.1	67.4	42.5	53.2	31.9	67.4	49.6	3.5		
31-Mar-85	14.0	13.0	68.0	46.0	59.0	34.0	67.0	50.0	10.0		
30-Jun-85	17.0	7.8	73.0	42.0	53.0	31.0	62.0	46.0	1.0		
30-Sep-85	18.0	17.0	78.0	47.0	62.0	38.0	71.0	47.0	47.0		
31-Dec-85	53.2	70.9	35.0	53.0	71.0	71.0	53.0	71.0	62.0		
19-Jun-86	25.0	15.0	140.0	98.0	130.0	77.0	170.0	120.0	7.7		
30-Jun-86	25.0	17.0	140.0	95.0	130.0	70.0	150.0	100.0	9.1		
04-Sep-86	2.0	9.5	64.0	42.0	53.0	32.0	58.0	48.0	8.1		
10-Dec-86	8.8	2.7	68.0	45.0	54.0	33.0	64.0	50.0	3.3		
20-Feb-87	11.0	6.6	66.0	44.0	54.0	32.0	63.0	48.0	32.0		
29-Apr-87	12.1	7.7	65.3	42.4	54.3	43.2	62.7	48.7	1.7		
19-Aug-87	11.0	6.0	65.0	46.0	54.0	33.0	61.0	51.0	0.4		
20-Nov-87	9.3	4.6	62.6	45.3	53.2	31.9	61.2	49.2	0.1		
27-Jan-88	10.0	3.7	64.0	45.0	54.0	31.0	61.0	48.0	0.9		
01-Jun-88	9.9	4.8	66.0	45.0	53.0	32.0	64.0	50.0	0.1		
23-Aug-88	13.2	6.4	66.1	48.5	53.9	33.5	64.8	51.2	0.9		
03-Nov-88	11.8	6.6	67.7	48.2	54.7	35.2	65.1	52.1	2.7		
09-Mar-89	12.0	7.6	64.0	45.0	52.6	32.3	61.5	48.8	5.7		
21-Jun-89	11.3	6.4	66.9	45.9	54.6	32.4	60.8		5.2		
01-Sep-89	10.0	6.0	65.0	46.0	54.0	34.0	59.0		8.0		
15-Nov-89	11.0	5.0	66.0	45.0	54.0	34.0	63.0		7.0	25.0	49.0
20-Feb-90	11.0	5.0	65.0	47.0	55.0	33.0	63.0		4.0	20.0	44.0
08-May-90	12.0	7.0	67.0	48.0	56.0	33.0	62.0		6.0	23.0	44.0
07-Aug-90	11.0	6.0	65.0	48.0	53.0	33.0	63.0		7.0	21.0	44.0
13-Nov-90	12.0	6.0	68.0	50.0	54.0	34.0	63.0		4.0	23.0	44.0
27-Feb-91	12.0	10.0	68.0	50.0	50.0	31.0	61.0		1.0	23.0	41.0
21-May-91	12.0	6.0	56.0	44.0	48.0	30.0	55.0		1.0	21.0	38.0
24-Sep-91	11.0	9.0	60.0	45.0	54.0	30.0	59.0		2.0	15.0	38.0
03-Dec-91	13.0	7.0	64.0	46.0	50.0	31.0	60.0		2.0	19.0	38.0
17-Mar-92	13.0	7.0	64.0	48.0	51.0	32.0	60.0		2.0	22.0	40.0
11-Jun-92	10.0	6.0	76.0	43.0	46.0	29.0	56.0		1.0	18.0	35.0
03-Sep-92	11	6	58	43	46	31	56		1	20	37
19-Nov-92	13.0	6.0	63.0	45.0	50.0	41.0	62.0		1.0	18.0	39.0

Ground Water Quality Data

Sulfates	mg/l										
	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Oct-79	220	240	930	1220							
31-Jan-80	520	630	2100	1700							
30-May-80	635	1075	2430	1860	1290						
30-Jun-80	632	1290	2625	1850	1200						
31-Jul-80	610	1400	2450	1980	1100						
31-Aug-80	612	1345	2975	1980	1150						
30-Sep-80	640	1550	2800	2075	960						
31-Oct-80	570	1535	3050	2020	1060						
30-Nov-80	613	1425	2750	1780	1050						
31-Dec-80	620	1520	3060	1780	1150						
31-Jan-81	638	1530	3012	1900	1140						
28-Feb-81	600	1550	2780	1980	1260						
31-Mar-81	658		3150	1890	1210						
30-Apr-81	620	1660	3030	1880	1220						
30-May-81	650	1730	3100	1910	1190						
30-Jun-81	626	1690	3040	2070	1105						
31-Aug-81	630	1750	3050	1910	1115						
31-Jan-82	613	1590	3100	1920	1260						
30-Apr-82	697	1766	3239	2056	1518						
31-Aug-82	662	1788	3185	2047	1295						
31-Dec-82	653	1749	3259	1979	1182	926	2395	2288	39		
30-Jun-83	658	1801	3226	2109	1228	943	2420	2324	41		
31-Dec-83	660	1820	3200	2075	1200	900	2338	2255	64		
29-Feb-84	637	1835	3235	2056	1175	937	2400	2250	77		
30-Jun-84	680	1900	3300	2075	1200	920	2400	2200	32		
31-Dec-84	637	1835	3235	2056	1175	937	2400	2250			
30-Jun-85	816	1890		2040	1210	909	2440	2300	18		
31-Dec-85	1080	1270	2870	2020	7820	79	7820	2120	79		
19-Jun-86	703	2010	3450	2120	1240	943	2500	2420	45		
30-Jun-86	691	2040	3400	2150	1890	949	2520	2420	43		
04-Sep-86	707	2020	3410	2160	1230	956	2470	2400	49		
10-Dec-86	680	1860	2620	2000	1140	911	2370	2240	77		
20-Feb-87	657	1910	2640	2030	1120	895	2100	1990	62		
29-Apr-87	664	1920	3200	1930	1310	1020	2300	2270	22		
19-Aug-87	691	2000	3400	2130	1140	951	2430	2380	26		
20-Nov-87	697	2040	3520	2170	1120	961	2560	2450	25		
27-Jan-88	690	1930	3020	2060	1130	919	2380	2300	22		
01-Jun-88	681	1900	3360	2120	1030	947	2450	2370	25		
23-Aug-88	648	1970	3330	2100	1050	915	2290	2330	7		
03-Nov-88	688	1980	3410	2120	1090	974	2500	2240	34		
09-Mar-89	694	1990	3410	2070	1180	975	2530	2400	41		
21-Jun-89	718	2040	3500	2180	1180	1020	2500		65		
01-Sep-89	352	2000	3500	2140	1140	1020	2250		60		
15-Nov-89	697	1990	2670	2150	1180	993	2250		105	2230	2560
20-Feb-90	692	2020	3330	2140	1210	1010	2460		98	2250	2490
08-May-90	684	2020	3480	2080	1180	1000	2070		51	1160	1260
07-Aug-90	685	1970	3400	2080	1140	973	2450		88	2240	2445
13-Nov-90	687	1980	3460	2130	1100	975	2460		89	2230	2470
27-Feb-91	662	1849	2712	1946	1028	967	1850		45	1512	1876
21-May-91	652	1885	2947	1988	1010	936	2255		51	2112	2299
24-Sep-91	692	1848	2532	1939	860	956	2240		49	1971	2215
03-Dec-91	677	1883	2214	1958	1035	968	2326		27	1919	2253
17-Mar-92	667	1899	3220	2035	1022	976	2330		21	2162	2314
11-Jun-92	642	1862	2894	1993	998	976	2304		26	2138	2293
03-Sep-92	670	1933	3312	2029	1033	1005	2352		30	2208	2366
19-Nov-92	654	1864	3200	1951	1055	1507	2343		21	2098	2362

Ground Water Quality Data

TDS	mg/l										
	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Oct-79	625	790	2100	2950							
31-Jan-80	870	1080	2450	2800							
30-May-80	1250	1950	4400	3600	2300						
30-Jun-80	1250	2300	4750	2500	2280						
31-Jul-80	1182	2449	4024	3198	2060						
31-Aug-80	1220	2278	4908	3480	2218						
30-Sep-80	1285	2769	4593	3525	2182						
31-Oct-80	1220	2652	4828	3402	2096						
30-Nov-80	1166	2492	4522	2990	1960						
31-Dec-80	1194	2648	4982	2998	2105						
31-Jan-81	1273	2768	5053	3330	2072						
28-Feb-81	1254	2835	4804	3322	2192						
31-Mar-81	1317		5122	3320	2256						
30-Apr-81	1330	3028	5130	3318	2309						
30-May-81	1306	2998	5198	3296	2297						
30-Jun-81	1188	2983	5387	3608	2114						
31-Aug-81	1197	2932	5124	3337	2119						
31-Dec-81	1199	2901	5167	3377	2190						
31-Jan-82	1200	2800	4950	3200	2250						
30-Apr-82	1200	2800	5125	3200	2500						
31-Aug-82	1200	2950	5300	3500	2250						
31-Dec-82	1326	3056	5366	3470	2180	1812	4116	3780	334		
30-Jun-83	1150	3500	4900	3500	2200	1650	4050	3850			
31-Dec-83	1200	2950	5150	3250	2100	1550	3950	3750			
30-Jun-84	1400	3200	5300	3500	2200	1700	4100	3700	280		
31-Dec-84	693	1479	2733	1581	1300		2000	2033	139		
30-Jun-85	1560	3130		3610	2200	1700	4300	3900	221		
31-Dec-85	4000	3700	5000	4600	6600	5100	5100	6800			
19-Jun-86	1280	3200	5500	3450	2130	1700	4140	3870	277		
30-Jun-86	1330	3250	5500	3610	3210	1700	4210	3850	292		
04-Sep-86	1250	3240	5320	3450	2040	1710	4040	3770	263		
10-Dec-86	1270	3140	5290	3530	2100	1710	4110	3820	403		
20-Feb-87	1270	3230	5330	3480	2050	1710	4120	3780	311		
29-Apr-87	1270	3180	5400	3340	2380	1880	4120	3810	249		
19-Aug-87	1280	3190	5320	3530	1990	1690	3990	3750	234		
20-Nov-87	1330	3260	5520	3570	1970	1720	4130	3840	236		
27-Jan-88	1310	3270	5100	3460	2030	1640	3960	3740	22		
01-Jun-88	1250	3140	5240	3430	1890	1660	4060	3720	25		
23-Aug-88	1220	3080	5230	3320	1930	1620	3010	3720	207		
03-Nov-88	1250	3150	5430	3450	1890	1710	4060	3670	170		
09-Mar-89	1280	3140	5270	3530	2010	1730	3960	3780			
21-Jun-89	1280	3210	5450	3580	2020	1750	4030		316		
01-Sep-89	1210	3040	5290	3430	1940	1760	3630		296		
15-Nov-89	1200	3060	5250	3370	2090	1860	3900		544	3430	399[illegible]
20-Feb-90	1280	3190	5300	3540	2110	1780	4030		202	3710	397[illegible]
08-May-90	1160	3050	5060	3240	1950	1660	3700		338	3000	374[illegible]
07-Aug-90	1210	3080	5220	3320	1970	1700	3750		344	3500	377[illegible]
13-Nov-90	1170	3150	5290	3280	1880	1720	3760		308	3440	378[illegible]
27-Feb-91	1272	3154	5268	3424	1850	1686	3260		252	2684	335[illegible]
21-May-91	1275	3037	5326	3348	1871	1740	3943		250	3613	396[illegible]
24-Sep-91	1352	3149	5309	3471	2139	1819	3810		266	3818	381[illegible]
03-Dec-91	1286	3179	5188	3462	1943	1810	3930		238	3661	384[illegible]
17-Mar-92	1285	3206	5317	3523	1922	1797	4024		237	3704	391[illegible]
11-Jun-92	990	2910	4930	3190	1810	1740	3900		219	3580	380[illegible]
03-Sep-92											
19-Nov-92											

Ground Water Quality Data

ARSENIC

	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Jul-80	0.0009	0.016	0.012	0.008	0.006						
31-Aug-80	0.004	0.004	0.0009	0.002	0.0009						
30-Sep-80	0.002	0.002	0.002	0.0009	0.0009						
31-Oct-80	0.0009	0.0009	0.0009	0.0009	0.0009						
30-Nov-80	0.002	0.004	0.004	0.002	0.002						
31-Dec-80	0.0009	0.0009	0.0009	0.0009	0.0009						
31-Jan-81	0.0009	0.0009	0.0009	0.0009	0.0009						
28-Feb-81	0.0009	0.0009	0.0009	0.0009	0.0009						
31-Mar-81	0.0009	0.0009	0.0009	0.0009	0.0009						
30-Apr-81	0.0009	0.0009	0.0009	0.0009	0.0009						
30-May-81	0.0009	0.0009	0.0009	0.0009	0.0009						
30-Jun-81	0.0009	0.0009	0.0009	0.0009	0.0009						
31-Aug-81	0.0009	0.0009	0.0009	0.0009	0.0009						
31-Jan-82	0.0009	0.0009	0.0009	0.0009	0.0009						
05-May-85	0.0009	0.0009	0.0009								
28-Jun-85	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.008		
23-Jul-85	0.0009	0.021	0.0009								
06-Aug-85	0.001	0.001	0.0009								
30-Sep-85	0.0009	0.0009	0.0009								
30-Oct-85	0.0009	0.0009	0.0009								
27-Nov-85	0.0009	0.0009	0.0009								
15-Dec-85	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		
24-Jan-86	0.0009	0.0009	0.0009								
28-Feb-86	0.0009	0.0009	0.0009								
27-Mar-86	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.002	0.0009		
08-Apr-86	0.0009	0.0009	0.0009								
02-May-86	0.0009	0.0009	0.0009								
04-Sep-86	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		
10-Dec-86	0.001	0.003	0.005								
20-Feb-87	0.0009	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.0009		
29-Apr-87	0.002	0.002	0.001	0.0009	0.0009	0.002	0.003	0.002	0.011		
20-Nov-87	0.003	0.005	0.006	0.002	0.001	0.001	0.009	0.008	0.013		
27-Jan-88	0.0030	0.0009	0.0030								
23-Aug-88	0.0140	0.0190	0.0250	0.0220	0.0170	0.0180	0.0230	0.0190	0.0070		
03-Nov-88	0.0009	0.0040	0.0110	0.0009	0.0009	0.0009	0.0009	0.0030	0.0009		
09-Mar-89	0.0150	0.0320	0.0460	0.0330	0.0190	0.0150	0.0360	0.0300	0.0070		
22-Jun-89	0.0040	0.0140	0.0330	0.0170	0.0100	0.0050	0.0210		0.0150		
01-Sep-89	0.0010	0.0050	0.0060	0.0030	0.0010	0.0000	0.0030		0.0060		
15-Nov-89	0.0010	0.0080	0.0100	0.0020	0.0070	0.0020	0.0030		0.0130	0.0030	0.00[illegible]
08-May-90	0.0020	0.0010	0.0050	0.0010	0.0009	0.0010	0.0010		0.0120	0.0010	0.00[illegible]
13-Nov-90	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		0.0110	0.0009	0.00[illegible]
27-Feb-91	0.0010	0.0009	0.0009	0.0020	0.0009	0.0020	0.0010		0.0140	0.0009	0.00[illegible]
24-Sep-91	0.0009	0.0010	0.0009	0.0020	0.0080	0.0009	0.0010		0.0130	0.0009	0.00[illegible]
17-Mar-92	0.0009	0.0009	0.0009	0.0020	0.0100	0.0020	0.0009		0.0130	0.0009	0.00[illegible]
03-Sep-92	0.0009	0.0009	0.0009	0.0009	0.0060	0.0060	0.0009		0.0210	0.0009	0.00[illegible]

SELENIUM

	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Jul-80	0.0009	0.025	0.0009	0.0009	0.0009						
31-Aug-80	0.002	0.026	0.005	0.002	0.003						
30-Sep-80	0.0009	0.012	0.0009	0.0009	0.0009						
31-Oct-80	0.0009	0.017	0.0009	0.0009	0.0009						
30-Nov-80	0.001	0.011	0.003	0.001	0.001						
31-Dec-80	0.0009	0.0009	0.0009	0.0009	0.0009						
31-Jan-81	0.0009	0.016	0.0009	0.0009	0.0009						
28-Feb-81	0.0009	0.0009	0.0009	0.0009	0.0009						
31-Mar-81	0.0009		0.0009	0.0009	0.0009						
30-Apr-81	0.0009	0.0009	0.0009	0.0009	0.0009						
30-May-81	0.0009	0.002	0.0009	0.0009	0.0009						
30-Jun-81	0.0009	0.01	0.0009	0.0009	0.0009						
31-Aug-81	0.0009	0.004	0.0009	0.0009	0.0009						
31-Jan-82	0.0009	0.009	0.003	0.003	0.0009						
30-Jun-84	0.0049	0.015	0.031	0.009	0.0049	0.0049	0.0049	0.005	0.0049		
05-May-85	0.0009	0.0009	0.0009								
28-Jun-85	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		
23-Jul-85	0.037	0.0009	0.0009								
06-Aug-85	0.0009	0.0009	0.0009								
30-Sep-85	0.0009	0.0009	0.0009								
30-Oct-85	0.0009	0.0009	0.0009								
27-Nov-85	0.0009	0.0009	0.0009								
15-Dec-85	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		
24-Jan-86	0.0009	0.0009	0.0009								
28-Feb-86	0.0009	0.0009	0.0009								
27-Mar-86	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		
08-Apr-86	0.0009	0.003	0.0009								
02-May-86	0.0009	0.0009	0.0009								
04-Sep-86	0.0009	0.0009	0.001	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		
10-Dec-86	0.0019	0.0019	0.0019								
20-Feb-87	0.0009	0.0009	0.002	0.0009	0.001	0.003	0.001	0.007	0.0009		
29-Apr-87	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009			
20-Nov-87	0.005	0.023	0.036	0.01	0.018	0.02	0.004	0.027	0.0009		
27-Jan-88	0.009	0.01	0.016								
23-Aug-88	0.014	0.045	0.091	0.008	0.061	0.072	0.015	0.057	0.0009		
03-Nov-88	0.005	0.024	0.037	0.005	0.026	0.029	0.003	0.03	0.0009		
09-Mar-89	0.004	0.017	0.027	0.019	0.005	0.002	0.021	0.027	0.001		
22-Jun-89	0.001	0.002	0.003	0.003	0.004	0.004	0.001		0.001		
01-Sep-89	0.001	0.001	0.004	0.003	0	0	0		0.001		
15-Nov-89	0.005	0.015	0.019	0.015	0.006	0.02	0.02		0.001	0.014	0.019
08-May-90	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009		0.0009	0.0009	0.0009
13-Nov-90	0.0009	0.004	0.003	0.0009	0.0009	0.0009	0.0009		0.0009	0.0009	
27-Feb-91	0.002	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019		0.0019	0.0019	0.0019
24-Sep-91	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019		0.0019	0.0019	0.0019
17-Mar-92	0.0019	0.002	0.0019	0.0019	0.0019	0.0019	0.0019		0.0019	0.0019	0.0019
03-Sep-92	0.0019	0.003	0.011	0.0019	0.0019	0.0019	0.0019		0.0019	0.0019	0.017

Ground Water Quality Data

Ra-226

pCi/l	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Jul-80	1	1.3	1	0.7	1						
31-Aug-80	0.7	1.7	0.6	0.7	0.6						
30-Sep-80	0.7	0.3	0.5	0.4	0.2						
31-Oct-80	0.8	1.9	1.1	0.9	1.1						
30-Nov-80	0.7	1.1	0.8	0.8	0.8						
31-Dec-80	0.5	0.4	0.3	0.7	0.4						
31-Jan-81	0.5	1.3	1.3	0.5	0.6						
28-Feb-81	0.6	1.7	0.6	0.9	0.6						
31-Mar-81	2	1.6	0.8	0.9	0.7						
30-Apr-81	2.2	1.3	1.8	0.5	0.3						
30-May-81	3.5	2.3	1.5	1.3	0.8						
30-Jun-81	1.5	2	2.3	1.2	1.8						
31-Aug-81	0.8	7.5	15.5	1.1	1.6						
30-Sep-81	0.4	1.1	0.5	0.8	0.2						
31-Jan-82	0.8	1.6	1.1	1	0.9						
30-Apr-82	0.3	0.6	0.5	1	0.3						
30-Jun-83	0.4	0.17	1.4	1	1.2	0.4	0.6	0.6	0.4		
30-Jun-84	3	8	8	7	2	2	6	3	7		
30-Jun-85	1	1.3	1	1.4	0.3	0.1	1.1	0.9	2		
31-Dec-85	0.5	0.9	5.3	0.9	0.8	0.1	0.7	0.4	0.55		
21-Mar-86	0.5	1	0.8	0.6	0.2	0.1	0.6	0.1	0.4		
19-Jun-86	0.5	0.9	5.3	0.9	0.8	0.1	0.7	0.4	0.055		
04-Sep-86	1.5	0.8	0.9	0.6	0.2	0.2	0.9	0.1	1.3		
10-Dec-86	0.4	0.5	1.1	0.7	0.3	0.3	0.7	0.3	0.3		
20-Feb-87	0.2	0.5	1.1	0.5	0.4	0.4	0.7	0.2	0.3		
29-Apr-87	0.6	0	0.3	0.4	0.3	0.2	0.6	0.3	0.5		
20-Nov-87	0.3	0.2	0.3	0.1	0	0.2	0.3	0	0.6		
27-Jan-88	0.6	0.2	0.8								
23-Aug-88	0.5	0.2	0.7	0.3	0.1	0.1	0.5	0.1	0.5		
03-Nov-88	0.1	0.2	0.3	0.1	0	0.2	0.7	0	0.5		
09-Mar-89	0.1	0.2	0.3	0.1	0.1	0.1	0.2	0.2	0.9		
01-Sep-89	0	0.5	0.2	0.2	0	0.1	0.5		0.2		
15-Nov-89	0.2	0.2	0.4	0.2	0.1	0.2	0.1		0.1	0.1	0.[illegible]
08-May-90	0.2	0.3	0.6	0.4	0.2	0.1	0.4		0.3	0.1	0.[illegible]
13-Nov-90	0.2	0.4	0.2	0.1	0.2	0.4	0.1		0.4	0.2	0.[illegible]
27-Feb-91	0.1	0.3	0.2	0.3	0	0.1	0.3		0.3	0.3	0.[illegible]
24-Sep-91	0.4	0.1	0.2	0	0	0	0.3		0.2	0.2	[illegible]
17-Mar-92	0.4	0.2	0.7	0.9	0.4	0.3	0.2		0.3	0.4	0.[illegible]
03-Sep-92	0.2	0.8	0.8	0.4	0.1	0.1	0.4		0.7	0.2	[illegible]

Ground Water Quality Data

Ra-228 pCi/l	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
27-Feb-91	1.7	2.5	1.1	2.1	1.2	0.9	2.8		1.4	0.5	1.[illegible]
24-Sep-91	1.8	2.2	1.9	1.9	0.8	0.7	2.1		0	0	0.[illegible]
17-Mar-92	1.6	1.6	0	2.1	0.4	0	1.6		0.6	0.9	0.[illegible]
03-Sep-92	1.8	0	2.5	1.4	0	0	0		0	0.6	0.[illegible]
Average	1.725	1.575	1.375	1.875	0.600	0.400	1.625	#DIV/0!	0.500	0.500	0.55[illegible]
Standard Deviation	0.083	0.965	0.936	0.286	0.447	0.406	1.030	#NUM!	0.574	0.324	0.37[illegible]
Minimum	1.600	0.000	0.000	1.400	0.000	0.000	0.000	0.000	0.000	0.000	0.30[illegible]
Maximum	1.800	2.500	2.500	2.100	1.200	0.900	2.800	0.000	1.400	0.900	1.20[illegible]

Ground Water Quality Data

Th-230

pCi/l	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
31-Jul-80	0.4	0.3	0.3	0.4	0.5						
31-Aug-80	0.4	0.4	0.5	0.3	0.3						
30-Sep-80	0.8	0.5	0.4	0.7	0.9						
31-Oct-80	0.5	0.9	0.4	0.9	1.1						
30-Nov-80	0.8	0.6	0.5	0.6	0.9						
31-Dec-80	0.5	0.4	0.8	0.9	0.6						
31-Jan-81	0.5	1.3	1.3	0.5	0.6						
28-Feb-81	0.5	0.8	0.6	0.7	0.6						
31-Mar-81	0.8	0.4	0.8	0.8	0.5						
30-Apr-81	0.5	0.6	0.6	0.5	0.9						
30-May-81	1.1	0.7	0.5	1.2	0.8						
30-Jun-81	1.7	1.1	0.8	1.3	0.7						
31-Aug-81	0.7	1.2	1.1	1.4	0.9						
31-Jan-82	1.1	0	0	1	2.9						
30-Apr-82	0.8	0.9	1.5	0.8	1.7						
31-Aug-82	0.2	0	0	0	0						
30-Jun-83	0	0.4	0.5	0.1	0.2	0	0.1	0.1	0		
30-Jun-84	2	4	1	0	0.1	2	0	5	2		
30-Jun-85	1.2	0.5	0.5	0.9	0.1	1.2	0.6	0.5	0.3		
31-Dec-85	0.1	0	0.7	0.1	0.1	0.1	0.5	0.1	0.05		
21-Mar-86	0.1	0	0.7	0.1	0.1	0.1	0.5	0.1	0.05		
19-Jun-86	0.1	0	0.7	0.1	0.1	0.1	0.5	0.1	0.05		
04-Sep-86	0.4	0.7	0.9	2.4	1.8	1.2	0	0.5	0.5		
10-Dec-86	0	0	0	0.5	0.1	0	0	0	0		
20-Feb-87	0.2	1.5	0	0	0.9	0	0	0	0.1		
29-Apr-87	0.1	0.1	0.2	0.6	0.3	1.9	5.4	4.3	1.2		
20-Nov-87	0	0	0	0.1	0	0.1	0	0.1	0		
27-Jan-88	0.1	0.1	0.3								
23-Aug-88	0.9	0	0.7	0	0.4	0	0	0	0.4		
03-Nov-88	0.7	0.2	0.3	0.4	0	0	0.5	0.5	0.2		
09-Mar-89	0	0	0	0.1	0	0.2	0.2	0.2	0		
01-Sep-89	0	0	0	0	0.1	0	0.4		0		
20-Nov-89	0	0	10	0.1	0	0	0		3.2	0	4.7
08-May-90	0.1	0	0.1	0	0	0	0		0	0	
13-Nov-90	0.2	0.1	0	0.1	0	0.2	0.2		0	0	0.
27-Feb-91	0	0	0.1	0	0	0	0		0.1	0	0.
24-Sep-91	0	0	0	0	0	0	0.1		0	0	0.
17-Mar-92	0	0	0	0	0	0	0		0	0	0
03-Sep-92	0	0	0	0	0	0	0		0	0	0.

Ground Water Quality Data

Pb-210

pCi/l	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#13	CULINARY	WM#14	WM#15
31-Jul-80	3	3	3	3	5						
31-Aug-80	3	3	5	2	3						
30-Sep-80	3	3	2	3	5						
31-Oct-80	3	3	3	2	3						
30-Nov-80	3	2	4	5	4						
31-Dec-80	5	3	3	4	2						
31-Jan-81	3	3	4	2	4						
28-Feb-81	4	5	4	3	5						
31-Mar-81	4		5	3	5						
30-Apr-81	4	5	5	3	5						
30-May-81	4	3	5	3	4						
30-Jun-81	3	5	6	3	5						
31-Aug-81	2	3	6	5	3						
31-Jan-82	0	5	0	0	8						
30-Apr-82	1.3	1.2	1.8	0.9	1.1						
31-Aug-82	0	0.5	1.03	0.9	0						
30-Jun-83	0	0	0.5	0	0	0	0	0	0		
30-Jun-84	1.2	9	7	1	3	1	8	1.2	8.8		
30-Jun-85	2.7	8.3	1.2	0	0.3	0.8	0	0.2	1.6		
31-Dec-85	0	1	0.4	0.2	0.3	0.9	0.1	0.2	0.2		
21-Mar-86	0	1	0.4	0.2	0.3	0.9	0.1	0.2	0.2		
19-Jun-86	0	1	0.4	0.2	0.3	0.9	0.1	0.2	0.2		
04-Sep-86	0.3	0	0	0	3.6	0.1	0.3	0	0		
10-Dec-86	2.2	3	0	0	0	0.8	0	0	0		
20-Feb-87	2.2	2.3	1.8	1.5	2.7	1.5	2.1	1.1	1.3		
29-Apr-87	3.1	0.2	0.5	6.6	2.4	4	0	1.8	0.9		
20-Nov-87	0.7	0.0	0.0	1.7	0.6	6.7	2.3	1.2	0.9		
27-Jan-88	0.0	0.0	0.0								
23-Aug-88	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0		
03-Nov-88	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0		
09-Mar-89	0.2	0.8	0.1	0.8	0.1	0.7	0.3	0.8	0.9		
01-Sep-89	0.0	0.1	0.0	0.5	0.0	0.1	0.0		0.3		
20-Nov-89	0.4	1.3	1.3	0.1	1.0	0.1	0.2		1.2	1.0	0.0
08-May-90	0.4	0.0	1.0	0.4	1.1	0.7	0.8		0.0	0.7	1.3
13-Nov-90	0.7	1.3	0.4	0.9	0.0	1.1	0.3		0.0	0.6	0.1
27-Feb-91	0.0	0.4	0.1	2.6	0.9	0.6	0.3		0.8	0.6	0.7
24-Sep-91	0.5	0.7	1.1	0.0	0.0	0.1	1.8		1.8	1.7	0.0
17-Mar-92	1.4	2.6	1.3	1.5	1.8	1.5	2.2		2.0	2.3	2.2
03-Sep-92	0.0	0.0	0.0	0.0	1.1	0.4	0.0		0.6	0.6	0.0

U-Nat uCi/ml

	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#13	CULINARY	MW#14	MW#15
30-Sep-81	2.7E-09	3.2E-08	2.4E-08	1.5E-08	1.4E-08				6.8E-10		
31-Dec-81	6.5E-10	3.0E-09	1.4E-08	3.0E-09	3.0E-09				6.9E-10		
31-Mar-82	6.5E-10	2.0E-09	2.7E-09	6.9E-10	6.8E-10				6.9E-10		
30-Jun-82	1.4E-09	4.7E-09	2.4E-08	1.3E-09	2.7E-09				7.0E-10		
30-Sep-82	6.8E-10	2.7E-09	8.9E-09	6.8E-10	6.7E-10				4.5E-09		
31-Dec-82	6.8E-10	6.6E-10	2.5E-08	6.7E-10	6.7E-10				6.6E-10		
31-Mar-83	7.4E-09	2.0E-08	1.0E-08	5.5E-09	8.0E-10	3.4E-10	5.0E-09	4.1E-09			
30-Jun-83	6.7E-10	3.4E-09	2.0E-08	6.8E-10	6.7E-10	6.8E-10	2.0E-09	4.0E-09			
30-Sep-83	2.3E-09	2.3E-09	1.4E-08	2.3E-09	5.6E-09	8.5E-09	1.1E-08	6.8E-09			
31-Dec-83	2.3E-09	6.0E-09	2.8E-08	6.7E-10	6.8E-10	6.9E-10	1.0E-08	1.4E-08			
31-Mar-84	2.71E-09	1.35E-09	1.49E-08	1.35E-09	1.35E-09	7.45E-09	2.91E-08	5.24E-09	3.25E-08		
30-Jun-84	2.71E-09	2.71E-09	1.29E-08	2.71E-09	2.71E-09	2.71E-09	1.83E-08	1.83E-08	2.71E-09		
30-Sep-84	8.12E-10	4.06E-10	1.22E-09	4.06E-10	4.06E-10	4.06E-10	4.06E-10	4.06E-10	4.06E-10		
31-Dec-84	4.06E-10	0.00E+00	1.49E-09	8.12E-10	0.00E+00	1.76E-09	1.62E-09	1.49E-09	1.35E-09		
31-Mar-85	1.76E-09	1.90E-09	1.56E-09	4.20E-09	6.09E-10	2.71E-10	4.74E-10	2.30E-09	2.03E-10		
30-Jun-85	7.99E-10	6.20E-09	1.08E-09	9.00E-10	6.03E-10	2.98E-10	6.80E-09	2.50E-09	1.50E-09		
30-Sep-85	1.35E-09	1.69E-08	3.05E-08	1.35E-09	3.39E-09	8.80E-09	3.39E-09	2.03E-09	1.66E-09		
31-Dec-85	1.70E-09	9.40E-09	2.06E-08	1.60E-09	5.00E-10	5.00E-10	6.60E-09	1.35E-08	2.15E-09		
31-Mar-86	1.90E-09	8.80E-09	1.90E-08	2.20E-09	1.10E-09	1.70E-09	9.60E-09	1.48E-08			
30-Jun-86	1.90E-09	6.40E-09	1.50E-08	1.80E-09	5.00E-09	1.50E-09	9.60E-09	1.10E-08	1.00E-09		
04-Sep-86	2.30E-09	5.80E-09	1.67E-08	1.00E-09	7.00E-10	4.00E-10	9.00E-09	1.17E-08	2.00E-09		
10-Dec-86	2.90E-09	8.20E-09	1.21E-08	1.90E-10	1.60E-09	1.90E-10	1.29E-08	1.17E-08	2.20E-09		
20-Feb-87	1.90E-10	3.50E-09	1.10E-08	1.90E-10	1.90E-10	1.90E-10	9.10E-09	7.00E-09	1.90E-10		
29-Apr-87	1.50E-09	3.10E-09	1.25E-08	1.30E-09	9.00E-10	3.00E-10	1.05E-08	9.50E-09	7.00E-10		
19-Aug-87	2.40E-09	6.20E-09	2.30E-08	1.50E-09	2.10E-09	7.00E-10	9.00E-09	1.20E-08	5.00E-10		
20-Nov-87	1.30E-09	4.10E-09	1.60E-08	9.00E-10	3.00E-10	5.00E-10	9.40E-09	1.20E-08	3.00E-10		
26-Jan-88	1.80E-09	4.10E-09	2.00E-08	1.60E-09	1.00E-09	1.90E-10	8.90E-09	1.20E-08	3.00E-10		
01-Jun-88	7.00E-10	4.70E-09	1.84E-08	1.40E-09	9.00E-10	5.00E-10	1.23E-08	1.43E-08	8.00E-10		
23-Aug-88	7.20E-09	1.10E-09	1.50E-09	5.40E-10	1.20E-10	5.00E-11	1.00E-09	1.20E-09	2.20E-10		
03-Nov-88	1.22E-09	4.94E-09	1.48E-07	3.60E-12	1.08E-09	2.71E-10	1.20E-07	1.23E-07	1.62E-09		
09-Mar-89	1.02E-09	6.00E-09	2.20E-08	1.40E-09	1.50E-09	9.00E-10	1.00E-08	0.00E+00	1.90E-09		
21-Jun-89	2.00E-09	6.80E-09	2.30E-08	1.20E-09	6.00E-10	8.00E-10	1.10E-08	0.00E+00	6.00E-10		
01-Sep-89	9.00E-10	8.80E-09	2.20E-08	2.60E-09	1.10E-09	1.60E-09	1.10E-08	0.00E+00	9.00E-10		
20-Nov-89	2.00E-10	9.50E-09	1.90E-08	9.00E-10	4.00E-10	6.00E-10	5.60E-09		0.00E+00	2.7E-08	4.4E-08
16-Feb-90	2.40E-09	7.40E-09	1.40E-08	1.60E-09	7.00E-10	7.00E-10	8.80E-09		3.00E-10	3.2E-08	3.0E-08
08-May-90	7.00E-10	8.00E-09	2.30E-08	1.60E-09	7.00E-10	8.00E-10	1.00E-08		3.00E-10	3.3E-08	3.0E-08
16-Aug-90	4.67E-10	5.87E-09	1.67E-08	1.27E-09	6.00E-10	4.67E-10	1.07E-08		4.00E-10	3.3E-08	2.5E-08
13-Nov-90	5.00E-10	7.20E-09	1.60E-08	1.20E-09	3.00E-10	6.00E-10	1.00E-08		5.00E-10	3.3E-08	2.4E-08
27-Feb-91	2.20E-10	3.50E-09	8.00E-09	1.30E-09	2.70E-10	2.00E-10	8.80E-09		2.00E-10	2.4E-08	2.0E-08
21-May-91	9.10E-10	4.30E-09	1.30E-08	7.70E-10	1.10E-09	2.30E-10	1.00E-08		8.60E-10	2.2E-08	1.8E-08
24-Sep-91	8.20E-10	7.60E-09	2.20E-08	9.00E-10	8.00E-10	7.40E-10	1.10E-08		9.90E-10	3.1E-08	3.3E-08
03-Dec-91	4.30E-10	9.50E-09	8.10E-09	7.40E-10	5.30E-10	2.40E-10	6.80E-09		2.40E-10	3.0E-08	2.3E-08
17-Mar-92	4.54E-10	7.07E-09	4.53E-09	1.02E-09	1.60E-09	2.70E-09	1.01E-08		1.46E-09	3.03E-08	2.37E-08
11-Jun-92	2.76E-09	4.66E-09	9.13E-09	2.00E-10	2.00E-10	2.00E-10	5.53E-09		2.00E-10	2.6E-08	1.9E-08
03-Sep-92	2.03E-09	1.15E-08	1.9E-08	4.06E-09	4.06E-09	3.39E-09	1.29E-08		2.03E-09	4.27E-08	2.78E-08
19-Nov-92	5.42E-10	1.02E-08	1.12E-08	1.42E-07	6.77E-10	3.18E-09	1.39E-08		1.83E-09	4.3E-08	2.7E-08

Ground Water Quality Data

Alkalinity (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					326	316	346	428	374	0
20-Nov-89	260	344	277	347	322	301	342	379	353	240
15-Dec-89					314	304	324	392	355	
24-Jan-90					300	300	319	382	353	
27-Feb-91	271	349	204	384	303	301	296	361	356	201
19-Nov-92	258	345	352	350	322	329	334	406	357	189

Ground Water Quality Data

Ammonia (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.7	0.6	0.2	0.1	0.1	
20-Nov-89	0.5	0.009	0.009	0.7	0.7	0.6	0.1	0.009	0.2	0.2
15-Dec-89					0.7	0.6	0.1	0.1	0.1	
24-Jan-90					0.5	0.5	0.09	0.09	0.09	

Ground Water Quality Data

Cadmium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.0049	0.0049	0.0049	0.0049	0.0049	
20-Nov-89	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
15-Dec-89					0.0049	0.007	0.006	0.0049	0.0049	
24-Jan-90					0.0049	0.007	0.007	0.0049	0.0049	
24-Sep-91	0.001	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
17-Mar-92	0.0009	0.0009	0.0009	0.0009	0.0009	0.001	0.001	0.0009	0.0009	0.0009
14-Sep-92	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009

Ground Water Quality Data

Cyanide (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.009	0.009	0.009	0.009	0.009	
20-Nov-89	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
15-Dec-89					0.009	0.009	0.009	0.009	0.009	
24-Jan-90					0.009	0.009	0.009	0.009	0.009	

Ground Water Quality Data

Chromium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.009	0.009	0.009	0.009	0.009	
20-Nov-89	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
15-Dec-89					0.009	0.009	0.009	0.009	0.009	
24-Jan-90					0.009	0.009	0.009	0.009	0.009	

Ground Water Quality Data

Calcium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
03-Sep-92	126	306	377	377	110	34.5	488	467	359	47
14-Nov-92	152	334	437	424	132	198	504	474	431	49

Ground Water Quality Data

Berylium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
24-Sep-91	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
17-Mar-92	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
03-Sep-92	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009

Ground Water Quality Data

2-Butanone

(ug/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					99	99	99	99	99	
20-Nov-89	99	99	99	99	99	99	99	99	99	99
15-Dec-89					9.9	9.9	9.9	9.9	9.9	
24-Jan-90					9.9	9.9	9.9	9.9	9.9	

Ground Water Quality Data

Chloroform (ug/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					4.9	4.9	4.9	4.9	4.9	
20-Nov-89	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
15-Dec-89					4.9	4.9	4.9	4.9	4.9	
24-Jan-90					4.9	4.9	4.9	4.9	4.9	

Ground Water Quality Data

Carbon Disulfide (ug/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					4.9	4.9	4.9	4.9	4.9	
20-Nov-89	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
15-Dec-89					4.9	4.9	4.9	4.9	4.9	
24-Jan-90					4.9	4.9	4.9	4.9	4.9	

Ground Water Quality Data

Acetone (ug/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					99	99	99	99	99	
20-Nov-89	99	99	99	99	99	99	99	99	99	99
15-Dec-89					9.9	9.9	9.9	9.9	9.9	
24-Jan-90					9.9	9.9	9.9	9.9	9.9	

Ground Water Quality Data

Methylene Chloride (ug/l) Date	MW#1	MW#2	MW#3	MW#4	MW#5	MW#11	MW#12	MW#14	MW#15	Culinary
01-Nov-89					4.9	4.9	4.9	4.9	4.9	
20-Nov-89	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	130
15-Dec-89					4.9	4.9	4.9	4.9	4.9	
24-Jan-90					4.9	4.9	4.9	4.9	4.9	

Ground Water Quality Data

Gross Beta Dissolved (pCi/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					12	21	30	43	55	
20-Nov-89	11	31	50	15	18	7	34	40	29	6.7
15-Dec-89					19	16	44	37	51	
24-Jan-90					13	10	29	37	41	
27-Feb-91	7.1	21	31	13	6.3	8.3	26	25	18	
24-Sep-91	15	21	63	40	17	18	25	33	42	5.6
17-Mar-92	20	28	42	22	13	16	25	56	29	4.2
03-Sep-92	12	58	60	10	10	14	38	67	39	4.2

Ground Water Quality Data

Gross Alpha Dissolved (pCi/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					7	42	47	53	89	
20-Nov-89	6.3	39	55	4	8	17	27	68	81	1.9
15-Dec-89	-				7	13	62	67	90	
24-Jan-90					0	0	16	40	68	
27-Feb-91	0	4	0	10	15	17	24	48	19	0.1
24-Sep-91	0	21	76	2	5	5	27	62	24	5.9
17-Mar-92	0	67	38	31	12	10	0	82	47	0.2
03-Sep-92	5	36	34	5	10	0	10	48	27	0

Ground Water Quality Data

Thallium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.009	0.009	0.009	0.009	0.009	
20-Nov-89	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
15-Dec-89					0.009	0.009	0.009	0.009	0.009	
24-Jan-90	-				0.009	0.009	0.009	0.009	0.009	

Ground Water Quality Data

Vanadium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.009	0.009	0.009	0.009	0.009	
20-Nov-89	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.03	0.04
15-Dec-89					0.009	0.009	0.009	0.009	0.01	
24-Jan-90					0.009	0.009	0.009	0.009	0.009	

Ground Water Quality Data

Nickel (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.009	0.009	0.03	0.03	0.02	
20-Nov-89	0.009	0.009	0.05	0.02	0.009	0.009	0.02	0.02	0.02	0.009
15-Dec-89					0.009	0.009	0.02	0.03	0.02	
24-Jan-90					0.009	0.009	0.009	0.01	0.009	
27-Feb-91	0.02	0.06	0.1	0.07	0.04	0.05	0.06	0.05	0.07	0.01
24-Sep-91	0.009	0.01	0.02	0.009	0.009	0.009	0.009	0.009	0.009	0.009
17-Mar-92	0.009	0.01	0.01	0.009	0.009	0.009	0.009	0.009	0.009	0.009
14-Sep-92	0.0009	0.0009	0.019	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009

Ground Water Quality Data

Molybdenum (mg/l)

Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.009	0.009	0.02	0.02	0.04	
20-Nov-89	0.01	0.02	0.009	0.02	0.009	0.009	0.02	0.02	0.009	0.009
15-Dec-89					0.009	0.009	0.02	0.02	0.03	
24-Jan-90					0.009	0.009	0.009	0.009	0.01	
24-Sep-91	0.001	0.003	0.01	0.014	0.0009	0.0009	0.006	0.025	0.001	
17-Mar-92	0.001	0.001	0.0009	0.0009	0.0009	0.0009	0.002	0.003	0.003	0.001
14-Sep-92	0.0009	0.0009	0.0009	0.0009	0.001	0.001	0.001	0.002	0.0009	0.001

Ground Water Quality Data

Mercury (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
01-Nov-89					0.00019	0.00019	0.00019	0.00019	0.00019	
20-Nov-89	0.00019	0.00019	0.00019	0.00019	0.00019	0.00019	0.00019	0.00019	0.00019	0.00019
15-Dec-89					0.00019	0.00019	0.00019	0.00019	0.00019	
24-Jan-90					0.00019	0.00019	0.00019	0.00019	0.00019	

Ground Water Quality Data

Potassium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
03-Sep-92	6.77	11.4	23.9	10.17	7.7	6.3	13.8	12	10.2	3.27
14-Nov-92	6.65	12.25	24.3	10.6	7.85	10.55	13.25	11.5	10.1	3.15

Ground Water Quality Data

Magnesium (mg/l) Date	MW#1	MW#2	WM#3	WM#4	WM#5	WM#11	WM#12	WM#14	WM#15	Culinary
03-Sep-92	60.5	105	252	192	42	12	231	161	166	23
14-Nov-92	63	104	244	185	43	73	224	157	172	21

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 15903

Sample Description: #2 Standpipe

Date Sample Received: February 4, 1993

Report Date: February 10, 1993

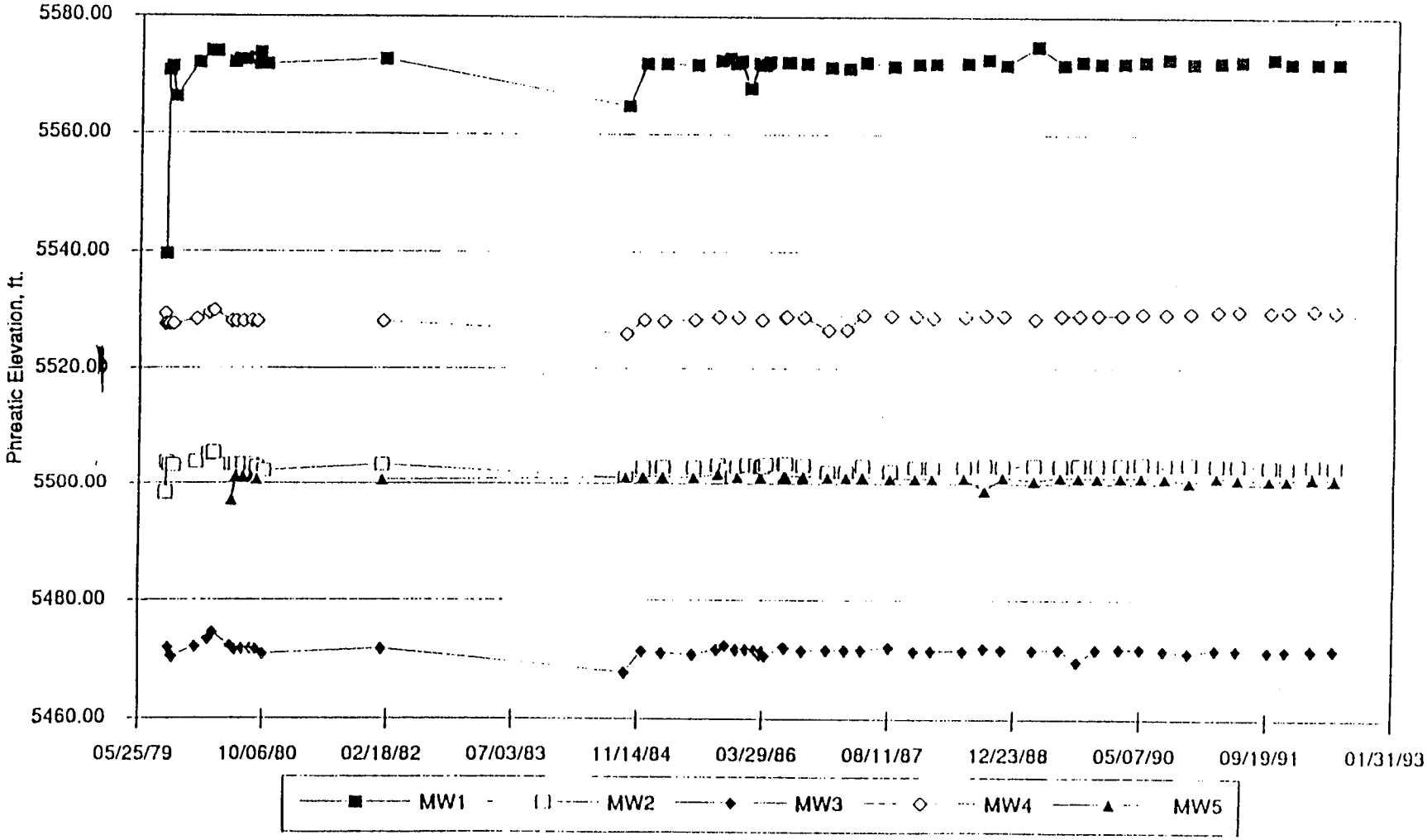
Units Of Measurement: mg/l

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst – T. Slade

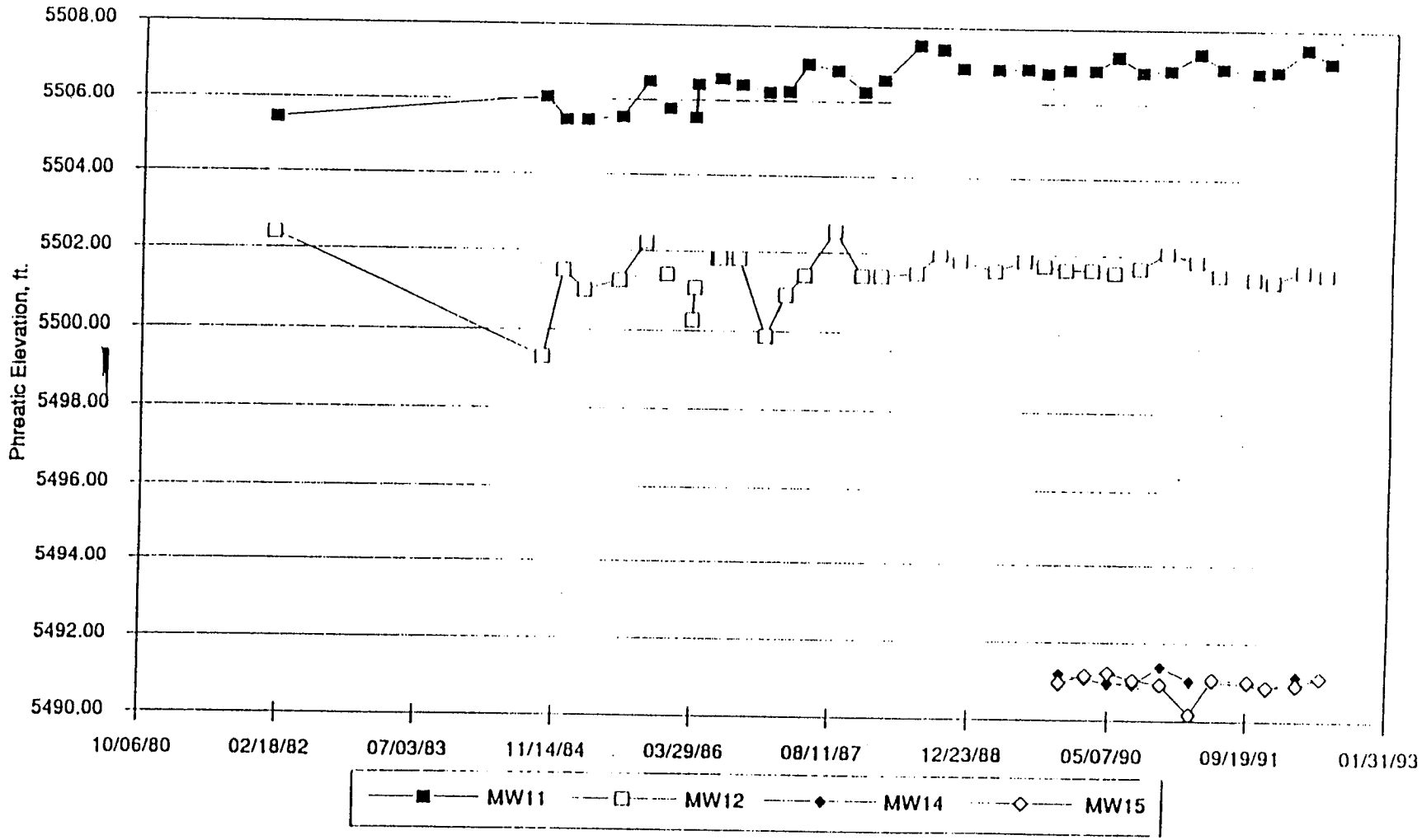
Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Ca	93.0	EPA 215.1	10-Feb-93	2,3
K	2.55	EPA 258.1	10-Feb-93	2,3
Mg	5.25	EPA 242.1	10-Feb-93	2,3
Na	26.0	EPA 273.1	10-Feb-93	2,3
Se	<0.002	EPA 270.2	10-Feb-93	2,3
Cl	175	EPA 325.3	09-Feb-93	2,3
SO4	99	EPA 375.3	09-Feb-93	2,3
Alkinity as CaCO3	138	EPA 310.1	08-Feb-93	2,3
pH	7.7		08-Feb-93	2,3

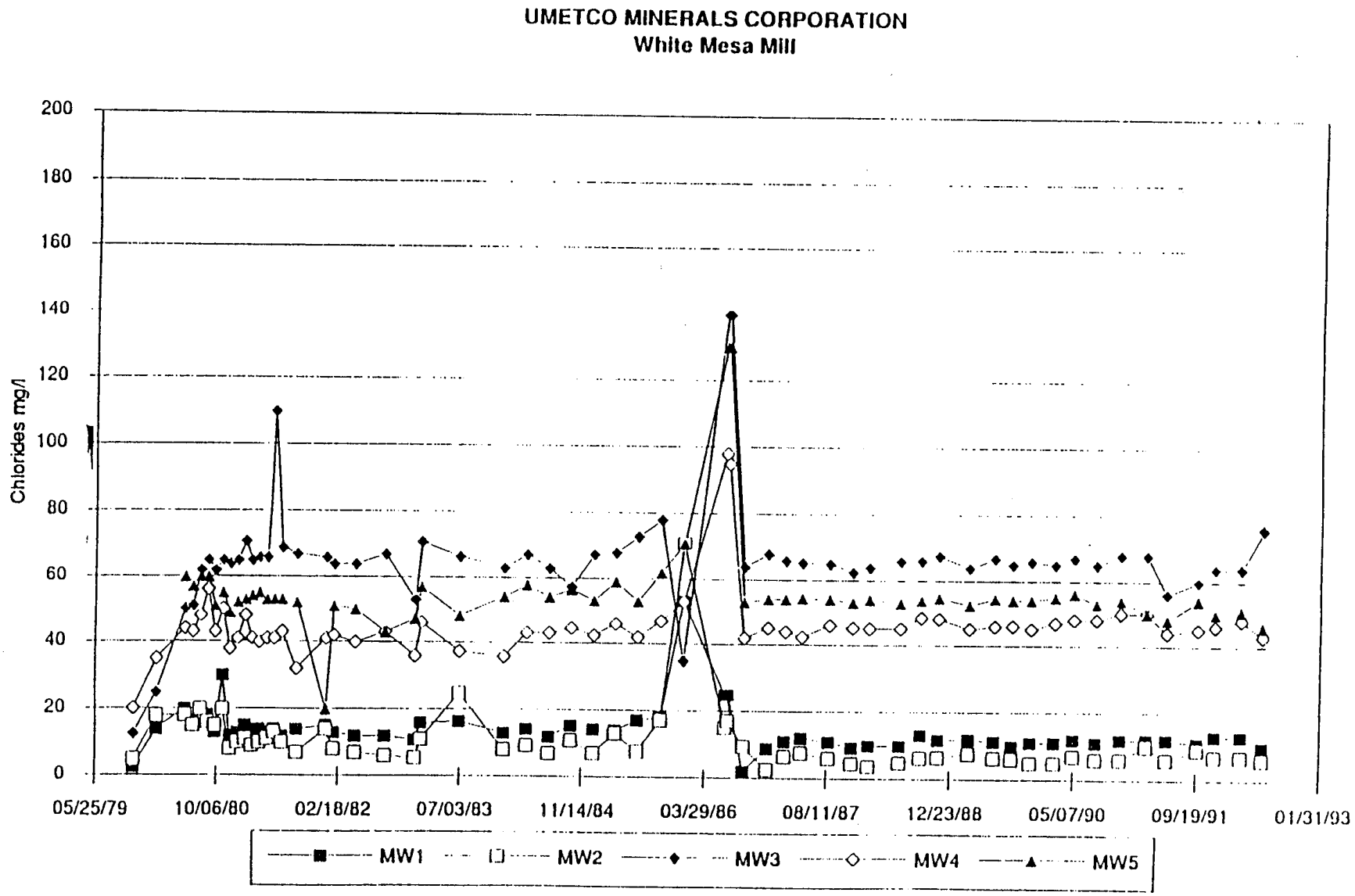
Approved by: Tony Slade

UMETCO MINERALS CORPORATION
White Mesa Mill



UMETCO MINERALS CORPORATION
WHITE MESA MILL

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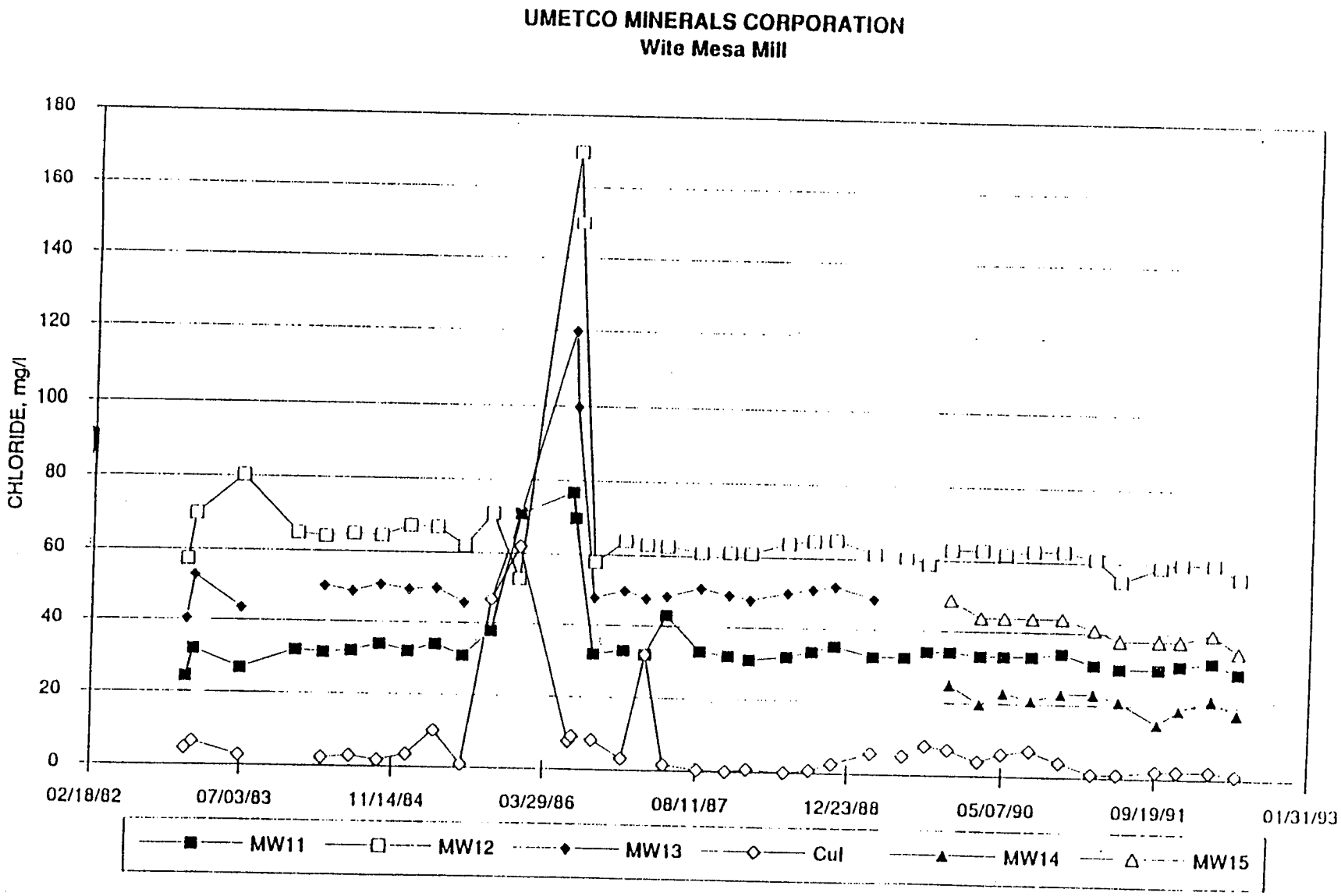
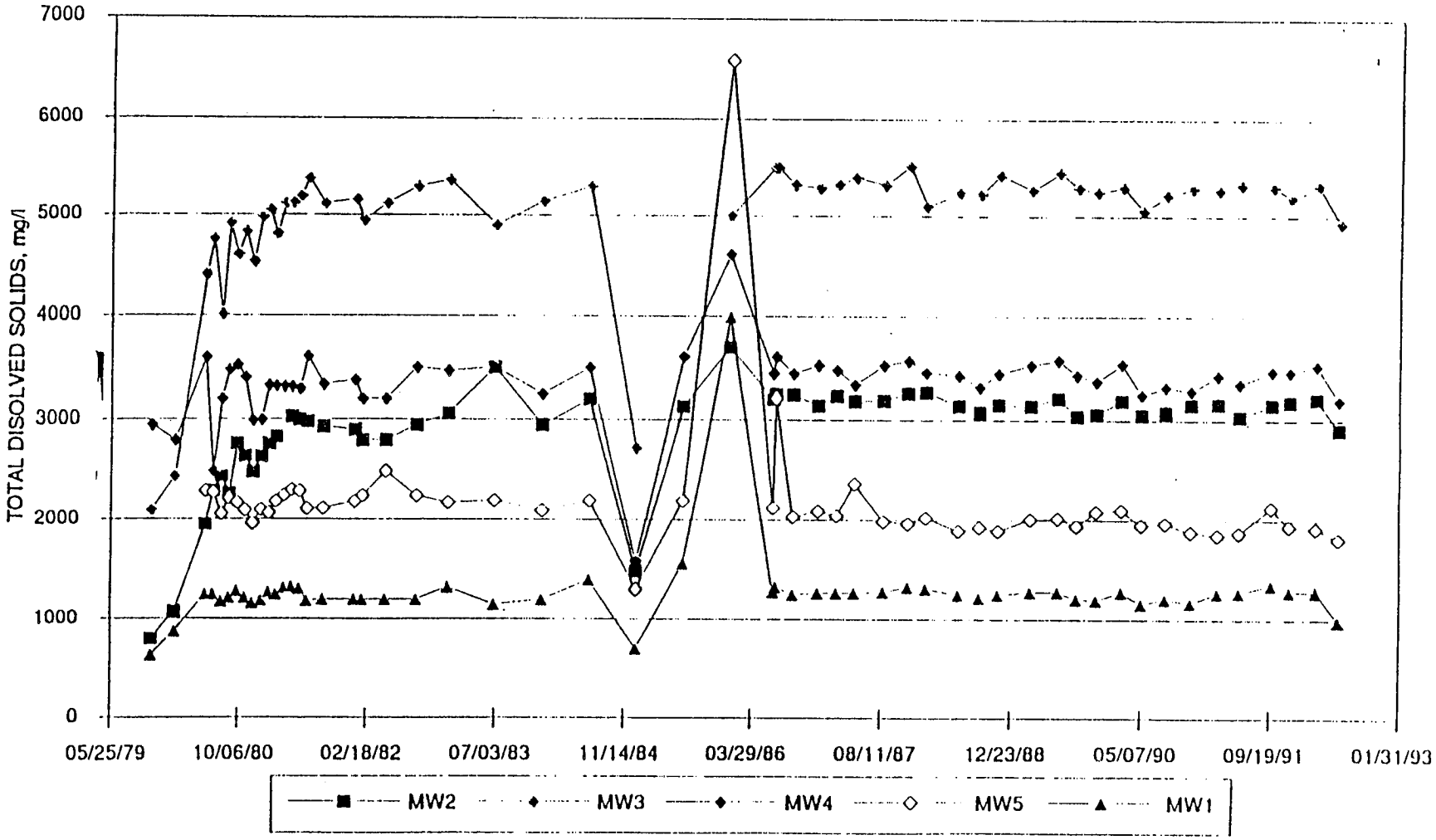
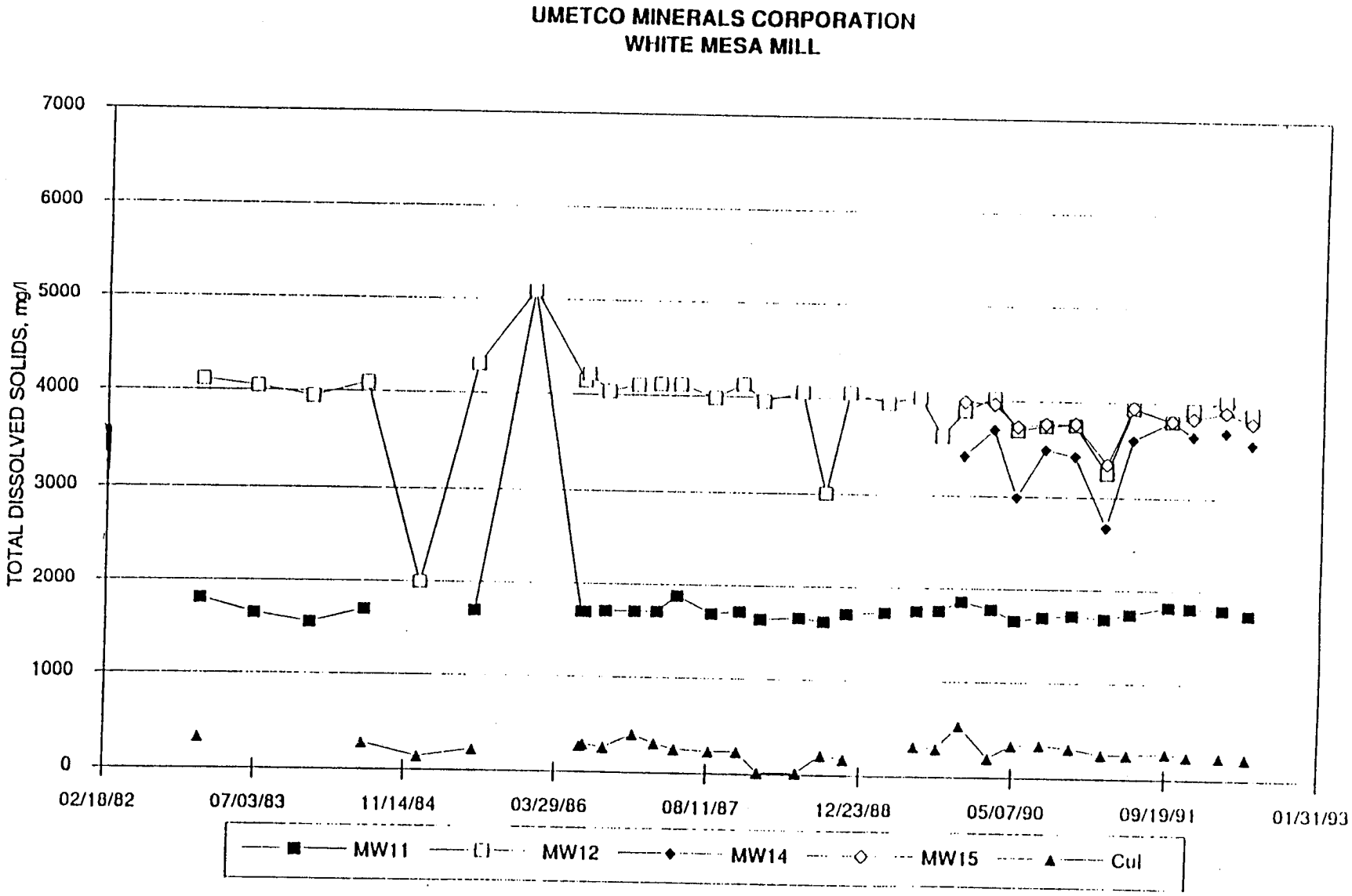
White Mesa Mill
Chlorides mg/l
200
180
160
140
120
100
80
60
40
20
0
05/25/79
10/06/80
02/18/82
07/03/83
11/14/84
03/29/86
08/11/87
12/23/88
05/07/90
09/19/91
01/31/93
MW1
MW2
MW3
MW4
MW5

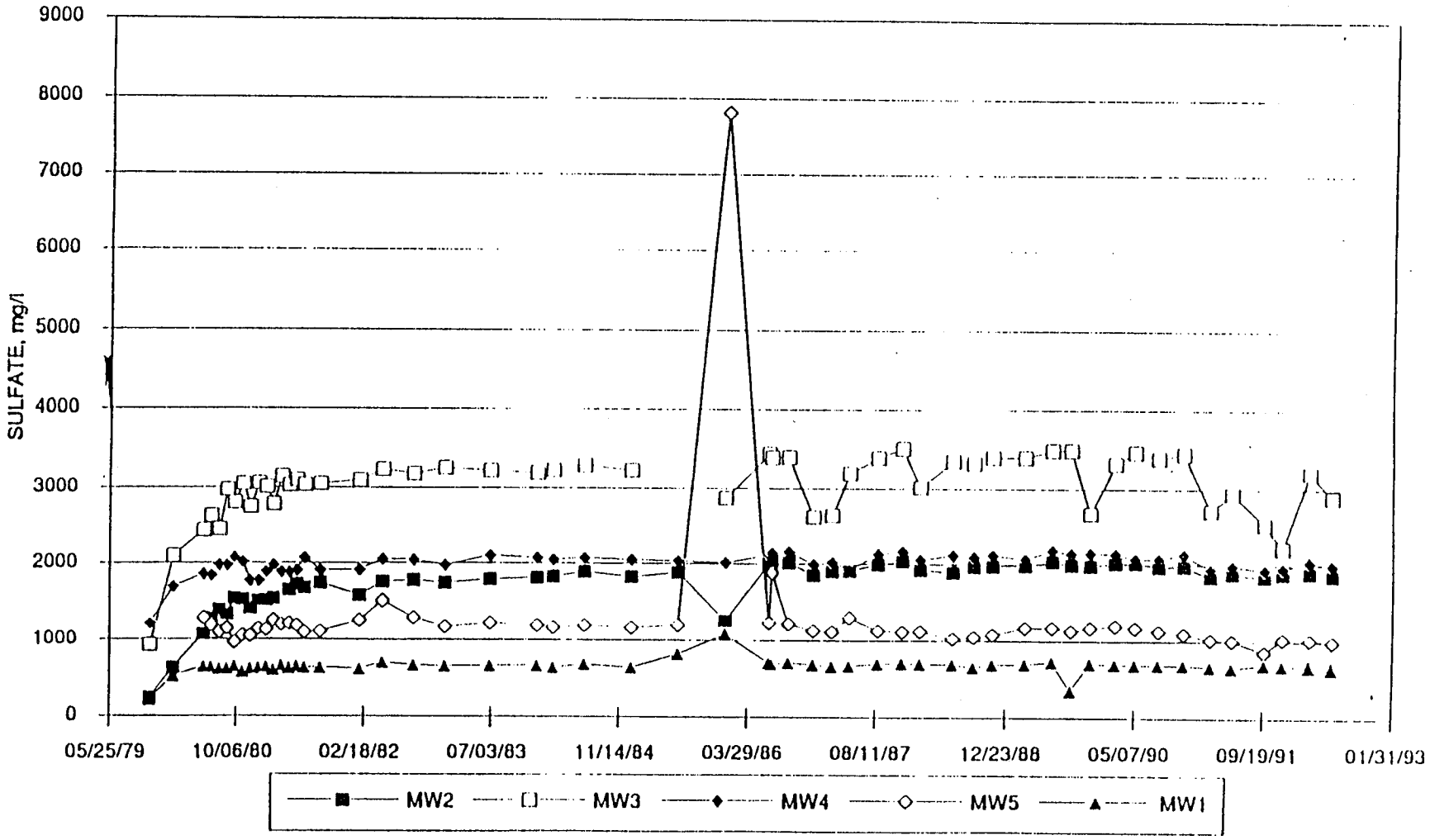

UMETCO MINERALS CORPORATION
Wite Mesa Mill
CHLORIDE, mg/l
180
160
140
120
100
80
60
40
20
0
02/18/82
07/03/83
11/14/84
03/29/86
08/11/87
12/23/88
05/07/90
09/19/91
01/31/93
MW11
MW12
MW13
Cul
MW14
MW15

UMETCO MINERALS CORPORATION
WHITE MESA MILL

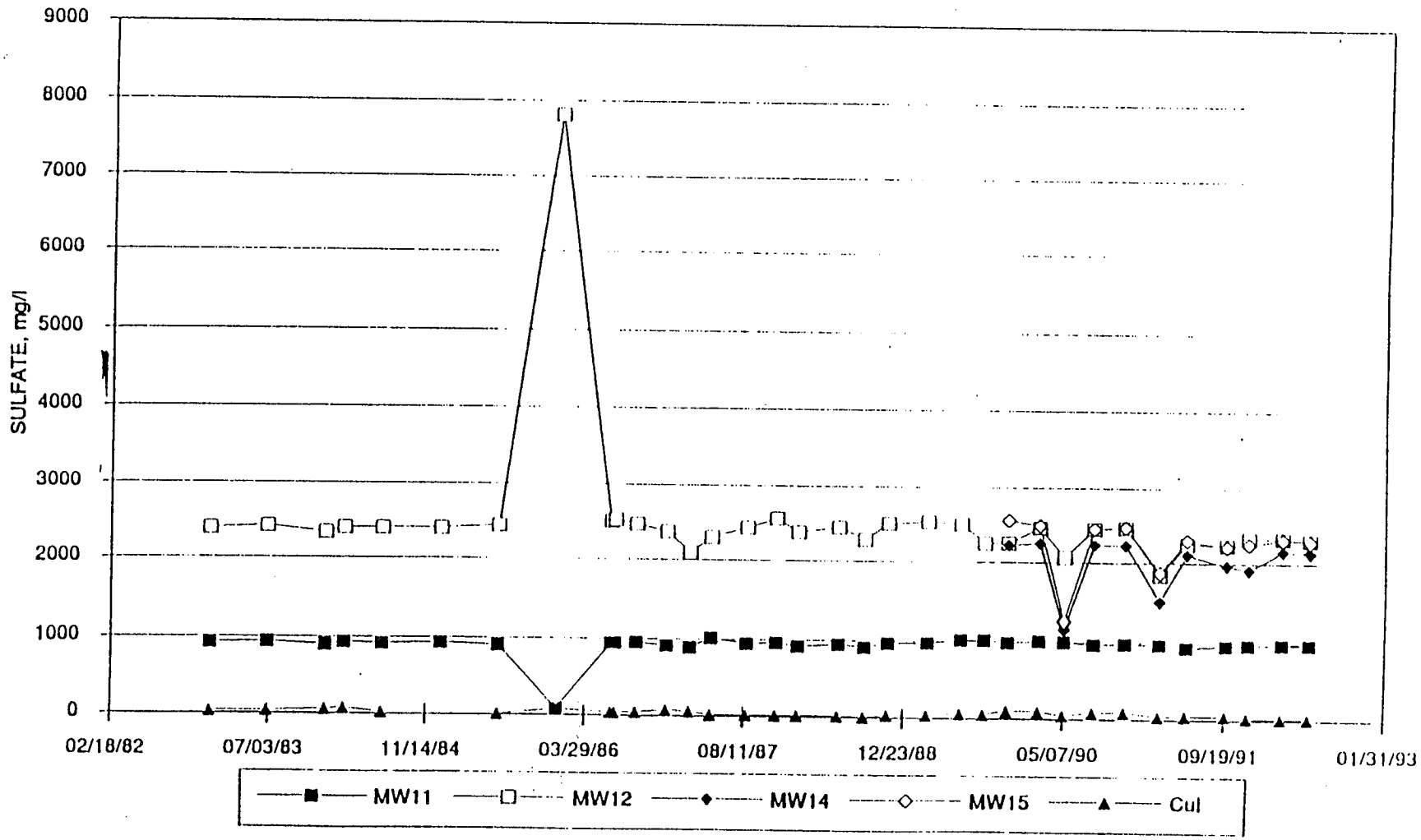


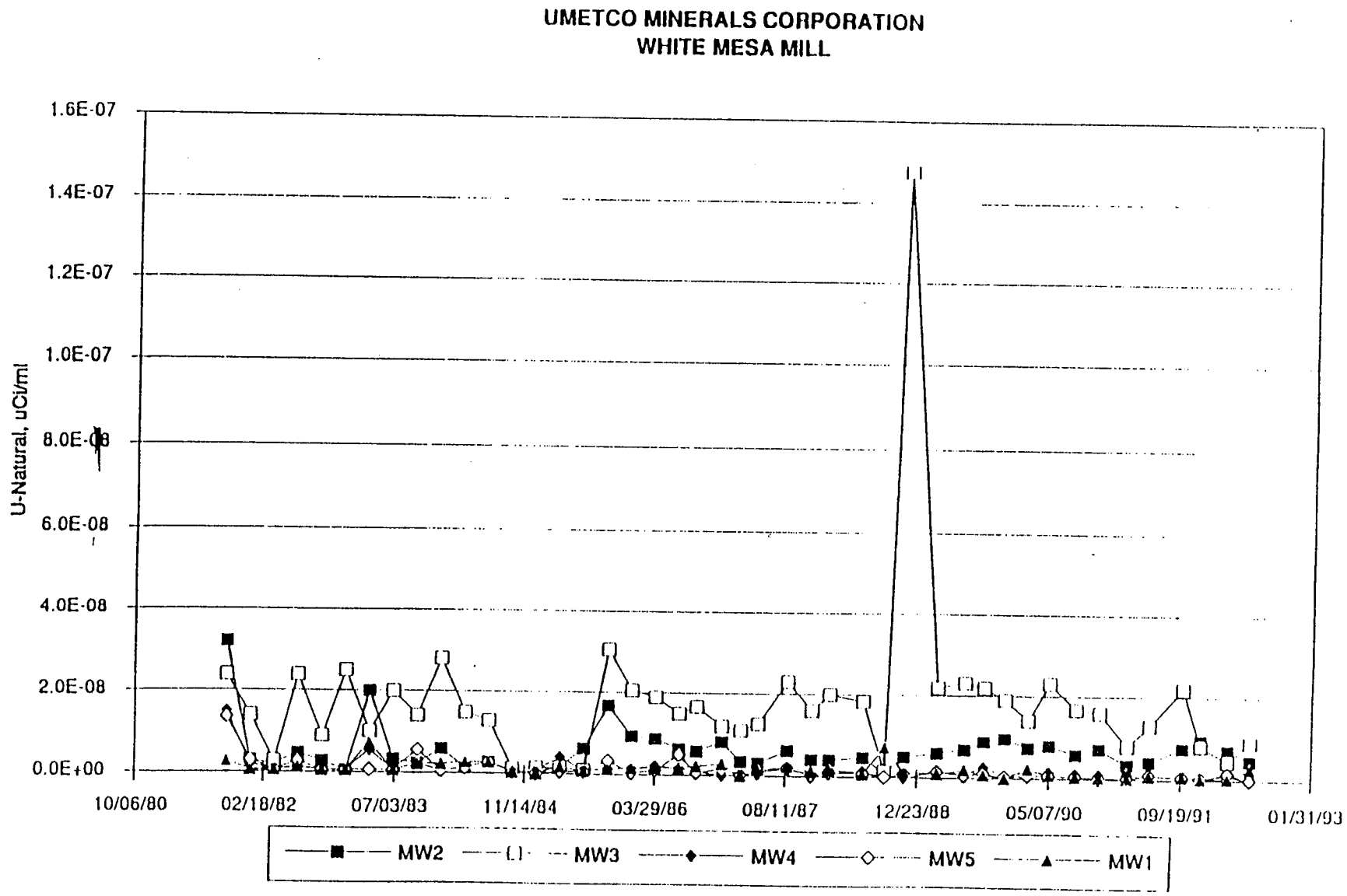

UMETCO MINERALS CORPORATION
WHITE MESA MILL
TOTAL DISSOLVED SOLIDS, mg/l
7000
6000
5000
4000
3000
2000
1000
0
02/18/82
07/03/83
11/14/84
03/29/86
08/11/87
12/23/88
05/07/90
09/19/91
01/31/93
MW11
MW12
MW14
MW15
Cul

UMETCO MINERALS CORPORATION
WHITE MESA MILL



UMETCO MINERALS CORPORATION
WHITE MESA MILL




UMETCO MINERALS CORPORATION
WHITE MESA MILL
U-Natural, uCi/ml
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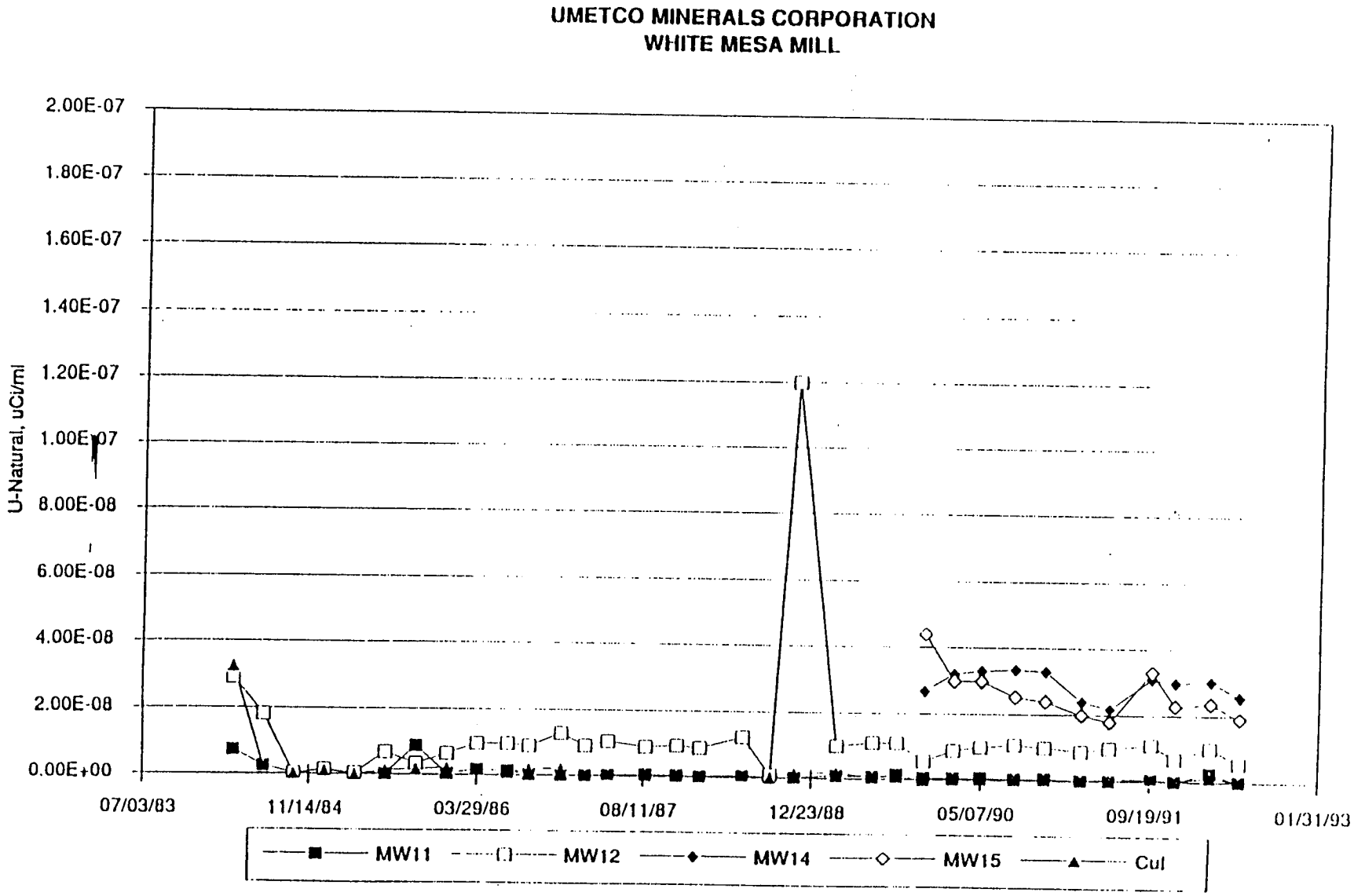
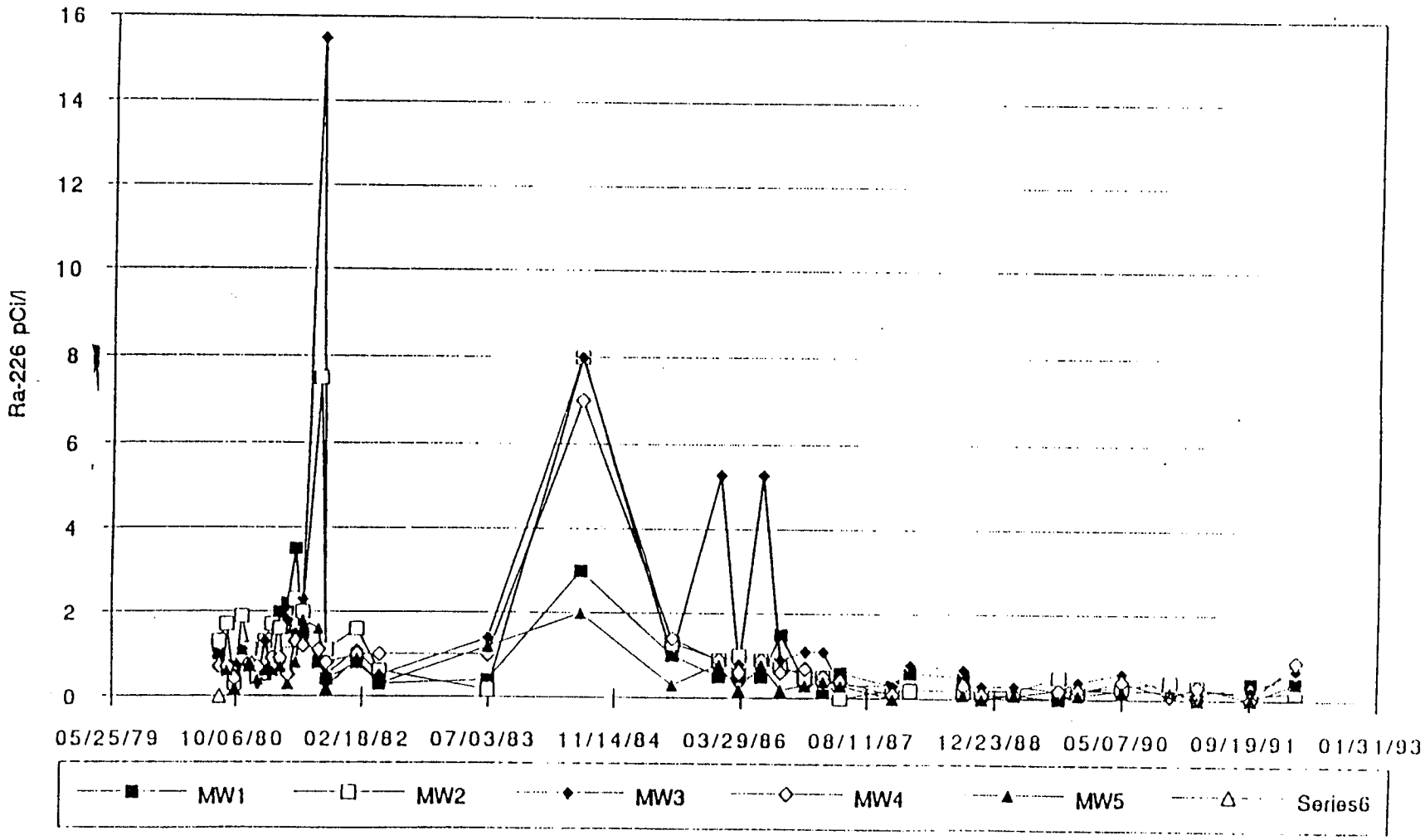
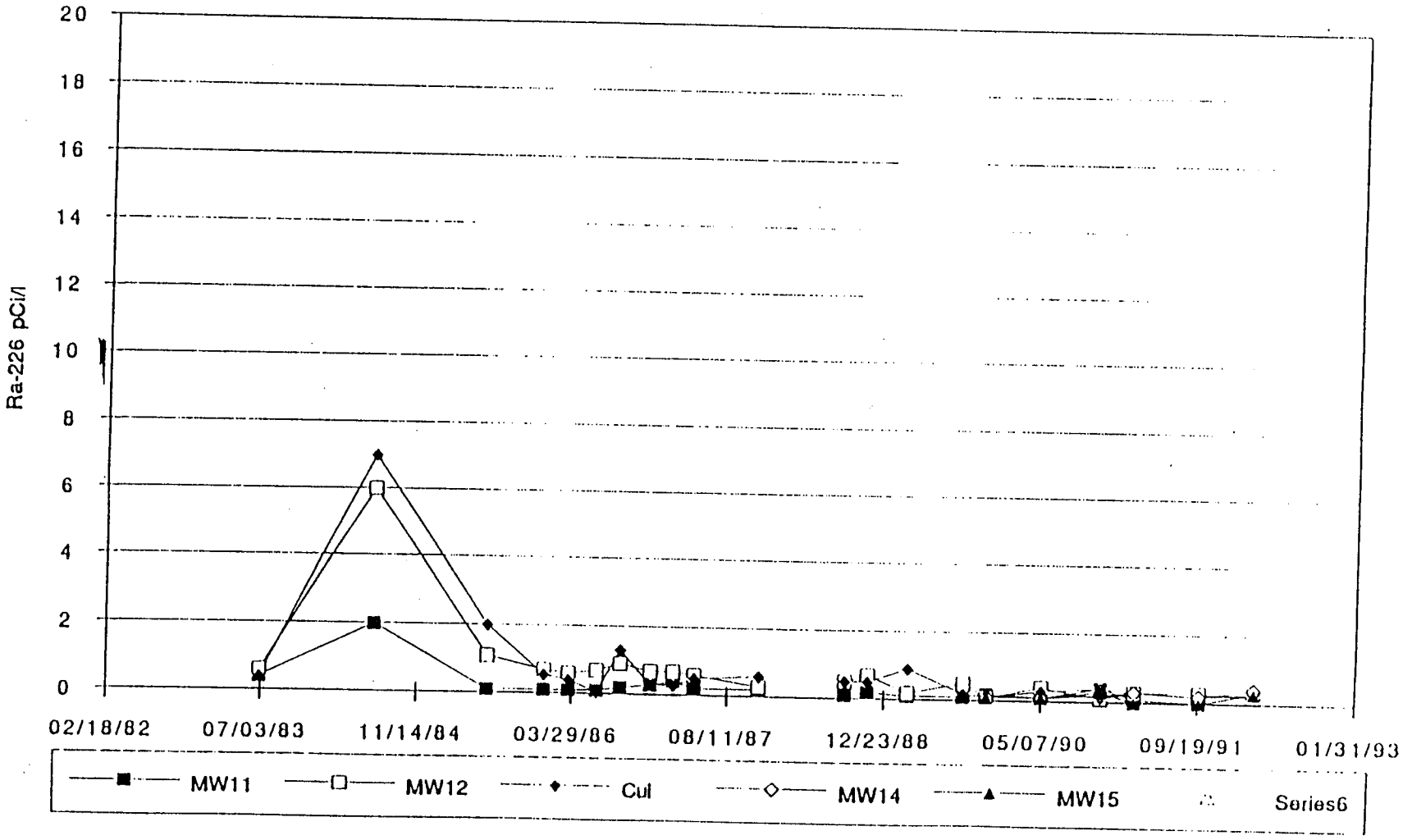
1.4E-07
1.2E-07
1.0E-07
8.0E-08
6.0E-08
4.0E-08
2.0E-08
0.0E+00
10/06/80
02/18/82
07/03/83
11/14/84
03/29/86
08/11/87
12/23/88
05/07/90
09/19/91
01/31/93
MW2
MW3
MW4
MW5
MW1


UMETCO MINERALS CORPORATION
WHITE MESA MILL
U-Natural, uCi/ml
2.00E-07
1.80E-07
1.60E-07
1.40E-07
1.20E-07
1.00E-07
8.00E-08
6.00E-08
4.00E-08
2.00E-08
0.00E+00
07/03/83
11/14/84
03/29/86
08/11/87
12/23/88
05/07/90
09/19/91
01/31/93
MW11
MW12
MW14
MW15
Cul

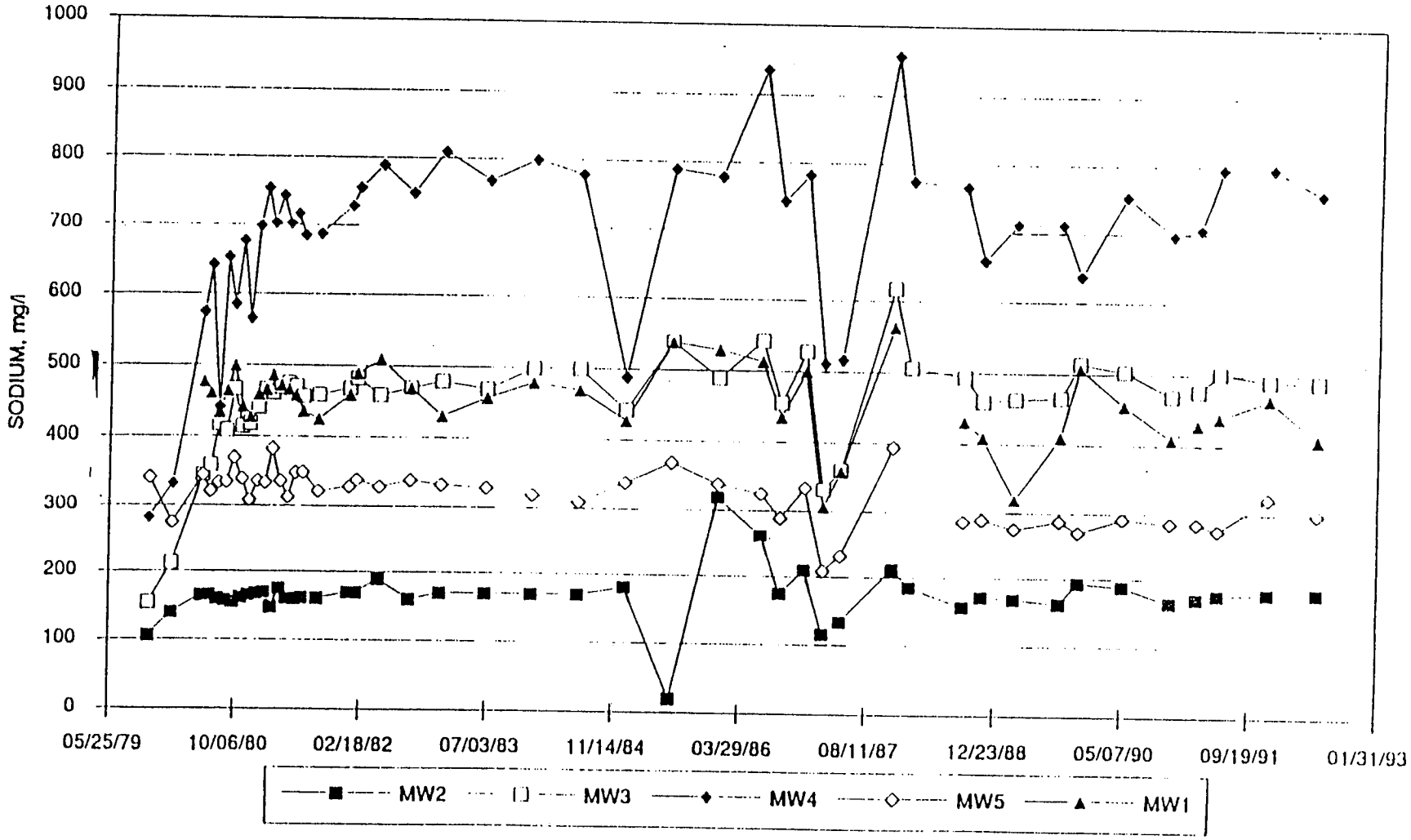
UMETCO MINERALS CORPORATION
WHITE MESA MILL



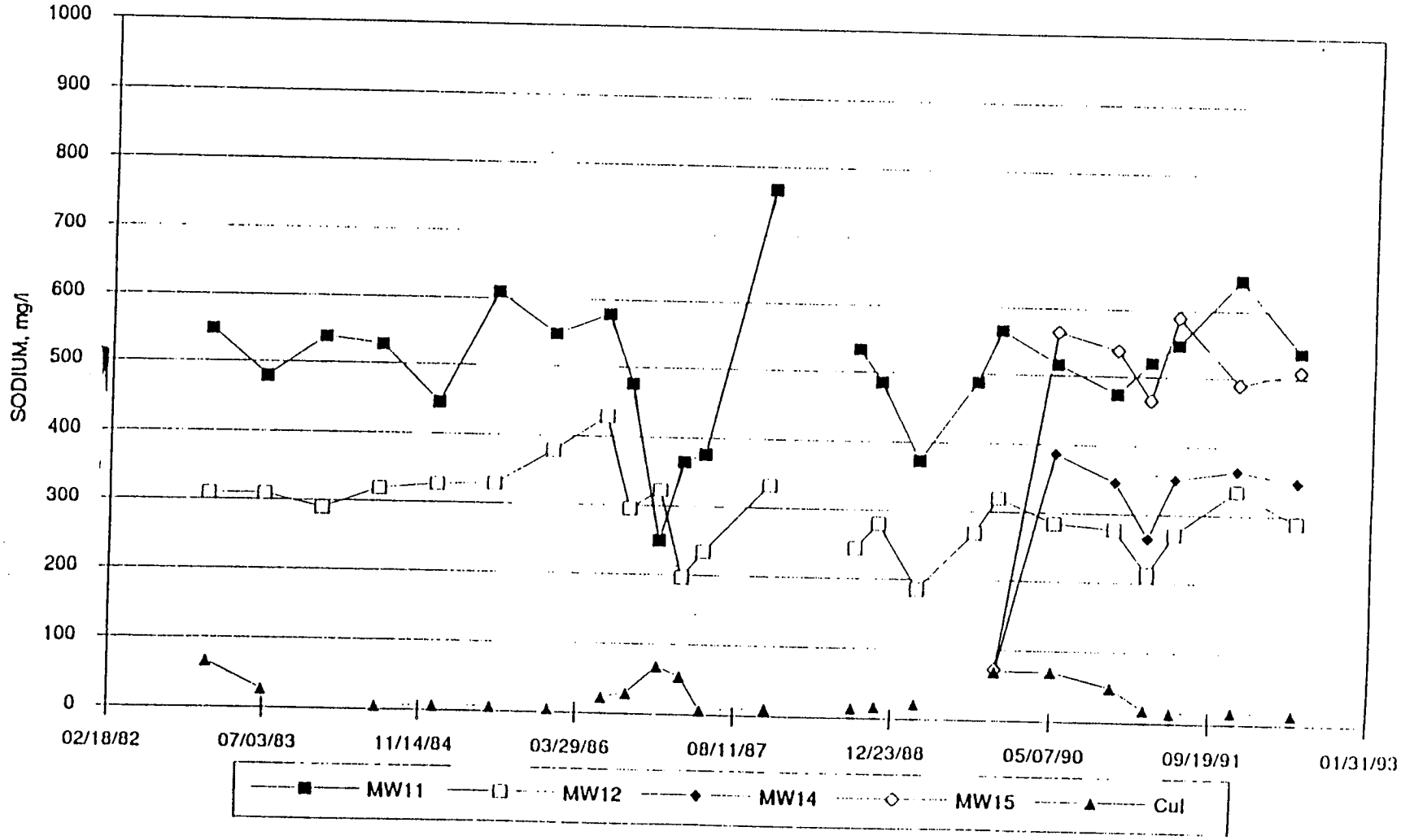
UMETCO MINERALS CORPORATION
WHITE MESA MILL



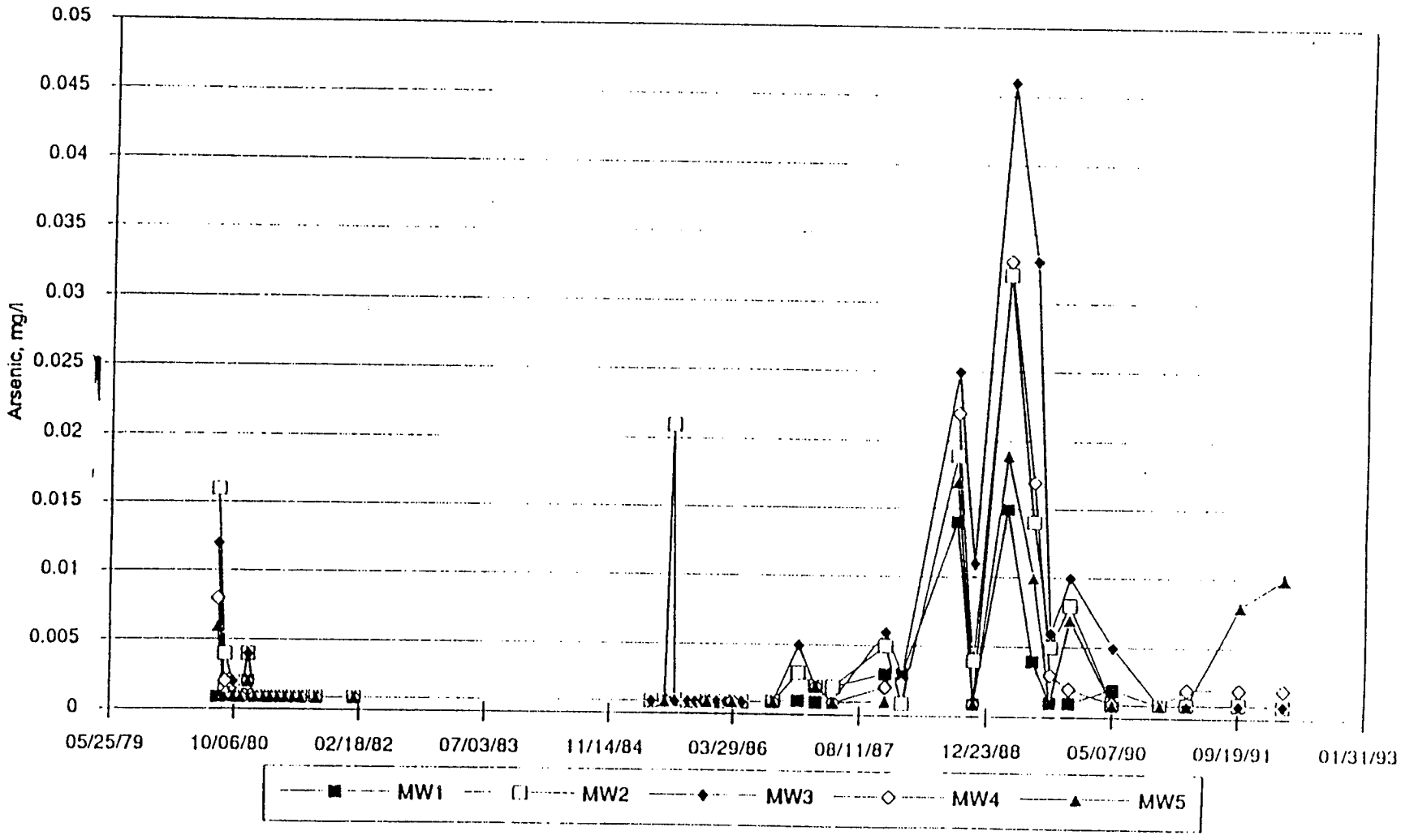
UMETCO MINERALS CORPORATION
WHITE MESA MILL



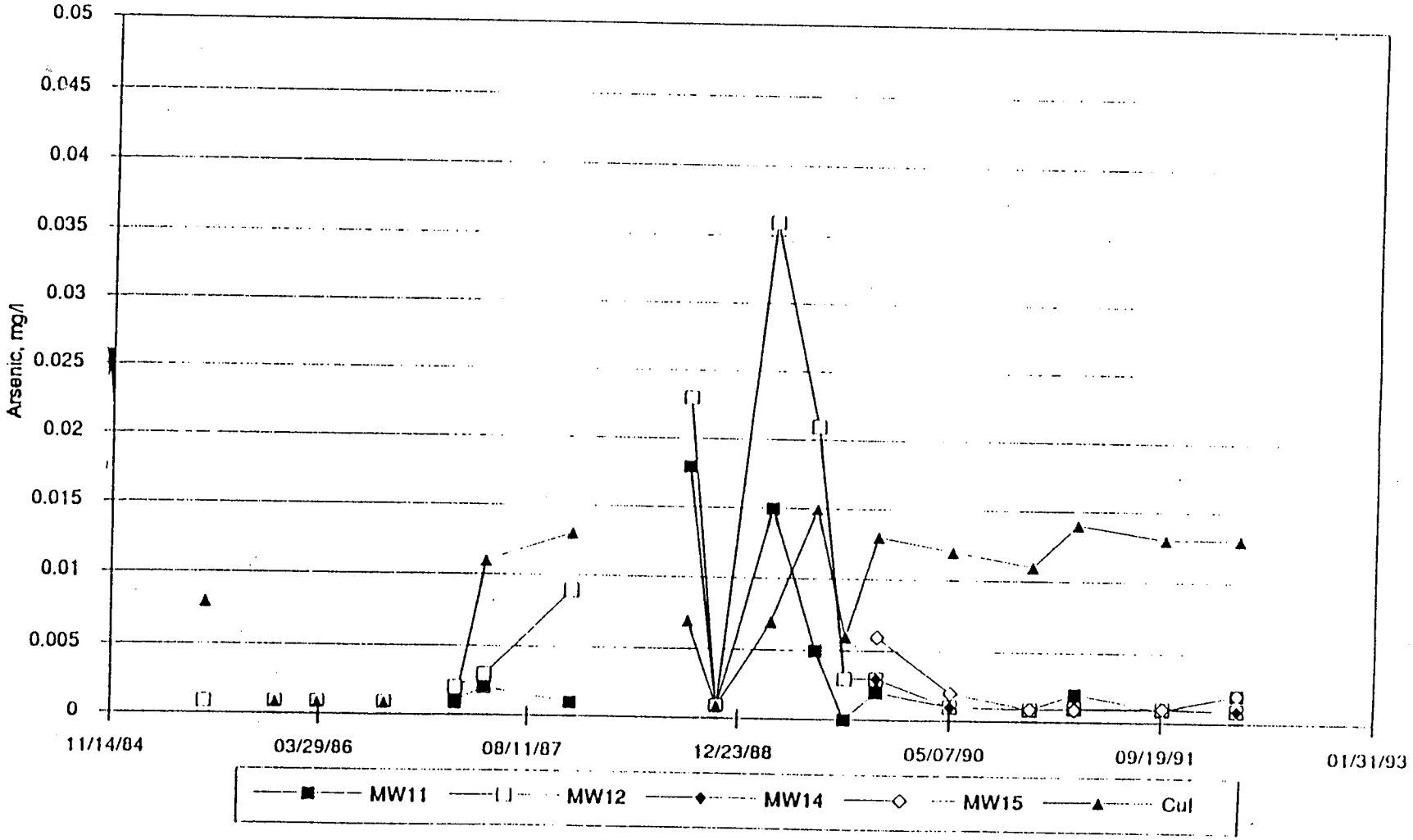
UMETCO MINERALS CORPORATION
WHITE MESA MILL



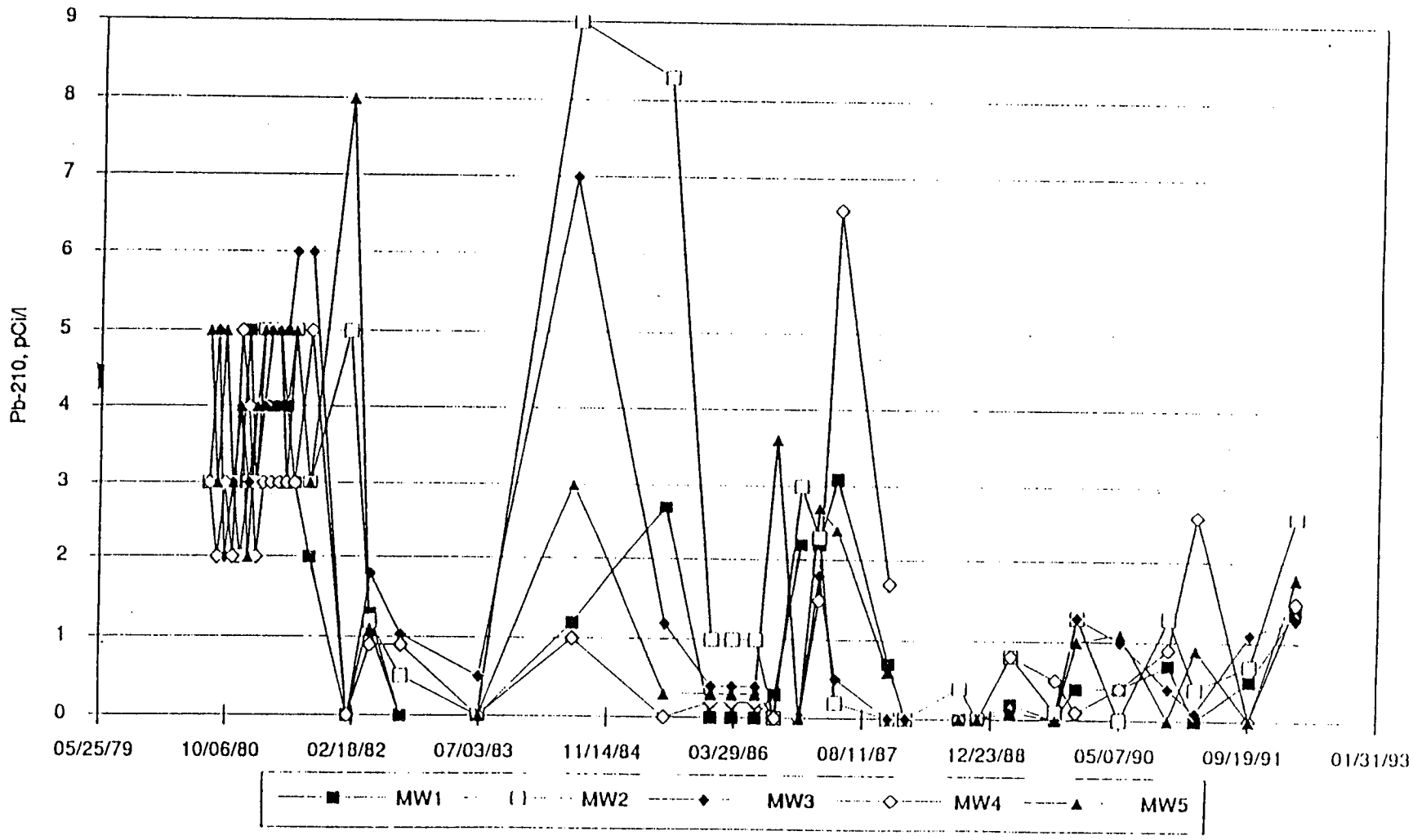
UMETCO MINERALS CORPORATION
White Mesa Mill



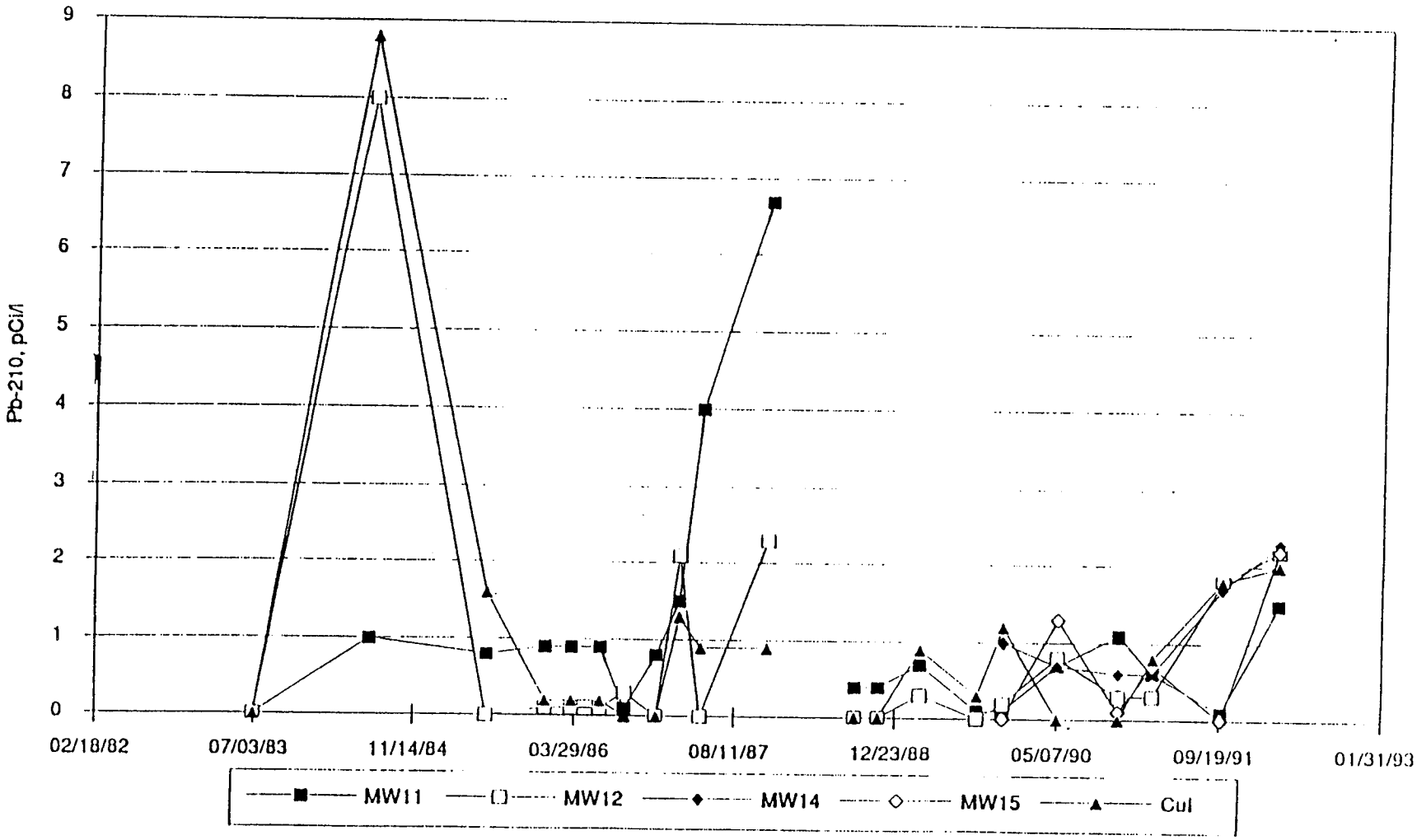
UMETCO MINERALS CORPORATION
White Mesa Mill



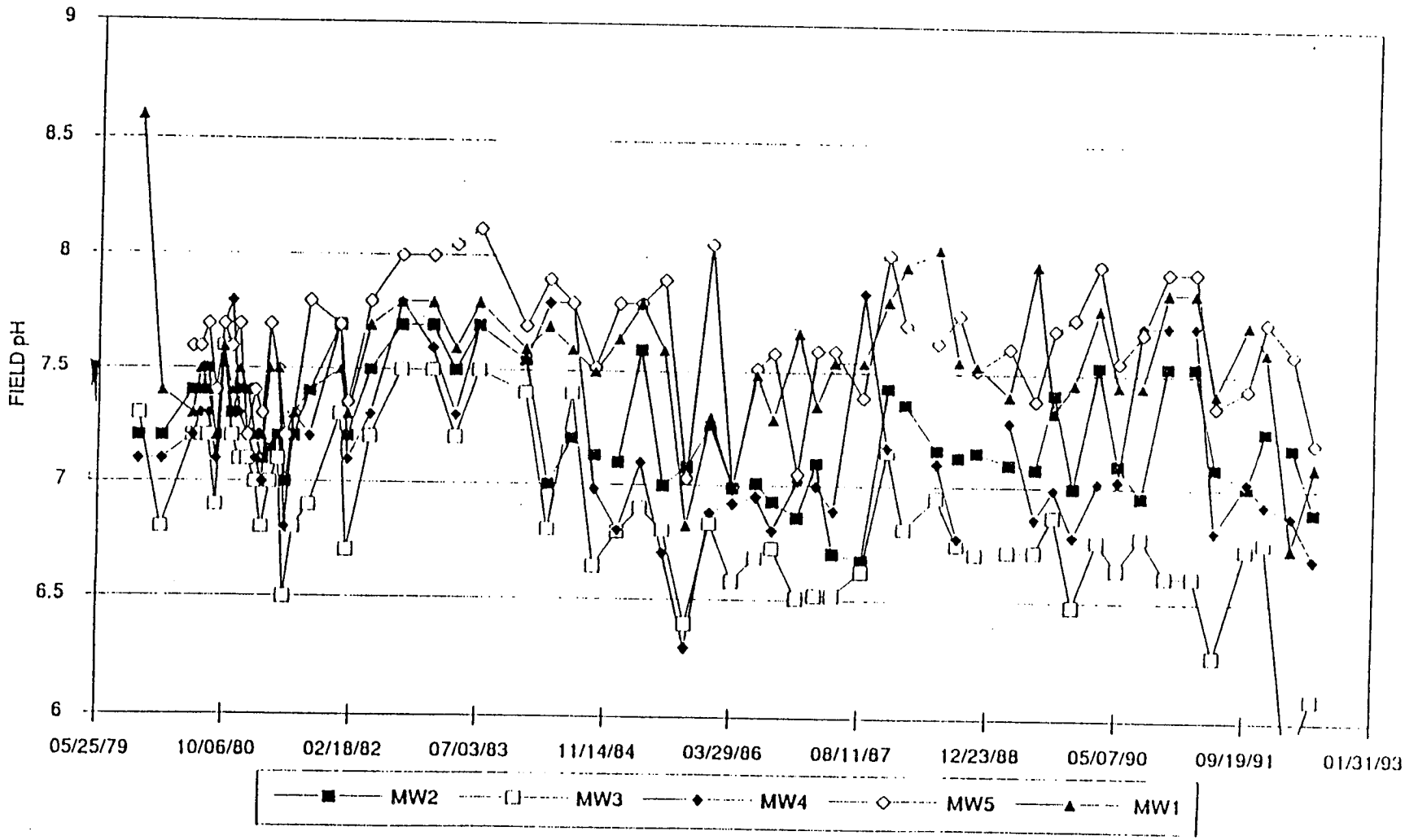
UMETCO MINERALS CORPORATION
WHITE MESA MILL



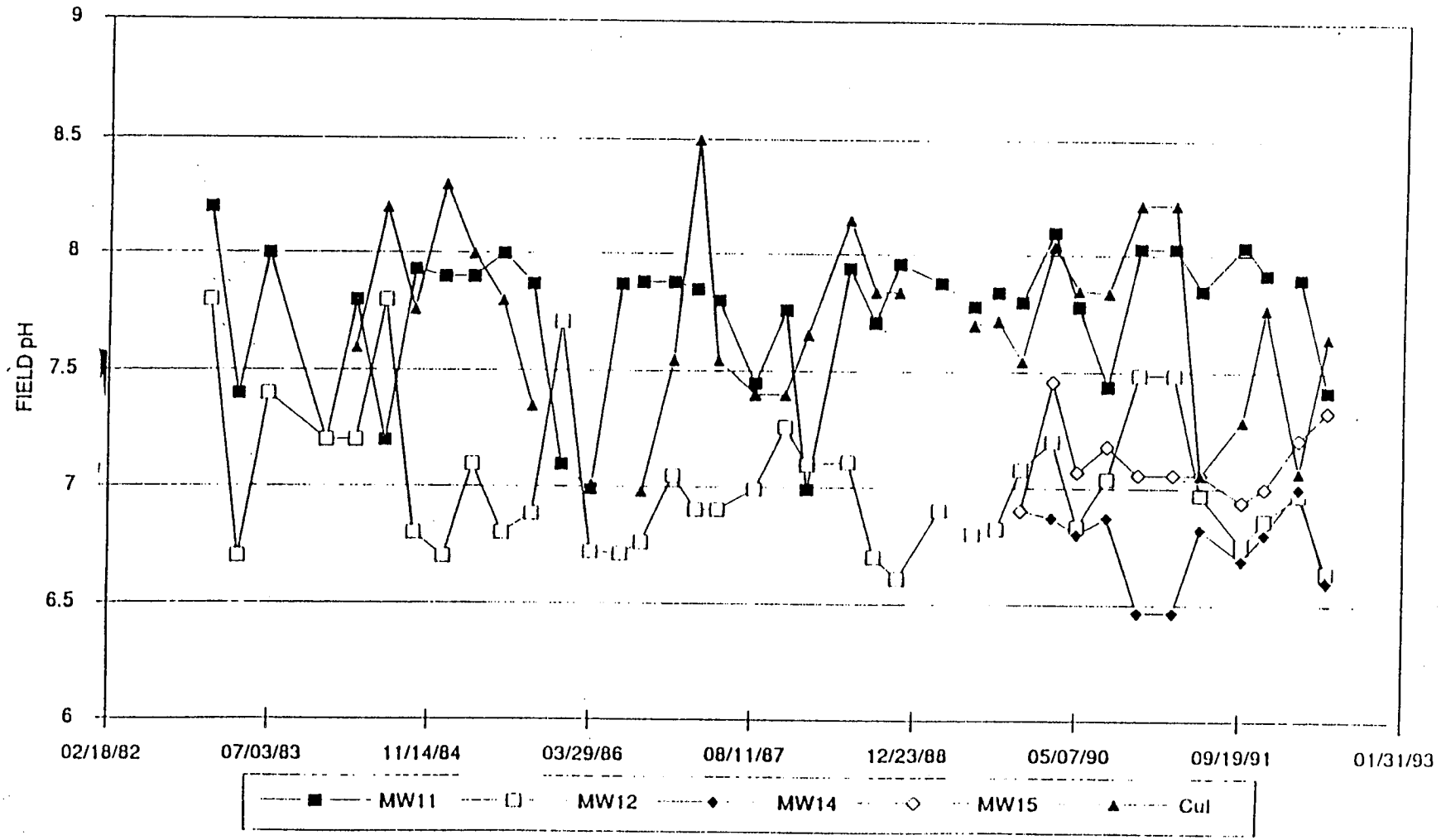
UMETCO MINERALS CORPORATION
WHITE MESA MILL



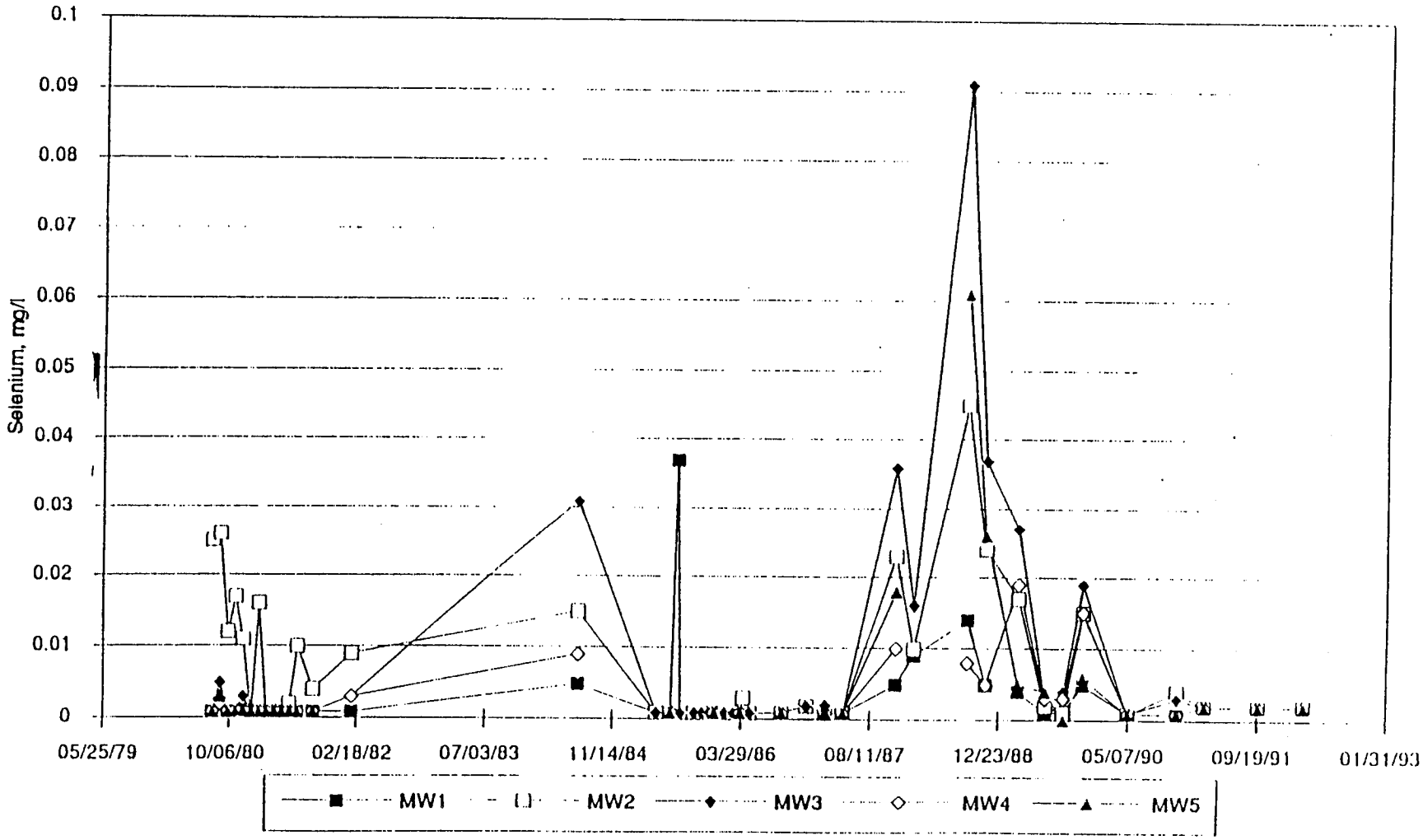
UMETCO MINERALS CORPORATION
WHITE MESA MILL



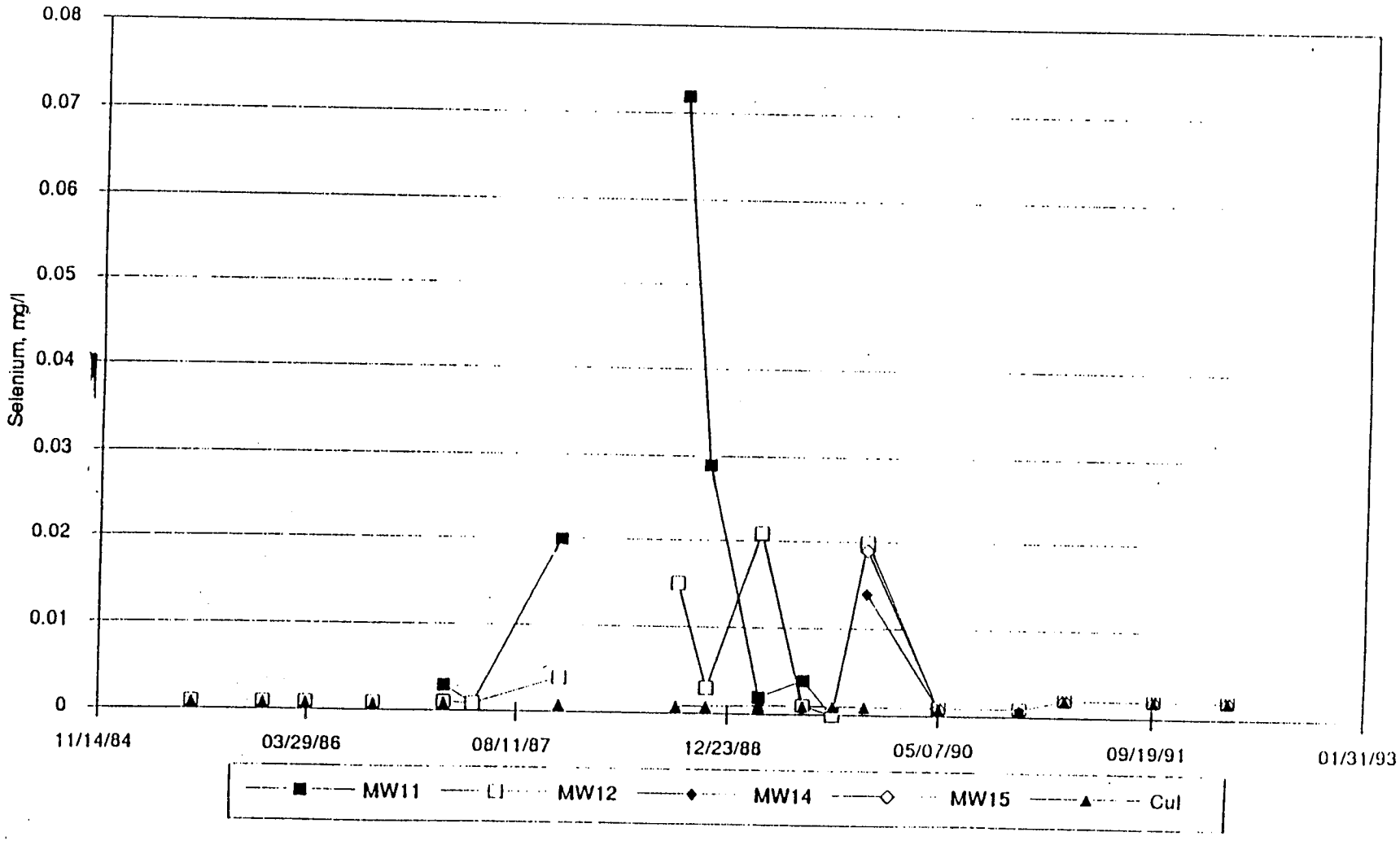
UMETCO MINERALS CORPORATION
WHITE MESA MILL



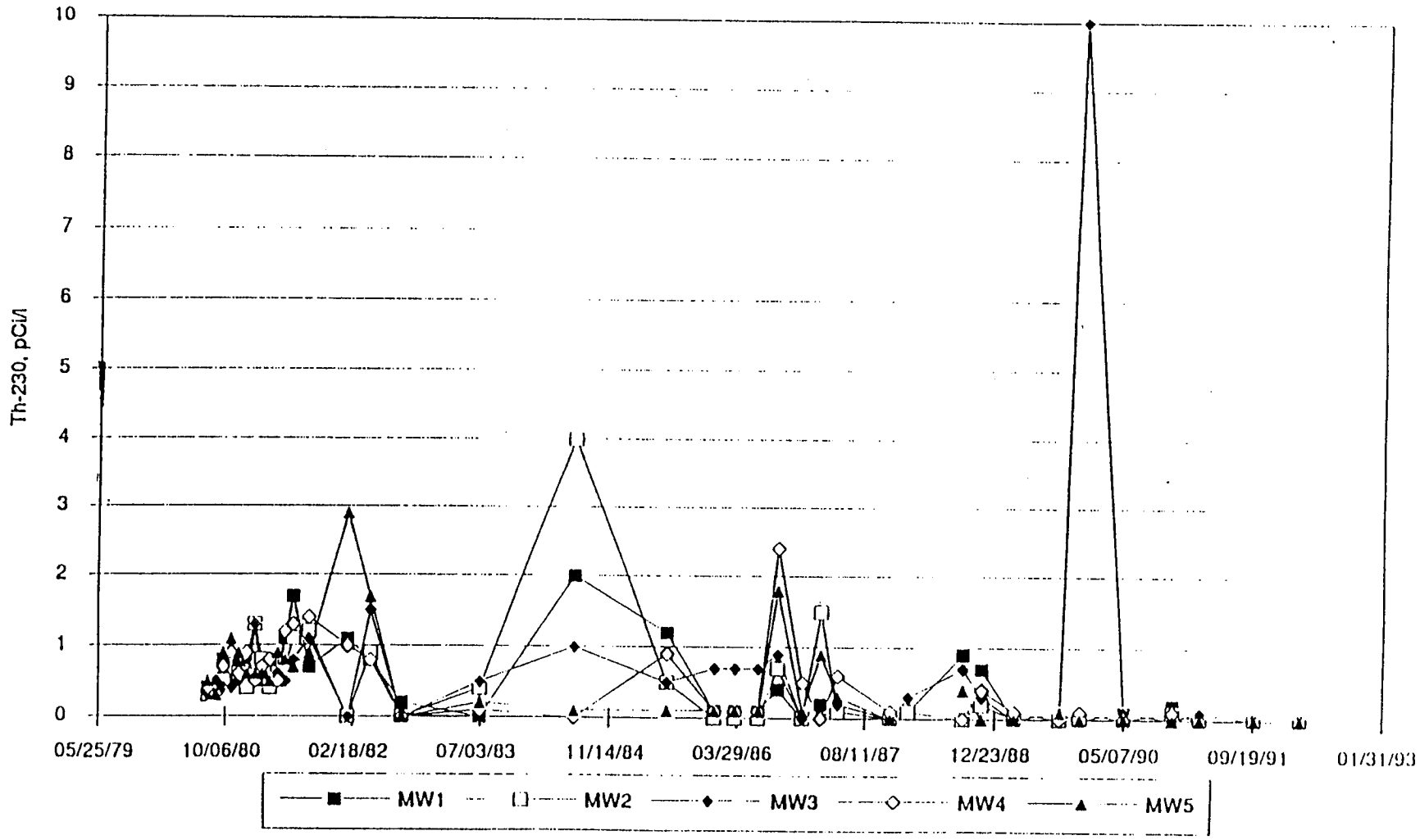
UMETCO MINERALS CORPORATION
WHITE MESA MILL



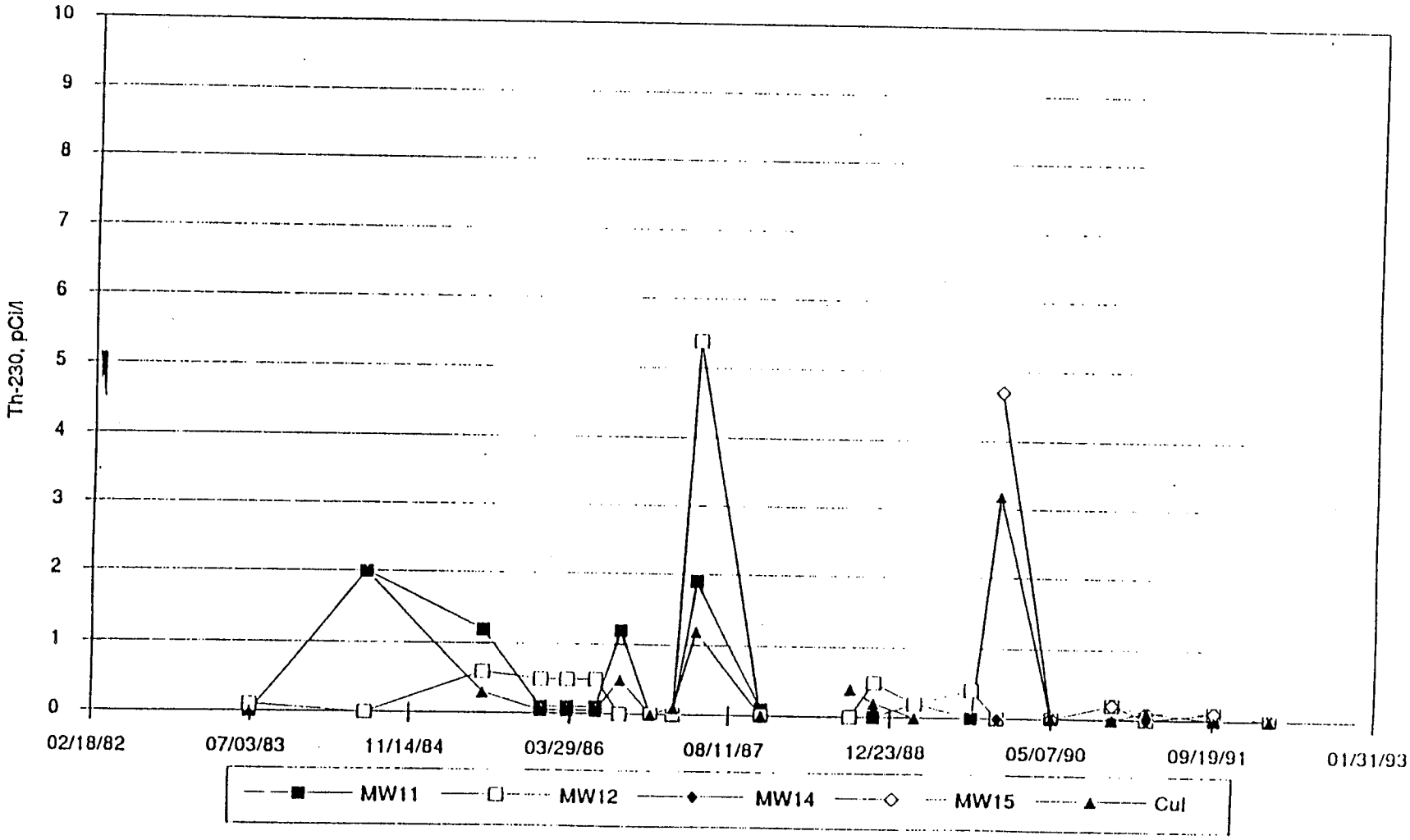
UMETCO MINERALS CORPORATION
WHITE MESA MILL



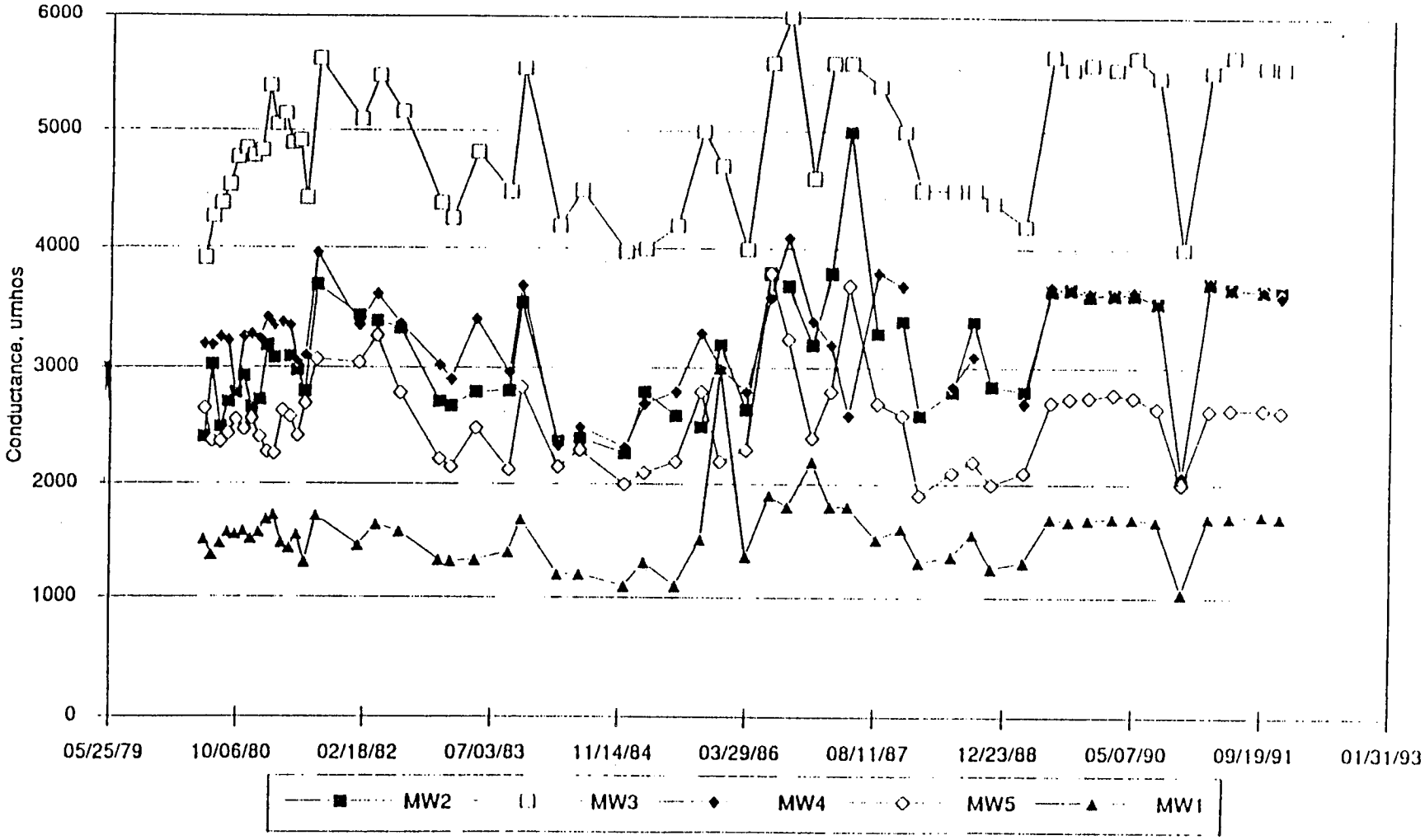
UMETCO MINERALS CORPORATION
WHITE MESA MILL



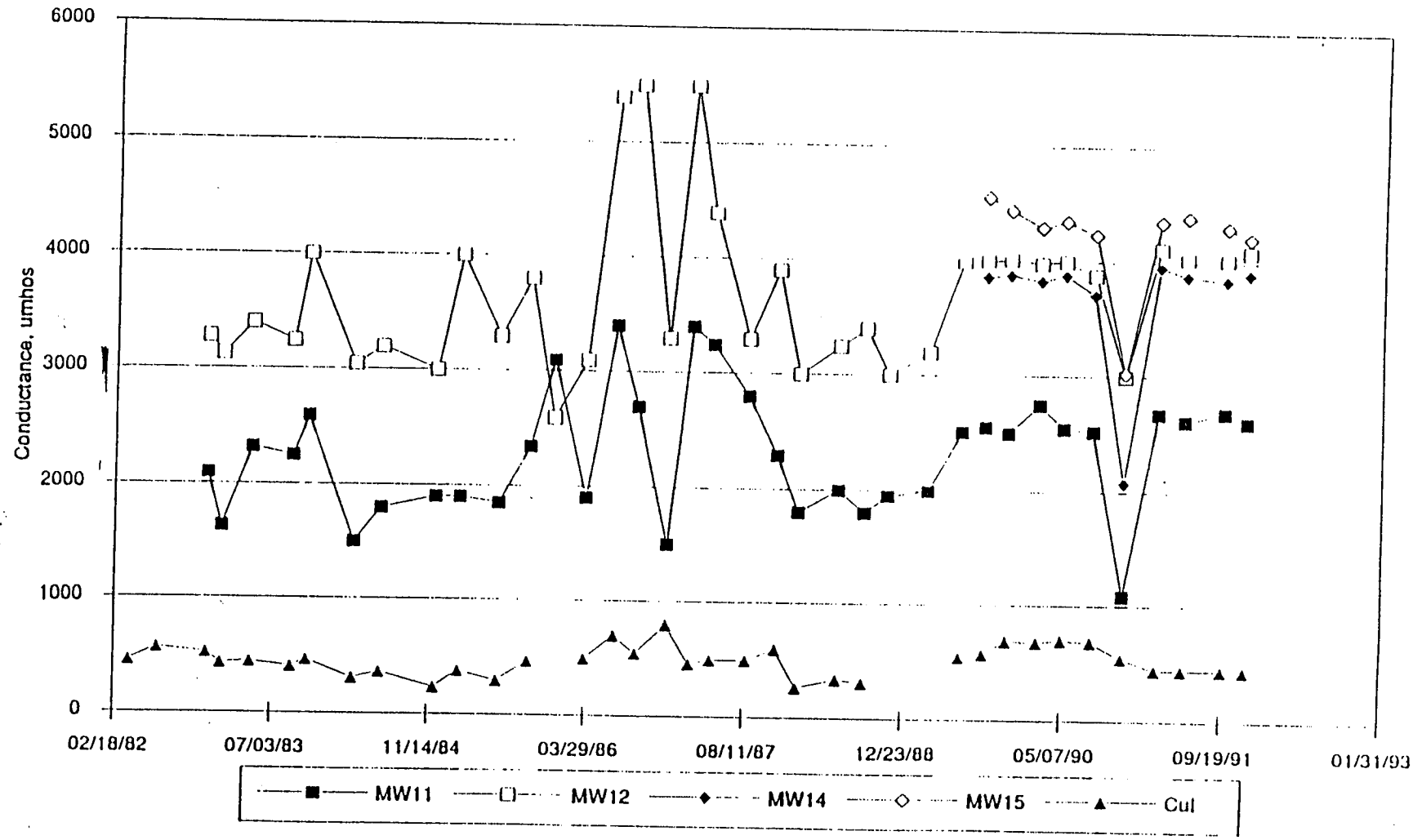
UMETCO MINERALS CORPORATION
WHITE MESA MILL



UMETCO MINERALS CORPORATION
WHITE MESA MILL



UMETCO MINERALS CORPORATION
WHITE MESA MILL



Chlorides-"T"Test
Monitor Well-MW-1

Date	Data set 1	Date	Data set 2
30-Nov-80	12	07-Aug-90	11.0
31 Dec-80	13	13-Nov 90	12.0
31-Jan-81	15	27-Feb 91	12.0
28 Feb-81	14	21 May-91	12.0
31-Mar-81	14	24-Sep-91	11.0
30-Apr-81	13	03-Dec 91	13.0
30-May-81	14	17-Mar 92	13.0
30-Jun-81	12	11 Jun 92	10.0
31-Aug-81	14	03-Sep 92	11
31-Dec 81	15	19-Nov-92	13.0

t Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	13.6	11.8
Variance	1	1
Observations	10	10
Pooled Variance	1.11	
Hypothesized Mean Differenc	0.00	
df	18.00	
t	3.82	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.10	

Data set 1	
Mean	13.60
Standard Error	0.34
Median	14.00
Mode	14.00
Standard Deviation	1.07
Variance	1.16
Kurtosis	-0.88
Skewness	-0.32
Range	3.00
Minimum	12.00
Maximum	15.00
Sum	136.00
Count	10

Data set 2	
Mean	11.80
Standard Error	0.33
Median	12.00
Mode	11.00
Standard Deviation	1.03
Variance	1.07
Kurtosis	-0.90
Skewness	-0.27
Range	3.00
Minimum	10.00
Maximum	13.00
Sum	118.00
Count	10

U-nat-"T"Test
Monitor Well-MW-1

Date	Data set 1	Date	Data set 2
30-Sep-81	2.7E-09	16-Aug-90	4.67E-10
31-Dec-81	6.5E-10	13-Nov-90	5.00E-10
31-Mar-82	6.5E-10	27-Feb-91	2.20E-10
30-Jun-82	1.4E-09	21-May-91	9.10E-10
30-Sep-82	6.8E-10	24-Sep-91	8.20E-10
31-Dec-82	6.8E-10	03-Dec-91	4.30E-10
31-Mar-83	7.4E-09	17-Mar-92	4.54E-10
30-Jun-83	6.7E-10	11-Jun-92	2.76E-09
30-Sep-83	2.3E-09	03-Sep-92	2.03E-09
31-Dec-83	2.3E-09	19-Nov-92	5.42E-10

t-Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	1.938E-09	9.133E-10
Variance	0	0
Observations	10	10
Pooled Variance	0.00	
Hypothesized Mean Differenc	0.00	
df	18.00	
t	1.45	
P(T<=t) one-tail	0.08	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.17	
t Critical two-tail	2.10	

Data set 1	
Mean	1.94E-09
Standard Error	6.59E-10
Median	1.02E-09
Mode	6.50E-10
Standard Deviation	2.08E-09
Variance	4.35E-18
Kurtosis	6.10E+00
Skewness	2.35E+00
Range	6.75E-09
Minimum	6.50E-10
Maximum	7.40E-09
Sum	1.94E-08
Count	10

Data set 2	
Mean	9.13E-10
Standard Error	2.60E-10
Median	5.21E-10
Mode	#N/A
Standard Deviation	8.23E-10
Variance	6.78E-19
Kurtosis	2.13E+00
Skewness	1.73E+00
Range	2.54E-09
Minimum	2.20E-10
Maximum	2.76E-09
Sum	9.13E-09
Count	10

Sulfates-"T"Test
Monitor Well-MW-1

Date	Data set 1	Date	Data set 2
31-Jan-80	520	07-Aug-90	685
30-May-80	635	13-Nov 90	687
30-Jun-80	632	27 Feb 91	662
31-Jul-80	610	21-May-91	652
31-Aug-80	612	24-Sep-91	692
30-Sep-80	640	03-Dec 91	677
31-Oct-80	570	17-Mar-92	667
30-Nov-80	613	11-Jun-92	642
31-Dec-80	620	03-Sep-92	670
31-Jan-81	638	19-Nov-92	654

t-Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	609	668.8
Variance	1400	274
Observations	10	10
Pooled Variance	836.98	
Hypothesized Mean Difference	0.00	
df	18.00	
t	-4.62	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.10	

Data set 1	
Mean	6.09E+02
Standard Error	1.18E+01
Median	6.17E+02
Mode	#N/A
Standard Deviation	3.74E+01
Variance	1.40E+03
Kurtosis	3.18E+00
Skewness	-1.80E+00
Range	1.20E+02
Minimum	5.20E+02
Maximum	6.40E+02
Sum	6.09E+03
Count	10

Data set 2	
Mean	6.69E+02
Standard Error	5.24E+00
Median	6.69E+02
Mode	#N/A
Standard Deviation	1.66E+01
Variance	2.74E+02
Kurtosis	-1.10E+00
Skewness	-1.29E-01
Range	5.00E+01
Minimum	6.42E+02
Maximum	6.92E+02
Sum	6.69E+03
Count	10

Chlorides-"T"Test
Monitor Well-MW-3

Date	Data set 1	Date	Data set 2
30-Nov-80	64	07-Aug-90	65.0
31 Dec-80	65	13-Nov 90	68.0
31-Jan-81	71	27-Feb 91	68.0
28-Feb-81	65	21-May 91	56.0
31-Mar-81	66	24-Sep 91	60.0
30-Apr 81	66	03 Dec 91	64.0
30-May 81	110	17-Mar 92	64.0
30-Jun-81	69	11-Jun 92	76.0
31-Aug 81	67	03 Sep 92	58
31-Dec 81	66	19-Nov-92	63.0

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	70.9	64.2
Variance	193	33
Observations	10	10
Pooled Variance	112.81	
Hypothesized Mean Difference	0.00	
df	18.00	
t	1.41	
P(T<=t) one-tail	0.09	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.18	
t Critical two-tail	2.10	

Data set 1	
Mean	70.90
Standard Error	4.39
Median	66.00
Mode	66.00
Standard Deviation	13.89
Variance	192.99
Kurtosis	9.40
Skewness	3.04
Range	46.00
Minimum	64.00
Maximum	110.00
Sum	709.00
Count	10

Data set 2	
Mean	64.20
Standard Error	1.81
Median	64.00
Mode	68.00
Standard Deviation	5.71
Variance	32.62
Kurtosis	1.02
Skewness	0.66
Range	20.00
Minimum	56.00
Maximum	76.00
Sum	642.00
Count	10

U-Nat-"T"Test
Monitor Well-MW-3

Date	Data set 1	Date	Data set 1
30-Sep-81	2.4E-08	16-Aug-90	1.67E-08
31-Dec-81	1.4E-08	13-Nov 90	1.60E-08
31-Mar-82	2.7E-09	27-Feb-91	8.00E-09
30-Jun-82	2.4E-08	21-May-91	1.30E-08
30-Sep-82	8.9E-09	24-Sep-91	2.20E-08
31-Dec-82	2.5E-08	03-Dec-91	8.10E-09
31-Mar-83	1.0E-08	17-Mar 92	4.53E-09
30-Jun-83	2.0E-08	11-Jun 92	9.13E-09
30-Sep-83	1.4E-08	03-Sep-92	1.9E-08
31-Dec-83	2.8E-08	19-Nov 92	1.12E-08

t-Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	1.706E-08	1.277E-08
Variance	0	0
Observations	10	10
Pooled Variance	0.00	
Hypothesized Mean Difference	0.00	
df	18.00	
t	1.35	
P(T<=t) one-tail	0.10	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.19	
t Critical two-tail	2.10	

	Data set 1
Mean	1.71E-08
Standard Error	2.64E-09
Median	1.70E-08
Mode	2.40E-08
Standard Deviation	8.36E-09
Variance	6.99E-17
Kurtosis	-1.09E+00
Skewness	-3.35E-01
Range	2.53E-08
Minimum	2.70E-09
Maximum	2.80E-08
Sum	1.71E-07
Count	10

	Data set 1
Mean	1.28E-08
Standard Error	1.76E-09
Median	1.21E-08
Mode	#N/A
Standard Deviation	5.56E-09
Variance	3.09E-17
Kurtosis	-9.33E-01
Skewness	2.46E-01
Range	1.75E-08
Minimum	4.53E-09
Maximum	2.20E-08
Sum	1.28E-07
Count	10

Sulfates-"T"Test
Monitor Well-MW-3

Date	Data set 1	Date	Data set 2
1/30/80	2100	11/3/88	3410
5/30/80	2430	3/9/89	3410
6/30/80	2625	6/21/89	3500
7/31/80	2450	9/1/89	3500
8/31/80	2975	11/15/89	2670
9/30/80	2800	2/20/90	3330
10/31/80	3050	5/8/90	3480
11/30/80	2750	8/7/90	3400
12/31/80	3068	11/13/90	3468
1/31/81	3012	2/27/91	2712

t-Test: Paired Two-Sample for Means

	Data set 1	Data set 2
Mean	2726	3288
Variance	104184	101881
Observations	10	10
Pearson Correlation	-0.41	
Pooled Variance	-42384.67	
Hypothesized Mean Differen	0.00	
df	9.00	
t	-3.30	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.83	
P(T<=t) two-tail	0.01	
t Critical two-tail	2.26	

Data set 1	
Mean	2726.00
Standard Err	102.07
Median	2775.00
Mode	#N/A
Standard Dev	322.78
Variance	104184.22
Kurtosis	-0.27
Skewness	-0.74
Range	968.00
Minimum	2100.00
Maximum	3068.00
Sum	27260.00
Count	10

Data set 2	
Mean	3288.00
Standard Error	100.94
Median	3410.00
Mode	#N/A
Standard Deviation	319.19
Variance	101880.89
Kurtosis	1.19
Skewness	-1.67
Range	830.00
Minimum	2670.00
Maximum	3500.00
Sum	32880.00
Count	10

Chlorides-"T"Test
Monitor Well-MW-5

Date	Data set 1	Date	Data set 2
30-Nov-80	64	07-Aug-90	49
31-Dec-80	65	13-Nov-90	52
31-Jan 81	71	27-Feb-91	53
28-Feb-81	65	21-May-91	54
31-Mar-81	66	24-Sep 91	55
30-Apr-81	66	03-Dec-91	53
30-May-81	110	17-Mar-92	53
30-Jun-81	69	11 Jun-92	53
31-Aug-81	67	03-Sep 92	52
31 Dec 81	66	19-Nov 92	20

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	70.9	49.4
Variance	193	109
Observations	10	10
Pooled Variance	151.07	
Hypothesized Mean Difference	0.00	
df	18.00	
t	3.91	
P(T<=t) one-tail	0.00	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.10	

Data set 1	
Mean	70.90
Standard Error	4.39
Median	66.00
Mode	66.00
Standard Deviation	13.89
Variance	192.99
Kurtosis	9.40
Skewness	3.04
Range	46.00
Minimum	64.00
Maximum	110.00
Sum	709.00
Count	10

Data set 2	
Mean	49.40
Standard Error	3.30
Median	53.00
Mode	53.00
Standard Deviation	10.45
Variance	109.16
Kurtosis	9.39
Skewness	-3.03
Range	35.00
Minimum	20.00
Maximum	55.00
Sum	494.00
Count	10

U Nat-"T"Test
Monitor Well-MW-5

Date	Data set 1	Date	Data set 2
30-Sep-81	1.4E-08	16-Aug-90	6.00E-10
31-Dec-81	3.0E-09	13-Nov-90	3.00E-10
31-Mar-82	6.8E-10	27 Feb 91	2.70E-10
30-Jun-82	2.7E-09	21-May 91	1.10E-09
30-Sep-82	6.7E-10	24 Sep 91	8.00E-10
31-Dec-82	6.7E-10	03-Dec 91	5.30E-10
31-Mar-83	8.0E-10	17-Mar 92	1.60E-09
30-Jun-83	6.7E-10	11-Jun-92	2.00E-10
30-Sep-83	5.6E-09	03-Sep-92	4.06E-09
31-Dec-83	6.8E-10	19-Nov-92	6.77E-10

t-Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	2.897E-09	1.014E-09
Variance	0	0
Observations	10	10
Pooled Variance	0.00	
Hypothesized Mean Difference	0.00	
df	18.00	
t	1.41	
P(T<=t) one-tail	0.09	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.18	
t Critical two-tail	2.10	

Data set 1	
Mean	2.90E-09
Standard Error	1.29E-09
Median	7.40E-10
Mode	6.70E-10
Standard Deviation	4.07E-09
Variance	1.65E-17
Kurtosis	5.90E+00
Skewness	2.37E+00
Range	1.28E-08
Minimum	6.70E-10
Maximum	1.35E-08
Sum	2.90E-08
Count	10

Data set 2	
Mean	1.01E-09
Standard Error	3.64E-10
Median	6.39E-10
Mode	#N/A
Standard Deviation	1.15E-09
Variance	1.32E-18
Kurtosis	6.53E+00
Skewness	2.45E+00
Range	3.86E-09
Minimum	2.00E-10
Maximum	4.06E-09
Sum	1.01E-08
Count	10

Chlorides-"T"Test
Monitor Well-MW-11

Date	Data set 1	Date	Data set 2
31-Mar-84	31.4	07-Aug-90	33.0
30-Jun-84	32.0	13-Nov-90	34.0
30-Sep-84	33.9	27-Feb-91	31.0
31-Dec-84	31.9	21-May-91	30.0
31-Mar-85	34.0	24-Sep-91	30.0
30-Jun-85	31.0	03-Dec-91	31.0
30-Sep-85	38.0	17-Mar-92	32.0
31-Dec-85	71.0	11-Jun-92	29.0
19-Jun-86	77.0	03-Sep-92	31
30-Jun-86	70.0	19-Nov-92	41.0

t-Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	45.016	32.2
Variance	371	12
Observations	10	10
Pooled Variance	191.46	
Hypothesized Mean Difference	0.00	
df	18.00	
t	2.07	
P(T<=t) one-tail	0.03	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.05	
t Critical two-tail	2.10	

Data set 1	
Mean	45.02
Standard Error	6.09
Median	33.93
Mode	#N/A
Standard Deviation	19.27
Variance	371.19
Kurtosis	-1.08
Skewness	1.03
Range	46.00
Minimum	31.00
Maximum	77.00
Sum	450.16
Count	10

Data set 2	
Mean	32.20
Standard Error	1.08
Median	31.00
Mode	31.00
Standard Deviation	3.43
Variance	11.73
Kurtosis	5.44
Skewness	2.17
Range	12.00
Minimum	29.00
Maximum	41.00
Sum	322.00
Count	10

U-Nat-"T"Test
Monitor Well-MW-11

Date	Data set 1	Date	Data set 2
31-Mar-84	7.45E-09	07-Aug-90	4.67E-10
30-Jun-84	2.71E-09	13-Nov-90	6.00E-10
30-Sep-84	4.06E-10	27-Feb-91	2.00E-10
31-Dec-84	1.76E-09	21-May-91	2.30E-10
31-Mar-85	2.71E-10	24-Sep 91	7.40E-10
30-Jun-85	2.98E-10	03-Dec-91	2.40E-10
30-Sep-85	8.80E-09	17-Mar-92	2.70E-09
31-Dec-85	5.00E-10	11-Jun-92	2.00E-10
19-Jun-86	1.70E-09	03-Sep-92	3.39E-09
30-Jun-86	1.50E-09	19-Nov-92	3.18E-09

t-Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	2.54E-09	1.195E-09
Variance	0	0
Observations	10	10
Pooled Variance	0.00	
Hypothesized Mean Difference	0.00	
df	18.00	
t	1.27	
P(T<=t) one-tail	0.11	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.22	
t Critical two-tail	2.10	

Data set 1	
Mean	2.54E-09
Standard Error	9.70E-10
Median	1.60E-09
Mode	#N/A
Standard Deviation	3.07E-09
Variance	9.40E-18
Kurtosis	1.12E+00
Skewness	1.54E+00
Range	8.53E-09
Minimum	2.71E-10
Maximum	8.80E-09
Sum	2.54E-08
Count	10

Data set 2	
Mean	1.19E-09
Standard Error	4.21E-10
Median	5.34E-10
Mode	2.00E-10
Standard Deviation	1.33E-09
Variance	1.77E-18
Kurtosis	-9.99E-01
Skewness	1.02E+00
Range	3.19E-09
Minimum	2.00E-10
Maximum	3.39E-09
Sum	1.19E-08
Count	10

Chlorides-"T"Test
Monitor Well-MW-12

Date	Data set 1	Date	Data set 2
31-Dec-82	57.4	07-Aug-90	63.0
25-Jan-83	70	13-Nov 90	63.0
30-Jun-83	80.5	27-Feb 91	61.0
31-Dec-83	65	21-May-91	55.0
31-Mar-84	64.1	24-Sep 91	59.0
30-Jun-84	65.0	03-Dec 91	60.0
30-Sep-84	64.6	17-Mar-92	60.0
31-Dec-84	67.4	11-Jun 92	56.0
31-Mar-85	67.0	03-Sep 92	56
30-Jun-85	62.0	19-Nov 92	62.0

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	66.301	59.5
Variance	36	9
Observations	10	10
Pooled Variance	22.46	
Hypothesized Mean Difference	0.00	
df	18 00	
t	3.21	
P(T<=t) one-tail	0 00	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.10	

Data set 1	
Mean	66.30
Standard Error	1.90
Median	65.00
Mode	65.00
Standard Deviation	6.02
Variance	36.20
Kurtosis	3.57
Skewness	1.35
Range	23.10
Minimum	57.40
Maximum	80.50
Sum	663.01
Count	10

Data set 2	
Mean	59.50
Standard Error	0.93
Median	60.00
Mode	63.00
Standard Deviation	2.95
Variance	8.72
Kurtosis	-1.31
Skewness	-0.39
Range	8.00
Minimum	55.00
Maximum	63.00
Sum	595.00
Count	10

U Nat-"T"Test
Monitor Well-MW-12

Date	Data set 1	Date	Data set 2
31-Mar-83	5.0E-09	07-Aug-90	1.07E-08
30 Jun-83	2.0E-09	13-Nov 90	1.00E-08
30-Sep-83	1.1E-08	27-Feb-91	8.80E-09
31-Dec-83	1.0E-08	21-May-91	1.00E-08
31-Mar-84	2.91E-08	24-Sep 91	1.10E-08
30-Jun-84	1.83E-08	03-Dec-91	6.80E-09
30-Sep-84	4.06E-10	17-Mar 92	1.01E-08
31-Dec-84	1.62E-09	11-Jun-92	5.53E-09
31-Mar-85	4.74E-10	03-Sep-92	1.29E-08
30-Jun-85	6.80E-09	19-Nov-92	1.39E-08

t Test: Two-Sample Assuming Equal Variances

	Data set 1	Data set 2
Mean	8.47E-09	9.973E-09
Variance	0	0
Observations	10	10
Pooled Variance	0.00	
Hypothesized Mean Difference	0.00	
df	18.00	
t	-0.50	
P(T<=t) one-tail	0.31	
t Critical one-tail	1.73	
P(T<=t) two-tail	0.62	
t Critical two-tail	2.10	

Data set 1	
Mean	8.47E-09
Standard Error	2.91E-09
Median	5.90E-09
Mode	#N/A
Standard Deviation	9.21E-09
Variance	8.48E-17
Kurtosis	1.81E+00
Skewness	1.44E+00
Range	2.87E-08
Minimum	4.06E-10
Maximum	2.91E-08
Sum	8.47E-08
Count	10

Data set 2	
Mean	9.97E-09
Standard Error	7.94E-10
Median	1.01E-08
Mode	1.00E-08
Standard Deviation	2.51E-09
Variance	6.31E-18
Kurtosis	7.89E-02
Skewness	-2.99E-01
Range	8.37E-09
Minimum	5.53E-09
Maximum	1.39E-08
Sum	9.97E-08
Count	10

Chlorides-mw-15 & mw-12

Date	mw-15	mw-12
15-Nov-89	49.0	63.0
20-Feb-90	44.0	63.0
08-May-90	44.0	62.0
07-Aug-90	44.0	63.0
13-Nov-90	44.0	63.0
27-Feb-91	41.0	61.0
21-May-91	38.0	55.0
24-Sep-91	38.0	59.0
03-Dec-91	38.0	60.0
17-Mar-92	40.0	60.0
11-Jun-92	35.0	56.0
03-Sep-92	37	56
19-Nov-92	39.0	62.0

t-Test: Two-Sample Assuming Unequal Variances

	mw-15	mw-12
Mean	40.84615	60.23077
Variance	15.30769	8.525641
Observations	13	13
Pearson Corr	0.813065	
Pooled Varian	3.5	
df	22.20217	
t	-14.31649	
P(T<=t) one-	6.25E-13	
t Critical one-	1.717144	
P(T<=t) two-	1.25E-12	
t Critical two-	2.073875	

Mw-15		Mw-12	
Mean	40.84615	Mean	60.23077
Standard Error	1.085134	Standard Error	0.809826
Median	40	Median	61
Mode	44	Mode	63
Standard Deviatio	3.912505	Standard Devial	2.91987
Variance	15.30769	Variance	8.525641
Kurtosis	-0.154432	Kurtosis	-0.803318
Skewness	0.550588	Skewness	-0.791194
Range	14	Range	8
Minimum	35	Minimum	55
Maximum	49	Maximum	63
Sum	531	Sum	783
Count	13	Count	13

CHLORIDES-MW-14 & MW-15

Date	mw-14-1	mw-15-1
15-Nov-89	25.0	49.0
20-Feb-90	20.0	44.0
08-May-90	23.0	44.0
07-Aug-90	21.0	44.0
13-Nov-90	23.0	44.0

Date	mw-14-2	mw-15-2
27-Feb-91	23.0	41.0
21-May-91	21.0	38.0
24-Sep-91	15.0	38.0
03-Dec-91	19.0	38.0
17-Mar-92	22.0	40.0
11-Jun-92	18.0	35.0
03-Sep-92	20	37
19-Nov-92	18.0	39.0

t-Test: Two-Sample Assuming Unequal Variances

	mw-14-1	mw-14-2
Mean	22.4	19.5
Variance	3.80	6.57
Observations	5	8
Pearson Correlation	#N/A	
Pooled Variance	3.5	
df	10.3862	
t	2.306074	
P(T<=t) one-tail	0.0219	
t Critical one-tail	1.812462	
P(T<=t) two-tail	0.043799	
t Critical two-tail	2.228139	

t-Test: Two-Sample Assuming Unequal Variances

	mw-15-1	mw-15-2
Mean	45.00	38.25
Variance	5	3.36
Observations	5	8
Pearson Correlation	#N/A	
Pooled Variance	3.5	
df	7.32449	
t	5.665187	
P(T<=t) one-tail	0.000381	
t Critical one-tail	1.894578	
P(T<=t) two-tail	0.000762	
t Critical two-tail	2.364623	

Chlorides Mw-14 & Mw-15

Date	mw-14	mw-15
15-Nov-89	25.0	49.0
20-Feb-90	20.0	44.0
08-May-90	23.0	44.0
07-Aug-90	21.0	44.0
13-Nov-90	23.0	44.0
27-Feb-91	23.0	41.0
21-May-91	21.0	38.0
24-Sep-91	15.0	38.0
03-Dec-91	19.0	38.0
17-Mar-92	22.0	40.0
11-Jun-92	18.0	35.0
03-Sep-92	20	37
19-Nov-92	18.0	39.0

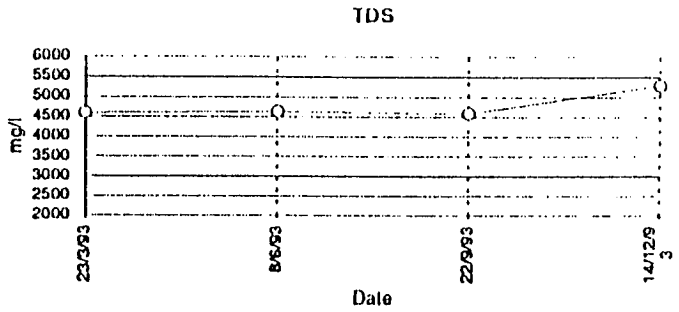
t-Test: Two-Sample Assuming Unequal Variances

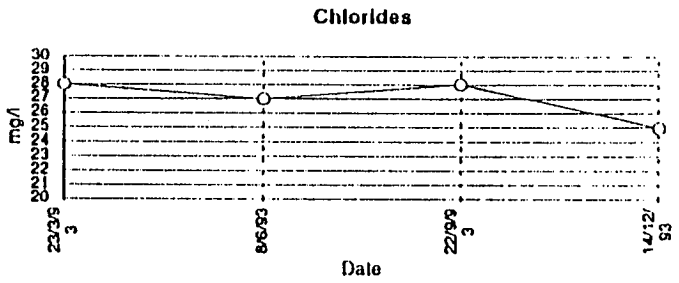
	mw-14	mw-15
Mean	20.61538	40.84615385
Variance	7.25641	15.30769231
Observations	13	13
Pearson Correlation	0.721347	
Pooled Variance	3.5	
df	21.28944	
t	-15.35589	
P(T<=t) one-tail	3.42E-13	
t Critical one-tail	1.720744	
P(T<=t) two-tail	6.84E-13	
t Critical two-tail	2.079614	

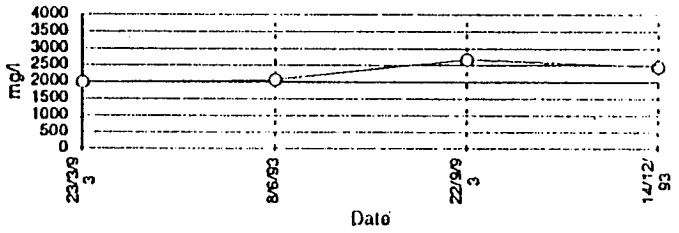
mw-14		mw-15	
Mean	20.61538	Mean	40.84615
Standard Error	0.747118	Standard Error	1.085134
Median	21	Median	40
Mode	23	Mode	44
Standard Deviation	2.693772	Standard Deviation	3.912505
Variance	7.25641	Variance	15.30769
Kurtosis	0.171462	Kurtosis	-0.154432
Skewness	-0.452377	Skewness	0.550588
Range	10	Range	14
Minimum	15	Minimum	35
Maximum	25	Maximum	49
Sum	268	Sum	531
Count	13	Count	13

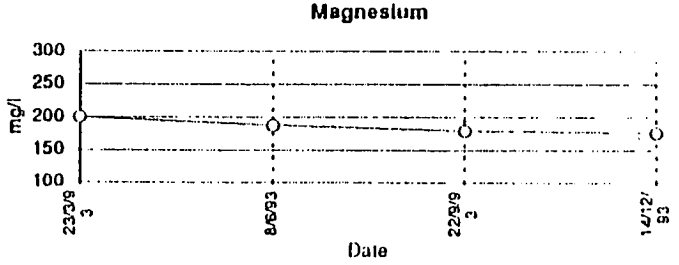
MONITOR WELL WMMW 17

Parameter	Units	LLD	Sample Date 23/3/93	8/6/93	22/9/93	14/12/93
Field Parameters						
Casing Elev.	Feet	0.001	5580	5580	5580	5580
Bottom Elev.	Feet	0.001				
Phreatic Elev.	Feet	0.1	5492.64	5492.41	5492.40	5494.64
Depth to Water	Feet	0.1	87.36	87.59	87.60	85.36
pH	Units	0.1	7.23	7.04	7.20	7.29
Temperature	°C	-2.				
Cond. @ 25 °C	µmhos/cm	25	4490	4880	4830	6450
Soluble Data						
SAR	%	--				
DO	mg/L	0.01				
TDS	mg/L	4mg/L	4607	4636	4592	5296
Carbonate	mg/L	1mg/L				
Bicarbonate	mg/L	1mg/L	384	385	383	385
Chlorides	mg/L	1mg/L	28	27	28	25
Sulfates	mg/L	0.1mg/L	2004	2079	2678	2460
Calcium	mg/L	0.05mg/L	406	388	375	372
Fluoride	mg/L	0.1mg/L				
Nitrite/N	mg/L	0.1mg/L				
Nitrate/N	mg/L	0.1mg/L				
Ammonia/N	mg/L	0.1mg/L				
Aluminum	mg/L	0.05mg/L				
Arsenic	mg/L	0.001mg/L	0.0009		0.0009	
Antimony	mg/L	3ug/L				
Boron	mg/L	10ug/L				
Barium	mg/L	10ug/L				
Beryllium	mg/L	10ug/L	0.0009		0.00019	
Cadmium	mg/L	5ug/L	0.0009		0.0002	
Chromium	mg/L	0.01mg/L				
Cobalt	mg/L	0.01mg/L				
Copper	mg/L	0.01mg/L				
Cyanide	mg/L	0.01mg/L				
Iron	mg/L	0.02mg/L				
Lead 210	mg/L	0.02mg/L	0.7			
Lithium	mg/L	0.05mg/L				
Magnesium	mg/L	0.05mg/L	200	188	180	177
Manganese	mg/L	0.01mg/L				
Mercury	mg/L	0.2ug/L				
Molybdenum	mg/L	10ug/L	0.0009		0.0009	
Nickel	mg/L	0.05mg/L	0.0009		0.0009	
Potassium	mg/L	0.5mg/L	17.8	17.7	18.7	18.6
Selenium	mg/L	2ug/L	0.0019		0.0019	
Silver	mg/L	0.01mg/L				
Sodium	mg/L	0.05mg/L	615	641	724	688
Thallium	mg/L	0.01mg/L				
Vanadium	mg/L	0.01mg/L				
Zinc	mg/L	5ug/L				
Sol. U-Nat.	pCi/L	0.2pCi/L	2.03E-08	1.29E-08	9.48E-09	9.48E-09
Sol. Th-230	pCi/L	0.2pCi/L				
Error Term	pCi/L					
Sol. Ra-226	pCi/L	0.2pCi/L		0.9		0.7
Error Term	pCi/L					
Sol. Ra-228	pCi/L	0.9pCi/L				1.8
Error Term	pCi/L					
Gross Alpha	pCi/L	2.0pCi/L			10	
Error Term	pCi/L					
Gross Beta	pCi/L	2.0pCi/L			40	
Error Term	pCi/L					



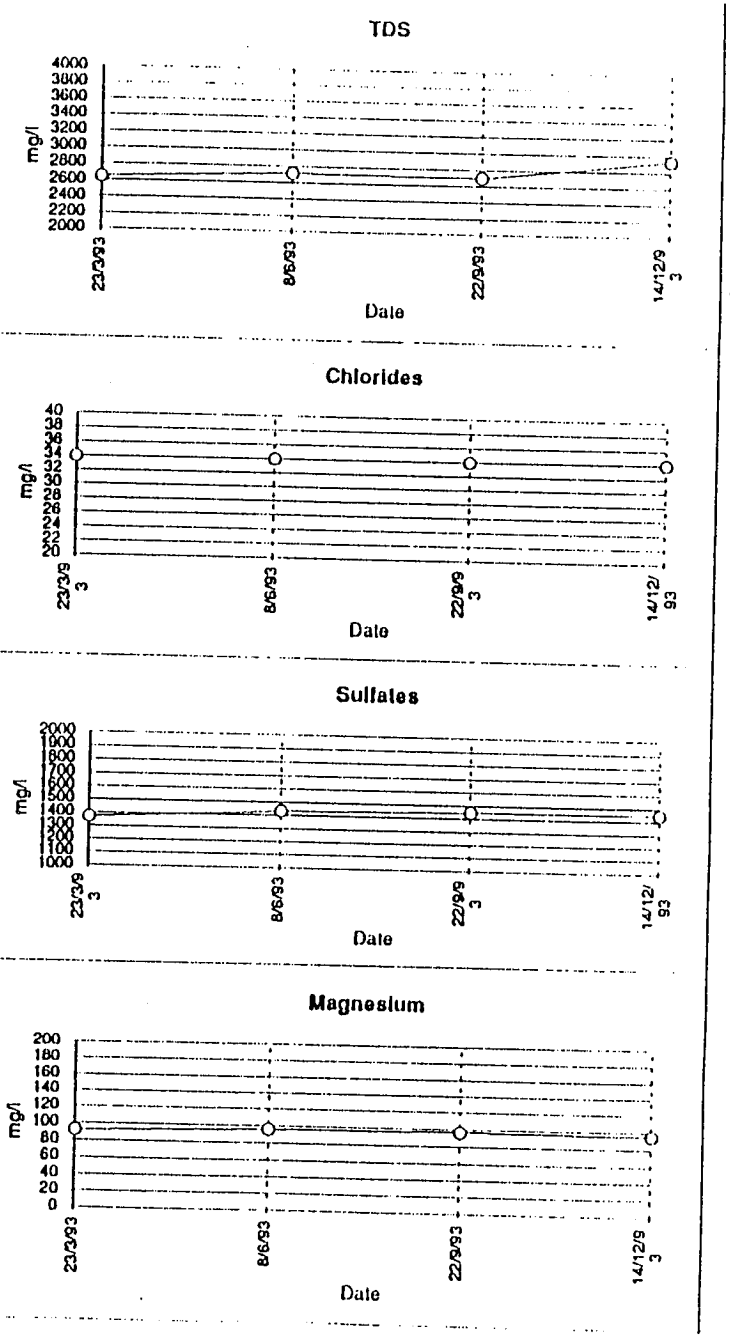






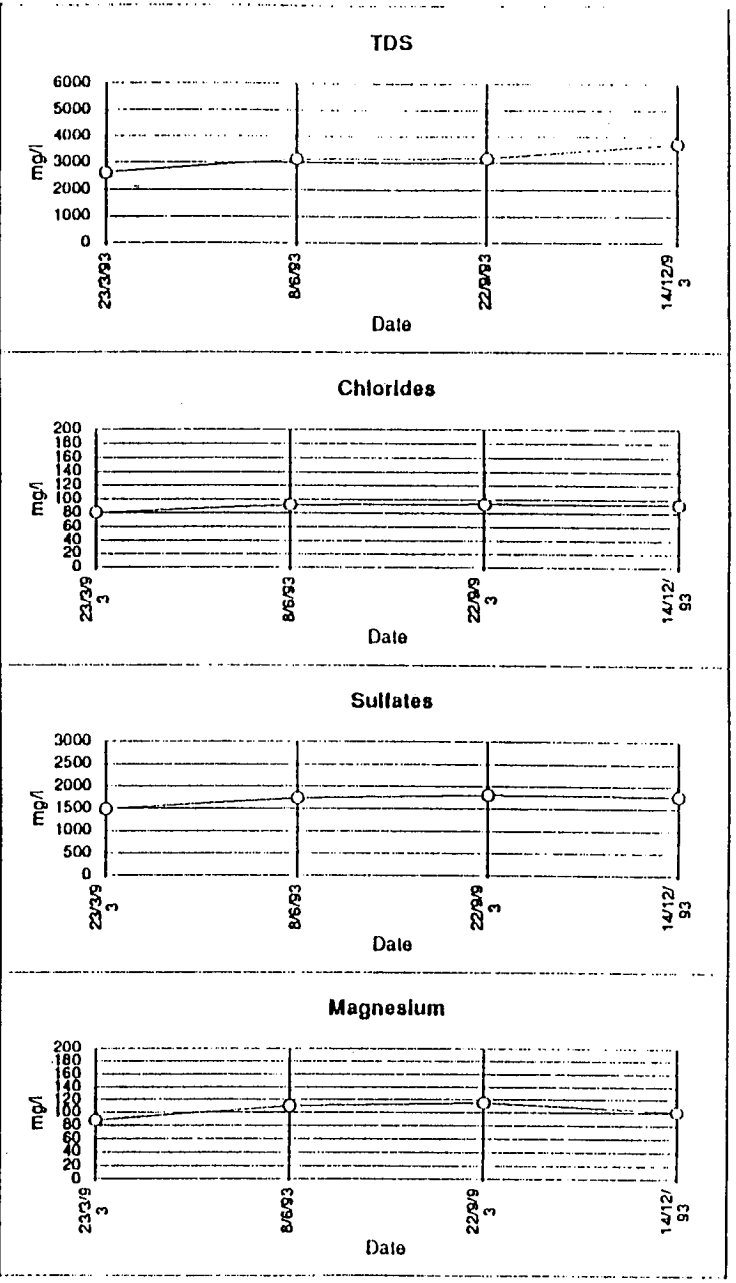
MONITOR WELL WMMW-18

Parameter	Units	LLD	Sample Date 23/3/93	8/6/93	22/9/93	14/12/93
Field Parameters						
Casing Elev.	Feet	0.001	5660.00	5660.00	5660.00	5660.00
Bottom Elev.	Feet	0.001				
Phreatic Elev.	Feet	0.1	5568.00	5567.88	5568.15	5568.18
Depth to Water	Feet	0.1	92.00	92.12	91.85	91.82
pH	Units	0.1	6.82	6.63	6.94	6.89
Temperature	°C	-2.	2800	2860	2830	3340
Cond. @ 25 °C	µmhos/cm	25				
Soluble Data						
SAR	%	--				
DO	mg/L	0.01				
TDS	mg/L	4mg/L	2655	2720	2700	2940
Carbonate	mg/L	1mg/L				
Bicarbonate	mg/L	1mg/L	324	325	323	328
Chlorides	mg/L	1mg/L	34	34	34	34
Sulfates	mg/L	0.1mg/L	1371	1431	1446	1446
Calcium	mg/L	0.05mg/L	415	445	437	419
Fluoride	mg/L	0.1mg/L				
Nitrite/N	mg/L	0.1mg/L				
Nitrate/N	mg/L	0.1mg/L				
Ammonia/N	mg/L	0.1mg/L				
Aluminum	mg/L	0.05mg/L				
Arsenic	mg/L	0.001mg/L	0.0009		0.0009	
Antimomy	mg/L	3ug/L				
Boron	mg/L	10ug/L				
Barium	mg/L	10ug/L				
Beryllium	mg/L	10ug/L	0.0009		0.00019	
Cadmium	mg/L	5ug/L	0.0009		0.0004	
Chromium	mg/L	0.01mg/L				
Cobalt	mg/L	0.01mg/L				
Copper	mg/L	0.01mg/L				
Cyanide	mg/L	0.01mg/L				
Iron	mg/L	0.02mg/L				
Lead 210	mg/L	0.02mg/L	1		0.5	
Lithium	mg/L	0.05mg/L				
Magnesium	mg/L	0.05mg/L	92	96	97	95
Manganese	mg/L	0.01mg/L				
Mercury	mg/L	0.2ug/L				
Molybdenum	mg/L	10ug/L	0.0009		0.0009	
Nickel	mg/L	0.05mg/L	0.005		0.0009	
Potassium	mg/L	0.5mg/L	7.1	7.6	7.8	7.4
Selenium	mg/L	2ug/L	0.0019		0.0019	
Silver	mg/L	0.01mg/L				
Sodium	mg/L	0.05mg/L	185	192	198	193
Thallium	mg/L	0.01mg/L				
Vanadium	mg/L	0.01mg/L				
Zinc	mg/L	5ug/L				
Sol. U-Nat.	pCi/L	0.2pCi/L	1.22E-08	9.48E-09	8.12E-09	1.08E-08
Sol. Th-230	pCi/L	0.2pCi/L		0.2		0.3
Error Term	pCi/L					
Sol. Ra-226	pCi/L	0.2pCi/L		0.7		0.8
Error Term	pCi/L					
Sol. Ra-228	pCi/L	0.9pCi/L				1.3
Error Term	pCi/L					
Gross Alpha	pCi/L	2.0pCi/L			12	
Error Term	pCi/L					
Gross Beta	pCi/L	2.0pCi/L			13	
Error Term	pCi/L					



MONITOR WELL WMMW-19

Parameter	Units	LLD	Sample Date 23/3/93	8/6/93	22/9/93	14/12/93
Field Parameters						
Casing Elev.	Feet	0.001	5650.00	5650.00	5650.00	5650.00
Bottom Elev.	Feet	0.001				
Phreatic Elev.	Feet	0.1	5564.73	5564.51	5564.70	5564.85
Depth to Water	Feet	0.1	85.27	85.49	85.30	85.15
pH	Units	0.1	7.39	7.48	7.52	7.57
Temperature	°C	-2.	3210	3490	3580	4170
Cond. @ 25 °C	µmhos/cm	25				
Soluble Data						
SAR	%	--				
DO	mg/L	0.01				
TDS	mg/L	4mg/L	2625	3144	3172	3694
Carbonate	mg/L	1mg/L				
Bicarbonate	mg/L	1mg/L	194	205	208	206
Chlorides	mg/L	1mg/L	81	92	94	93
Sulfates	mg/L	0.1mg/L	1500	1736	1811	1783
Calcium	mg/L	0.05mg/L	245	316	305	287
Fluoride	mg/L	0.1mg/L				
Nitrite/N	mg/L	0.1mg/L				
Nitrate/N	mg/L	0.1mg/L				
Ammonia/N	mg/L	0.1mg/L				
Aluminum	mg/L	0.05mg/L				
Arsenic	mg/L	0.001mg/L	0.0009		0.0009	
Antimony	mg/L	3ug/L				
Boron	mg/L	10ug/L				
Barium	mg/L	10ug/L				
Beryllium	mg/L	10ug/L	0.0009		0.00019	
Cadmium	mg/L	5ug/L	0.0009		0.0004	
Chromium	mg/L	0.01mg/L				
Cobalt	mg/L	0.01mg/L				
Copper	mg/L	0.01mg/L				
Cyanide	mg/L	0.01mg/L				
Iron	mg/L	0.02mg/L				
Lead 210	mg/L	0.02mg/L	0.6			
Lithium	mg/L	0.05mg/L				
Magnesium	mg/L	0.05mg/L	88	111	115	102
Manganese	mg/L	0.01mg/L				
Mercury	mg/L	0.2ug/L				
Molybdenum	mg/L	10ug/L	0.007		0.004	
Nickel	mg/L	0.05mg/L	0.0009		0.004	
Potassium	mg/L	0.5mg/L	12.7	11.8	13	12.8
Selenium	mg/L	2ug/L	0.005		0.0019	
Silver	mg/L	0.01mg/L				
Sodium	mg/L	0.05mg/L	432	438	476	475
Thallium	mg/L	0.01mg/L				
Vanadium	mg/L	0.01mg/L				
Zinc	mg/L	5ug/L				
Sol. U-Nat.	pCi/L	0.2pCi/L	1.00E-08	9.50E-09	8.80E-09	8.10E-09
Sol. Th-230	pCi/L	0.2pCi/L				
Error Term	pCi/L					
Sol. Ra-226	pCi/L	0.2pCi/L		0.4		0.8
Error Term	pCi/L					
Sol. Ra-228	pCi/L	0.9pCi/L				1.2
Error Term	pCi/L					
Gross Alpha	pCi/L	2.0pCi/L			7	
Error Term	pCi/L					
Gross Beta	pCi/L	2.0pCi/L			21	
Error Term	pCi/L					



data collected was
~ Nov 1991
per RUH

HOLT JET PUMP WELL

PARAMETER	RESULTS	DRINKING WATER STANDARDS MG/L UNLESS OTHERWISE SPECIFIED
ARSENIC	<0.001	0.05
BARIUM	0.02	1
CADMIUM	0.024	0.01
CHROMIUM	<0.01	0.05
LEAD	0.04	0.05
MERCURY	<0.0002	0.002
NITRATE	2.3	10
SELENIUM	0.50	0.01
SILVER	<0.01	0.05
RADIUM (226)	8.9 pCi/l	
RADIUM 228	17 pCi/l	
RADIUM (226 + 228)	25.9 pCi/l	5 pCi/l
TH-230	0.0 pCi/l	
URANIUM	0.0114	
GROSS ALPHA	200 pCi/l	15 pCi/l
GROSS BETA	100 pCi/l	4 MREM/YR
CHLORIDE	208	250
COPPER	<0.01	1
IRON	0.93	0.3
MANGANESE	7.73	0.05
pH	4.24	6.5-8.5
SULFATE	1470	250
TOTAL DISSOLVED SOLIDS	2500	500
ZINC	2.15	5
ALUMINUM	52.3	
AMMONIA	3.0	
ANTIMONY	<0.003	
BERYLLIUM	0.05	
BORON	0.23	
CALCIUM	453	
ALKALINITY (CO3)	12	
ALKALINITY (HCO3)	241	
COBALT	0.42	
CYANIDE	0.02	
GALLIUM	0.05	
LITHIUM	1.9	
MAGNESIUM	523	
MOLYBDENUM	<0.01	
NICKEL	0.41	
NO2	0.01	
PHOSPHATE	<0.1	
POTASSIUM	5.9	
SODIUM	157	
STRONTIUM	8.93	
THALLIUM	<0.01	
TOTAL SUSPENDED SOLIDS	5	
TIN	<0.005	
TITANIUM	<0.05	
VANADIUM	0.01	

JONES WELL

PARAMETER	RESULTS	DRINKING WATER STANDARDS MG/L UNLESS OTHERWISE SPECIFIED
ARSENIC	<0.001	0.05
BARIUM	<0.01	1
CADMIUM	<0.005	0.01
CHROMIUM	<0.01	0.05
LEAD	<0.02	0.05
MERCURY	<0.0002	0.002
NITRATE	<0.01	10
SELENIUM	0.002	0.01
SILVER	<0.01	0.05
RADIUM 226	0.3 pCi/l	
RADIUM 228	0.4 pCi/l	
RADIUM (226 + 228)	0.7 pCi/l	5 pCi/l
TH-230	0.1 pCi/l	
URANIUM	0.0057	
GROSS ALPHA	2.8 pCi/l	15 pCi/l
GROSS BETA	7.2 pCi/l	4 MREM/YR
CHLORIDE	15	250
COPPER	<0.01	1
IRON	<0.01	0.3
MANGANESE	0.04	0.05
pH	8.15	6.5-8.5
SULFATE	480	250
TOTAL DISSOLVED SOLIDS	1020	500
ZINC	0.011	5
ALUMINUM	<0.05	
AMMONIA	0.5	
ANTIMONY	<0.003	
BERYLLIUM	<0.01	
BORON	0.51	
CALCIUM	10.7	
ALKALINITY (CO3)	8	
ALKALINITY (HCO3)	348	
COBALT	<0.01	
CYANIDE	0.02	
GALLIUM	<0.05	
LITHIUM	0.2	
MAGNESIUM	3.15	
MOLYBDENUM	0.02	
NICKEL	<0.01	
NO2	<0.01	
PHOSPHOROUS	<0.1	
POTASSIUM	2.5	
SODIUM	372	
STRONTIUM	0.58	
THALLIUM	<0.01	
TOTAL SUSPENDED SOLIDS	13	
TIN	<0.005	
TITANIUM	<0.05	
VANADIUM	<0.01	

ANDERSON WELL

PARAMETER	RESULTS	DRINKING WATER STANDARDS MG/L UNLESS OTHERWISE SPECIFIED
ARSENIC	<0.001	0.05
BARIUM	<0.01	1
CADMIUM	<0.005	0.01
CHROMIUM	<0.01	0.05
LEAD	<0.02	0.05
MERCURY	<0.0002	0.002
NITRATE	0.2	10
SELENIUM	0.002	0.01
SILVER	<0.01	0.05
RADIUM (226)	1.3 pCi/l	
RADIUM 228	1.2 pCi/l	
RADIUM (226 + 228)	2.5 pCi/l	5 pCi/l
TH-230	0.0 pCi/L	
URANIUM	0.0488	
GROSS ALPHA	38 pCi/l	15 pCi/l
GROSS BETA	26 pCi/l	4 MREM/YR
✓CHLORIDE	55	250
COPPER	<0.01	1
IRON	6.89	0.3
MANGANESE	2.36	0.05
pH	6.59	6.5-8.5
✓SULFATE	1530	250
TOTAL DISSOLVED SOLIDS	2550	500
ZINC	0.270	5
ALUMINUM	<0.05	
AMMONIA	<0.1	
ANTIMONY	<0.003	
BERYLLIUM	<0.01	
BORON	0.04	
✓CALCIUM	500	
✓ALKALINITY (CO3)	12	
✓ALKALINITY (HCO3)	228	
COBALT	0.01	
CYANIDE	0.02	
GALLIUM	0.05	
LITHIUM	0.1	
✓MAGNESIUM	107	
MOLYBDENUM	0.01	
NICKEL	<0.01	
NO2	0.01	
PHOSPHATE	<0.1	
✓POTASSIUM	5.4	
✓SODIUM	95.6	
STRONTIUM	2.65	
THALLIUM	<0.01	
TOTAL SUSPENDED SOLIDS	9	
TIN	<0.005	
TITANIUM	<0.05	
VANADIUM	0.01	

HOLT WINDMILL WELL

PARAMETER	RESULTS	DRINKING WATER STANDARDS MG/L UNLESS OTHERWISE SPECIFIED
ARSENIC	<0.001	0.05
BARIUM	0.04	1
CADMIUM	0.006	0.01
CHROMIUM	<0.01	0.05
LEAD	<0.04	0.05
MERCURY	<0.0002	0.002
NITRATE	0.5	10
SELENIUM	<0.002	0.01
SILVER	<0.01	0.05
RADIUM (226)	0.7 pCi/l	
RADIUM 228	1.6 pCi/l	
RADIUM (226 + 228)	2.3 pCi/l	5 pCi/l
TH-230	0.0 pCi/l	
URANIUM	0.0066	
GROSS ALPHA	10 pCi/l	15 pCi/l
GROSS BETA	18 pCi/l	4 MREM/YR
CHLORIDE	24	250
COPPER	<0.01	1
IRON	0.32	0.3
MANGANESE	1.20	0.05
pH	8.57	6.5-8.5
SULFATE	1190	250
TOTAL DISSOLVED SOLIDS	2140	500
ZINC	0.105	5
ALUMINUM	<0.05	
AMMONIA	0.2	
ANTIMONY	<.003	
BERYLLIUM	<0.01	
BORON	0.09	
CALCIUM	215	
ALKALINITY (CO_3)	12	
ALKALINITY (HCO_3)	192	
COBALT	<0.01	
CYANIDE	0.02	
GALLIUM	0.09	
LITHIUM	0.1	
MAGNESIUM	224	
MOLYBDENUM	<0.01	
NICKEL	0.01	
NO_2	0.1	
PHOSPHATE	<0.1	
POTASSIUM	11.7	
SODIUM	39.9	
STRONTIUM	3.66	
THALLIUM	<0.01	
TOTAL SUSPENDED SOLIDS	53	
TIN	<0.005	
TITANIUM	<0.05	
VANADIUM	0.02	

TABLE 1

Parameter	CELL 2 LDS		FLY ASH POND				
	C2 LDS	Blind Duplicate	Upper Pool	Lower Pool	Previous Sample	Slimes Drain	Blank
Na, mg/l *	34	36	391	279	570	2345	ND
Ni, mg/l	0.02	0.02	0.05	0.04	3.8	7.2	ND
K, mg/l *	2.6	3.3	7.2	9.6	23	251	0.03
Se, mg/l	ND	ND	0.028	0.23	0.005	0.64	ND
Ag, mg/l	ND	ND	ND	ND	0.002	0.005	ND
Sr, mg/l	2.2	2.5	1.1	2.1	1.4	14	ND
Ti, mg/l	0.04	0.05	0.05	0.04	0.06	1.1	ND
U, uCi/ml	1.2E-08	1.0E-08	2.6E-07	2.7E-07	1.0E-07	1.0E-05	ND
V, mg/l	0.03	0.03	9.7	11	0.43	165	ND
Zn, mg/l	ND	ND	ND	ND	7.9	50	ND
Zr, mg/l	ND	ND	ND	ND	ND	ND	ND
Total Alkalinity, meq/l *	3.8	3.92	2.52	1.38	0.8	ND	0.2
NH3--N, mg/l	ND	ND	1.4	4.0	57	1761	ND
Cl, mg/l	179	180	134	74	526	3191	ND
CN (Total), mg/l	ND	ND	ND	ND	ND	ND	ND
P (total), mg/l	ND	ND	0.1	0.3	0.2	6.2	ND
SO4, mg/l *	150	159	654	688	1414	38404	ND
TDS, mg/l	765	770	1514	1393	2899	67710	ND
TSS, mg/l	ND	ND	ND	ND	ND	ND	ND
Report Date	Feb-91	Feb-91	Feb-91	Feb-91	Oct-90	Feb-91	Feb-91

Sept. 1991

mg/l = milligrams per liter
pCi/l = picoCuries per liter
mmg/l = micrograms per liter
ND = not detected
NS = not sampled

Note: The blank sample is obtained by flushing the sampling equipment with deionized water. After 10 to 20 minutes of flushing, fresh deionized water is pumped through the equipment and sampled.

Sept. 1991

TABLE 1

Parameter	CELL 2 LDS		FLY ASH POND				
	C2 LDS	Blind Duplicate	Upper Pool	Lower Pool	Previous Sample	Slimes Drain	Blank
Gross Alpha, pCi/l	4.50	7.00	260	250	230	14000	0.0
Gross Beta, pCi/l	4.70	3.60	130	130	140	6200	1.0
Ra-226, pCi/l	1.70	1.40	0.7	3.4	53	40	0.0
Ra-228, pCi/l	1.50	1.60	1.0	0.7	1.8	1.9	1.4
Th-230, pCi/l	0.00	0.00	2.4	2.9	30	3650	0.5
acetone, mmg/l	ND	ND	ND	ND	NS	513.61	ND
2-butanone, mmg/l	ND	ND	ND	ND	NS	15.13	ND
chloroform, mmg/l	ND	ND	ND	ND	NS	16.84	ND
toluene, mmg/l	ND	ND	ND	ND	NS	6.25	ND
di-n-butyl pthalate, mmg/l	ND	ND	1.3	ND	NS	1.08	ND
fluoranthene, mmg/l	ND	ND	1.15	ND	NS	ND	ND
chrysene, mmg/l	ND	ND	1.73	ND	NS	ND	ND
bis(2-ethylhexyl)pthalate, mmg/l	ND	ND	1.79	1.2	NS	1.13	ND
benzo(a)pyrene, mmg/l	ND	ND	1.76	ND	NS	ND	ND
phenol, mmg/l	ND	ND	ND	ND	NS	38.4	ND
napthalene, mmg/l	ND	ND	ND	ND	NS	2.44	ND
dimethyl pthalate, mmg/l	ND	ND	ND	ND	NS	2.70	ND
diethyl pthalate, mmg/l	ND	ND	ND	ND	NS	18.10	ND
Al, mg/l	0.08	0.08	0.46	0.33	1.8	2450	0.01
As, mg/l	0.004	0.004	0.24	0.43	0.092	0.28	0.002
Ba, mg/l	0.10	0.10	0.03	0.04	0.10	ND	ND
B, mg/l	0.1	0.1	0.3	0.3	0.2	3.5	ND
Ca, mg/l	108	110	72	112	81	474	ND
Cd, mg/l	0.001	0.002	0.002	0.002	0.066	4.2	0.001
Cr, mg/l	0.006	0.005	0.002	0.003	0.006	1.0	ND
Co, mg/l	ND	ND	ND	ND	1.0	14	ND
Cu, mg/l	ND	ND	ND	ND	2.0	177	ND
Pb, mg/l	0.008	0.005	0.007	0.025	0.082	0.21	ND
Mg, mg/l	51	52	23	35	121	2450	ND
Mn, mg/l	4.1	4.1	ND	ND	2.3	128	ND
Mo, mg/l	0.030	0.030	1.6	2.8	0.49	0.44	ND

ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 639
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13695

Sample Description: WMMW #1

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst – R. Martin
4) Analyst – V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	5.42 meq/l	271.77-116 EPA 310.1	15-Mar-91	2,4
As	0.001	EPA 206.2	28-Mar-91	1,3
Be	0.001	EPA 210.2	03-Apr-91	1,3
Ca	123	EPA 215.1	22-Mar-91	1,3
Cl	12	EPA 325.3	18-Mar-91	2,3
Mg	52	EPA 242.1	22-Mar-91	1,3
Mn	0.22	EPA 243.1	25-Mar-91	1,3
Na	171	EPA 273.1	21-Mar-91	1,3
Ni	0.02	EPA 249.2	27-Mar-91	1,3
K	6.0	EPA 258.1	22-Mar-91	1,3
Se	0.002	EPA 270.2	11-Apr-91	1,3
SO4	692	EPA 375.3	16-Mar-91	2,3
TDS	1272	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	2.2E-10	ASTM D2907	18-Apr-91	1,4

Approved by: [signature]
Chief Chemist

ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13898

Sample Description: WMMW #2

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst -- R. Martin
4) Analyst -- V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	6.98 meq/l	EPA 310.1	15-Mar-91	2,4
As	<0.001	EPA 206.2	28-Mar-91	1,3
Be	0.004	EPA 210.2	03-Apr-91	1,3
Ca	298	EPA 215.1	22-Mar-91	1,3
Cl	10	EPA 325.3	18-Mar-91	2,3
Mg	91	EPA 242.1	22-Mar-91	1,3
Mn	0.02	EPA 243.1	25-Mar-91	1,3
Na	477	EPA 273.1	21-Mar-91	1,3
Ni	0.06	EPA 249.2	27-Mar-91	1,3
K	11	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	1849	EPA 375.3	16-Mar-91	2,3
TDS	3154	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	3.5E-09	ASTM D2907	18-Apr-91	1,4

Approved by: Vern L. Martin
Chief Chemist

ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13897

Sample Description: WMMW #3

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	4.08 meq/l	204.204 EPA 310.1	15-Mar-91	2,4
As	<0.001	EPA 206.2	28-Mar-91	1,3
Be	0.006	EPA 210.2	03-Apr-91	1,3
Ca	407	EPA 215.1	22-Mar-91	1,3
Cl	68	EPA 325.3	18-Mar-91	2,3
Mg	234	EPA 242.1	22-Mar-91	1,3
Mn	0.30	EPA 243.1	25-Mar-91	1,3
Na	708	EPA 273.1	21-Mar-91	1,3
Ni	0.10	EPA 249.2	27-Mar-91	1,3
K	25	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	2712	EPA 375.3	18-Mar-91	2,3
TDS	5268	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	8.0E-09	ASTM D2907	18-Apr-91	1,4

Approved by: Vance S. Martin
Chief Chemist

ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13898

Sample Description: WMMW #4

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	6.96 meq/l	384.3 EPA 310.1	15-Mar-91	2,4
As	0.002	EPA 206.2	28-Mar-91	1,3
Ba	0.004	EPA 210.2	03-Apr-91	1,3
Mg	174	EPA 242.1	22-Mar-91	1,3
Mn	1.4	EPA 243.1	25-Mar-91	1,3
Na	284	EPA 273.1	21-Mar-91	1,3
Ni	0.07	EPA 249.2	27-Mar-91	1,3
K	10	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	1946	EPA 375.3	16-Mar-91	2,3
TDS	3424	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	1.3E-09	ASTM D2907	18-Apr-91	1,4

Approved by: [signature]
Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13899

Sample Description: WMMW #5 duplicated with 15k

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	8.06 meq/l	303,302 EPA 310.1	15-Mar-91	2,4
As	<0.001	EPA 206.2	28-Mar-91	1,3
Be	0.003	EPA 210.2	09-Apr-91	1,3
Ca	118	EPA 215.1	22-Mar-91	1,3
Cl	50	EPA 325.3	18-Mar-91	2,3
Mg	34	EPA 242.1	22-Mar-91	1,3
Mn	0.28	EPA 243.1	25-Mar-91	1,3
Na	430	EPA 273.1	21-Mar-91	1,3
Ni	0.04	EPA 249.2	27-Mar-91	1,3
K	7.4	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	1028	EPA 375.3	18-Mar-91	2,3
TDS	1850	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	2.7E-10	ASTM D2907	18-Apr-91	1,4

Approved by: [signature]
Chief Chemist

ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13900

Sample Description: WMMW #11

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	6.02 meq/l 301	EPA 310.1	15-Mar-91	2,4
As	0.002	EPA 206.2	28-Mar-91	1,3
Be	0.002	EPA 210.2	03-Apr-91	1,3
Ca	33	EPA 215.1	22-Mar-91	1,3
Cl	31	EPA 325.3	18-Mar-91	2,3
Mg	8.7	EPA 242.1	22-Mar-91	1,3
Mn	0.08	EPA 243.1	25-Mar-91	1,3
Na	522	EPA 273.1	21-Mar-91	1,3
Ni	0.05	EPA 249.2	27-Mar-91	1,3
K	6.0	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	967	EPA 375.3	16-Mar-91	2,3
TDS	1686	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	<2.0E-10	ASTM D2907	18-Apr-91	1,4

Approved by: James E. Martin
Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13901

Sample Description: WMMW #12

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst – R. Martin
4) Analyst – V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	5.92 meq/l 296.2/6	EPA 310.1	15-Mar-91	2,4
As	0.001	EPA 206.2	28-Mar-91	1,3
Be	0.004	EPA 210.2	03-Apr-91	1,3
Ca	313	EPA 215.1	22-Mar-91	1,3
Cl	61	EPA 325.3	18-Mar-91	2,3
Mg	61	EPA 242.1	22-Mar-91	1,3
Mn	1.3	EPA 243.1	25-Mar-91	1,3
Na	213	EPA 273.1	21-Mar-91	1,3
Ni	0.06	EPA 249.2	27-Mar-91	1,3
K	9.6	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	1850	EPA 375.3	16-Mar-91	2,3
TDS	3260	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	8.8E-09	ASTM D2907	18-Apr-91	1,4

Approved by: James E. Martin
Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 639
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13902

Sample Description: WMMW #13A

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst -- R. Martin
4) Analyst -- V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	0.14 meq/l	EPA 310.1	15-Mar-91	2,4
As	0.002	EPA 206.2	26-Mar-91	1,3
Be	0.001	EPA 210.2	03-Apr-91	1,3
Ca	0.62	EPA 215.1	22-Mar-91	1,3
Cl	<1	EPA 325.3	18-Mar-91	2,3
Mg	0.04	EPA 242.1	22-Mar-91	1,3
Mn	0.01	EPA 243.1	25-Mar-91	1,3
Na	<0.01	EPA 273.1	21-Mar-91	1,3
Ni	0.02	EPA 249.2	27-Mar-91	1,3
K	0.02	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	11	EPA 375.3	16-Mar-91	2,3
TDS	15	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	1.6E-09	ASTM D2907	18-Apr-91	1,4

Background of de-i water recycled through hose reel after a good flush with plain water.

Approved by: Vance S. Martin
Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 639
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13903

Sample Description: WMMW #14

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	7.22 meq/l	EPA 310.1	15-Mar-91	2,4
As	<0.001	EPA 206.2	28-Mar-91	1,3
Be	0.003	EPA 210.2	03-Apr-91	1,3
Ca	308	EPA 215.1	22-Mar-91	1,3
Cl	23	EPA 325.3	18-Mar-91	2,3
Mg	41	EPA 242.1	22-Mar-91	1,3
Mn	1.6	EPA 243.1	25-Mar-91	1,3
Na	265	EPA 273.1	21-Mar-91	1,3
Ni	0.05	EPA 249.2	27-Mar-91	1,3
K	7.9	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	1512	EPA 375.3	18-Mar-91	2,3
TDS	2684	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	2.4E-08	ASTM D2907	18-Apr-91	1,4

Approved by: [signature]
Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13904

Sample Description: WMMW #15

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	7.12 meq/l	EPA 310.1	15-Mar-91	2,4
As	<0.001	EPA 206.2	28-Mar-91	1,3
Be	0.004	EPA 210.2	03-Apr-91	1,3
Ca	385	EPA 215.1	22-Mar-91	1,3
Cl	41	EPA 325.3	18-Mar-91	2,3
Mg	120	EPA 242.1	22-Mar-91	1,3
Mn	0.95	EPA 243.1	25-Mar-91	1,3
Na	466	EPA 273.1	21-Mar-91	1,3
Ni	0.07	EPA 249.2	27-Mar-91	1,3
K	9.4	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	1876	EPA 375.3	16-Mar-91	2,3
TDS	3358	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	2.0E-08	ASTM D2907	18-Apr-91	1,4

Approved by: Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 589
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13905

Sample Description: WMMW #15A duplicate of 5

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst -- R. Martin
4) Analyst -- V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	5.78 meq/l	EPA 310.1	15-Mar-91	2,4
As	<0.001	EPA 206.2	28-Mar-91	1,3
Be	0.003	EPA 210.2	03-Apr-91	1,3
Ca	116	EPA 215.1	22-Mar-91	1,3
Cl	50	EPA 325.3	18-Mar-91	2,3
Mg	34	EPA 242.1	22-Mar-91	1,3
Mn	0.28	EPA 243.1	25-Mar-91	1,3
Na	427	EPA 273.1	21-Mar-91	1,3
Ni	0.04	EPA 249.2	27-Mar-91	1,3
K	7.5	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	950	EPA 375.3	16-Mar-91	2,3
TDS	1808	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	3.4E-10	ASTM D2907	18-Apr-91	1,4

Approved by: [signature]
Chief Chemist

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL

QUALITY CONTROL DATA SHEET

Yc: RAVH
GGR
NWB
JSH
SRC ✓

Number Of Samples Received: 14
Type Of Sample Container(s): Plastic 1 liter

DUPLICATE and LLD RESULTS

on computer 4-23-91

Laboratory Sample ID	Parameter	Result	Duplicate Result	Coefficient of Variation (%)	LLD
13895	Total Alkalinity	5.42	5.36	0.8	.1 meq/l
13906	Arsenic – As	0.014	0.014	0.0	.001 mg/l
13895	Beryllium – Be	0.001	0.001	0.0	.001 mg/l
13896	Calcium – Ca	298	282	3.9	.01 mg/l
13897	Chloride – Cl	68	66	2.1	1 mg/l
13898	Magnesium – Mg	174	172	0.8	.01 mg/l
13901	Manganese – Mn	1.3	1.5	10.1	.01 mg/l
13904	Sodium – Na	466	457	1.4	.01 mg/l
13903	Nickle – Ni	0.05	0.05	0.0	.01 mg/l
13904	Potassium – K	9.4	8.9	3.9	.01 mg/l
13897	Selenium – Se	<.002	<.002	0.0	.002 mg/l
13906	Sulfate – SO4	45	43	3.2	4 mg/l
	[illegible]	[illegible]	[illegible]	0.5	10 mg/l

UMETCO MINERALS CORP.
ANALYTICAL LABORATORY
WHITE MESA MILL
P.O. BOX 669
BLANDING, UTAH 84511

REPORT OF ANALYSIS

Laboratory Sample ID: 13906

Sample Description: Culinary

Date Sample Received: 05-Mar-91

Report Date: 18-Apr-91

Reference Code(s):
1) Filtered .45u pH<2 HNO3
2) Unfiltered Raw
3) Analyst - R. Martin
4) Analyst - V. Martin

Units Of Measurement: mg/l except where otherwise specified

Parameter	Value	Method Number	Analysis Date	Reference Code(s)
Total Alkalinity	4.02 meq/l	EPA 310.1	15-Mar-91	2,4
As	0.014	EPA 206.2	28-Mar-91	1,3
Be	<0.001	EPA 210.2	03-Apr-91	1,3
Mg	20	EPA 242.1	22-Mar-91	1,3
Mn	0.02	EPA 243.1	25-Mar-91	1,3
Na	19	EPA 273.1	21-Mar-91	1,3
Ni	0.01	EPA 249.2	27-Mar-91	1,3
K	4.8	EPA 258.1	22-Mar-91	1,3
Se	<0.002	EPA 270.2	11-Apr-91	1,3
SO4	45	EPA 375.3	16-Mar-91	2,3
TDS	252	EPA 160.1	15-Mar-91	2,3
U (uCi/ml)	<2.0E-10	ASTM D2907	18-Apr-91	1,4

Approved by: Chief Chemist

APPENDIX C

HELP MODEL OF TAILINGS CELLS

JFL 7/22/94

Titan Environmental

PMW 7/20/94

By: PMW, 7/20/94 EFN, #4111-001
Chkd By:

Subject: Running the HELP (Hydrologic Evaluation of Landfill Performance) Model for several scenarios at the White Mesa Tailings Facility, Blanding, Utah.

Purpose: Using the HELP model, determine the performance of the tailings caps and tailings cells under local (Blanding, UT) precipitation and temperature conditions and latitudes, and solar indexes from Milford, Utah. Water movement through tailings Cell 3 and Cell 4 were determined. Tailings within Cell 3 were considered saturated while tailings within Cell 4 were considered unsaturated. Tailings cells 3 and 4 were modeled using a PVC liner with 1% leakage and without the PVC liner (100% leakage).

Additional work: For comparison purposes, both cells were modeled using 20 years of default climate data from Grand Junction, Colorado.

Methods:

1. Input local climate data into HELP model. Five years of precipitation data was obtained from Utah State University. Temperature data was obtained from the Application for Source Material License, dated September 26, 1978. Tables 1 and 2 identify the precipitation and temperature data. The remaining climate data was input using the default parameters from the Milford, Utah area. Milford is located in southwestern Utah, in similar climates and elevation. Elevation at Milford is 5000 feet. Elevation at Blanding (southeastern Utah) is 5600 feet. The additional HELP runs used the default climate data from Grand Junction, Colorado. Grand Junction has similar climatic conditions, yet is lower in elevation (4600 feet) and has a longer growing season.

2. Identify soil layers within the cap and tailings. The cap and tailings are described in the Reclamation Plan, White Mesa Project, Blanding, UT, dated June, 1988. Default soil parameters from HELP were used for each of the 7 layers. Figures 1 and 2 identify the layers of the cap, tailings and liner. Figure 2 also identifies the individual parameters used for each of the soil layers, including the initial soil moisture, soil type number, thickness and layer number. Table 3 defines the soil types by number. Table 3 identifies the default soil types within the HELP model.

3. Calculate the area of the two cells. Figures 3 and 4 present Cells 3 and 4, respectively. Cell 3 equals 3,150,000 feet^2. Cell 4 equals 1,650,000 feet^2.

4. Run the HELP model. Several scenarios were run for each of the tailings cells. The four scenarios for Cell 3 are: 1) saturated tailings with the PVC liner at 1% leakage and Blanding climate data, 2) saturated tailings without the PVC liner (100% leakage) and

JFH 7/22/94
PMW 7/20/94

Blanding climate data, 3) saturated tailings with the PVC liner and 20 years of simulated Grand Junction climate data, and 4) saturated tailings without the PVC liner and 20 years of simulated Grand Junction climate data. The two scenarios for Cell 4 are: 1) unsaturated tailings with the PVC liner at 1% leakage and Blanding climate data, and 2) unsaturated tailings without the PVC liner (100% leakage) and Blanding climate data. The HELP runs are presented at the end of this calculation brief.

Summary: Table 4 summarizes the HELP runs.

JFL
7/22/14

PMW
7/20/14

3/15

Daily Precipitation Values, Station #42073807, Blanding, Utah									
January, 1988 through February, 1994									
Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)
1/1/88	0	1/1/90	0	1/1/91	0	1/1/92	0	1/1/93	0
1/2/88	0	1/2/90	0	1/2/91	0	1/2/92	0	1/2/93	0
1/3/88	0	1/3/90	0.2	1/3/91	0.15	1/3/92	0.04	1/3/93	0
1/4/88	0.06	1/4/90	0	1/4/91	0.96	1/4/92	0.31	1/4/93	0
1/5/88	0.19	1/5/90	0	1/5/91	0.08	1/5/92	0.02	1/5/93	0
1/6/88	0.17	1/6/90	0	1/6/91	0	1/6/92	0.42	1/6/93	0.34
1/7/88	0	1/7/90	0	1/7/91	0	1/7/92	0.03	1/7/93	0.36
1/8/88	0.01	1/8/90	0	1/8/91	0	1/8/92	0	1/8/93	1
1/9/88	0	1/9/90	0	1/9/91	0	1/9/92	0	1/9/93	0.01
1/10/88	0	1/10/90	0	1/10/91	0	1/10/92	0	1/10/93	0.51
1/11/88	0								
1/12/88	0	1/11/90	0	1/11/91	0	1/11/92	0	1/11/93	0.41
1/13/88	0	1/12/90	0	1/12/91	0	1/12/92	0	1/12/93	0
1/14/88	0	1/13/90	0.04	1/13/91	0.01	1/13/92	0	1/13/93	0.21
1/15/88	0	1/14/90	0	1/14/91	0	1/14/92	0	1/14/93	0.2
1/16/88	0	1/15/90	0.14	1/15/91	0.02	1/15/92	0	1/15/93	0
1/17/88	0.89	1/16/90	0.03	1/16/91	0	1/16/92	0	1/16/93	0.49
1/18/88	0.71	1/17/90	0.06	1/17/91	0	1/17/92	0	1/17/93	0.16
1/19/88	0	1/18/90	0.29	1/18/91	0	1/18/92	0	1/18/93	0.88
1/20/88	0	1/19/90	0.32	1/19/91	0	1/19/92	0	1/19/93	0.31
1/21/88	0	1/20/90	0	1/20/91	0	1/20/92	0	1/20/93	0
1/22/88	0	1/21/90	0	1/21/91	0	1/21/92	0	1/21/93	0
1/23/88	0	1/22/90	0	1/22/91	0	1/22/92	0	1/22/93	0
1/24/88	0	1/23/90	0	1/23/91	0	1/23/92	0	1/23/93	0
1/25/88	0	1/24/90	0	1/24/91	0	1/24/92	0	1/24/93	0
1/26/88	0	1/25/90	0	1/25/91	0	1/25/92	0	1/25/93	0
1/27/88	0	1/26/90	0	1/26/91	0	1/26/92	0	1/26/93	0
1/28/88	0	1/27/90	0	1/27/91	0	1/27/92	0	1/27/93	0
1/29/88	0	1/28/90	0	1/28/91	0	1/28/92	0	1/28/93	0
1/30/88	0	1/29/90	0	1/29/91	0	1/29/92	0	1/29/93	0
1/31/88	0	1/30/90	0	1/30/91	0	1/30/92	0	1/30/93	0.22
2/1/88	0	1/31/90	0.03	1/31/91	0	1/31/92	0	1/31/93	0.21
2/2/88	0.4	2/1/90	0.06	2/1/91	0	2/1/92	0	2/1/93	0.16
2/3/88	0.06	2/2/90	0.03	2/2/91	0	2/2/92	0	2/2/93	0
2/4/88	0	2/3/90	0	2/3/91	0	2/3/92	0	2/3/93	0
2/5/88	0	2/4/90	0	2/4/91	0	2/4/92	0.01	2/4/93	0
2/6/88	0	2/5/90	0	2/5/91	0	2/5/92	0	2/5/93	0
2/7/88	0	2/6/90	0	2/6/91	0	2/6/92	0	2/6/93	0
2/8/88	0	2/7/90	0	2/7/91	0	2/7/92	0	2/7/93	0
2/9/88	0	2/8/90	0	2/8/91	0	2/8/92	0.02	2/8/93	1.16
2/10/88	0	2/9/90	0	2/9/91	0	2/9/92	0	2/9/93	0.48
2/11/88	0	2/10/90	0	2/10/91	0	2/10/92	0.3	2/10/93	0.02
2/12/88	0	2/11/90	0	2/11/91	0	2/11/92	0.27	2/11/93	0
2/13/88	0	2/12/90	0	2/12/91	0	2/12/92	0.05	2/12/93	0
2/14/88	0	2/13/90	0	2/13/91	0	2/13/92	0.66	2/13/93	0
2/15/88	0	2/14/90	0.16	2/14/91	0	2/14/92	0	2/14/93	0.01
2/16/88	0	2/15/90	0.06	2/15/91	0	2/15/92	0	2/15/93	0.01
2/17/88	0	2/16/90	0	2/16/91	0.03	2/16/92	0.23	2/16/93	0.08
2/18/88	0	2/17/90	0	2/17/91	0.02	2/17/92	0	2/17/93	0
2/19/88	0	2/18/90	0.03	2/18/91	0	2/18/92	0	2/18/93	0.05
2/20/88	0	2/19/90	0.01	2/19/91	0	2/19/92	0	2/19/93	0.62
2/21/88	0	2/20/90	0.03	2/20/91	0	2/20/92	0	2/20/93	0.7
2/22/88	0	2/21/90	0	2/21/91	0	2/21/92	0	2/21/93	0
2/23/88	0	2/22/90	0	2/22/91	0	2/22/92	0	2/22/93	0
2/24/88	0	2/23/90	0	2/23/91	0	2/23/92	0	2/23/93	0
2/25/88	0	2/24/90	0	2/24/91	0	2/24/92	0	2/24/93	0.4
2/26/88	0	2/25/90	0	2/25/91	0	2/25/92	0	2/25/93	0.04
2/27/88	0.04	2/26/90	0	2/26/91	0	2/26/92	0	2/26/93	0
2/28/88	0	2/27/90	0	2/27/91	0	2/27/92	0	2/27/93	0
2/29/88	0	2/28/90	0	2/28/91	0.4	2/28/92	0	2/28/93	0
3/1/88	0	3/1/90	0.02	3/1/91	0.9	2/29/92	0	3/1/93	0
3/2/88	0	3/2/90	0	3/2/91	0	3/1/92	0	3/2/93	0
3/3/88	0	3/3/90	0	3/3/91	0	3/2/92	0	3/3/93	0
3/4/88	0	3/4/90	0	3/4/91	0	3/3/92	0.34	3/4/93	0

TABLE 1

HPL 7/28/94

Pmm 8/10/94

4/15

Daily Precipitation Values, Station #42073807, Blanding, Utah									
January, 1988 through February, 1994									
Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)
3/5/88	0	3/5/90	0	3/5/91	0	3/4/92	0	3/5/93	0
3/6/88	0.01	3/6/90	0.01	3/6/91	0	3/5/92	0	3/6/93	0
3/7/88	0	3/7/90	0	3/7/91	0	3/6/92	0	3/7/93	0
3/8/88	0	3/8/90	0	3/8/91	0	3/7/92	0	3/8/93	0
3/9/88	0	3/9/90	0	3/9/91	0	3/8/92	0.25	3/9/93	0
3/10/88	0.01	3/10/90	0.02	3/10/91	0	3/9/92	0.03	3/10/93	0
3/11/88	0	3/11/90	0.15	3/11/91	0	3/10/92	0	3/11/93	0
3/12/88	0	3/12/90	0.23	3/12/91	0	3/11/92	0	3/12/93	0
3/13/88	0	3/13/90	0.06	3/13/91	0	3/12/92	0	3/13/93	0
3/14/88	0	3/14/90	0	3/14/91	0.06	3/13/92	0	3/14/93	0
3/15/88	0	3/15/90	0	3/15/91	0.01	3/14/92	0	3/15/93	0
3/16/88	0.01	3/16/90	0	3/16/91	0	3/15/92	0	3/16/93	0
3/17/88	0	3/17/90	0	3/17/91	0	3/16/92	0	3/17/93	0
3/18/88	0	3/18/90	0	3/18/91	0	3/17/92	0	3/18/93	0.19
3/19/88	0	3/19/90	0	3/19/91	0.03	3/18/92	0	3/19/93	0
3/20/88	0	3/20/90	0	3/20/91	0	3/19/92	0	3/20/93	0
3/21/88	0	3/21/90	0	3/21/91	0.14	3/20/92	0	3/21/93	0
3/22/88	0	3/22/90	0	3/22/91	0	3/21/92	0.03	3/22/93	0
3/23/88	0	3/23/90	0	3/23/91	0	3/22/92	0.02	3/23/93	0
3/24/88	0	3/24/90	0	3/24/91	0	3/23/92	0.05	3/24/93	0
3/25/88	0	3/25/90	0	3/25/91	0	3/24/92	0.02	3/25/93	0
3/26/88	0	3/26/90	0	3/26/91	0.26	3/25/92	0	3/26/93	0.06
3/27/88	0	3/27/90	0	3/27/91	0	3/26/92	0	3/27/93	0.47
3/28/88	0	3/28/90	0	3/28/91	0	3/27/92	0.5	3/28/93	0
3/29/88	0	3/29/90	0	3/29/91	0	3/28/92	0.37	3/29/93	0.01
3/30/88	0	3/30/90	0.08	3/30/91	0	3/29/92	0	3/30/93	0
3/31/88	0	3/31/90	0	3/31/91	0	3/30/92	0.13	3/31/93	0
4/1/88	0	4/1/90	0	4/1/91	0	3/31/92	0.11	4/1/93	0
4/2/88	0	4/2/90	0	4/2/91	0	4/1/92	0.05	4/2/93	0
4/3/88	0	4/3/90	0	4/3/91	0	4/2/92	0	4/3/93	0
4/4/88	0.02	4/4/90	0	4/4/91	0	4/3/92	0	4/4/93	0.03
4/5/88	0	4/5/90	0	4/5/91	0	4/4/92	0	4/5/93	0.04
4/6/88	0	4/6/90	0	4/6/91	0	4/5/92	0	4/6/93	0.5
4/7/88	0	4/7/90	0.06	4/7/91	0	4/6/92	0	4/7/93	0
4/8/88	0	4/8/90	0.11	4/8/91	0	4/7/92	0	4/8/93	0
4/9/88	0	4/9/90	0	4/9/91	0	4/8/92	0	4/9/93	0
4/10/88	0	4/10/90	0	4/10/91	0	4/9/92	0	4/10/93	0
4/11/88	0	4/11/90	0	4/11/91	0	4/10/92	0	4/11/93	0
4/12/88	0	4/12/90	0	4/12/91	0	4/11/92	0	4/12/93	0
4/13/88	0	4/13/90	0	4/13/91	0	4/12/92	0	4/13/93	0
4/14/88	0.06	4/14/90	0	4/14/91	0	4/13/92	0	4/14/93	0
4/15/88	0.2	4/15/90	0	4/15/91	0	4/14/92	0	4/15/93	0
4/16/88	0.16	4/16/90	0	4/16/91	0	4/15/92	0.03	4/16/93	0.02
4/17/88	0.2	4/17/90	0	4/17/91	0	4/16/92	0.03	4/17/93	0
4/18/88	0.02	4/18/90	0	4/18/91	0	4/17/92	0	4/18/93	0
4/19/88	0	4/19/90	0	4/19/91	0	4/18/92	0	4/19/93	0
4/20/88	0	4/20/90	0	4/20/91	0	4/19/92	0	4/20/93	0
4/21/88	0.01	4/21/90	0	4/21/91	0	4/20/92	0	4/21/93	0
4/22/88	0.08	4/22/90	0	4/22/91	0	4/21/92	0	4/22/93	0
4/23/88	0.01	4/23/90	0	4/23/91	0.01	4/22/92	0	4/23/93	0
4/24/88	0.02	4/24/90	0.48	4/24/91	0	4/23/92	0	4/24/93	0
4/25/88	0	4/25/90	0	4/25/91	0	4/24/92	0	4/25/93	0
4/26/88	0	4/26/90	0	4/26/91	0	4/25/92	0	4/26/93	0
4/27/88	0	4/27/90	0	4/27/91	0	4/26/92	0	4/27/93	0
4/28/88	0	4/28/90	0	4/28/91	0	4/27/92	0	4/28/93	0
4/29/88	0	4/29/90	0.09	4/29/91	0	4/28/92	0	4/29/93	0
4/30/88	0	4/30/90	0.06	4/30/91	0	4/29/92	0	4/30/93	0
5/1/88	0	5/1/90	0.83	5/1/91	0	4/30/92	0	5/1/93	0
5/2/88	0	5/2/90	0	5/2/91	0	5/1/92	0	5/2/93	0
5/3/88	0	5/3/90	0	5/3/91	0	5/2/92	0	5/3/93	0
5/4/88	0	5/4/90	0	5/4/91	0	5/3/92	0	5/4/93	0.05
5/5/88	0	5/5/90	0	5/5/91	0	5/4/92	0.07	5/5/93	0.5
5/6/88	0	5/6/90	0	5/6/91	0	5/5/92	0	5/6/93	0
5/7/88	0	5/7/90	0	5/7/91	0	5/6/92	0	5/7/93	0.06

Table 1 (cont.)

JFL 7/22/94

pmm 7/20/94

5/15

Daily Precipitation Values, Station #42073807, Blanding, Utah									
January, 1988 through February, 1994									
Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)
5/8/88	0	5/8/90	0	5/8/91	0	5/7/92	0.19	5/8/93	0.15
5/9/88	0	5/9/90	0	5/9/91	0	5/8/92	0	5/9/93	0
5/10/88	0	5/10/90	0	5/10/91	0	5/9/92	0.96	5/10/93	0
5/11/88	0	5/11/90	0	5/11/91	0	5/10/92	0	5/11/93	0
5/12/88	0	5/12/90	0	5/12/91	0	5/11/92	0	5/12/93	0
5/13/88	0	5/13/90	0	5/13/91	0	5/12/92	0	5/13/93	0
5/14/88	0	5/14/90	0	5/14/91	0	5/13/92	0	5/14/93	0
5/15/88	0	5/15/90	0	5/15/91	0.06	5/14/92	0	5/15/93	0.02
5/16/88	0	5/16/90	0	5/16/91	0	5/15/92	0	5/16/93	0.08
5/17/88	0.64	5/17/90	0	5/17/91	0	5/16/92	0	5/17/93	0.35
5/18/88	0.3	5/18/90	0	5/18/91	0	5/17/92	0	5/18/93	0
5/19/88	0.15	5/19/90	0	5/19/91	0	5/18/92	0	5/19/93	0
5/20/88	0	5/20/90	0	5/20/91	0	5/19/92	0.06	5/20/93	0.01
5/21/88	0	5/21/90	0	5/21/91	0	5/20/92	0.05	5/21/93	0
5/22/88	0	5/22/90	0	5/22/91	0	5/21/92	0.06	5/22/93	0
5/23/88	0	5/23/90	0	5/23/91	0	5/22/92	0.36	5/23/93	0
5/24/88	0	5/24/90	0	5/24/91	0	5/23/92	0.02	5/24/93	0
5/25/88	0	5/25/90	0	5/25/91	0	5/24/92	0.2	5/25/93	0.05
5/26/88	0	5/26/90	0	5/26/91	0	5/25/92	0.15	5/26/93	0.11
5/27/88	0	5/27/90	0	5/27/91	0	5/26/92	0.13	5/27/93	0.19
5/28/88	0	5/28/90	0	5/28/91	0	5/27/92	0.05	5/28/93	0.05
5/29/88	0.17	5/29/90	0.02	5/29/91	0	5/28/92	0	5/29/93	0
5/30/88	0.01	5/30/90	0	5/30/91	0	5/29/92	0.03	5/30/93	0
5/31/88	0	5/31/90	0	5/31/91	0.43	5/30/92	0	5/31/93	0
6/1/88	0	6/1/90	0	6/1/91	0	5/31/92	0	6/1/93	0
6/2/88	0	6/2/90	0	6/2/91	0	6/1/92	0	6/2/93	0
6/3/88	0	6/3/90	0	6/3/91	0	6/2/92	0	6/3/93	0
6/4/88	0	6/4/90	0	6/4/91	0	6/3/92	0	6/4/93	0
6/5/88	0	6/5/90	0	6/5/91	0	6/4/92	0.01	6/5/93	0
6/6/88	0	6/6/90	0	6/6/91	0	6/5/92	0.03	6/6/93	0.01
6/7/88	0	6/7/90	0	6/7/91	0	6/6/92	0	6/7/93	0.01
6/8/88	0	6/8/90	0	6/8/91	0	6/7/92	0	6/8/93	0.06
6/9/88	0	6/9/90	0.04	6/9/91	0	6/8/92	0.16	6/9/93	0
6/10/88	0	6/10/90	1.09	6/10/91	0	6/9/92	0	6/10/93	0
6/11/88	0	6/11/90	0	6/11/91	0	6/10/92	0	6/11/93	0
6/12/88	0	6/12/90	0	6/12/91	0	6/11/92	0	6/12/93	0
6/13/88	0	6/13/90	0	6/13/91	0	6/12/92	0	6/13/93	0
6/14/88	0	6/14/90	0	6/14/91	0.05	6/13/92	0	6/14/93	0
6/15/88	0	6/15/90	0	6/15/91	0	6/14/92	0	6/15/93	0
6/16/88	0	6/16/90	0	6/16/91	0	6/15/92	0	6/16/93	0
6/17/88	0	6/17/90	0	6/17/91	0	6/16/92	0	6/17/93	0.04
6/18/88	0	6/18/90	0	6/18/91	0	6/17/92	0	6/18/93	0
6/19/88	0	6/19/90	0	6/19/91	0	6/18/92	0	6/19/93	0
6/20/88	0	6/20/90	0	6/20/91	0	6/19/92	0	6/20/93	0
6/21/88	0	6/21/90	0	6/21/91	0	6/20/92	0	6/21/93	0
6/22/88	0.02	6/22/90	0	6/22/91	0	6/21/92	0	6/22/93	0
6/23/88	0.01	6/23/90	0	6/23/91	0	6/22/92	0	6/23/93	0
6/24/88	0.05	6/24/90	0	6/24/91	0	6/23/92	0	6/24/93	0
6/25/88	0.27	6/25/90	0	6/25/91	0	6/24/92	0	6/25/93	0
6/26/88	0.11	6/26/90	0	6/26/91	0	6/25/92	0.08	6/26/93	0
6/27/88	0.52	6/27/90	0	6/27/91	0	6/26/92	0	6/27/93	0
6/28/88	0.42	6/28/90	0	6/28/91	0	6/27/92	0	6/28/93	0
6/29/88	0	6/29/90	0	6/29/91	0	6/28/92	0.01	6/29/93	0
6/30/88	0	6/30/90	0	6/30/91	0	6/29/92	0	6/30/93	0
7/1/88	0	7/1/90	0	7/1/91	0	6/30/92	0	7/1/93	0
7/2/88	0	7/2/90	0	7/2/91	0	7/1/92	0	7/2/93	0
7/3/88	0	7/3/90	0	7/3/91	0	7/2/92	0	7/3/93	0
7/4/88	0	7/4/90	0	7/4/91	0	7/3/92	0	7/4/93	0
7/5/88	0	7/5/90	0	7/5/91	0	7/4/92	0	7/5/93	0
7/6/88	0	7/6/90	0	7/6/91	0	7/5/92	0	7/6/93	0
7/7/88	0	7/7/90	0.78	7/7/91	0	7/6/92	0	7/7/93	0
7/8/88	0	7/8/90	0.73	7/8/91	0.1	7/7/92	0	7/8/93	0
7/9/88	0	7/9/90	0.02	7/9/91	0.45	7/8/92	0.4	7/9/93	0
7/10/88	0	7/10/90	0	7/10/91	0.01	7/9/92	0	7/10/93	0

Table 1 (cont)

SFL 7/28/94

PMW 8/20/94

6/15

Daily Precipitation Values, Station #42073807, Blanding, Utah
January, 1988 through February, 1994

Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)
7/11/88	0	7/11/90	0	7/11/91	0	7/10/92	0	7/11/93	0
7/12/88	0	7/12/90	0	7/12/91	0	7/11/92	0	7/12/93	0
7/13/88	0	7/13/90	0	7/13/91	0	7/12/92	1.33	7/13/93	0
7/14/88	0	7/14/90	0.05	7/14/91	0	7/13/92	0.02	7/14/93	0
7/15/88	0	7/15/90	0	7/15/91	0	7/14/92	0	7/15/93	0
7/16/88	0	7/16/90	0	7/16/91	0	7/15/92	0	7/16/93	0
7/17/88	0.05	7/17/90	0	7/17/91	0	7/16/92	0	7/17/93	0
7/18/88	0	7/18/90	0.01	7/18/91	0	7/17/92	0	7/18/93	0
7/19/88	0	7/19/90	0	7/19/91	0	7/18/92	0.08	7/19/93	0
7/20/88	0	7/20/90	0	7/20/91	0.28	7/19/92	0	7/20/93	0
7/21/88	0	7/21/90	0.03	7/21/91	0	7/20/92	0	7/21/93	0
7/22/88	0	7/22/90	0	7/22/91	0	7/21/92	0	7/22/93	0
7/23/88	0	7/23/90	0.01	7/23/91	0.04	7/22/92	0.1	7/23/93	0
7/24/88	0	7/24/90	0.02	7/24/91	0.23	7/23/92	0.08	7/24/93	0.01
7/25/88	0	7/25/90	0.05	7/25/91	0.08	7/24/92	0	7/25/93	0
7/26/88	0.16	7/26/90	0	7/26/91	0.01	7/25/92	0.17	7/26/93	0
7/27/88	0	7/27/90	0	7/27/91	0	7/26/92	0	7/27/93	0
7/28/88	0	7/28/90	0.02	7/28/91	0	7/27/92	0	7/28/93	0
7/29/88	0.13	7/29/90	0	7/29/91	0	7/28/92	0.02	7/29/93	0
7/30/88	0.05	7/30/90	0.19	7/30/91	0	7/29/92	0	7/30/93	0
7/31/88	0.12	7/31/90	0	7/31/91	0	7/30/92	0	7/31/93	0
8/1/88	0.13	8/1/90	0	8/1/91	0.03	7/31/92	0	8/1/93	0
8/2/88	0	8/2/90	0.25	8/2/91	0.04	8/1/92	0	8/2/93	0
8/3/88	0	8/3/90	0	8/3/91	0.08	8/2/92	0	8/3/93	0
8/4/88	0	8/4/90	0	8/4/91	0	8/3/92	0	8/4/93	0.01
8/5/88	0.38	8/5/90	0	8/5/91	0.01	8/4/92	0	8/5/93	0
8/6/88	0.02	8/6/90	0	8/6/91	0.56	8/5/92	0.02	8/6/93	0.03
8/7/88	0	8/7/90	0	8/7/91	0	8/6/92	0.01	8/7/93	0.03
8/8/88	0	8/8/90	0	8/8/91	0	8/7/92	0	8/8/93	0.03
8/9/88	0	8/9/90	0	8/9/91	0	8/8/92	0	8/9/93	0.03
8/10/88	0	8/10/90	0	8/10/91	0	8/9/92	0.03	8/10/93	0.01
8/11/88	0.04	8/11/90	0.04	8/11/91	0	8/10/92	0	8/11/93	0
8/12/88	0.07	8/12/90	0	8/12/91	0.36	8/11/92	0.04	8/12/93	0
8/13/88	0	8/13/90	0.15	8/13/91	0	8/12/92	0	8/13/93	0
8/14/88	0	8/14/90	0.07	8/14/91	0	8/13/92	0	8/14/93	0
8/15/88	0.09	8/15/90	0.05	8/15/91	0.01	8/14/92	0	8/15/93	0
8/16/88	0.05	8/16/90	0.24	8/16/91	0	8/15/92	0	8/16/93	0
8/17/88	0	8/17/90	0	8/17/91	0	8/16/92	0	8/17/93	0
8/18/88	0	8/18/90	0	8/18/91	0.06	8/17/92	0.19	8/18/93	0
8/19/88	0	8/19/90	0	8/19/91	0	8/18/92	0	8/19/93	0.03
8/20/88	0.24	8/20/90	0	8/20/91	0	8/19/92	0	8/20/93	0
8/21/88	0.15	8/21/90	0	8/21/91	0	8/20/92	0	8/21/93	0.02
8/22/88	0	8/22/90	0	8/22/91	0	8/21/92	0	8/22/93	0
8/23/88	0	8/23/90	0	8/23/91	0	8/22/92	0.37	8/23/93	0
8/24/88	0	8/24/90	0	8/24/91	0	8/23/92	0.16	8/24/93	0
8/25/88	0	8/25/90	0	8/25/91	0	8/24/92	0	8/25/93	0.08
8/26/88	0	8/26/90	0	8/26/91	0	8/25/92	0	8/26/93	0.74
8/27/88	0	8/27/90	0	8/27/91	0.01	8/26/92	0	8/27/93	0
8/28/88	0	8/28/90	0	8/28/91	0	8/27/92	0	8/28/93	0.73
8/29/88	0	8/29/90	0	8/29/91	0	8/28/92	0	8/29/93	0
8/30/88	0.18	8/30/90	0	8/30/91	0	8/29/92	0	8/30/93	0
8/31/88	0.47	8/31/90	0	8/31/91	0.02	8/30/92	0.28	8/31/93	0.05
9/1/88	0.01	9/1/90	0.01	9/1/91	0	8/31/92	0.16	9/1/93	0
9/2/88	0	9/2/90	0.32	9/2/91	0	9/1/92	0	9/2/93	0
9/3/88	0	9/3/90	0.1	9/3/91	0	9/2/92	0	9/3/93	0
9/4/88	0	9/4/90	0	9/4/91	0	9/3/92	0	9/4/93	0
9/5/88	0	9/5/90	0.08	9/5/91	0	9/4/92	0	9/5/93	0
9/6/88	0	9/6/90	0.1	9/6/91	0.93	9/5/92	0	9/6/93	0
9/7/88	0	9/7/90	0	9/7/91	0.25	9/6/92	0	9/7/93	0
9/8/88	0	9/8/90	0	9/8/91	0	9/7/92	0	9/8/93	0
9/9/88	0	9/9/90	0	9/9/91	0	9/8/92	0	9/9/93	0
9/10/88	0.32	9/10/90	0	9/10/91	0	9/9/92	0	9/10/93	0
9/11/88	0.05	9/11/90	0	9/11/91	0.13	9/10/92	0	9/11/93	0
9/12/88	0.58	9/12/90	0	9/12/91	0	9/11/92	0	9/12/93	0.01

Table 1 (cont)

JEL
7/28/94

PMW
7/20/94

7/15

Daily Precipitation Values, Station #42073807, Blanding, Utah
January, 1988 through February, 1994

Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)
9/13/88	0	9/13/90	0	9/13/91	0.01	9/12/92	0	9/13/93	0.6
9/14/88	0	9/14/90	0	9/14/91	0	9/13/92	0	9/14/93	0
9/15/88	0	9/15/90	0	9/15/91	0	9/14/92	0	9/15/93	0
9/16/88	0	9/16/90	0	9/16/91	0	9/15/92	0.13	9/16/93	0
9/17/88	0	9/17/90	0	9/17/91	0	9/16/92	0	9/17/93	0
9/18/88	0	9/18/90	0.63	9/18/91	0	9/17/92	0	9/18/93	0.22
9/19/88	0	9/19/90	0	9/19/91	0	9/18/92	0.22	9/19/93	0
9/20/88	0	9/20/90	0.16	9/20/91	0	9/19/92	0.47	9/20/93	0
9/21/88	0.08	9/21/90	0	9/21/91	0	9/20/92	0.08	9/21/93	0
9/22/88	0	9/22/90	0	9/22/91	0	9/21/92	0	9/22/93	0
9/23/88	0	9/23/90	0.06	9/23/91	0	9/22/92	0	9/23/93	0
9/24/88	0	9/24/90	0	9/24/91	0	9/23/92	0	9/24/93	0
9/25/88	0	9/25/90	0	9/25/91	0	9/24/92	0	9/25/93	0
9/26/88	0	9/26/90	0	9/26/91	0	9/25/92	0	9/26/93	0
9/27/88	0.03	9/27/90	0	9/27/91	0	9/26/92	0	9/27/93	0
9/28/88	0	9/28/90	0.23	9/28/91	0	9/27/92	0	9/28/93	0
9/29/88	0	9/29/90	0	9/29/91	0	9/28/92	0	9/29/93	0
9/30/88	0	9/30/90	0	9/30/91	0	9/29/92	0	9/30/93	0
10/1/88	0	10/1/90	0.01	10/1/91	0	9/30/92	0	10/1/93	0
10/2/88	0	10/2/90	1.1	10/2/91	0	10/1/92	0	10/2/93	0
10/3/88	0	10/3/90	0.02	10/3/91	0	10/2/92	0	10/3/93	0
10/4/88	0	10/4/90	0	10/4/91	0	10/3/92	0	10/4/93	0
10/5/88	0	10/5/90	0	10/5/91	0	10/4/92	0	10/5/93	0
10/6/88	0.02	10/6/90	0	10/6/91	0	10/5/92	0	10/6/93	0.61
10/7/88	0.04	10/7/90	0.1	10/7/91	0	10/6/92	0	10/7/93	0.21
10/8/88	0.02	10/8/90	0	10/8/91	0	10/7/92	0	10/8/93	0.19
10/9/88	0	10/9/90	0	10/9/91	0	10/8/92	0	10/9/93	0
10/10/88	0	10/10/90	0	10/10/91	0	10/9/92	0	10/10/93	0.01
10/11/88	0	10/11/90	0	10/11/91	0	10/10/92	0	10/11/93	0.1
10/12/88	0	10/12/90	0	10/12/91	0	10/11/92	0	10/12/93	0
10/13/88	0	10/13/90	0	10/13/91	0	10/12/92	0	10/13/93	0
10/14/88	0	10/14/90	0	10/14/91	0	10/13/92	0	10/14/93	0
10/15/88	0	10/15/90	0	10/15/91	0	10/14/92	0	10/15/93	0
10/16/88	0	10/16/90	0	10/16/91	0	10/15/92	0	10/16/93	0.09
10/17/88	0	10/17/90	0	10/17/91	0	10/16/92	0	10/17/93	0.2
10/18/88	0	10/18/90	0.2	10/18/91	0	10/17/92	0	10/18/93	0.02
10/19/88	0	10/19/90	0.28	10/19/91	0	10/18/92	0	10/19/93	0
10/20/88	0	10/20/90	0.11	10/20/91	0	10/19/92	0	10/20/93	0
10/21/88	0	10/21/90	0	10/21/91	0	10/20/92	0	10/21/93	0
10/22/88	0	10/22/90	0	10/22/91	0.02	10/21/92	0.11	10/22/93	0
10/23/88	0	10/23/90	0	10/23/91	0	10/22/92	0	10/23/93	0
10/24/88	0	10/24/90	0	10/24/91	0.08	10/23/92	0	10/24/93	0
10/25/88	0	10/25/90	0	10/25/91	0	10/24/92	0.37	10/25/93	0
10/26/88	0	10/26/90	0	10/26/91	0	10/25/92	0.15	10/26/93	0
10/27/88	0	10/27/90	0	10/27/91	0.69	10/26/92	0	10/27/93	0
10/28/88	0	10/28/90	0	10/28/91	0.26	10/27/92	0.04	10/28/93	0
10/29/88	0	10/29/90	0	10/29/91	0.26	10/28/92	0.26	10/29/93	0
10/30/88	0.02	10/30/90	0	10/30/91	0.1	10/29/92	0.12	10/30/93	0
10/31/88	0	10/31/90	0	10/31/91	0	10/30/92	0.22	10/31/93	0
11/1/88	0	11/1/90	0	11/1/91	0	10/31/92	0.19	11/1/93	0
11/2/88	0	11/2/90	0.35	11/2/91	0	11/1/92	0	11/2/93	0
11/3/88	0	11/3/90	0.37	11/3/91	0	11/2/92	0	11/3/93	0
11/4/88	0	11/4/90	0	11/4/91	0	11/3/92	0	11/4/93	0
11/5/88	0	11/5/90	0	11/5/91	0	11/4/92	0	11/5/93	0
11/6/88	0	11/6/90	0.01	11/6/91	0	11/5/92	0	11/6/93	0
11/7/88	0	11/7/90	0.12	11/7/91	0	11/6/92	0	11/7/93	0
11/8/88	0	11/8/90	0	11/8/91	0	11/7/92	0	11/8/93	0
11/9/88	0	11/9/90	0	11/9/91	0	11/8/92	0	11/9/93	0
11/10/88	0	11/10/90	0	11/10/91	0.03	11/9/92	0	11/10/93	0
11/11/88	0.56	11/11/90	0	11/11/91	0	11/10/92	0.14	11/11/93	0.64
11/12/88	0	11/12/90	0	11/12/91	0	11/11/92	0	11/12/93	0.3
11/13/88	0	11/13/90	0	11/13/91	0	11/12/92	0	11/13/93	0.14
11/14/88	0	11/14/90	0	11/14/91	0.49	11/13/92	0	11/14/93	0
11/15/88	0.25	11/15/90	0	11/15/91	0.95	11/14/92	0	11/15/93	0

Table 1 (cont.)

JFL 7/22/94

8/15

Daily Precipitation Values, Station #42073807, Blanding, Utah									
January, 1988 through February, 1994									
Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)	Date	Precipitation (inches)
11/16/88	0	11/16/90	0	11/16/91	0.03	11/15/92	0	11/16/93	0
11/17/88	0.02	11/17/90	0	11/17/91	0	11/16/92	0	11/17/93	0
11/18/88	0	11/18/90	0	11/18/91	0.07	11/17/92	0	11/18/93	0
11/19/88	0	11/19/90	0	11/19/91	0	11/18/92	0.01	11/19/93	0
11/20/88	0	11/20/90	0.09	11/20/91	0	11/19/92	0	11/20/93	0
11/21/88	0	11/21/90	0	11/21/91	0	11/20/92	0.12	11/21/93	0
11/22/88	0	11/22/90	0	11/22/91	0	11/21/92	0	11/22/93	0
11/23/88	0	11/23/90	0	11/23/91	0	11/22/92	0	11/23/93	0
11/24/88	0	11/24/90	0	11/24/91	0	11/23/92	0	11/24/93	0
11/25/88	0.07	11/25/90	0	11/25/91	0	11/24/92	0	11/25/93	0
11/26/88	0.11	11/26/90	0.48	11/26/91	0	11/25/92	0	11/26/93	0
11/27/88	0	11/27/90	0.01	11/27/91	0	11/26/92	0	11/27/93	0
11/28/88	0	11/28/90	0	11/28/91	0	11/27/92	0	11/28/93	0
11/29/88	0	11/29/90	0	11/29/91	0	11/28/92	0	11/29/93	0
11/30/88	0	11/30/90	0	11/30/91	0.01	11/29/92	0	11/30/93	0
12/1/88	0.03	12/1/90	0	12/1/91	0	11/30/92	0	12/1/93	0
12/2/88	0	12/2/90	0	12/2/91	0	12/1/92	0	12/2/93	0
12/3/88	0	12/3/90	0	12/3/91	0	12/2/92	0	12/3/93	0
12/4/88	0	12/4/90	0	12/4/91	0	12/3/92	0	12/4/93	0
12/5/88	0	12/5/90	0	12/5/91	0	12/4/92	0.13	12/5/93	0
12/6/88	0	12/6/90	0	12/6/91	0	12/5/92	0.81	12/6/93	0
12/7/88	0	12/7/90	0	12/7/91	0	12/6/92	0	12/7/93	0
12/8/88	0	12/8/90	0	12/8/91	0	12/7/92	-99999	12/8/93	0
12/9/88	0	12/9/90	0	12/9/91	0	12/8/92	0.28	12/9/93	0
12/10/88	0	12/10/90	0	12/10/91	0.02	12/9/92	0	12/10/93	0
12/11/88	0	12/11/90	0	12/11/91	0.26	12/10/92	0	12/11/93	0
12/12/88	0	12/12/90	0.27	12/12/91	0	12/11/92	0	12/12/93	0.07
12/13/88	0	12/13/90	0.04	12/13/91	0	12/12/92	0.5	12/13/93	0
12/14/88	0	12/14/90	0	12/14/91	0	12/13/92	0	12/14/93	0
12/15/88	0	12/15/90	0.06	12/15/91	0	12/14/92	0	12/15/93	0.07
12/16/88	0	12/16/90	0.11	12/16/91	0	12/15/92	0	12/16/93	0.18
12/17/88	0	12/17/90	0	12/17/91	0	12/16/92	0	12/17/93	0
12/18/88	0	12/18/90	0	12/18/91	0.54	12/17/92	0	12/18/93	0
12/19/88	0	12/19/90	0.06	12/19/91	0.43	12/18/92	0.2	12/19/93	0
12/20/88	0.05	12/20/90	0.36	12/20/91	0	12/19/92	0	12/20/93	0
12/21/88	0.38	12/21/90	0	12/21/91	0	12/20/92	0	12/21/93	0
12/22/88	0	12/22/90	0	12/22/91	0	12/21/92	0	12/22/93	0
12/23/88	0.2	12/23/90	0	12/23/91	0	12/22/92	0	12/23/93	0
12/24/88	0.13	12/24/90	0	12/24/91	0	12/23/92	0	12/24/93	0
12/25/88	0.09	12/25/90	0	12/25/91	0	12/24/92	0	12/25/93	0
12/26/88	0	12/26/90	0	12/26/91	0	12/25/92	0	12/26/93	0
12/27/88	0	12/27/90	0	12/27/91	0	12/26/92	0	12/27/93	0.1
12/28/88	0	12/28/90	0	12/28/91	0	12/27/92	0	12/28/93	0
12/29/88	0	12/29/90	0	12/29/91	0.05	12/28/92	0.3	12/29/93	0
12/30/88	0	12/30/90	0	12/30/91	0.11	12/29/92	0	12/30/93	0
12/31/88	0	12/31/90	0	12/31/91	0.02	12/30/92	0.07	12/31/93	0
						12/31/92	0		
Notes:	Source: Utah Climet Center, Utah State University, Logan, UT.								

Table 1 (cont.)

SFL
7/22/94
FMW
7/20/94

9/15

PLATE 2.2-1

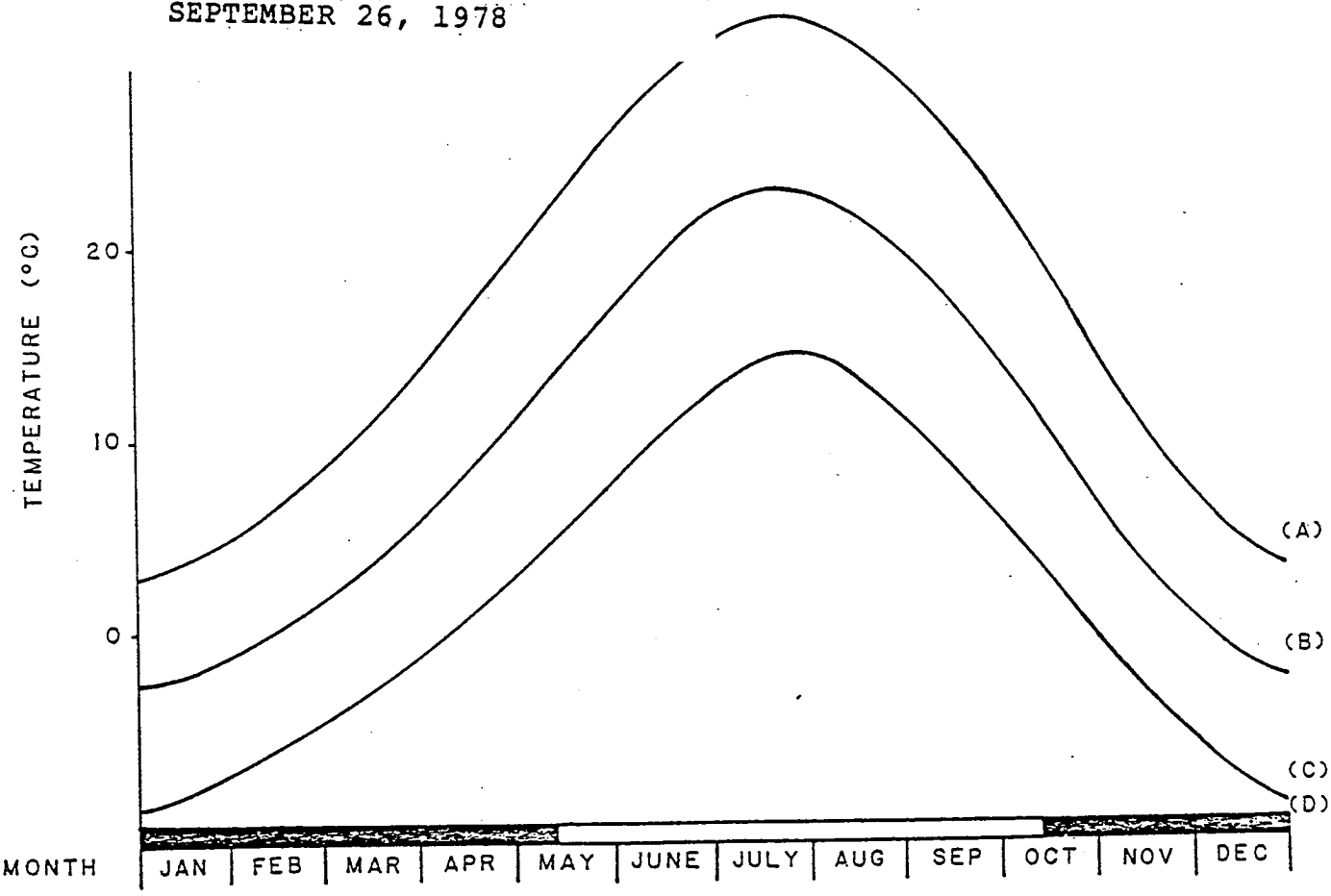
MONTHLY MEANS AND EXTREMES OF TEMPERATURES BLANDING, UTAH

APPLICATION FOR SOURCE MATERIAL LICENSE

Source

ANNUAL MEAN: 9.9°C

REVISED
SEPTEMBER 26, 1978



MONTH	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
EXTREME MAX.	16	18	24	27	33	38	38	37	34	29	21	15
MEAN MAX.	3.8	6.9	10.9	16.3	22.8	28.7	31.9	30.2	26.0	18.8	10.2	4.5
°F	27.5	32.9	38.1	47.1	57.4	66.9	73.6	70.9	63.0	51.6	38.5	28.9
°C MEAN	-2.5	0.5	3.4	8.4	14.1	19.4	23.1	21.6	17.2	10.9	3.6	-1.7
MEAN MIN.	-8.8	-5.9	-3.2	0.4	5.4	10.1	14.2	13.1	8.4	2.9	-3.2	-7.8
EXTREME MIN.	-29	-22	-15	-11	-6	-1	8	3	-5	-12	-19	-22

(A) MEAN DAILY MAXIMUM
(B) MEAN MONTHLY
(C) MEAN DAILY MINIMUM
(D) FREEZE DATES

TABLE 2

DAMES & MOORE

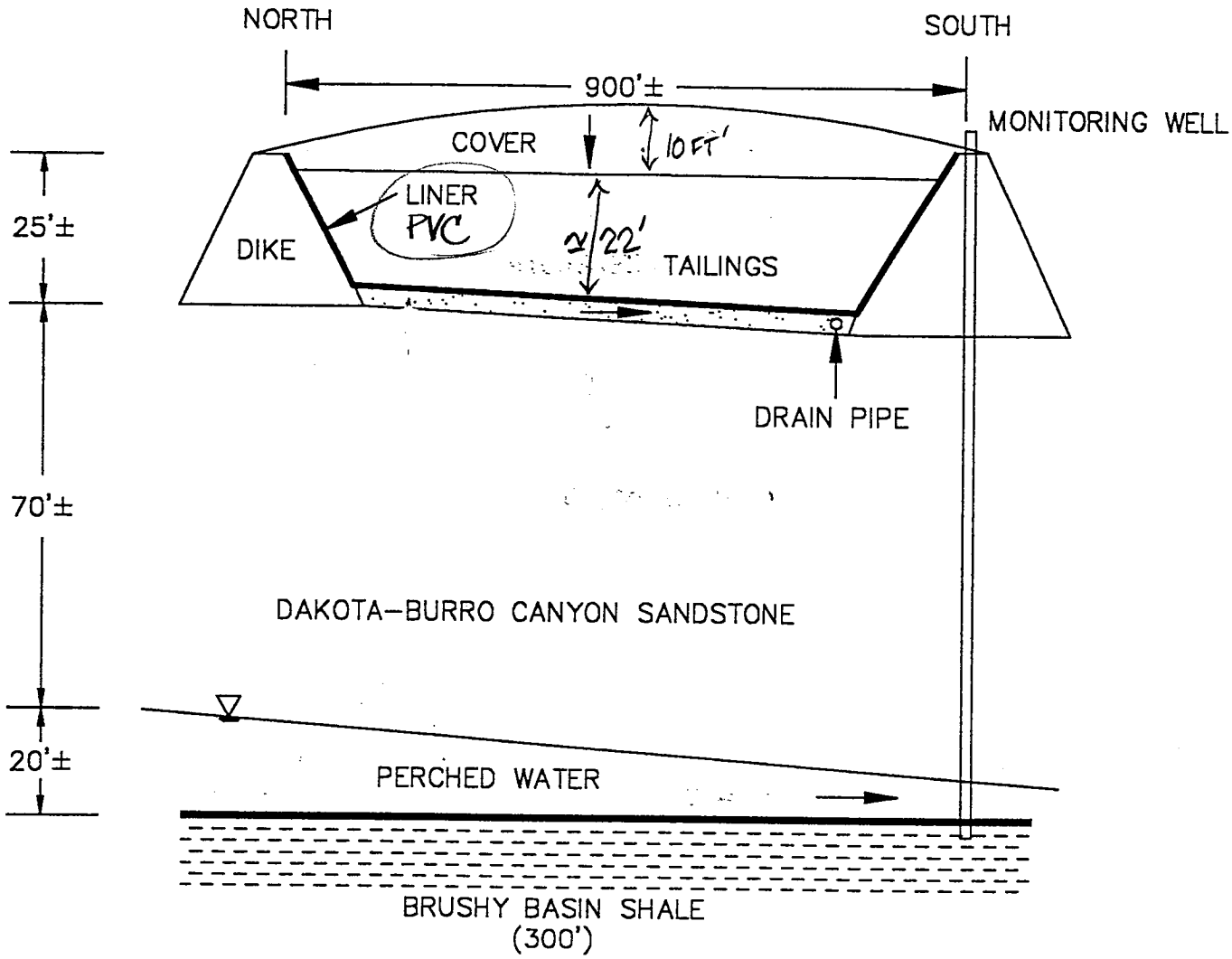
JFL
7/22/94

PMW
7/20/94

10/15

CELLS 3&4, SCHEMATIC

NTS



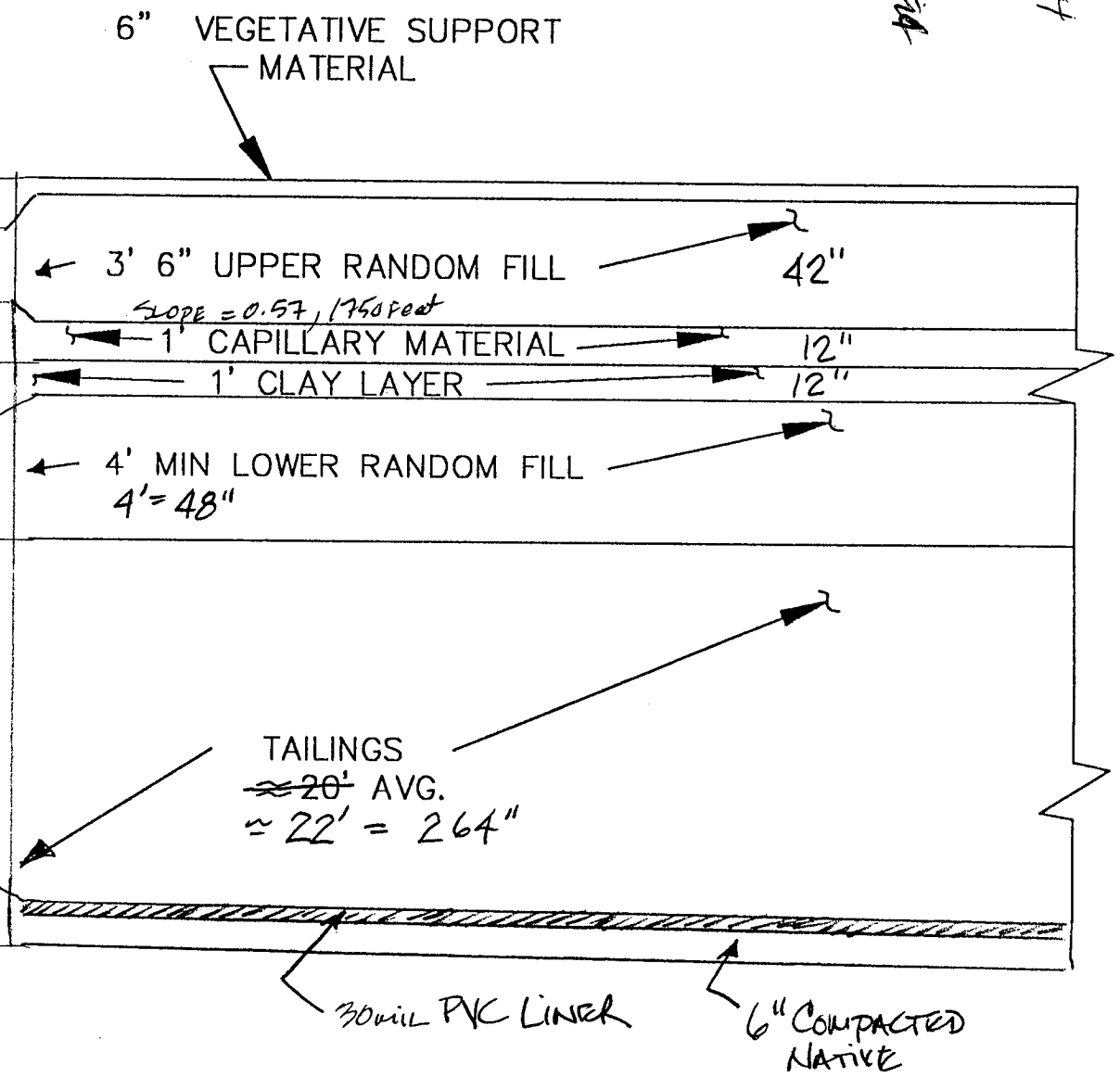
~~K = feet per year~~
~~Q = cubic feet per year per square foot~~
~~V = feet per year~~
~~T = years~~

FIGURE 1

SFL 7/22/94

Pmw 2/20/94

Soil Layer #	Initial Soil Moisture (Vol/Vol)	HELP Soil #	Drainage Type
1	0.14	#9	Vertical
2	0.14	#10	Vertical
3	0.06	#5	Lateral
4	0.43	#16	Barrier
5	0.14	#10	Verical
6	Cell 4 = 0.14 UNSATURATED Cell 3 = 0.33 SATURATED	#10	Vertical
7	0.43	#16	Barrier Liner



RECLAMATION COVER

FIGURE 2

Soil Types Available in HELP V2.0

12/15

JFL
7/22/94

PMW
7/20/94

Table 3

DEFAULT, UNVEGETATED, UNCOMPACTED SOIL CHARACTERISTICS

SOIL TEXTURE HELP	SOIL TEXTURE USDA	SOIL TEXTURE USCS	DIMENSIONLESS POROSITY	DIMENSIONLESS FIELD CAPACITY	DIMENSIONLESS WILTING POINT	SAT. HYD. CONDUCTIVITY (CM/SEC)
1	CoS	GS	0.417	0.045	0.018	1.0E-02
2	S	SW	0.437	0.062	0.024	5.8E-03
3	FS	SM	0.457	0.083	0.033	3.1E-03
4	LS	SM	0.437	0.105	0.047	1.7E-03
5	LFS	SM	0.457	0.131	0.058	1.0E-03
6	SL	SM	0.453	0.190	0.085	7.2E-04
7	FSL	SM	0.473	0.222	0.104	5.2E-04
8	L	ML	0.463	0.232	0.116	3.7E-04
9	SiL	ML	0.501	0.284	0.135	1.9E-04
10	SCL	SC	0.398	0.244	0.136	1.2E-04
11	CL	CL	0.464	0.310	0.187	6.4E-05
12	SiCL	CL	0.471	0.342	0.210	4.2E-05
13	SC	CH	0.430	0.321	0.221	3.3E-05

ENTER RETURN TO VIEW THE REST OF THE SOIL TYPES.

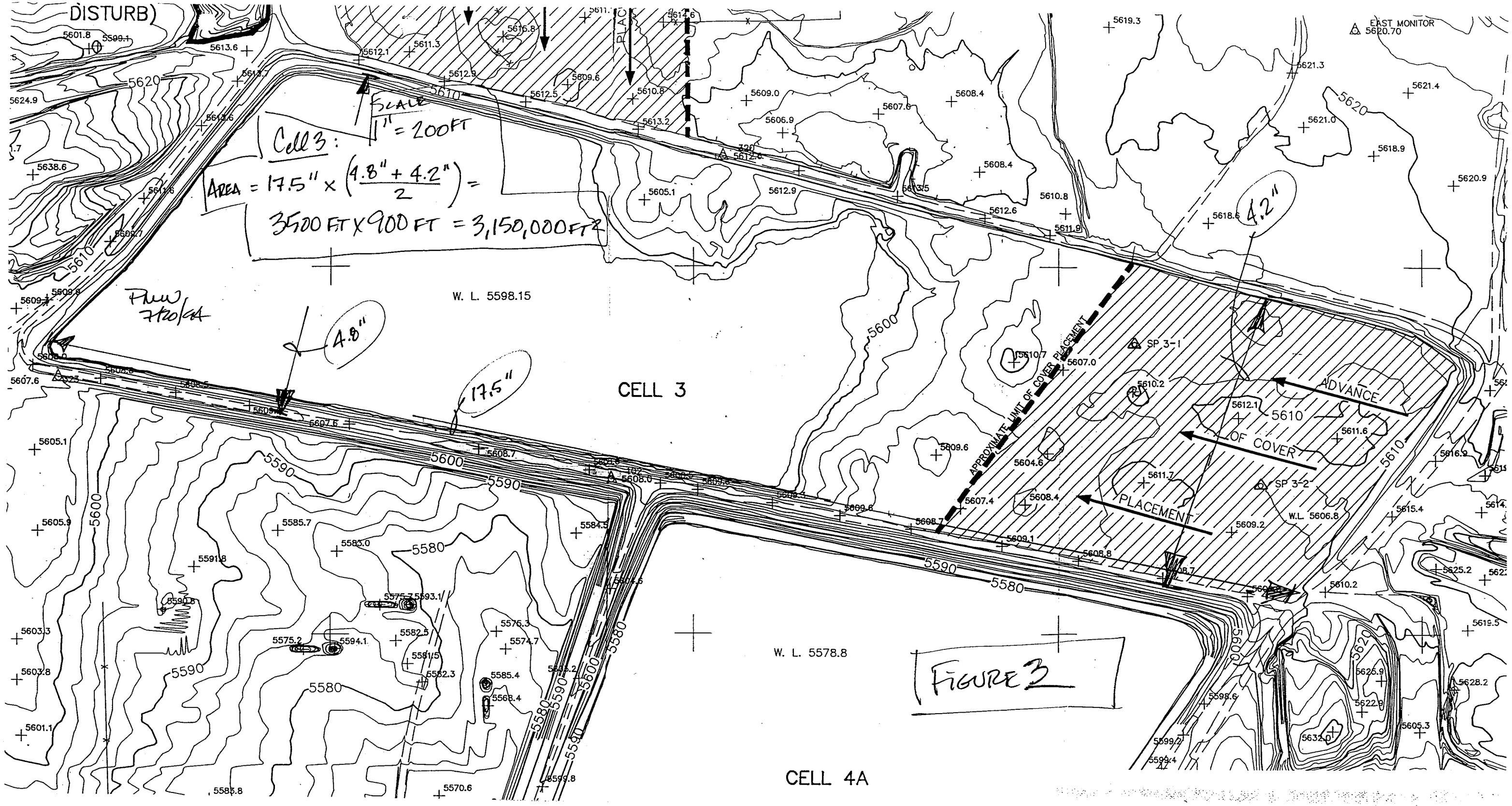
11	CL	CL	0.464	0.310	0.187	6.4E-05
12	SiCL	CL	0.471	0.342	0.210	4.2E-05
13	SC	CH	0.430	0.321	0.221	3.3E-05

ENTER RETURN TO VIEW THE REST OF THE SOIL TYPES.

SOIL TEXTURE HELP	SOIL TEXTURE USDA	SOIL TEXTURE USCS	DIMENSIONLESS POROSITY	DIMENSIONLESS FIELD CAPACITY	DIMENSIONLESS WILTING POINT	SAT. HYD. CONDUCTIVITY (CM/SEC)
14	SiC	CH	0.479	0.371	0.251	2.5E-05
15	C	CH	0.475	0.378	0.265	1.7E-05
16	Liner Soil		0.430	0.366	0.280	1.0E-07
17	Liner Soil		0.400	0.356	0.290	1.0E-08
18	Mun. Waste		0.520	0.294	0.140	2.0E-04
19	USER SPECIFIED SOIL CHARACTERISTICS					
20	USER SPECIFIED SOIL CHARACTERISTICS					

5.9 ENTER SOIL TEXTURE OF SOIL LAYER 1.

TABLE 3


DISTURB)
SCALE
1" = 200FT
Cell 3:
AREA = 17.5" x (4.8" + 4.2" / 2) =
3500 FT x 900 FT = 3,150,000 FT²
PMW
7/20/04
4.8"
17.5"
4.2"
W. L. 5598.15
CELL 3
W. L. 5578.8
CELL 4A
APPROXIMATE LIMIT OF COVER PLACEMENT
ADVANCE
OF COVER
PLACEMENT
EAST MONITOR
5620.70
SP 3-1
SP 3-2
W.L. 5606.8
FIGURE 3

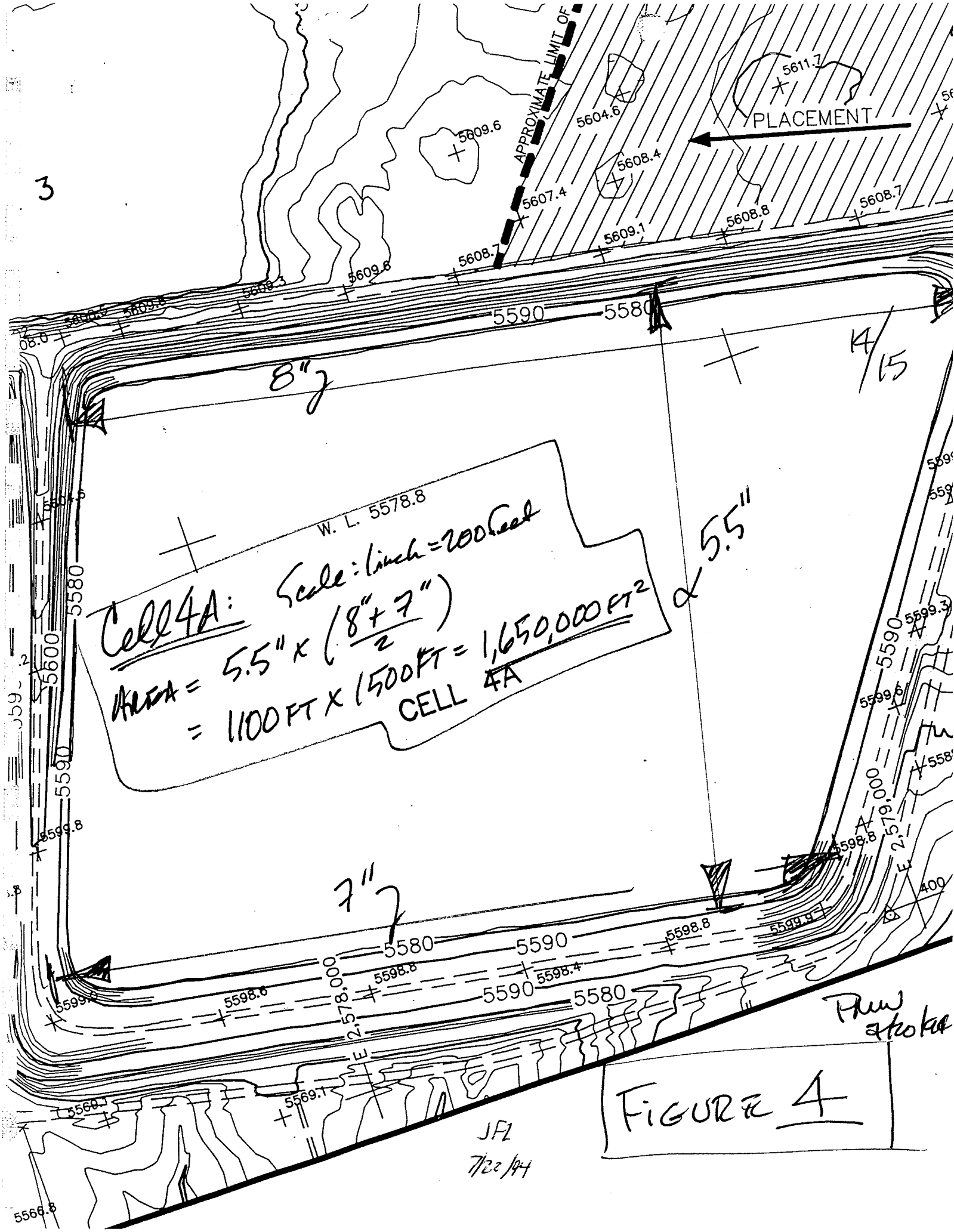

3
APPROXIMATE LIMIT OF
PLACEMENT
5611.7
5604.6
5609.6
5608.4
5607.4
5608.7
5608.8
5609.1
5609.6
5609.3
5609.8
5600.5
5590
5580
8"
14/15
W. L. 5578.8
Cell 4A: Scale: 1 inch = 200 feet
AREA = 5.5" x (8" + 7" / 2)
= 1100 FT x 1500 FT = 1,650,000 FT²
CELL 4A
5.5"
5600
5599.8
5599.3
5599.6
5598.8
5599.9
5598.6
5598.4
5599.0
5569.1
5566.8
E 2,578,000
E 2,579,000
400
7"
JFL
7/22/94
Prew 2/20/94

FIGURE 4

JFZ 7/22/94

Table 4
HELP Model Summaries for Cells 3 and 4
White Mesa Tailings Facility, Blanding, Utah

HELP Run	Precipitation (inches)	Runoff (inches)	Evapotranspiration (inches)	Lateral Drainage from Layer 3 (ft^3)	Percolation from Layer 4 (ft^3)	Percolation from Layer 7 (ft^3)	Change in Water Storage
Cell 3, saturated with PVC liner, Blanding climate data	13.77	0.2	12.67	26	64989	137415	99352
Cell 3, saturated, no liner, Blanding climate data	13.77	0.2	12.67	26	64989	1562025	-1325258
Cell 3, saturated, with PVC liner and 20 yrs Grand Junction climate data	7.94	0	7.93	0	0	120661	-117348
Cell 3, saturated, no liner and 20 yrs Grand Junction climate data	7.94	0	7.93	0	0	390507	-387194
Cell 4, unsaturated with PVC liner, Blanding climate data	13.77	0.2	12.67	14	34060	0	124099
Cell 4, unsaturated, no liner, Blanding climate data	13.77	0.2	12.67	14	34060	0	124099

only 5 yrs. of DATA

PMW 7/20/94

```
**********************************************************************
WHITE MESA TAILINGS FACILITY
CELL 3, WET, INCLUDING LAYER 7, PVC LINER
BLANDING CLIMATE DATA
**********************************************************************
                    POOR GRASS

                    LAYER  1
                    --------
              VERTICAL PERCOLATION LAYER
 THICKNESS                  =    6.00 INCHES
 POROSITY                   =    0.5010 VOL/VOL
 FIELD CAPACITY             =    0.2837 VOL/VOL
 WILTING POINT              =    0.1353 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY   =    0.000342000014 CM/SEC

                    LAYER  2
                    --------
              VERTICAL PERCOLATION LAYER
 THICKNESS                  =   42.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
 FIELD CAPACITY             =    0.2173 VOL/VOL
 WILTING POINT              =    0.1361 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY   =    0.000006000000 CM/SEC

                    LAYER  3
                    --------
               LATERAL DRAINAGE LAYER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.3573 VOL/VOL
 FIELD CAPACITY             =    0.1127 VOL/VOL
 WILTING POINT              =    0.0580 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.0600 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY   =    0.000050000002 CM/SEC
 SLOPE                      =    0.57 PERCENT
 DRAINAGE LENGTH                =  1750.0 FEET

                    LAYER  4
                    ---------
                BARRIER SOIL LINER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.4300 VOL/VOL
 FIELD CAPACITY             =    0.3663 VOL/VOL
 WILTING POINT              =    0.2802 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.4300 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY   =    0.000000100000 CM/SEC

                    LAYER  5
                    --------
              VERTICAL PERCOLATION LAYER
 THICKNESS                  =   48.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
```

FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 6

VERTICAL PERCOLATION LAYER
THICKNESS = 264.00 INCHES
POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.3300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 7

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
THICKNESS = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3663 VOL/VOL
WILTING POINT = 0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000000100000 CM/SEC
LINER LEAKAGE FRACTION = 0.01000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER = 87.21
TOTAL AREA OF COVER = 3150000. SQ FT
EVAPORATIVE ZONE DEPTH = 28.00 INCHES
UPPER LIMIT VEG. STORAGE = 10.3210 INCHES
INITIAL VEG. STORAGE = 3.9200 INCHES
INITIAL SNOW WATER CONTENT = 0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 109.0200 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.

CLIMATOLOGICAL DATA

USER SPECIFIED RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR MILFORD UTAH

MAXIMUM LEAF AREA INDEX = 1.60
START OF GROWING SEASON (JULIAN DATE) = 138
END OF GROWING SEASON (JULIAN DATE) = 276

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
26.40	32.10	38.20	46.30	55.90	65.80
74.30	72.10	62.60	50.30	36.80	28.20

****

MONTHLY TOTALS FOR YEAR 1988

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.60	0.50	0.02	0.78	1.27	1.40
	0.64	1.70	1.06	0.10	1.04	0.85
RUNOFF (INCHES)	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION (INCHES)	1.003	1.175	0.020	0.276	0.569	2.174
	0.834	1.644	1.388	0.100	0.306	0.395
LATERAL DRAINAGE FROM LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 7 (INCHES)	0.0459	0.0434	0.0463	0.0447	0.0461	0.0446
	0.0460	0.0459	0.0444	0.0458	0.0442	0.0457

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON LAYER 7 (INCHES)	258.07	257.68	257.30	256.90	256.51	256.11
	255.72	255.32	254.93	254.54	254.15	253.76
STD. DEV. OF DAILY HEAD ON LAYER 7 (INCHES)	0.12	0.00	0.11	0.18	0.15	0.13
	0.00	0.10	0.12	0.00	0.17	0.13

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ANNUAL TOTALS FOR YEAR 1988

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	10.96	2877001.	100.00
RUNOFF	0.000	0.	0.00
EVAPOTRANSPIRATION	9.885	2594779.	90.19
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.5430	142529.	4.95
CHANGE IN WATER STORAGE	0.532	139691.	4.86

```
 SOIL WATER AT START OF YEAR       109.02     28617752.

 SOIL WATER AT END OF YEAR         109.55     28757442.

 SNOW WATER AT START OF YEAR         0.00          0.

 SNOW WATER AT END OF YEAR           0.00          0.

 ANNUAL WATER BUDGET BALANCE         0.00          2.     0.00
*************************************************************************
              MONTHLY TOTALS FOR YEAR 1990
-------------------------------------------------------------------------
                 JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                 ------- ------- ------- ------- ------- -------
PRECIPITATION (INCHES)  1.11   0.38   0.57   0.80   0.85   1.13
                 1.91   0.80   1.69   1.82   1.43   0.90

RUNOFF (INCHES)       0.000  0.000  0.000  0.000  0.007  0.027
                 0.000  0.000  0.000  0.029  0.000  0.000

EVAPOTRANSPIRATION     0.788  1.136  0.566  0.413  1.864  0.758
   (INCHES)        2.272  0.908  1.597  1.707  1.245  0.648

LATERAL DRAINAGE FROM   0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  3 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM       0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  4 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM       0.0456 0.0411 0.0455 0.0439 0.0453 0.0438
 LAYER  7 (INCHES)    0.0452 0.0451 0.0436 0.0450 0.0435 0.0448
-------------------------------------------------------------------------
              MONTHLY SUMMARIES FOR DAILY HEADS
-------------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  4 (INCHES)      0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  4 (INCHES)   0.00   0.00   0.00   0.00   0.00   0.00

AVG. DAILY HEAD ON     253.36 252.98 252.61 252.22 251.83 251.45
 LAYER  7 (INCHES)    251.06 250.67 250.28 249.90 249.51 249.13

STD. DEV. OF DAILY HEAD  0.11   0.11   0.13   0.08   0.18   0.15
 ON LAYER  7 (INCHES)   0.11   0.06   0.12   0.13   0.10   0.09
*************************************************************************
              ANNUAL TOTALS FOR YEAR 1990
-------------------------------------------------------------------------
                       (INCHES)   (CU. FT.)   PERCENT
                       --------   ---------   -------
 PRECIPITATION           13.39     3514875.   100.00

 RUNOFF                  0.063      16508.     0.47
```

EVAPOTRANSPIRATION	13.902	3649268.	103.82
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.5323	139735.	3.98
CHANGE IN WATER STORAGE	-1.107	-290634.	-8.27
SOIL WATER AT START OF YEAR	109.55	28757442.	
SOIL WATER AT END OF YEAR	108.44	28466808.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.00	0.	
ANNUAL WATER BUDGET BALANCE	0.00	-1.	0.00

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MONTHLY TOTALS FOR YEAR 1991

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.22	0.45	1.40	0.01	0.49	0.05
	1.20	1.18	1.32	1.41	1.58	1.43
RUNOFF (INCHES)	0.018	0.000	0.008	0.000	0.000	0.000
	0.000	0.000	0.008	0.000	0.040	0.000
EVAPOTRANSPIRATION	1.306	0.588	1.407	0.366	0.094	0.384
(INCHES)	0.822	1.620	1.312	0.266	1.047	0.858
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0448	0.0404	0.0446	0.0431	0.0445	0.0430
LAYER 7 (INCHES)	0.0444	0.0443	0.0428	0.0442	0.0427	0.0440

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON	248.74	248.37	248.00	247.62	247.24	246.86
LAYER 7 (INCHES)	246.48	246.10	245.72	245.34	244.97	244.59

STD. DEV. OF DAILY HEAD 0.16 0.03 0.12 0.10 0.12 0.16
ON LAYER 7 (INCHES) 0.07 0.11 0.09 0.13 0.11 0.16

****

ANNUAL TOTALS FOR YEAR 1991

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	11.74	3081750.	100.00
RUNOFF	0.074	19552.	0.63
EVAPOTRANSPIRATION	10.071	2643531.	85.78
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.5228	137247.	4.45
CHANGE IN WATER STORAGE	1.072	281420.	9.13
SOIL WATER AT START OF YEAR	108.44	28466808.	
SOIL WATER AT END OF YEAR	109.40	28718424.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.11	29804.	
ANNUAL WATER BUDGET BALANCE	0.00	0.	0.00

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MONTHLY TOTALS FOR YEAR 1992

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	0.82	1.54	1.85	0.11	2.33	0.29
	2.20	1.26	0.90	1.24	0.27	2.29
RUNOFF (INCHES)	0.000	0.001	0.000	0.000	0.017	0.000
	0.075	0.000	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION (INCHES)	0.843	1.590	1.879	1.221	1.556	1.144
	3.022	0.935	1.227	0.370	0.440	1.062
LATERAL DRAINAGE FROM LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 7 (INCHES)	0.0440	0.0411	0.0438	0.0424	0.0437	0.0422
	0.0436	0.0435	0.0420	0.0434	0.0419	0.0433

MONTHLY SUMMARIES FOR DAILY HEADS

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-----------------------------------------------------------------------
AVG. DAILY HEAD ON        0.00  0.00  0.00  0.00  0.00  0.00
 LAYER  4 (INCHES)      0.00  0.00  0.00  0.00  0.00  0.00

STD. DEV. OF DAILY HEAD   0.00  0.00  0.00  0.00  0.00  0.00
 ON LAYER  4 (INCHES)   0.00  0.00  0.00  0.00  0.00  0.00

AVG. DAILY HEAD ON      244.21 243.84 243.47 243.10 242.72 242.35
 LAYER  7 (INCHES)    241.98 241.60 241.23 240.86 240.49 240.12

STD. DEV. OF DAILY HEAD   0.15  0.16  0.10  0.07  0.09  0.15
 ON LAYER  7 (INCHES)   0.17  0.13  0.09  0.11  0.10  0.14
***********************************************************************
              ANNUAL TOTALS FOR YEAR 1992
-----------------------------------------------------------------------
                        (INCHES)   (CU. FT.)   PERCENT
                        --------   ---------   -------
 PRECIPITATION              15.10     3963750.   100.00

 RUNOFF                     0.095      25025.     0.63

 EVAPOTRANSPIRATION        15.290    4013554.   101.26

 LATERAL DRAINAGE FROM LAYER  3     0.0000        0.     0.00

 PERCOLATION FROM LAYER  4          0.0000        0.     0.00

 PERCOLATION FROM LAYER  7          0.5149     135170.    3.41

 CHANGE IN WATER STORAGE           -0.800    -209997.   -5.30

 SOIL WATER AT START OF YEAR       109.40    28718424.

 SOIL WATER AT END OF YEAR         108.71    28536844.

 SNOW WATER AT START OF YEAR         0.11       29804.

 SNOW WATER AT END OF YEAR           0.01        1387.

 ANNUAL WATER BUDGET BALANCE         0.00          -1.     0.00
***********************************************************************
            MONTHLY TOTALS FOR YEAR 1993
-----------------------------------------------------------------------
                JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
               ------- ------- ------- ------- ------- -------
PRECIPITATION (INCHES)  5.31   3.73   0.73   0.59   1.62   0.12
                 0.01   1.79   0.83   1.43   1.08   0.42

RUNOFF (INCHES)        0.283  0.489  0.000  0.000  0.000  0.000
                 0.000  0.000  0.000  0.000  0.000  0.000

EVAPOTRANSPIRATION     0.950  1.452  1.732  1.304  0.833  0.995
   (INCHES)          1.476  1.276  1.050  1.533  1.219  0.368
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LATERAL DRAINAGE FROM   0.0000 0.0000 0.0000 0.0000 0.0001 0.0001
 LAYER  3 (INCHES)     0.0001 0.0001 0.0001 0.0001 0.0000 0.0000

PERCOLATION FROM        0.0000 0.0000 0.0654 0.1240 0.1348 0.1326
 LAYER  4 (INCHES)     0.1370 0.1356 0.1291 0.1308 0.1238 0.1249

PERCOLATION FROM        0.0432 0.0390 0.0431 0.0416 0.0429 0.0415
 LAYER  7 (INCHES)     0.0428 0.0427 0.0413 0.0426 0.0412 0.0425
-----------------------------------------------------------------------
            MONTHLY SUMMARIES FOR DAILY HEADS
-----------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.64   2.62   3.36   3.59
 LAYER  4 (INCHES)      3.59   3.42   3.17   2.87   2.55   2.20

STD. DEV. OF DAILY HEAD  0.00   0.00   0.69   0.35   0.12   0.03
 ON LAYER  4 (INCHES)   0.03   0.06   0.08   0.09   0.10   0.10

AVG. DAILY HEAD ON     239.74 239.38 239.03 238.66 238.29 237.93
 LAYER  7 (INCHES)    237.56 237.19 236.83 236.46 236.10 235.73

STD. DEV. OF DAILY HEAD  0.09   0.12   0.07   0.11   0.12   0.15
 ON LAYER  7 (INCHES)   0.10   0.07   0.10   0.14   0.00   0.13
***********************************************************************
              ANNUAL TOTALS FOR YEAR 1993
-----------------------------------------------------------------------
                      (INCHES)  (CU. FT.)  PERCENT
                      --------  ---------  -------
 PRECIPITATION          17.66    4635750.   100.00

 RUNOFF                0.772     202776.     4.37

 EVAPOTRANSPIRATION    14.187    3724166.   80.34

 LATERAL DRAINAGE FROM LAYER  3   0.0005      131.    0.00

 PERCOLATION FROM LAYER  4        1.2379    324945.    7.01

 PERCOLATION FROM LAYER  7        0.5044    132397.    2.86

 CHANGE IN WATER STORAGE          2.195     576280.   12.43

 SOIL WATER AT START OF YEAR     108.71    28536844.

 SOIL WATER AT END OF YEAR       110.91    29114510.

 SNOW WATER AT START OF YEAR       0.01       1387.

 SNOW WATER AT END OF YEAR         0.00          0.

 ANNUAL WATER BUDGET BALANCE       0.00          0.    0.00
***********************************************************************
   AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1988 THROUGH 1993
-----------------------------------------------------------------------
            JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
```

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              ------- ------- ------- ------- ------- -------
PRECIPITATION
-------------
 TOTALS          2.01   1.32   0.91   0.46   1.31   0.60
            1.19   1.35   1.16   1.20   1.08   1.18

 STD. DEVIATIONS   1.86   1.43   0.72   0.37   0.71   0.62
            0.90   0.40   0.35   0.65   0.51   0.72

RUNOFF
------
 TOTALS          0.060  0.098  0.002  0.000  0.005  0.005
            0.015  0.000  0.002  0.006  0.008  0.000

 STD. DEVIATIONS   0.125  0.219  0.004  0.000  0.007  0.012
            0.034  0.000  0.003  0.013  0.018  0.001

EVAPOTRANSPIRATION
------------------
 TOTALS          0.978  1.188  1.121  0.716  0.983  1.091
            1.685  1.277  1.315  0.795  0.851  0.666

 STD. DEVIATIONS   0.202  0.385  0.798  0.502  0.723  0.670
            0.954  0.355  0.202  0.761  0.446  0.298

LATERAL DRAINAGE FROM LAYER  3
------------------------------
 TOTALS          0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

 STD. DEVIATIONS   0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM LAYER  4
-------------------------
 TOTALS          0.0000 0.0000 0.0131 0.0248 0.0270 0.0265
            0.0274 0.0271 0.0258 0.0262 0.0248 0.0250

 STD. DEVIATIONS   0.0000 0.0000 0.0293 0.0554 0.0603 0.0593
            0.0613 0.0606 0.0577 0.0585 0.0554 0.0559

PERCOLATION FROM LAYER  7
-------------------------
 TOTALS          0.0447 0.0410 0.0447 0.0432 0.0445 0.0430
            0.0444 0.0443 0.0428 0.0442 0.0427 0.0441

 STD. DEVIATIONS   0.0011 0.0016 0.0013 0.0012 0.0013 0.0012
            0.0013 0.0013 0.0012 0.0013 0.0012 0.0013
***************************************************************************
AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1988 THROUGH 1993
---------------------------------------------------------------------------
                    (INCHES)      (CU. FT.)   PERCENT
                  ---------------  -----------  -------
PRECIPITATION          13.77  ( 2.695)   3614625.   100.00
```

RUNOFF	0.201 (0.321)	52772.	1.46
EVAPOTRANSPIRATION	12.667 (2.510)	3325060.	91.99
LATERAL DRAINAGE FROM LAYER 3	0.0001 (0.0002)	26.	0.00
PERCOLATION FROM LAYER 4	0.2476 (0.5536)	64989.	1.80
PERCOLATION FROM LAYER 7	0.5235 (0.0150)	137415.	3.80
CHANGE IN WATER STORAGE	0.378 (1.360)	99352.	2.75

****

PEAK DAILY VALUES FOR YEARS 1988 THROUGH 1993

	(INCHES)	(CU. FT.)
PRECIPITATION	1.33	349125.0
RUNOFF	0.209	54815.7
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.5
PERCOLATION FROM LAYER 4	0.0044	1162.2
HEAD ON LAYER 4	3.6	
PERCOLATION FROM LAYER 7	0.0015	393.2
HEAD ON LAYER 7	258.3	
SNOW WATER	2.53	665421.9

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3469

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1354

****

FINAL WATER STORAGE AT END OF YEAR 1993

LAYER	(INCHES)	(VOL/VOL)
1	0.92	0.1529
2	7.95	0.1892
3	1.85	0.1539
4	5.16	0.4300
5	7.96	0.1658
6	84.50	0.3201
7	2.58	0.4300
SNOW WATER	0.00	

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*********************************************************************
WHITE MESA TAILINGS FACILITY
CELL 3, WET, WITHOUT THE LAYER 7 PVC LINER
BLANDING CLIMATE DATA
*********************************************************************
                POOR GRASS

                  LAYER  1
                  --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =    6.00 INCHES
 POROSITY                   =    0.5010 VOL/VOL
 FIELD CAPACITY             =    0.2837 VOL/VOL
 WILTING POINT              =    0.1353 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000342000014 CM/SEC

                  LAYER  2
                  --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =   42.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
 FIELD CAPACITY             =    0.2173 VOL/VOL
 WILTING POINT              =    0.1361 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000006000000 CM/SEC

                  LAYER  3
                  --------
             LATERAL DRAINAGE LAYER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.3573 VOL/VOL
 FIELD CAPACITY             =    0.1127 VOL/VOL
 WILTING POINT              =    0.0580 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.0600 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000050000002 CM/SEC
 SLOPE                      =    0.57 PERCENT
 DRAINAGE LENGTH            =  1750.0 FEET

                  LAYER  4
                  --------
              BARRIER SOIL LINER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.4300 VOL/VOL
 FIELD CAPACITY             =    0.3663 VOL/VOL
 WILTING POINT              =    0.2802 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.4300 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000000100000 CM/SEC

                  LAYER  5
                  --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =   48.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
```

FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 6

VERTICAL PERCOLATION LAYER
THICKNESS = 264.00 INCHES
POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.3300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 7

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
THICKNESS = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3663 VOL/VOL
WILTING POINT = 0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000000100000 CM/SEC
LINER LEAKAGE FRACTION = 1.00000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER = 87.21
TOTAL AREA OF COVER = 3150000. SQ FT
EVAPORATIVE ZONE DEPTH = 28.00 INCHES
UPPER LIMIT VEG. STORAGE = 10.3210 INCHES
INITIAL VEG. STORAGE = 3.9200 INCHES
INITIAL SNOW WATER CONTENT = 0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 109.0200 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.
CLIMATOLOGICAL DATA

USER SPECIFIED RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR MILFORD UTAH
MAXIMUM LEAF AREA INDEX = 1.60
START OF GROWING SEASON (JULIAN DATE) = 138
END OF GROWING SEASON (JULIAN DATE) = 276

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
26.40	32.10	38.20	46.30	55.90	65.80
74.30	72.10	62.60	50.30	36.80	28.20

****
MONTHLY TOTALS FOR YEAR 1988

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.60	0.50	0.02	0.78	1.27	1.40
	0.64	1.70	1.06	0.10	1.04	0.85
RUNOFF (INCHES)	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.003	1.175	0.020	0.276	0.569	2.174
(INCHES)	0.834	1.644	1.388	0.100	0.306	0.395
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	4.2828	3.4955	3.2217	2.6811	2.3827	1.9828
LAYER 7 (INCHES)	1.7622	1.5117	1.2580	1.1180	0.9304	0.8268

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON	239.42	205.56	176.41	150.86	128.91	110.01
LAYER 7 (INCHES)	93.77	79.59	67.60	57.30	48.43	40.82
STD. DEV. OF DAILY HEAD	11.02	8.91	8.20	6.83	6.07	5.05
ON LAYER 7 (INCHES)	4.49	3.85	3.20	2.85	2.37	2.10

****

ANNUAL TOTALS FOR YEAR 1988

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	10.96	2877001.	100.00
RUNOFF	0.000	0.	0.00
EVAPOTRANSPIRATION	9.885	2594779.	90.19
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	25.4537	6681596.	232.24
CHANGE IN WATER STORAGE	-24.379	-6399377.	******
SOIL WATER AT START OF YEAR	109.02	28617752.	

```
 SOIL WATER AT END OF YEAR          84.64     22218374.

 SNOW WATER AT START OF YEAR         0.00          0.

 SNOW WATER AT END OF YEAR           0.00          0.

 ANNUAL WATER BUDGET BALANCE         0.00          3.    0.00
*************************************************************************
              MONTHLY TOTALS FOR YEAR 1990
-------------------------------------------------------------------------
                  JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                  ------- ------- ------- ------- ------- -------
PRECIPITATION (INCHES)  1.11   0.38   0.57   0.80   0.85   1.13
                  1.91   0.80   1.69   1.82   1.43   0.90

RUNOFF (INCHES)        0.000  0.000  0.000  0.000  0.007  0.027
                  0.000  0.000  0.000  0.029  0.000  0.000

EVAPOTRANSPIRATION     0.788  1.136  0.566  0.413  1.864  0.758
   (INCHES)        2.272  0.908  1.597  1.707  1.245  0.648

LATERAL DRAINAGE FROM  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  3 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM       0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  4 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM       0.7093 0.5536 0.5298 0.4409 0.3918 0.3261
 LAYER  7 (INCHES)    0.2898 0.2486 0.2069 0.1839 0.1530 0.1360
-------------------------------------------------------------------------
              MONTHLY SUMMARIES FOR DAILY HEADS
-------------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  4 (INCHES)      0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  4 (INCHES)   0.00   0.00   0.00   0.00   0.00   0.00

AVG. DAILY HEAD ON      34.16  28.70  24.00  19.80  16.19  13.08
 LAYER  7 (INCHES)     10.41   8.08   6.10   4.41   2.95   1.70

STD. DEV. OF DAILY HEAD  1.81   1.41   1.35   1.12   1.00   0.83
 ON LAYER  7 (INCHES)   0.74   0.63   0.53   0.47   0.39   0.35
*************************************************************************
              ANNUAL TOTALS FOR YEAR 1990
-------------------------------------------------------------------------
                      (INCHES)   (CU. FT.)   PERCENT
                      --------   ---------   -------
 PRECIPITATION          13.39     3514875.   100.00

 RUNOFF                0.063       16508.     0.47

 EVAPOTRANSPIRATION           13.902     3649268.   103.82
```

LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	4.1697	1094534.	31.14
CHANGE IN WATER STORAGE	-4.745	-1245433.	-35.43
SOIL WATER AT START OF YEAR	84.64	22218374.	
SOIL WATER AT END OF YEAR	79.90	20972942.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.00	0.	
ANNUAL WATER BUDGET BALANCE	0.00	-1.	0.00

****

MONTHLY TOTALS FOR YEAR 1991

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.22	0.45	1.40	0.01	0.49	0.05
	1.20	1.18	1.32	1.41	1.58	1.43
RUNOFF (INCHES)	0.018	0.000	0.008	0.000	0.000	0.000
	0.000	0.000	0.008	0.000	0.040	0.000
EVAPOTRANSPIRATION	1.306	0.588	1.407	0.366	0.094	0.384
(INCHES)	0.822	1.620	1.312	0.266	1.047	0.858
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.1166	0.0128	0.0000	0.0000	0.0000	0.0000
LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON	0.60	0.01	0.00	0.00	0.00	0.00
LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.30	0.02	0.00	0.00	0.00	0.00
ON LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00

****

ANNUAL TOTALS FOR YEAR 1991

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	11.74	3081750.	100.00
RUNOFF	0.074	19552.	0.63
EVAPOTRANSPIRATION	10.071	2643531.	85.78
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.1295	33984.	1.10
CHANGE IN WATER STORAGE	1.465	384684.	12.48
SOIL WATER AT START OF YEAR	79.90	20972942.	
SOIL WATER AT END OF YEAR	81.25	21327820.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.11	29804.	
ANNUAL WATER BUDGET BALANCE	0.00	-1.	0.00

****

MONTHLY TOTALS FOR YEAR 1992

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	0.82	1.54	1.85	0.11	2.33	0.29
	2.20	1.26	0.90	1.24	0.27	2.29
RUNOFF (INCHES)	0.000	0.001	0.000	0.000	0.017	0.000
	0.075	0.000	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION	0.843	1.590	1.879	1.221	1.556	1.144
(INCHES)	3.022	0.935	1.227	0.370	0.440	1.062
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00

```
STD. DEV. OF DAILY HEAD   0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  4 (INCHES)    0.00   0.00   0.00   0.00   0.00   0.00

AVG. DAILY HEAD ON        0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)      0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD   0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)    0.00   0.00   0.00   0.00   0.00   0.00
*************************************************************************
              ANNUAL TOTALS FOR YEAR 1992
-------------------------------------------------------------------------
                        (INCHES)   (CU. FT.)   PERCENT
                        --------   ---------   -------
 PRECIPITATION              15.10     3963750.   100.00

 RUNOFF                     0.095      25025.     0.63

 EVAPOTRANSPIRATION         15.290     4013554.   101.26

 LATERAL DRAINAGE FROM LAYER  3      0.0000        0.     0.00

 PERCOLATION FROM LAYER  4           0.0000        0.     0.00

 PERCOLATION FROM LAYER  7           0.0000        1.     0.00

 CHANGE IN WATER STORAGE            -0.285     -74830.    -1.89

 SOIL WATER AT START OF YEAR         81.25     21327820.

 SOIL WATER AT END OF YEAR           81.07     21281408.

 SNOW WATER AT START OF YEAR          0.11        29804.

 SNOW WATER AT END OF YEAR            0.01         1387.

 ANNUAL WATER BUDGET BALANCE          0.00            0.     0.00
*************************************************************************
             MONTHLY TOTALS FOR YEAR 1993
-------------------------------------------------------------------------
                JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                ------- ------- ------- ------- ------- -------
PRECIPITATION (INCHES)  5.31   3.73   0.73   0.59   1.62   0.12
                 0.01   1.79   0.83   1.43   1.08   0.42

RUNOFF (INCHES)        0.283  0.489  0.000  0.000  0.000  0.000
                 0.000  0.000  0.000  0.000  0.000  0.000

EVAPOTRANSPIRATION     0.950  1.452  1.732  1.304  0.833  0.995
   (INCHES)          1.476  1.276  1.050  1.533  1.219  0.368

LATERAL DRAINAGE FROM   0.0000 0.0000 0.0000 0.0000 0.0001 0.0001
 LAYER  3 (INCHES)     0.0001 0.0001 0.0001 0.0001 0.0000 0.0000
```

```
PERCOLATION FROM      0.0000 0.0000 0.0654 0.1240 0.1348 0.1326
 LAYER  4 (INCHES)   0.1370 0.1356 0.1291 0.1308 0.1238 0.1249

PERCOLATION FROM      0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  7 (INCHES)   0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
-----------------------------------------------------------------
            MONTHLY SUMMARIES FOR DAILY HEADS
-----------------------------------------------------------------
AVG. DAILY HEAD ON      0.00   0.00   0.64   2.62   3.36   3.59
 LAYER  4 (INCHES)     3.59   3.42   3.17   2.87   2.55   2.20

STD. DEV. OF DAILY HEAD  0.00   0.00   0.69   0.35   0.12   0.03
 ON LAYER  4 (INCHES)   0.03   0.06   0.08   0.09   0.10   0.10

AVG. DAILY HEAD ON      0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)     0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)   0.00   0.00   0.00   0.00   0.00   0.00
*****************************************************************
             ANNUAL TOTALS FOR YEAR 1993
-----------------------------------------------------------------
                      (INCHES)  (CU. FT.)  PERCENT
                      --------  ---------  -------
 PRECIPITATION          17.66    4635750.   100.00

 RUNOFF                0.772     202776.     4.37

 EVAPOTRANSPIRATION    14.187    3724166.   80.34

 LATERAL DRAINAGE FROM LAYER  3   0.0005      131.    0.00

 PERCOLATION FROM LAYER  4        1.2379    324945.    7.01

 PERCOLATION FROM LAYER  7        0.0000        11.    0.00

 CHANGE IN WATER STORAGE          2.700     708667.   15.29

 SOIL WATER AT START OF YEAR      81.07    21281408.

 SOIL WATER AT END OF YEAR        83.78    21991462.

 SNOW WATER AT START OF YEAR       0.01        1387.

 SNOW WATER AT END OF YEAR         0.00           0.

 ANNUAL WATER BUDGET BALANCE       0.00          -1.    0.00
*****************************************************************
   AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1988 THROUGH 1993
-----------------------------------------------------------------
             JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
             ------- ------- ------- ------- ------- -------
 PRECIPITATION
 -------------
```

```
 TOTALS          2.01  1.32  0.91  0.46  1.31  0.60
            1.19  1.35  1.16  1.20  1.08  1.18

 STD. DEVIATIONS  1.86  1.43  0.72  0.37  0.71  0.62
            0.90  0.40  0.35  0.65  0.51  0.72

RUNOFF
------
 TOTALS          0.060  0.098  0.002  0.000  0.005  0.005
            0.015  0.000  0.002  0.006  0.008  0.000

 STD. DEVIATIONS  0.125  0.219  0.004  0.000  0.007  0.012
            0.034  0.000  0.003  0.013  0.018  0.001

EVAPOTRANSPIRATION
------------------
 TOTALS          0.978  1.188  1.121  0.716  0.983  1.091
            1.685  1.277  1.315  0.795  0.851  0.666

 STD. DEVIATIONS  0.202  0.385  0.798  0.502  0.723  0.670
            0.954  0.355  0.202  0.761  0.446  0.298

LATERAL DRAINAGE FROM LAYER 3
-----------------------------
 TOTALS          0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

 STD. DEVIATIONS  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM LAYER 4
------------------------
 TOTALS          0.0000 0.0000 0.0131 0.0248 0.0270 0.0265
            0.0274 0.0271 0.0258 0.0262 0.0248 0.0250

 STD. DEVIATIONS  0.0000 0.0000 0.0293 0.0554 0.0603 0.0593
            0.0613 0.0606 0.0577 0.0585 0.0554 0.0559

PERCOLATION FROM LAYER 7
------------------------
 TOTALS          1.0218 0.8124 0.7503 0.6244 0.5549 0.4618
            0.4104 0.3521 0.2930 0.2604 0.2167 0.1926

 STD. DEVIATIONS  1.8466 1.5186 1.4005 1.1655 1.0358 0.8619
            0.7660 0.6571 0.5469 0.4860 0.4044 0.3594
***********************************************************************
 AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1988 THROUGH 1993
-----------------------------------------------------------------------
                    (INCHES)      (CU. FT.)   PERCENT
                  ----------------  -----------  -------
PRECIPITATION          13.77  ( 2.695)   3614625.   100.00

RUNOFF                0.201  ( 0.321)     52772.     1.46
```

EVAPOTRANSPIRATION	12.667 (2.510)	3325060.	91.99
LATERAL DRAINAGE FROM LAYER 3	0.0001 (0.0002)	26.	0.00
PERCOLATION FROM LAYER 4	0.2476 (0.5536)	64989.	1.80
PERCOLATION FROM LAYER 7	5.9506 (11.0482)	1562025.	43.21
CHANGE IN WATER STORAGE	-5.049 (11.168)	-1325258.	-36.66

****

PEAK DAILY VALUES FOR YEARS 1988 THROUGH 1993

	(INCHES)	(CU. FT.)
PRECIPITATION	1.33	349125.0
RUNOFF	0.209	54815.7
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.5
PERCOLATION FROM LAYER 4	0.0044	1162.2
HEAD ON LAYER 4	3.6	
PERCOLATION FROM LAYER 7	0.1481	38869.1
HEAD ON LAYER 7	257.9	
SNOW WATER	2.53	665421.9

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3469

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1354

****

FINAL WATER STORAGE AT END OF YEAR 1993

LAYER	(INCHES)	(VOL/VOL)
1	0.92	0.1529
2	7.95	0.1892
3	1.85	0.1539
4	5.16	0.4300
5	7.96	0.1658
6	57.37	0.2173
7	2.58	0.4300
SNOW WATER	0.00	

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*********************************************************************
WHITE MESA TAILINGS FACILITY
CELL 3, WET, INCLUDING LAYER 7, PVC LINER
20 YEARS GRAND JUNCTION CLIMATE DATA
*********************************************************************
                POOR GRASS

                LAYER  1
                --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =    6.00 INCHES
 POROSITY                   =    0.5010 VOL/VOL
 FIELD CAPACITY             =    0.2837 VOL/VOL
 WILTING POINT              =    0.1353 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000342000014 CM/SEC

                LAYER  2
                --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =   42.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
 FIELD CAPACITY             =    0.2173 VOL/VOL
 WILTING POINT              =    0.1361 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000006000000 CM/SEC

                LAYER  3
                --------
            LATERAL DRAINAGE LAYER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.3573 VOL/VOL
 FIELD CAPACITY             =    0.1127 VOL/VOL
 WILTING POINT              =    0.0580 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.0600 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000050000002 CM/SEC
 SLOPE                      =    0.57 PERCENT
 DRAINAGE LENGTH            =  1750.0 FEET

                LAYER  4
                --------
            BARRIER SOIL LINER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.4300 VOL/VOL
 FIELD CAPACITY             =    0.3663 VOL/VOL
 WILTING POINT              =    0.2802 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.4300 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000000100000 CM/SEC

                LAYER  5
                --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =   48.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
```

FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 6

VERTICAL PERCOLATION LAYER
THICKNESS = 264.00 INCHES
POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.3300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 7

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
THICKNESS = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3663 VOL/VOL
WILTING POINT = 0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000000100000 CM/SEC
LINER LEAKAGE FRACTION = 0.01000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER = 87.21
TOTAL AREA OF COVER = 3150000. SQ FT
EVAPORATIVE ZONE DEPTH = 28.00 INCHES
UPPER LIMIT VEG. STORAGE = 10.3210 INCHES
INITIAL VEG. STORAGE = 3.9200 INCHES
INITIAL SNOW WATER CONTENT = 0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 109.0200 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.

CLIMATOLOGICAL DATA

SYNTHETIC RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR GRAND JUNCTION COLORADO

MAXIMUM LEAF AREA INDEX = 1.60
START OF GROWING SEASON (JULIAN DATE) = 116
END OF GROWING SEASON (JULIAN DATE) = 288

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	33.50	41.90	51.70	62.10	72.30
78.90	75.90	67.10	54.90	39.60	28.30

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.72	0.54	0.60	0.73	0.57	0.39
	0.52	0.96	0.73	0.88	0.73	0.56
STD. DEVIATIONS	0.40	0.26	0.28	0.44	0.43	0.22
	0.37	0.42	0.71	0.44	0.42	0.36
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.001	0.001	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.555	0.718	0.704	0.747	0.736	0.577
	0.513	0.907	0.719	0.697	0.517	0.539
STD. DEVIATIONS	0.192	0.260	0.285	0.467	0.411	0.327
	0.327	0.440	0.668	0.482	0.239	0.194
LATERAL DRAINAGE FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 7						
TOTALS	0.0393	0.0358	0.0392	0.0379	0.0391	0.0378
	0.0390	0.0389	0.0376	0.0388	0.0375	0.0387
STD. DEVIATIONS	0.0041	0.0038	0.0042	0.0040	0.0042	0.0040
	0.0041	0.0041	0.0040	0.0041	0.0040	0.0041

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 20

	(INCHES)	(CU. FT.)	PERCENT

PRECIPITATION	7.94	(1.572)	2084906. 100.00
RUNOFF	0.000	(0.001)	122. 0.01
EVAPOTRANSPIRATION	7.929	(1.452)	2081472. 99.84
LATERAL DRAINAGE FROM LAYER 3	0.0000	(0.0000)	0. 0.00
PERCOLATION FROM LAYER 4	0.0000	(0.0000)	0. 0.00
PERCOLATION FROM LAYER 7	0.4597	(0.0487)	120661. 5.79
CHANGE IN WATER STORAGE	-0.447	(0.832)	-117348. -5.63

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 20

	(INCHES)	(CU. FT.)
PRECIPITATION	0.91	238875.0
RUNOFF	0.006	1572.3
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.0
PERCOLATION FROM LAYER 4	0.0000	0.0
HEAD ON LAYER 4	0.0	
PERCOLATION FROM LAYER 7	0.0015	393.2
HEAD ON LAYER 7	258.3	
SNOW WATER	0.67	175610.8
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2232	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1356	

****

FINAL WATER STORAGE AT END OF YEAR 20

LAYER	(INCHES)	(VOL/VOL)
1	1.18	0.1961
2	5.80	0.1380
3	0.72	0.0600
4	5.16	0.4300
5	6.72	0.1400
6	77.93	0.2952
7	2.58	0.4300
SNOW WATER	0.00	

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*********************************************************************
WHITE MESA TAILINGS FACILITY
CELL 3, WET, WITHOUT PVC LAYER 7
20 YEARS GRAND JUNCTION CLIMATE DATA
*********************************************************************
                POOR GRASS

                LAYER 1
                --------
            VERTICAL PERCOLATION LAYER
THICKNESS                  =    6.00 INCHES
POROSITY                   =    0.5010 VOL/VOL
FIELD CAPACITY             =    0.2837 VOL/VOL
WILTING POINT              =    0.1353 VOL/VOL
INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY  =    0.000342000014 CM/SEC

                LAYER 2
                --------
            VERTICAL PERCOLATION LAYER
THICKNESS                  =   42.00 INCHES
POROSITY                   =    0.3325 VOL/VOL
FIELD CAPACITY             =    0.2173 VOL/VOL
WILTING POINT              =    0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY  =    0.000006000000 CM/SEC

                LAYER 3
                --------
            LATERAL DRAINAGE LAYER
THICKNESS                  =   12.00 INCHES
POROSITY                   =    0.3573 VOL/VOL
FIELD CAPACITY             =    0.1127 VOL/VOL
WILTING POINT              =    0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT       =    0.0600 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY  =    0.000050000002 CM/SEC
SLOPE                      =    0.57 PERCENT
DRAINAGE LENGTH            =  1750.0 FEET

                LAYER 4
                --------
            BARRIER SOIL LINER
THICKNESS                  =   12.00 INCHES
POROSITY                   =    0.4300 VOL/VOL
FIELD CAPACITY             =    0.3663 VOL/VOL
WILTING POINT              =    0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT       =    0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY  =    0.000000100000 CM/SEC

                LAYER 5
                --------
            VERTICAL PERCOLATION LAYER
THICKNESS                  =   48.00 INCHES
POROSITY                   =    0.3325 VOL/VOL
```

FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 6

VERTICAL PERCOLATION LAYER
THICKNESS = 264.00 INCHES
POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.3300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 7

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
THICKNESS = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3663 VOL/VOL
WILTING POINT = 0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000000100000 CM/SEC
LINER LEAKAGE FRACTION = 1.00000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER = 87.21
TOTAL AREA OF COVER = 3150000. SQ FT
EVAPORATIVE ZONE DEPTH = 28.00 INCHES
UPPER LIMIT VEG. STORAGE = 10.3210 INCHES
INITIAL VEG. STORAGE = 3.9200 INCHES
INITIAL SNOW WATER CONTENT = 0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 109.0200 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.
CLIMATOLOGICAL DATA

SYNTHETIC RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR GRAND JUNCTION COLORADO

MAXIMUM LEAF AREA INDEX = 1.60
START OF GROWING SEASON (JULIAN DATE) = 116
END OF GROWING SEASON (JULIAN DATE) = 288

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
25.50	33.50	41.90	51.70	62.10	72.30
78.90	75.90	67.10	54.90	39.60	28.30

****
AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 20

```
-----------------------------------------------------------------------
                JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                ------- ------- ------- ------- ------- -------
 PRECIPITATION
 -------------
  TOTALS          0.72   0.54   0.60   0.73   0.57   0.39
                0.52   0.96   0.73   0.88   0.73   0.56

  STD. DEVIATIONS  0.40   0.26   0.28   0.44   0.43   0.22
                0.37   0.42   0.71   0.44   0.42   0.36
 RUNOFF
 ------
  TOTALS          0.000  0.000  0.000  0.000  0.000  0.000
                0.000  0.000  0.000  0.000  0.000  0.000

  STD. DEVIATIONS  0.000  0.000  0.000  0.000  0.000  0.000
                0.000  0.000  0.001  0.001  0.000  0.000

 EVAPOTRANSPIRATION
 ------------------
  TOTALS          0.555  0.718  0.704  0.747  0.736  0.577
                0.513  0.907  0.719  0.697  0.517  0.539

  STD. DEVIATIONS  0.192  0.260  0.285  0.467  0.411  0.327
                0.327  0.440  0.668  0.482  0.239  0.194

 LATERAL DRAINAGE FROM LAYER  3
 ------------------------------
  TOTALS          0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
                0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

  STD. DEVIATIONS  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
                0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

 PERCOLATION FROM LAYER  4
 -------------------------
  TOTALS          0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
                0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

  STD. DEVIATIONS  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
                0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

 PERCOLATION FROM LAYER  7
 -------------------------
  TOTALS          0.2556 0.1978 0.1885 0.1569 0.1394 0.1160
                0.1031 0.0885 0.0736 0.0654 0.0544 0.0484

  STD. DEVIATIONS  0.9613 0.7599 0.7275 0.6054 0.5380 0.4477
                0.3979 0.3413 0.2841 0.2525 0.2101 0.1867
***********************************************************************
AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS   1 THROUGH  20
-----------------------------------------------------------------------
                     (INCHES)      (CU. FT.)   PERCENT
                   ---------------  -----------  -------
```

PRECIPITATION	7.94	(1.572)	2084906.	100.00
RUNOFF	0.000	(0.001)	122.	0.01
EVAPOTRANSPIRATION	7.929	(1.452)	2081472.	99.84
LATERAL DRAINAGE FROM LAYER 3	0.0000	(0.0000)	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	(0.0000)	0.	0.00
PERCOLATION FROM LAYER 7	1.4876	(5.7122)	390507.	18.73
CHANGE IN WATER STORAGE	-1.475	(5.662)	-387194.	-18.57

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 20

	(INCHES)	(CU. FT.)
PRECIPITATION	0.91	238875.0
RUNOFF	0.006	1572.3
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.0
PERCOLATION FROM LAYER 4	0.0000	0.0
HEAD ON LAYER 4	0.0	
PERCOLATION FROM LAYER 7	0.1481	38869.1
HEAD ON LAYER 7	257.9	
SNOW WATER	0.67	175610.8

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.2232

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1356

****

FINAL WATER STORAGE AT END OF YEAR 20

LAYER	(INCHES)	(VOL/VOL)
1	1.18	0.1961
2	5.80	0.1380
3	0.72	0.0600
4	5.16	0.4300
5	6.72	0.1400
6	57.37	0.2173
7	2.58	0.4300
SNOW WATER	0.00	

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*********************************************************************
WHITE MESA TAILINGS FACILITY
CELL 4, DRY, INCLUDING LAYER 7, PVC LINER
BLANDING CLIMATE DATA
*********************************************************************
                POOR GRASS

                LAYER  1
                --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =    6.00 INCHES
 POROSITY                   =    0.5010 VOL/VOL
 FIELD CAPACITY             =    0.2837 VOL/VOL
 WILTING POINT              =    0.1353 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000342000014 CM/SEC

                LAYER  2
                --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =   42.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
 FIELD CAPACITY             =    0.2173 VOL/VOL
 WILTING POINT              =    0.1361 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000006000000 CM/SEC

                LAYER  3
                --------
             LATERAL DRAINAGE LAYER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.3573 VOL/VOL
 FIELD CAPACITY             =    0.1127 VOL/VOL
 WILTING POINT              =    0.0580 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.0600 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000050000002 CM/SEC
 SLOPE                  =    0.57 PERCENT
 DRAINAGE LENGTH            =  1750.0 FEET

                LAYER  4
                --------
              BARRIER SOIL LINER
 THICKNESS                  =   12.00 INCHES
 POROSITY                   =    0.4300 VOL/VOL
 FIELD CAPACITY             =    0.3663 VOL/VOL
 WILTING POINT              =    0.2802 VOL/VOL
 INITIAL SOIL WATER CONTENT       =    0.4300 VOL/VOL
 SATURATED HYDRAULIC CONDUCTIVITY  =    0.000000100000 CM/SEC

                LAYER  5
                --------
            VERTICAL PERCOLATION LAYER
 THICKNESS                  =   48.00 INCHES
 POROSITY                   =    0.3325 VOL/VOL
```

FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 6

VERTICAL PERCOLATION LAYER
THICKNESS = 264.00 INCHES
POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 7

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
THICKNESS = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3663 VOL/VOL
WILTING POINT = 0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000000100000 CM/SEC
LINER LEAKAGE FRACTION = 0.01000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER = 87.21
TOTAL AREA OF COVER = 1650000. SQ FT
EVAPORATIVE ZONE DEPTH = 28.00 INCHES
UPPER LIMIT VEG. STORAGE = 10.3210 INCHES
INITIAL VEG. STORAGE = 3.9200 INCHES
INITIAL SNOW WATER CONTENT = 0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 58.8600 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.

CLIMATOLOGICAL DATA

USER SPECIFIED RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR MILFORD UTAH

MAXIMUM LEAF AREA INDEX = 1.60
START OF GROWING SEASON (JULIAN DATE) = 138
END OF GROWING SEASON (JULIAN DATE) = 276

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
26.40	32.10	38.20	46.30	55.90	65.80
74.30	72.10	62.60	50.30	36.80	28.20

****

MONTHLY TOTALS FOR YEAR 1988

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.60	0.50	0.02	0.78	1.27	1.40
	0.64	1.70	1.06	0.10	1.04	0.85
RUNOFF (INCHES)	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.003	1.175	0.020	0.276	0.569	2.174
(INCHES)	0.834	1.644	1.388	0.100	0.306	0.395
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00

****

ANNUAL TOTALS FOR YEAR 1988

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	10.96	1507000.	100.00
RUNOFF	0.000	0.	0.00
EVAPOTRANSPIRATION	9.885	1359170.	90.19
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.0000	0.	0.00
CHANGE IN WATER STORAGE	1.075	147830.	9.81

SOIL WATER AT START OF YEAR 58.86 8093250.

SOIL WATER AT END OF YEAR 59.94 8241080.

SNOW WATER AT START OF YEAR 0.00 0.

SNOW WATER AT END OF YEAR 0.00 0.

ANNUAL WATER BUDGET BALANCE 0.00 1. 0.00

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MONTHLY TOTALS FOR YEAR 1990

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.11	0.38	0.57	0.80	0.85	1.13
	1.91	0.80	1.69	1.82	1.43	0.90
RUNOFF (INCHES)	0.000	0.000	0.000	0.000	0.007	0.027
	0.000	0.000	0.000	0.029	0.000	0.000
EVAPOTRANSPIRATION (INCHES)	0.788	1.136	0.566	0.413	1.864	0.758
	2.272	0.908	1.597	1.707	1.245	0.648
LATERAL DRAINAGE FROM LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD ON LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00

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ANNUAL TOTALS FOR YEAR 1990

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	13.39	1841125.	100.00
RUNOFF	0.063	8647.	0.47

EVAPOTRANSPIRATION	13.902	1911521.	103.82
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.0000	0.	0.00
CHANGE IN WATER STORAGE	-0.575	-79043.	-4.29
SOIL WATER AT START OF YEAR	59.94	8241080.	
SOIL WATER AT END OF YEAR	59.36	8162037.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.00	0.	
ANNUAL WATER BUDGET BALANCE	0.00	0.	0.00

****

MONTHLY TOTALS FOR YEAR 1991

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.22	0.45	1.40	0.01	0.49	0.05
	1.20	1.18	1.32	1.41	1.58	1.43
RUNOFF (INCHES)	0.018	0.000	0.008	0.000	0.000	0.000
	0.000	0.000	0.008	0.000	0.040	0.000
EVAPOTRANSPIRATION	1.306	0.588	1.407	0.366	0.094	0.384
(INCHES)	0.822	1.620	1.312	0.266	1.047	0.858
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00

```
 ON LAYER  7 (INCHES)    0.00    0.00    0.00    0.00    0.00    0.00
*********************************************************************
            ANNUAL TOTALS FOR YEAR 1991
---------------------------------------------------------------------
                        (INCHES)   (CU. FT.)   PERCENT
                        --------   ---------   -------
 PRECIPITATION                11.74      1614250.   100.00

 RUNOFF                    0.074       10242.     0.63

 EVAPOTRANSPIRATION           10.071     1384707.    85.78

 LATERAL DRAINAGE FROM LAYER  3     0.0000        0.     0.00

 PERCOLATION FROM LAYER  4         0.0000        0.     0.00

 PERCOLATION FROM LAYER  7         0.0000        0.     0.00

 CHANGE IN WATER STORAGE            1.595     219302.    13.59

 SOIL WATER AT START OF YEAR       59.36     8162037.

 SOIL WATER AT END OF YEAR         60.84     8365727.

 SNOW WATER AT START OF YEAR        0.00          0.

 SNOW WATER AT END OF YEAR          0.11       15612.

 ANNUAL WATER BUDGET BALANCE        0.00          0.     0.00
*********************************************************************
            MONTHLY TOTALS FOR YEAR 1992
---------------------------------------------------------------------
                JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                ------- ------- ------- ------- ------- -------
 PRECIPITATION (INCHES)  0.82    1.54    1.85    0.11    2.33    0.29
                2.20    1.26    0.90    1.24    0.27    2.29

RUNOFF (INCHES)        0.000   0.001   0.000   0.000   0.017   0.000
                0.075   0.000   0.000   0.000   0.000   0.002

EVAPOTRANSPIRATION     0.843   1.590   1.879   1.221   1.556   1.145
   (INCHES)            3.021   0.936   1.226   0.371   0.440   1.060

LATERAL DRAINAGE FROM   0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
 LAYER  3 (INCHES)      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

PERCOLATION FROM        0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
 LAYER  4 (INCHES)      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

PERCOLATION FROM        0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
 LAYER  7 (INCHES)      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
 ---------------------------------------------------------------------
            MONTHLY SUMMARIES FOR DAILY HEADS
---------------------------------------------------------------------
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AVG. DAILY HEAD ON        0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  4 (INCHES)      0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD   0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  4 (INCHES)   0.00   0.00   0.00   0.00   0.00   0.00

AVG. DAILY HEAD ON        0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)      0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD   0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)   0.00   0.00   0.00   0.00   0.00   0.00
*************************************************************************
            ANNUAL TOTALS FOR YEAR 1992
-------------------------------------------------------------------------
                      (INCHES)   (CU. FT.)   PERCENT
                      --------   ---------   -------
 PRECIPITATION          15.10     2076250.   100.00

 RUNOFF                0.095      13106.     0.63

 EVAPOTRANSPIRATION    15.290     2102365.   101.26

 LATERAL DRAINAGE FROM LAYER  3    0.0000      0.     0.00

 PERCOLATION FROM LAYER  4         0.0000      0.     0.00

 PERCOLATION FROM LAYER  7         0.0000      0.     0.00

 CHANGE IN WATER STORAGE          -0.285     -39220.   -1.89

 SOIL WATER AT START OF YEAR       60.84     8365727.

 SOIL WATER AT END OF YEAR         60.66     8341379.

 SNOW WATER AT START OF YEAR        0.11       15612.

 SNOW WATER AT END OF YEAR          0.01        740.

 ANNUAL WATER BUDGET BALANCE        0.00          0.     0.00
*************************************************************************
            MONTHLY TOTALS FOR YEAR 1993
-------------------------------------------------------------------------
JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                -------- -------- -------- -------- -------- --------
 PRECIPITATION (INCHES)  5.31   3.73   0.73   0.59   1.62   0.12
                0.01   1.79   0.83   1.43   1.08   0.42

RUNOFF (INCHES)        0.284  0.490  0.000  0.000  0.000  0.000
                0.000  0.000  0.000  0.000  0.000  0.000

EVAPOTRANSPIRATION     0.950  1.449  1.728  1.303  0.837  0.996
   (INCHES)          1.475  1.277  1.048  1.531  1.219  0.369

LATERAL DRAINAGE FROM  0.0000 0.0000 0.0000 0.0000 0.0001 0.0001
```

```
 LAYER  3 (INCHES)     0.0001  0.0001  0.0001  0.0001  0.0000  0.0000

PERCOLATION FROM       0.0000  0.0000  0.0655  0.1240  0.1349  0.1326
 LAYER  4 (INCHES)     0.1371  0.1357  0.1292  0.1309  0.1239  0.1250

PERCOLATION FROM       0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
 LAYER  7 (INCHES)     0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
-----------------------------------------------------------------------
            MONTHLY SUMMARIES FOR DAILY HEADS
-----------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.64   2.62   3.36   3.60
 LAYER  4 (INCHES)       3.59   3.43   3.18   2.88   2.55   2.21

STD. DEV. OF DAILY HEAD  0.00   0.00   0.69   0.35   0.12   0.03
 ON LAYER  4 (INCHES)    0.03   0.06   0.08   0.09   0.10   0.10

AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)       0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)    0.00   0.00   0.00   0.00   0.00   0.00
***********************************************************************
             ANNUAL TOTALS FOR YEAR 1993
-----------------------------------------------------------------------
                      (INCHES)   (CU. FT.)   PERCENT
                      --------   ---------   -------
 PRECIPITATION          17.66    2428250.    100.00

 RUNOFF                 0.774     106369.      4.38

 EVAPOTRANSPIRATION    14.183    1950185.     80.31

 LATERAL DRAINAGE FROM LAYER  3   0.0005        69.      0.00

 PERCOLATION FROM LAYER  4        1.2386     170301.     7.01

 PERCOLATION FROM LAYER  7        0.0000         0.      0.00

 CHANGE IN WATER STORAGE          2.703      371627.    15.30

 SOIL WATER AT START OF YEAR      60.66     8341379.

 SOIL WATER AT END OF YEAR        63.37     8713746.

 SNOW WATER AT START OF YEAR       0.01         740.

 SNOW WATER AT END OF YEAR         0.00           0.

 ANNUAL WATER BUDGET BALANCE       0.00           0.      0.00
***********************************************************************
   AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1988 THROUGH 1993
-----------------------------------------------------------------------
             JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
             ------- ------- ------- ------- ------- -------
```

PRECIPITATION

TOTALS	2.01	1.32	0.91	0.46	1.31	0.60
	1.19	1.35	1.16	1.20	1.08	1.18
STD. DEVIATIONS	1.86	1.43	0.72	0.37	0.71	0.62
	0.90	0.40	0.35	0.65	0.51	0.72

RUNOFF

TOTALS	0.060	0.098	0.002	0.000	0.005	0.005
	0.015	0.000	0.002	0.006	0.008	0.000
STD. DEVIATIONS	0.125	0.219	0.004	0.000	0.007	0.012
	0.034	0.000	0.003	0.013	0.018	0.001

EVAPOTRANSPIRATION

TOTALS	0.978	1.188	1.120	0.716	0.984	1.091
	1.685	1.277	1.315	0.795	0.852	0.666
STD. DEVIATIONS	0.202	0.385	0.798	0.502	0.722	0.670
	0.954	0.355	0.202	0.761	0.446	0.298

LATERAL DRAINAGE FROM LAYER 3

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION FROM LAYER 4

TOTALS	0.0000	0.0000	0.0131	0.0248	0.0270	0.0265
	0.0274	0.0271	0.0258	0.0262	0.0248	0.0250
STD. DEVIATIONS	0.0000	0.0000	0.0293	0.0555	0.0603	0.0593
	0.0613	0.0607	0.0578	0.0585	0.0554	0.0559

PERCOLATION FROM LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1988 THROUGH 1993

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	13.77 (2.695)	1893375.	100.00

RUNOFF	0.201 (0.322)	27673.	1.46
EVAPOTRANSPIRATION	12.666 (2.509)	1741590.	91.98
LATERAL DRAINAGE FROM LAYER 3	0.0001 (0.0002)	14.	0.00
PERCOLATION FROM LAYER 4	0.2477 (0.5539)	34060.	1.80
PERCOLATION FROM LAYER 7	0.0000 (0.0000)	.0.	0.00
CHANGE IN WATER STORAGE	0.903 (1.355)	124099.	6.55

****

PEAK DAILY VALUES FOR YEARS 1988 THROUGH 1993

	(INCHES)	(CU. FT.)
PRECIPITATION	1.33	182875.0
RUNOFF	0.209	28712.2
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.3
PERCOLATION FROM LAYER 4	0.0044	609.1
HEAD ON LAYER 4	3.6	
PERCOLATION FROM LAYER 7	0.0000	0.0
HEAD ON LAYER 7	0.0	
SNOW WATER	2.53	348554.3

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3469

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1354

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FINAL WATER STORAGE AT END OF YEAR 1993

LAYER	(INCHES)	(VOL/VOL)
1	0.92	0.1529
2	7.95	0.1892
3	1.85	0.1541
4	5.16	0.4300
5	7.96	0.1658
6	36.96	0.1400
7	2.58	0.4300
SNOW WATER	0.00	

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WHITE MESA TAILINGS FACILITY
CELL 4, DRY, WITHOUT LAYER 7 PVC LINER
BLANDING CLIMATE DATA
**********************************************************************

                POOR GRASS

                 LAYER  1
                 --------
            VERTICAL PERCOLATION LAYER
  THICKNESS                  =    6.00 INCHES
  POROSITY                   =    0.5010 VOL/VOL
  FIELD CAPACITY             =    0.2837 VOL/VOL
  WILTING POINT              =    0.1353 VOL/VOL
  INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY  =    0.000342000014 CM/SEC

                 LAYER  2
                 --------
            VERTICAL PERCOLATION LAYER
  THICKNESS                  =   42.00 INCHES
  POROSITY                   =    0.3325 VOL/VOL
  FIELD CAPACITY             =    0.2173 VOL/VOL
  WILTING POINT              =    0.1361 VOL/VOL
  INITIAL SOIL WATER CONTENT       =    0.1400 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY  =    0.000006000000 CM/SEC

                 LAYER  3
                 --------
             LATERAL DRAINAGE LAYER
  THICKNESS                  =   12.00 INCHES
  POROSITY                   =    0.3573 VOL/VOL
  FIELD CAPACITY             =    0.1127 VOL/VOL
  WILTING POINT              =    0.0580 VOL/VOL
  INITIAL SOIL WATER CONTENT       =    0.0600 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY  =    0.000050000002 CM/SEC
  SLOPE                  =    0.57 PERCENT
  DRAINAGE LENGTH            =  1750.0 FEET

                 LAYER  4
                 --------
              BARRIER SOIL LINER
  THICKNESS                  =   12.00 INCHES
  POROSITY                   =    0.4300 VOL/VOL
  FIELD CAPACITY             =    0.3663 VOL/VOL
  WILTING POINT              =    0.2802 VOL/VOL
  INITIAL SOIL WATER CONTENT       =    0.4300 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY  =    0.000000100000 CM/SEC

                 LAYER  5
                 --------
            VERTICAL PERCOLATION LAYER
  THICKNESS                  =   48.00 INCHES
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POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 6

VERTICAL PERCOLATION LAYER
THICKNESS = 264.00 INCHES
POROSITY = 0.3325 VOL/VOL
FIELD CAPACITY = 0.2173 VOL/VOL
WILTING POINT = 0.1361 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.1400 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000006000000 CM/SEC

LAYER 7

BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
THICKNESS = 6.00 INCHES
POROSITY = 0.4300 VOL/VOL
FIELD CAPACITY = 0.3663 VOL/VOL
WILTING POINT = 0.2802 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4300 VOL/VOL
SATURATED HYDRAULIC CONDUCTIVITY = 0.000000100000 CM/SEC
LINER LEAKAGE FRACTION = 1.00000000

GENERAL SIMULATION DATA

SCS RUNOFF CURVE NUMBER = 87.21
TOTAL AREA OF COVER = 1650000. SQ FT
EVAPORATIVE ZONE DEPTH = 28.00 INCHES
UPPER LIMIT VEG. STORAGE = 10.3210 INCHES
INITIAL VEG. STORAGE = 3.9200 INCHES
INITIAL SNOW WATER CONTENT = 0.0000 INCHES
INITIAL TOTAL WATER STORAGE IN
SOIL AND WASTE LAYERS = 58.8600 INCHES

SOIL WATER CONTENT INITIALIZED BY USER.

CLIMATOLOGICAL DATA

USER SPECIFIED RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
SOLAR RADIATION FOR MILFORD UTAH

MAXIMUM LEAF AREA INDEX = 1.60
START OF GROWING SEASON (JULIAN DATE) = 138
END OF GROWING SEASON (JULIAN DATE) = 276

NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
26.40	32.10	38.20	46.30	55.90	65.80
74.30	72.10	62.60	50.30	36.80	28.20

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MONTHLY TOTALS FOR YEAR 1988

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.60	0.50	0.02	0.78	1.27	1.40
	0.64	1.70	1.06	0.10	1.04	0.85
RUNOFF (INCHES)	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION (INCHES)	1.003	1.175	0.020	0.276	0.569	2.174
	0.834	1.644	1.388	0.100	0.306	0.395
LATERAL DRAINAGE FROM LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD ON LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00

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ANNUAL TOTALS FOR YEAR 1988

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	10.96	1507000.	100.00
RUNOFF	0.000	0.	0.00
EVAPOTRANSPIRATION	9.885	1359170.	90.19
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.0000	0.	0.00
CHANGE IN WATER STORAGE	1.075	147830.	9.81

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 SOIL WATER AT START OF YEAR        58.86      8093250.

 SOIL WATER AT END OF YEAR          59.94      8241080.

 SNOW WATER AT START OF YEAR         0.00          0.

 SNOW WATER AT END OF YEAR           0.00          0.

 ANNUAL WATER BUDGET BALANCE         0.00          1.     0.00
*************************************************************************
              MONTHLY TOTALS FOR YEAR 1990
-------------------------------------------------------------------------
                 JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                 ------- ------- ------- ------- ------- -------
 PRECIPITATION (INCHES)  1.11   0.38   0.57   0.80   0.85   1.13
                 1.91   0.80   1.69   1.82   1.43   0.90

RUNOFF (INCHES)        0.000  0.000  0.000  0.000  0.007  0.027
                 0.000  0.000  0.000  0.029  0.000  0.000

EVAPOTRANSPIRATION     0.788  1.136  0.566  0.413  1.864  0.758
   (INCHES)          2.272  0.908  1.597  1.707  1.245  0.648

LATERAL DRAINAGE FROM  0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  3 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM       0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  4 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM       0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  7 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 -------------------------------------------------------------------------
              MONTHLY SUMMARIES FOR DAILY HEADS
-------------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  4 (INCHES)     0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  4 (INCHES)  0.00   0.00   0.00   0.00   0.00   0.00

AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)     0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)  0.00   0.00   0.00   0.00   0.00   0.00
*************************************************************************
              ANNUAL TOTALS FOR YEAR 1990
-------------------------------------------------------------------------
                       (INCHES)   (CU. FT.)   PERCENT
                       --------   ---------   -------
 PRECIPITATION            13.39     1841125.   100.00

 RUNOFF                   0.063       8647.     0.47
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EVAPOTRANSPIRATION	13.902	1911521.	103.82
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.0000	0.	0.00
CHANGE IN WATER STORAGE	-0.575	-79043.	-4.29
SOIL WATER AT START OF YEAR	59.94	8241080.	
SOIL WATER AT END OF YEAR	59.36	8162037.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.00	0.	
ANNUAL WATER BUDGET BALANCE	0.00	0.	0.00

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MONTHLY TOTALS FOR YEAR 1991

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	1.22	0.45	1.40	0.01	0.49	0.05
	1.20	1.18	1.32	1.41	1.58	1.43
RUNOFF (INCHES)	0.018	0.000	0.008	0.000	0.000	0.000
	0.000	0.000	0.008	0.000	0.040	0.000
EVAPOTRANSPIRATION	1.306	0.588	1.407	0.366	0.094	0.384
(INCHES)	0.822	1.620	1.312	0.266	1.047	0.858
LATERAL DRAINAGE FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
STD. DEV. OF DAILY HEAD	0.00	0.00	0.00	0.00	0.00	0.00
ON LAYER 4 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00
AVG. DAILY HEAD ON	0.00	0.00	0.00	0.00	0.00	0.00
LAYER 7 (INCHES)	0.00	0.00	0.00	0.00	0.00	0.00

STD. DEV. OF DAILY HEAD 0.00 0.00 0.00 0.00 0.00 0.00
ON LAYER 7 (INCHES) 0.00 0.00 0.00 0.00 0.00 0.00

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ANNUAL TOTALS FOR YEAR 1991

	(INCHES)	(CU. FT.)	PERCENT
PRECIPITATION	11.74	1614250.	100.00
RUNOFF	0.074	10242.	0.63
EVAPOTRANSPIRATION	10.071	1384707.	85.78
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.	0.00
PERCOLATION FROM LAYER 4	0.0000	0.	0.00
PERCOLATION FROM LAYER 7	0.0000	0.	0.00
CHANGE IN WATER STORAGE	1.595	219302.	13.59
SOIL WATER AT START OF YEAR	59.36	8162037.	
SOIL WATER AT END OF YEAR	60.84	8365727.	
SNOW WATER AT START OF YEAR	0.00	0.	
SNOW WATER AT END OF YEAR	0.11	15612.	
ANNUAL WATER BUDGET BALANCE	0.00	0.	0.00

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MONTHLY TOTALS FOR YEAR 1992

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION (INCHES)	0.82	1.54	1.85	0.11	2.33	0.29
	2.20	1.26	0.90	1.24	0.27	2.29
RUNOFF (INCHES)	0.000	0.001	0.000	0.000	0.017	0.000
	0.075	0.000	0.000	0.000	0.000	0.002
EVAPOTRANSPIRATION (INCHES)	0.843	1.590	1.879	1.221	1.556	1.145
	3.021	0.936	1.226	0.371	0.440	1.060
LATERAL DRAINAGE FROM LAYER 3 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 4 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION FROM LAYER 7 (INCHES)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS

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-----------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  4 (INCHES)     0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  4 (INCHES)  0.00   0.00   0.00   0.00   0.00   0.00

AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)     0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)  0.00   0.00   0.00   0.00   0.00   0.00
***********************************************************************
              ANNUAL TOTALS FOR YEAR 1992
-----------------------------------------------------------------------
                      (INCHES)   (CU. FT.)   PERCENT
                      --------   ---------   -------
 PRECIPITATION          15.10     2076250.   100.00

 RUNOFF                0.095      13106.     0.63

 EVAPOTRANSPIRATION          15.290     2102365.   101.26

 LATERAL DRAINAGE FROM LAYER  3     0.0000        0.     0.00

 PERCOLATION FROM LAYER  4          0.0000        0.     0.00

 PERCOLATION FROM LAYER  7          0.0000        0.     0.00

 CHANGE IN WATER STORAGE           -0.285     -39220.    -1.89

 SOIL WATER AT START OF YEAR        60.84     8365727.

 SOIL WATER AT END OF YEAR         60.66     8341379.

 SNOW WATER AT START OF YEAR         0.11       15612.

 SNOW WATER AT END OF YEAR           0.01        740.

 ANNUAL WATER BUDGET BALANCE        0.00          0.     0.00
***********************************************************************
             MONTHLY TOTALS FOR YEAR 1993
-----------------------------------------------------------------------
                JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                ------- ------- ------- ------- ------- -------
PRECIPITATION (INCHES)  5.31   3.73   0.73   0.59   1.62   0.12
                 0.01   1.79   0.83   1.43   1.08   0.42

RUNOFF (INCHES)       0.284  0.490  0.000  0.000  0.000  0.000
                 0.000  0.000  0.000  0.000  0.000  0.000

EVAPOTRANSPIRATION     0.950  1.449  1.728  1.303  0.837  0.996
   (INCHES)          1.475  1.277  1.048  1.531  1.219  0.369
```

```
LATERAL DRAINAGE FROM   0.0000 0.0000 0.0000 0.0000 0.0001 0.0001
 LAYER  3 (INCHES)    0.0001 0.0001 0.0001 0.0001 0.0000 0.0000

PERCOLATION FROM       0.0000 0.0000 0.0655 0.1240 0.1349 0.1326
 LAYER  4 (INCHES)    0.1371 0.1357 0.1292 0.1309 0.1239 0.1250

PERCOLATION FROM       0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
 LAYER  7 (INCHES)    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
-----------------------------------------------------------------------
            MONTHLY SUMMARIES FOR DAILY HEADS
-----------------------------------------------------------------------
AVG. DAILY HEAD ON       0.00   0.00   0.64   2.62   3.36   3.60
 LAYER  4 (INCHES)      3.59   3.43   3.18   2.88   2.55   2.21

STD. DEV. OF DAILY HEAD  0.00   0.00   0.69   0.35   0.12   0.03
 ON LAYER  4 (INCHES)   0.03   0.06   0.08   0.09   0.10   0.10

AVG. DAILY HEAD ON       0.00   0.00   0.00   0.00   0.00   0.00
 LAYER  7 (INCHES)      0.00   0.00   0.00   0.00   0.00   0.00

STD. DEV. OF DAILY HEAD  0.00   0.00   0.00   0.00   0.00   0.00
 ON LAYER  7 (INCHES)   0.00   0.00   0.00   0.00   0.00   0.00
***********************************************************************
            ANNUAL TOTALS FOR YEAR 1993
-----------------------------------------------------------------------
                      (INCHES)  (CU. FT.)  PERCENT
                      --------  ---------  -------
 PRECIPITATION          17.66    2428250.   100.00

 RUNOFF                0.774     106369.     4.38

 EVAPOTRANSPIRATION    14.183    1950185.   80.31

 LATERAL DRAINAGE FROM LAYER  3   0.0005      69.    0.00

 PERCOLATION FROM LAYER  4        1.2386    170301.    7.01

 PERCOLATION FROM LAYER  7        0.0000       0.    0.00

 CHANGE IN WATER STORAGE          2.703     371627.   15.30

 SOIL WATER AT START OF YEAR      60.66    8341379.

 SOIL WATER AT END OF YEAR        63.37    8713746.

 SNOW WATER AT START OF YEAR       0.01       740.

 SNOW WATER AT END OF YEAR         0.00         0.

 ANNUAL WATER BUDGET BALANCE       0.00         0.    0.00
***********************************************************************
   AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1988 THROUGH 1993
-----------------------------------------------------------------------
            JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
```

```
              ------- ------- ------- ------- ------- -------
PRECIPITATION
-------------
 TOTALS          2.01   1.32   0.91   0.46   1.31   0.60
            1.19   1.35   1.16   1.20   1.08   1.18

 STD. DEVIATIONS   1.86   1.43   0.72   0.37   0.71   0.62
            0.90   0.40   0.35   0.65   0.51   0.72

RUNOFF
------
 TOTALS          0.060  0.098  0.002  0.000  0.005  0.005
            0.015  0.000  0.002  0.006  0.008  0.000

 STD. DEVIATIONS   0.125  0.219  0.004  0.000  0.007  0.012
            0.034  0.000  0.003  0.013  0.018  0.001

EVAPOTRANSPIRATION
------------------
 TOTALS          0.978  1.188  1.120  0.716  0.984  1.091
            1.685  1.277  1.315  0.795  0.852  0.666

 STD. DEVIATIONS   0.202  0.385  0.798  0.502  0.722  0.670
            0.954  0.355  0.202  0.761  0.446  0.298

LATERAL DRAINAGE FROM LAYER  3
------------------------------
 TOTALS          0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

 STD. DEVIATIONS   0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

PERCOLATION FROM LAYER  4
-------------------------
 TOTALS          0.0000 0.0000 0.0131 0.0248 0.0270 0.0265
            0.0274 0.0271 0.0258 0.0262 0.0248 0.0250

 STD. DEVIATIONS   0.0000 0.0000 0.0293 0.0555 0.0603 0.0593
            0.0613 0.0607 0.0578 0.0585 0.0554 0.0559

PERCOLATION FROM LAYER  7
-------------------------
 TOTALS          0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

 STD. DEVIATIONS   0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
            0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

***********************************************************************
AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1988 THROUGH 1993
-----------------------------------------------------------------------
                    (INCHES)      (CU. FT.)   PERCENT
                  ---------------  -----------  -------
```

PRECIPITATION	13.77	(2.695)	1893375.	100.00
RUNOFF	0.201	(0.322)	27673.	1.46
EVAPOTRANSPIRATION	12.666	(2.509)	1741590.	91.98
LATERAL DRAINAGE FROM LAYER 3	0.0001	(0.0002)	14.	0.00
PERCOLATION FROM LAYER 4	0.2477	(0.5539)	34060.	1.80
PERCOLATION FROM LAYER 7	0.0000	(0.0000)	0.	0.00
CHANGE IN WATER STORAGE	0.903	(1.355)	124099.	6.55

****

PEAK DAILY VALUES FOR YEARS 1988 THROUGH 1993

	(INCHES)	(CU. FT.)
PRECIPITATION	1.33	182875.0
RUNOFF	0.209	28712.2
LATERAL DRAINAGE FROM LAYER 3	0.0000	0.3
PERCOLATION FROM LAYER 4	0.0044	609.1
HEAD ON LAYER 4	3.6	
PERCOLATION FROM LAYER 7	0.0000	0.0
HEAD ON LAYER 7	0.0	
SNOW WATER	2.53	348554.3
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3469	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1354	

****

FINAL WATER STORAGE AT END OF YEAR 1993

LAYER	(INCHES)	(VOL/VOL)
1	0.92	0.1529
2	7.95	0.1892
3	1.85	0.1541
4	5.16	0.4300
5	7.96	0.1658
6	36.96	0.1400
7	2.58	0.4300
SNOW WATER	0.00	

****

APPENDIX D

PERCHED WATER SEEPAGE VELOCITY, TRAVEL TIME, FLUX CALCULATIONS

TITAN Environmental

By JFL Date 7/20/94 Subject MOISTURE RETENTION BENEATH WET CELL Sheet No 1 of 2

Chkd by RMW Date 7/22/94 Proj No 4111-001

1/5" x 1/5"

OBJECTIVE: TO ESTIMATE THE AMOUNT OF MOISTURE STORAGE IN THE UNSATURATED PORTION OF THE DAKOTA/BURRO CANYON SANDSTONE BENEATH A WET TAILINGS DISPOSAL CELL. ALSO, GIVEN THE HELP MODEL RESULTS, AN ESTIMATE OF TIME FOR CONSTITUENTS TO MIGRATE FROM THE BOTTOM OF A CELL TO THE PERCHED WATER TABLE CAN BE MADE.

TABLE 1 PRESENTS THE RESULTS OF MOISTURE RETENTION TESTS FOR THE DAKOTA/BURRO CANYON. THIS TABLE INDICATES THAT 5.48 % MOISTURE IS RETAINED BY THESE UNITS UNDER GRAVITY DRAINAGE.

FIGURES 1 THRU 3 ARE WELL LOGS FOR WELLS WMMW-17, -18, AWO-19. THESE DATA INDICATE THAT THE UNSATURATED ZONE HAS THE FOLLOWING THICKNESS:

WELL #	SURFACE ELEVATION	WATER ELEVATION	UNSATURATED THICKNESS
WMMW-17	5575.06	5488.56	86.5 Ft
WMMW-18	5657.58	5565.58	92.0 Ft.
WMMW-19	5655.05	5505.05	150 Ft.
		Avg:	109.5 Ft.

AS SHOWN IN THE HELP MODEL - THE AREA OF THE WET CELL (CELL #3) IS APPROXIMATELY: 3,150,000 Ft^2. THE TOTAL VOLUME OF MOISTURE STORAGE BENEATH THIS CELL WOULD BE ESTIMATED AT:

$$3{,}150{,}000\ Ft^2 \times 109.5\ Ft \times 0.0548 = \underline{18{,}901{,}890\ Ft^3}$$

BASED ON THE HELP MODEL RESULTS (TABLE 2) THE ESTIMATED INFILTRATION INTO THE UNSATURATED ZONE FOR A WET CELL (USING 20 YEAR SIMULATION DATA FOR GRAND JUNCTION, CO). IS:

CELL W/ LEAKY LINER : 120,661 Ft^3/yr. (Avg)

CELL W/O LINER : 390,507 Ft^3/yr. (Avg).

TITAN Environmental

By JFL Date 7/26/94 Subject MOISTURE RETENTION BENEATH WET CELL Sheet No 2 of 2

Chkd by PLW Date 7/22/94 Proj No 4111-001

1/5" x 1/5"

THE ESTIMATE TIME TO FILL THE AVAILABLE STORAGE IN THE DAKOTA / BURRO CANYON SANDSTONE (18,901,890 ft^3) IS:

CELL W/ LEAKY LINER: $\frac{18,901,890\ ft^3}{120,661\ ft^3/yr} = \sim 156$ YEARS.

CELL W/O LINER: $\frac{18,901,890\ ft^3}{390,507\ ft^3/yr} = \sim 48$ YEARS.

THEREFORE THE ESTIMATE TIME TO REACH THE PERCHED WATER OF THE DAKOTA / BURRO CANYON RANGES FROM 50 to 150 YEARS.

Dup 7/22/94

Table 1

Properties of the Dakota/Burro Canyon Sandstones

Well No. and Sample Interval		Moisture Content (Percent)	Moisture Content Volumetric	Dry Unit Weight (lbs/cu ft)	Porosity (Percent)	Particle Sp. Gr.	Saturation (Percent)	Retained Moisture	Liquid Limit	Plastic Limit	Plasticity Index	Rock Type	Formation
WMMW-16	26.4' - 38.4'	1.51	3.3	135.2	17.9	2.64	18.2	5.1				Sandstone	Dakota
WMMW-16	37.8' - 38.4'	0.4	0.8	127.4	22.4	63	3.7	6.3				Sandstone	Dakota
WMMW-16	45.0' - 45.5'	5.6	12.6	140.9	16.4	2.7	77.2		29.6	15.4	14.2	Sandy Mudstone	Burro Canyon
WMMW-16	47.5' - 48.0'	2.56	5.9	142.8	12	2.6	48.9	4.37				Sandstone	Burro Canyon
WMMW-16	53.5' - 54.1'	0.68	1.4	129	19.9	2.58	7.1	6.38				Sandstone	Burro Canyon
WMMW-16	60.5' - 61.0'	0.11	0.2	117.9	27.3	2.61	0.8	9.89				Sandstone	Burro Canyon
WMMW-16	65.5' - 66.0'	2.62	5.5	131.5	19.3	2.62	28.2	7.13				Sandstone	Burro Canyon
WMMW-16	73.0' - 73.5'	0.13	0.3	130.3	20.6	2.63	1.3	5.5				Sandstone	Burro Canyon
WMMW-16	82.0' - 82.4'	0.05	0.1	134.3	18.5	2.64	0.6	4.78				Sandstone	Burro Canyon
WMMW-16	90.0' - 90.7	0.12	0.3	161.5	2	2.64	12.8	0.85				Sandstone	Burro Canyon
WMMW-16	91.1' - 91.4'	5.2	9.8	118.1	29.1	2.67	33.8		33.7	16.2	17.5	Claystone	Burro Canyon
WMMW-17	27.0' - 27.5'	0.29	0.6	138.8	13.4	2.57	4.8	5.11				Sandstone	Dakota
WMMW-17	49.0' - 49.5	3.62	7.1	121.9	26	2.64	27.2	9.6				Sandstone	Dakota
WMMW-17	104.0' - 104.5'	0.17	0.4	161.4	1.7	2.67	26.6	0.81				Sandstone	Burro Canyon
Average:		1.65	3.4	135	17.6	2.63	21	5.48					

Figure 1

✓ Phw 7/22/94

PEEL Environmental Services
Arvada, CO (303)422-5116

Project: White Mesa	Surface Elev. 5657.58	T. D. = 148.5'	Hole No.: WMMW-18
Date: 12/07/92	Depth to Water: 92'	Geologist: F. A. Peel	UMETCO Minerals Corporation

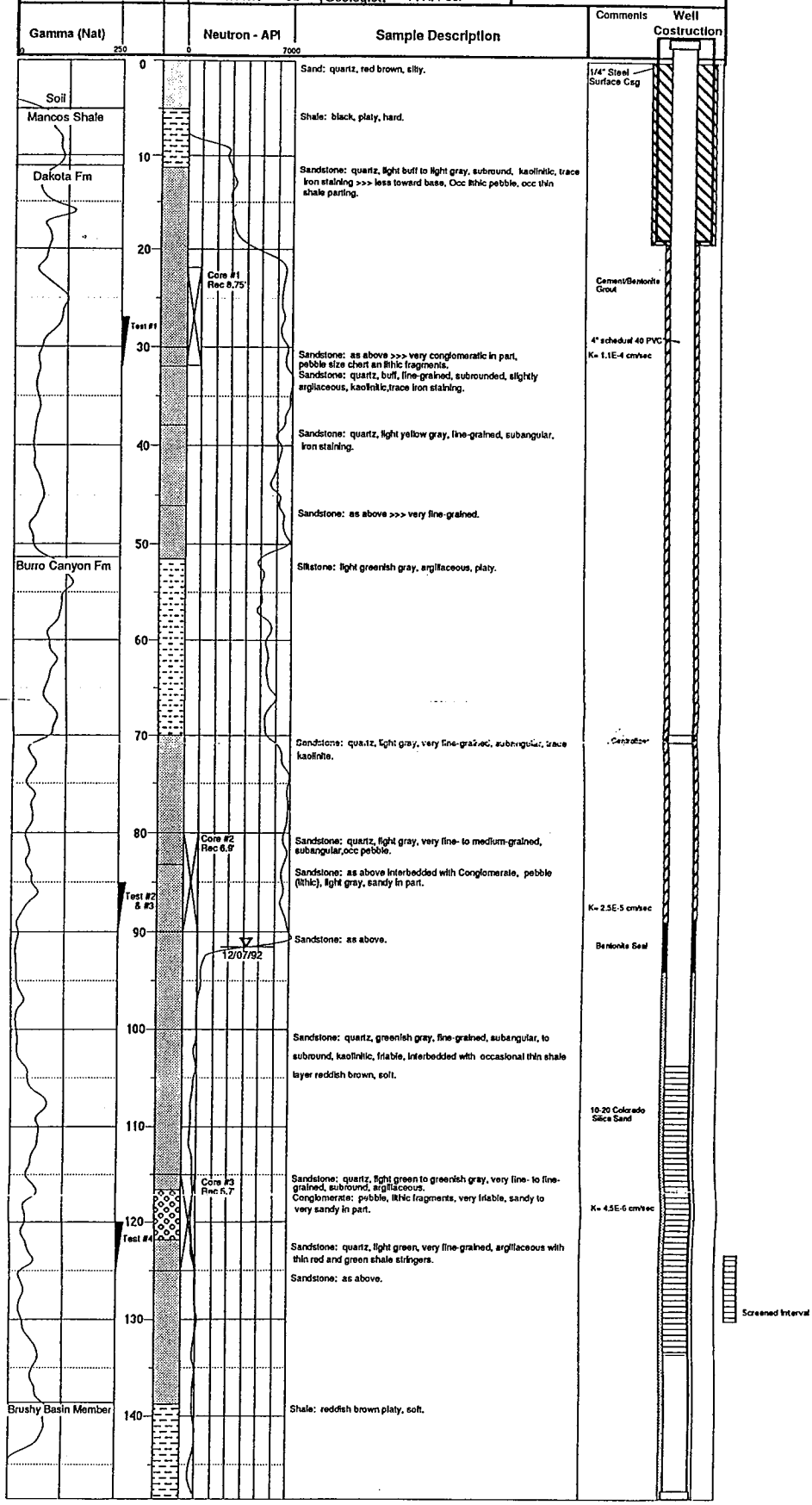


FIGURE 2

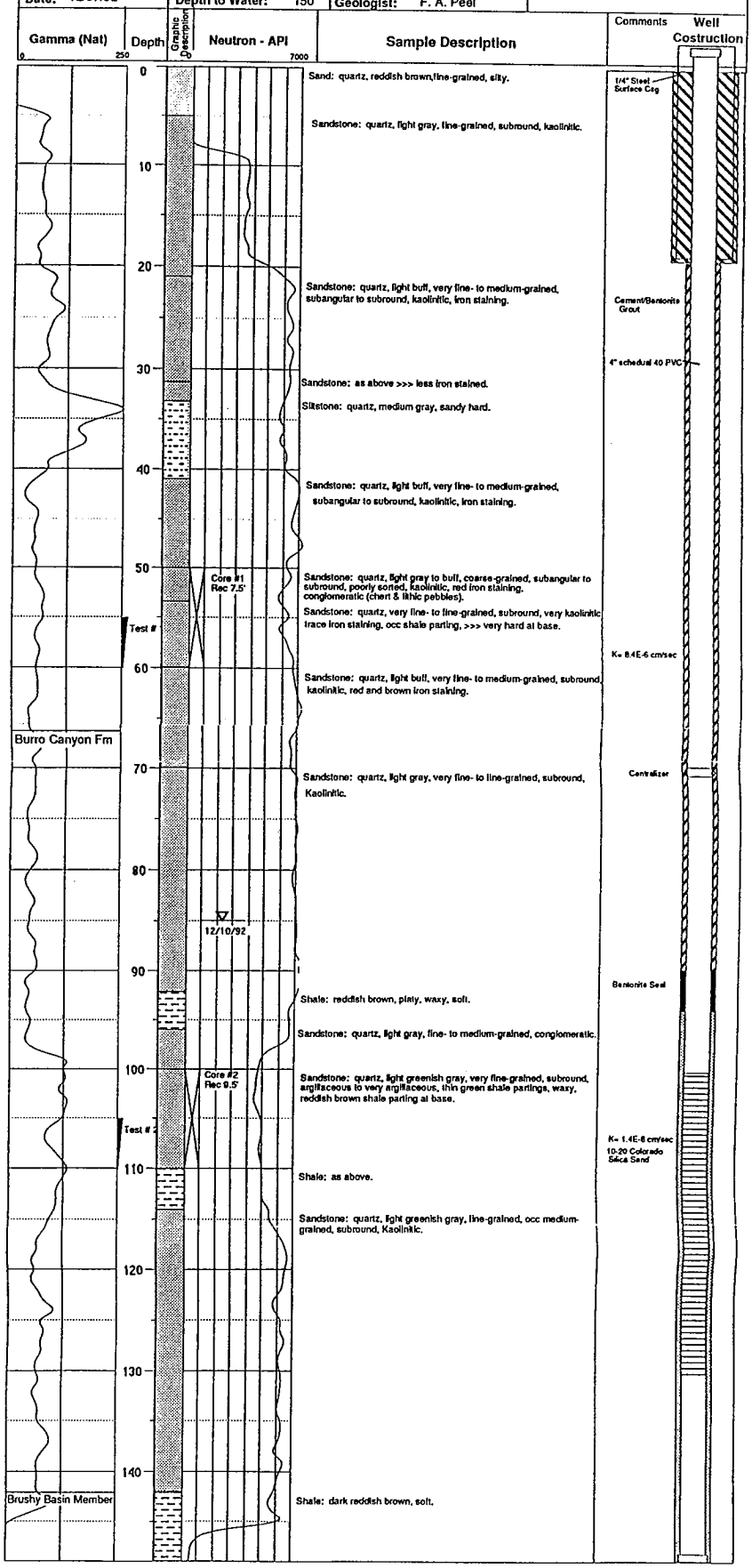
PMW 7/22/94

PEEL Environmental Services
Arvada, CO (303)422-5116

Borehole No.: WMMW-19

Project: White Mesa | Surface Elev. 5655.05 | T. D. = 149 | UMETCO Minerals Corporation

Date: 12/07/92 | Depth to Water: 150 | Geologist: F. A. Peel



Note: well was logged before the well recharged

PEEL Environmental Services
Arvada, CO (303)422-5118

Bore Hole No. : WMMW-17

Project: White Mesa	Surface Elev. 5575.06	T. D. = 110'	UMETCO Minerals Corporation
Date: 12/07/92	Depth to Water: 86.5'	Geologist: F. A. Peel	

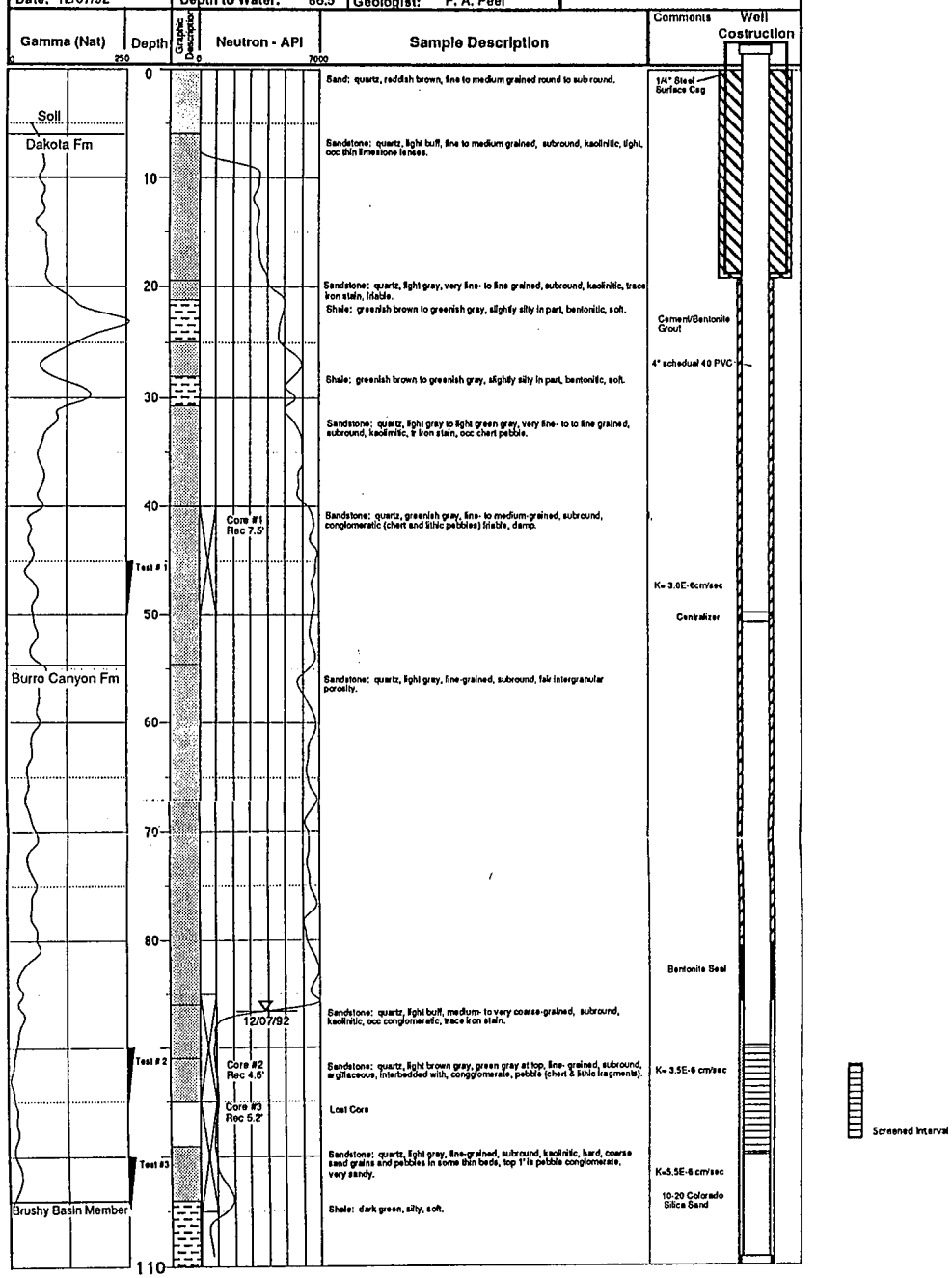


FIGURE 3

✓ [illegible] 2/22/94

Table 2
HELP Model Summaries for Cells 3 and 4
White Mesa Tailings Facility, Blanding, Utah

HELP Run	Precipitation (inches)	Runoff (inches)	Evapotranspiration (inches)	Lateral Drainage from Layer 3 (ft^3)	Percolation from Layer 4 (ft^3)	Percolation from Layer 7 (ft^3)	Change in Water Storage
Cell 3, saturated with PVC liner, Blanding climate data	13.77	0.2	12.67	26	64989	137415	99352
Cell 3, saturated, no liner, Blanding climate data	13.77	0.2	12.67	26	64989	1562025	-1325258
Cell 3, saturated, with PVC liner and 20 yrs Grand Junction climate data	7.94	0	7.93	0	0	120661	-117348
Cell 3, saturated, no liner and 20 yrs Grand Junction climate data	7.94	0	7.93	0	0	390507	-387194
Cell 4, unsaturated with PVC liner, Blanding climate data	13.77	0.2	12.67	14	34060	0	124099
Cell 4, unsaturated, no liner, Blanding climate data	13.77	0.2	12.67	14	34060	0	124099

4 YRS. OF DATA

FMW
7/22/94

TITAN Environmental

By JFL Date 7/20/94 Subject BURRO CANYON - SEEPAGE VELOCITY, TRAVEL TIME, FLUX. Sheet No 1 of 3

Chkd by [illegible] Date 7/22/94 Proj No 4111-001

1/5" × 1/5"

OBJECTIVE: TO CALCULATE SEEPAGE VELOCITY IN SATURATED PORTION OF BURRO CANYON FORMATION. ALSO, USE SEEPAGE VELOCITY TO ESTIMATE TRAVEL TIME FROM WHITE MESA SITE TO EDGE OF MESA, AND FLUX UNDER THE SITE.

SEEPAGE VELOCITY CALCULATION:

TABLE 1 SUMMARIZES HYDRAULIC CONDUCTIVITY FOR BURRO CANYON FORMATION. THE GEOMETRIC MEAN FOR THE BURRO CANYON HYDRAULIC CONDUCTIVITY IS 1.01E-5 cm/sec OR 10.5 FEET/YEAR.

TABLE 2 SUMMARIZES THE PHYSICAL PROPERTIES FOR THE BURRO CANYON. AS SHOWN, THE AVERAGE POROSITY IS 17.6 PERCENT.

FIGURE 1 PRESENTS A PERCHED WATER LEVEL MAP. BASED ON THIS FIGURE, THE HYDRAULIC GRADIENT WITHIN THE BURRO CANYON UNDER THE SITE IS 0.015 FEET/FOOT.

USING DARCY'S LAW:

$$\text{SEEPAGE VELOCITY} = \frac{Ki}{n}$$

K = HYDRAULIC CONDUCTIVITY

i = HYDRAULIC GRADIENT

n = POROSITY (EFFECTIVE)

BASED ON SITE DATA:

$$\text{SEEPAGE VELOCITY} = \frac{(10.5)(0.015)}{0.176} = \underline{0.89 \text{ FEET/YEAR}}$$

TITAN Environmental

By JFL Date 7/20/94 Subject Burro Canyon - SEEPAGE Sheet No 2 of 3
Chkd By [illegible] Date 7/22/94 Velocity, Travel Time, Flux Proj No 4111-001
1/5" × 1/5"

FLUX ESTIMATE

THE FLUX (VOLUMETRIC FLOW) WITHIN THE SATURATED PORTION OF THE BURRO CANYON CAN BE ESTIMATED USING THE AVERAGE VELOCITY ($V=Ki$) AND THE SATURATED FLOW FACE AREA BENEATH THE SITE.

THE SATURATED FLOW FACE AREA IS EQUAL TO THE SITE WIDTH (PERPENDICULAR TO FLOW) MULTIPLIED BY SATURATED THICKNESS.

FIGURE 2 SHOWS THE SATURATED THICKNESS OF THE PERCHED WATER WITHIN THE BURRO CANYON. IN THE CENTER OF THE SITE, THE SITE WIDTH IS 3800 FEET. THE SATURATED THICKNESS IS APPROXIMATELY 23 FEET (ESTIMATED OFF MAP).

THE FLOW FACE AREA IS: $3800 \times 23 = 87{,}400\ Ft^2$

THE AVERAGE FLOW VELOCITY IS ($V=Ki$): $(10.5)(.015) = 0.16\ Ft/yr$

THE FLUX = $87{,}400 \times 0.16 = \underline{13{,}765.5\ Ft^3/yr}$

$= \underline{102{,}966\ \text{gallons/yr}}$

$= \underline{0.2\ \text{gallons/minute (gpm)}}$

TITAN Environmental

By JFL Date 7/20/94 Subject BURRO CANYON- SEEPAGE VELOCITY, TRAVEL TIME, FLUX Sheet No 3 of 3

Chkd by [illegible] Date 7/22/94 Proj No 4111-001

1/5" × 1/5"

TRAVEL TIME ESTIMATE:

TRAVEL TIME THROUGH THE SATURATED PORTION OF THE BURRO CANYON FROM THE WHITE MESA SITE TO THE ADJACENT CANYONS CAN BE ESTIMATED USING SEEPAGE VELOCITY AND DISTANCE FROM SITE TO CANYONS.

FIGURE 3 SHOWS THE SITE LAYOUT WITH RESPECT TO ADJACENT CORRAL & WESTWATER CANYONS. FIGURE 2 ALSO SHOWS DISTANCES FROM THE CENTER OF CELL #3 AT THE SITE TO DOWNGRADIENT EDGES OF CANYONS.

AS SHOWN THE DOWNGRADIENT DISTANCES FROM THE SITE RANGE FROM 8,000 TO 12,000 FEET.

TRAVEL TIME CAN BE ESTIMATED AS:

$$\text{TRAVEL TIME} = GWTT = \frac{\text{DISTANCE}}{\text{SEEPAGE VELOCITY}}$$

USING A SEEPAGE VELOCITY OF 0.89 FEET/YR.,

GWTT RANGES FROM + 8,900 + + 13,400 YEARS.

Table ~~1~~ 2 — Hydraulic

Summary of ~~Hydrologic~~ Properties
White Mesa Tailings Facility, Blanding, Utah

Pmw 7/22/94

Boring/Well Location	Test Type	Interval (ft-ft)	Document Referenced		Hydraulic Conductivity (ft/yr)	Hydraulic Conductivity (cm/sec)
Soils						
6	Laboratory Test	9	D&M		1.2E+01	1.2E-05
7	Laboratory Test	4.5	D&M		1.0E+01	1.0E-05
10	Laboratory Test	4	D&M		1.2E+01	1.2E-05
12	Laboratory Test	9	D&M		1.4E+02	1.4E-04
16	Laboratory Test	4.5	D&M		2.2E+01	2.1E-05
17	Laboratory Test	4.5	D&M		9.3E+01	9.0E-05
19	Laboratory Test	4	D&M		7.0E+01	6.8E-05
22	Laboratory Test	4	D&M		3.9E+00	3.8E-06
			Geometric Mean		2.45E+01	2.37E-05
Dakota Sandstone						
No. 3	Injection Test	28-33	D&M	1	5.68E+02	5.49E-04
No. 3	Injection Test	33-42.5	D&M		2.80E+00	2.71E-06
No. 12	Injection Test	16-22.5	D&M		5.10E+00	4.93E-06
No. 12	Injection Test	22.5-37.5	D&M		7.92E+01	7.66E-05
No. 19	Injection Test	26-37.5	D&M		7.00E+00	6.77E-06
No. 19	Injection Test	37.5-52.5	D&M		9.44E+02	9.12E-04
			Geometric Mean		4.03E+01	3.89E-05
Burro Canyon Formation						
No. 3	Injection Test	42.5-52.5	D&M		5.80E+00	5.61E-06
No. 3	Injection Test	52.5-63	D&M		1.62E+01	1.57E-05
No. 3	Injection Test	63-72.5	D&M		5.30E+00	5.13E-06
No. 3	Injection Test	72.5-92.5	D&M		3.20E+00	3.09E-06
No. 3	Injection Test	92.5-107.5	D&M		4.90E+00	4.74E-06
No. 3	Injection Test	122.5-142	D&M		6.00E-01	5.80E-07
No. 9	Injection Test	27.5-42.5	D&M		2.70E+00	2.61E-06
No. 9	Injection Test	42.5-59	D&M		2.00E+00	1.93E-06
No. 9	Injection Test	59-82.5	D&M		7.00E-01	6.77E-07
No. 9	Injection Test	82.5-107.5	D&M		1.10E+00	1.06E-06
No. 9	Injection Test	107.5-132	D&M		3.00E-01	2.90E-07
No. 12	Injection Test	37.5-57.5	D&M		9.01E-01	8.70E-07
No. 12	Injection Test	57.5-82.5	D&M		1.40E+00	1.35E-06
No. 12	Injection Test	82.5-102.5	D&M		1.07E+01	1.03E-05
No. 28	Injection Test	76-87.5	D&M		4.30E+00	4.16E-06
No. 28	Injection Test	87.5-107.5	D&M		3.00E-01	2.90E-07
No. 28	Injection Test	107.5-132.5	D&M		2.00E-01	1.93E-07
WMMW1	7 Recovery	92-112	Peel	2	3.00E+00	2.90E-06
WMMW3	7 Recovery	67-87	Peel		2.97E+00	2.87E-06
WMMW5	7 Recovery	95.5-133.5	H-E		1.31E+01	1.27E-05
WMMW5	7 Recovery	95.5-133.5	Peel		2.10E+01	2.03E-05
WMMW11	7 Recovery	90.7-130.4	H-E	3	1.23E+03	1.19E-03
WMMW11	7 Single well drawdown	90.7-130.4	Peel		1.63E+03	1.58E-03
WMMW12	7 Recovery	84-124	H-E		6.84E+01	6.61E-05
WMMW12	7 Recovery	84-124	Peel		6.84E+01	6.61E-05
WMMW14	Single well drawdown	90-120	5 H-E		1.21E+03	1.16E-03
WMMW14	Single well drawdown	90-120	6 H-E		4.02E+02	3.88E-04
WMMW15	Single well drawdown	99-129	H-E		3.65E+01	3.53E-05
WMMW15	7 Recovery	99-129	Peel		2.58E+01	2.49E-05

MEHYD.XLS/[7/21/94]

Table 1 Hydraulic

Summary of ~~Hydrologic~~ Properties
White Mesa Tailings Facility, Blanding, Utah
(Continued)

Pmw 7/22/94

Boring/Well Location	Test Type	Interval (ft-ft)	Document Referenced	Hydraulic Conductivity (ft/yr)	Hydraulic Conductivity (cm/sec)
WMMW16	Injection Test	28.5-31.5	Peel	9.42E+02	9.10E-04
WMMW16	Injection Test	45.5-51.5	Peel	5.28E+01	5.10E-05
WMMW16	Injection Test	65.5-71.5	Peel	8.07E+01	7.80E-05
WMMW16	Injection Test	85.5-91.5	Peel	3.00E+01	2.90E-05
WMMW17	Injection Test	45-50	Peel	3.10E+00	3.00E-06
WMMW17	Injection Test	90-95	Peel	3.62E+00	3.50E-06
WMMW17	Injection Test	100-105	Peel	5.69E+00	5.50E-06
WMMW18	Injection Test	27-32	Peel	1.14E+02	1.10E-04
WMMW18	Injection Test	85-90	Peel	2.59E+01	2.50E-05
WMMW18	Injection Test	85-90	Peel	2.69E+01	2.60E-05
WMMW18	Injection Test	120-125	Peel	4.66E+00	4.50E-06
WMMW18	Injection Test	55-60	Peel	8.69E+00	8.40E-06
WMMW19	Injection Test	95-100	Peel	1.45E+00	1.40E-06
WMMW19	Injection Test		Geometric mean	1.05E+01	1.01E-05
Brushy Basin Member Garfield County, Utah	Injection Test	NA	D'Appolonia (4b)	2.07E+00	2.00E-06
	Injection Test	NA	D'Appolonia	2.07E+01	2.00E-05
	Injection Test	NA	D'Appolonia	9.30E+00	9.00E-06
	Injection Test	NA	D'Appolonia	2.69E+01	2.60E-05
	Injection Test	NA	D'Appolonia	5.17E+01	5.00E-05
	Injection Test	NA	D'Appolonia	5.27E+01	5.10E-05
	Injection Test	NA	D'Appolonia	3.21E+01	3.10E-05
	Injection Test	NA	D'Appolonia	4.24E+01	4.10E-05
	Injection Test	NA	D'Appolonia	1.00E+00	1.00E-06
	Injection Test	NA	D'Appolonia	2.89E+01	2.80E-05
	Injection Test	NA	Geometric Mean	1.65E+01	1.60E-05
Entrada/Navajo Sandstones WW-1	Recovery		D'Appolonia (4a)	3.80E+02	3.67E-04
WW-1	Multi-well drawdown		" "	4.66E+02	4.50E-04
WW-1,2,3	Multi-well drawdown		" "	4.24E+02	4.10E-04
			Geometric Mean	4.22E+02	4.08E-04

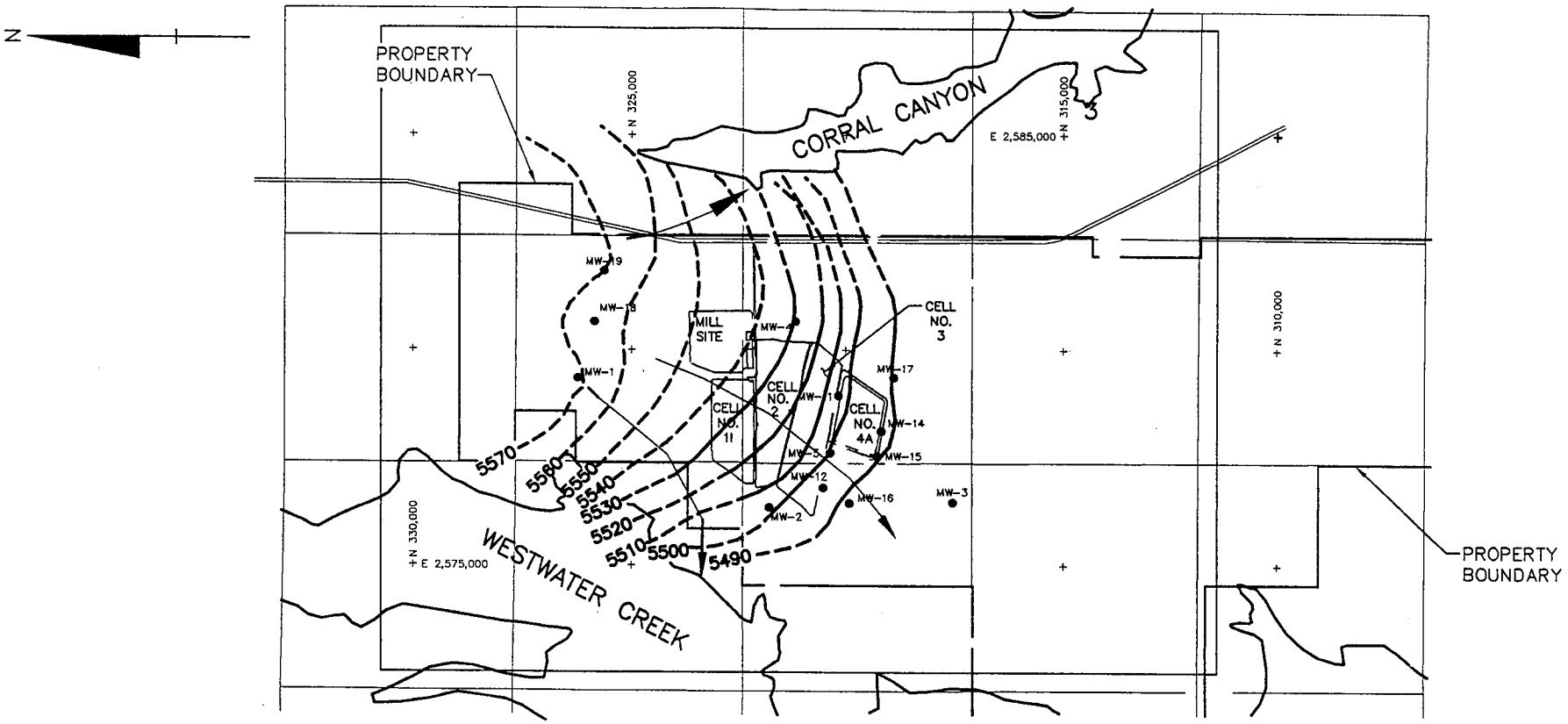
Notes:
(1) D&M = Dames & Moore, Environmental Report, White Mesa Uranium Project, January, 1978.
(2) Peel = Peel Environmental Services, UMETCO Minerals Corp., Ground Water Study, White Mesa Facility, June, 1994.
(3) H-E = Hydro-Engineering, Groundj-Water Hydrology at the White Mesa Tailings Facility, July, 1991.
(4a) D'Appolonia, Assessment of the Water Supply System, White Mesa Project, Feb. 1981
(4b) D'Appolonia, Geotechnical Site Evaluation, Farley Project, Garfield Co., Utah, June, 1984.
(5) Early test data.
(6) Late test data.
(7) Test data reanalyzed by TEC.

Table 2

Properties of the Dakota/Burro Canyon Sandstones

Well No. and Sample Interval		Moisture Content (Percent)	Moisture Content Volumetric	Dry Unit Weight (lbs/cu ft)	Porosity (Percent)	Particle Sp. Gr.	Saturation (Percent)	Retained Moisture	Liquid Limit	Plastic Limit	Plasticity Index	Rock Type	Formation
WMMW-16	26.4' - 38.4'	1.51	3.3	135.2	17.9	2.64	18.2	5.1				Sandstone	Dakota
WMMW-16	37.8' - 38.4'	0.4	0.8	127.4	22.4	63	3.7	6.3				Sandstone	Dakota
WMMW-16	45.0' - 45.5'	5.6	12.6	140.9	16.4	2.7	77.2		29.6	15.4	14.2	Sandy Mudstone	Burro Canyon
WMMW-16	47.5' - 48.0'	2.56	5.9	142.8	12	2.6	48.9	4.37				Sandstone	Burro Canyon
WMMW-16	53.5' - 54.1'	0.68	1.4	129	19.9	2.58	7.1	6.38				Sandstone	Burro Canyon
WMMW-16	60.5' - 61.0'	0.11	0.2	117.9	27.3	2.61	0.8	9.89				Sandstone	Burro Canyon
WMMW-16	65.5' - 66.0'	2.62	5.5	131.5	19.3	2.62	28.2	7.13				Sandstone	Burro Canyon
WMMW-16	73.0' - 73.5'	0.13	0.3	130.3	20.6	2.63	1.3	5.5				Sandstone	Burro Canyon
WMMW-16	82.0' - 82.4'	0.05	0.1	134.3	18.5	2.64	0.6	4.78				Sandstone	Burro Canyon
WMMW-16	90.0' - 90.7	0.12	0.3	161.5	2	2.64	12.8	0.85				Sandstone	Burro Canyon
WMMW-16	91.1' - 91.4'	5.2	9.8	118.1	29.1	2.67	33.8		33.7	16.2	17.5	Claystone	Burro Canyon
WMMW-17	27.0' - 27.5'	0.29	0.6	138.8	13.4	2.57	4.8	5.11				Sandstone	Dakota
WMMW-17	49.0' - 49.5	3.62	7.1	121.9	26	2.64	27.2	9.6				Sandstone	Dakota
WMMW-17	104.0' - 104.5'	0.17	0.4	161.4	1.7	2.67	26.6	0.81				Sandstone	Burro Canyon
Average:		1.65	3.4	135	17.6	2.63	21	5.48					

DRAWING NUMBER 4111-B9



LEGEND:

5550 CONTOUR IN FEET ABOVE MEAN SEA LEVEL

SCALE

2000 0 2000 4000 FEET

PERCHED GROUND WATER LEVELS
WHITE MESA MILL
BLANDING, UTAH

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

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FIGURE 2.4

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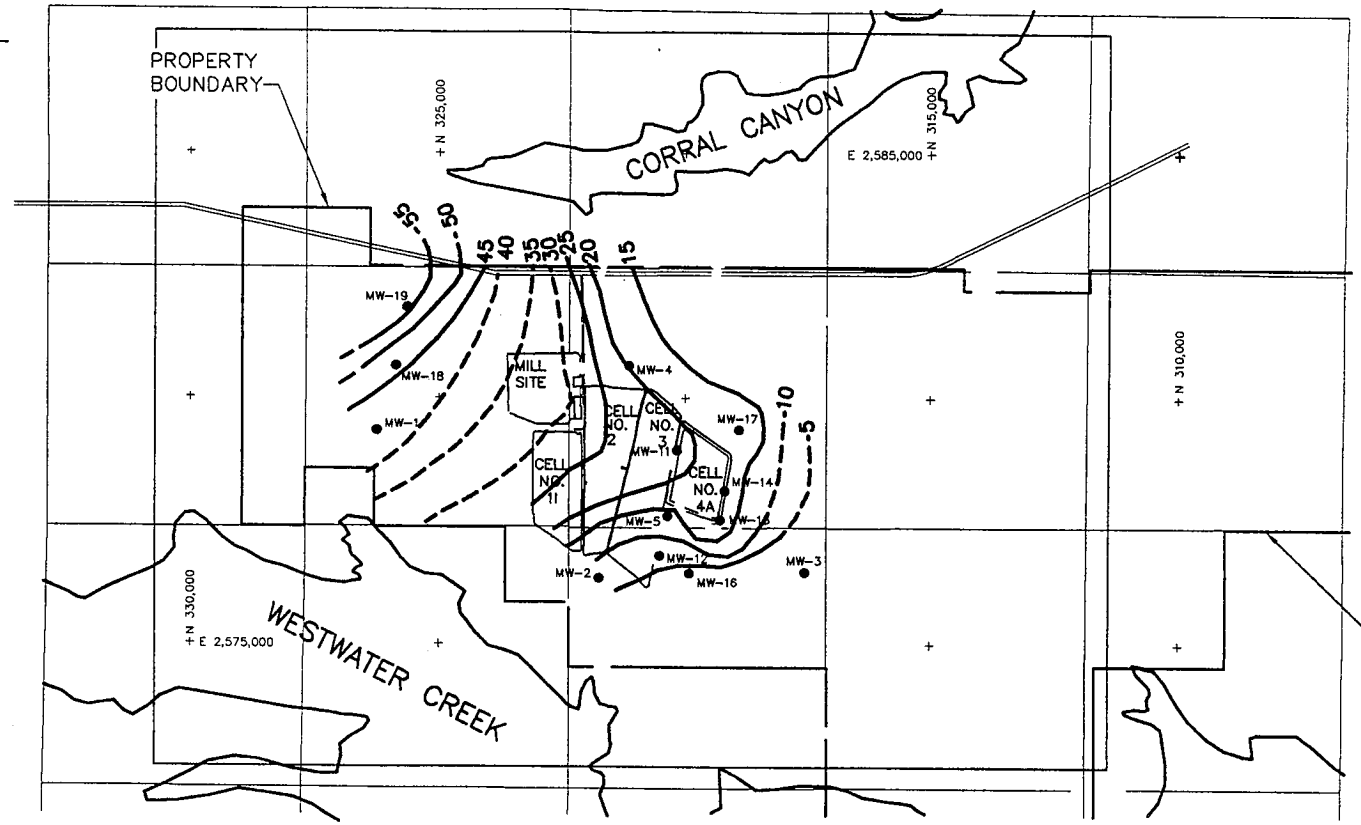
DRAWING NUMBER 4111-B8



SCALE

2000 0 2000 4000 FEET

LEGEND:

-5 SATURATED THICKNESS IN FEET

SATURATED THICKNESS
BURRO CANYON FORMATION
WHITE MESA MILL
BLANDING, UTAH

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FIGURE 2.5

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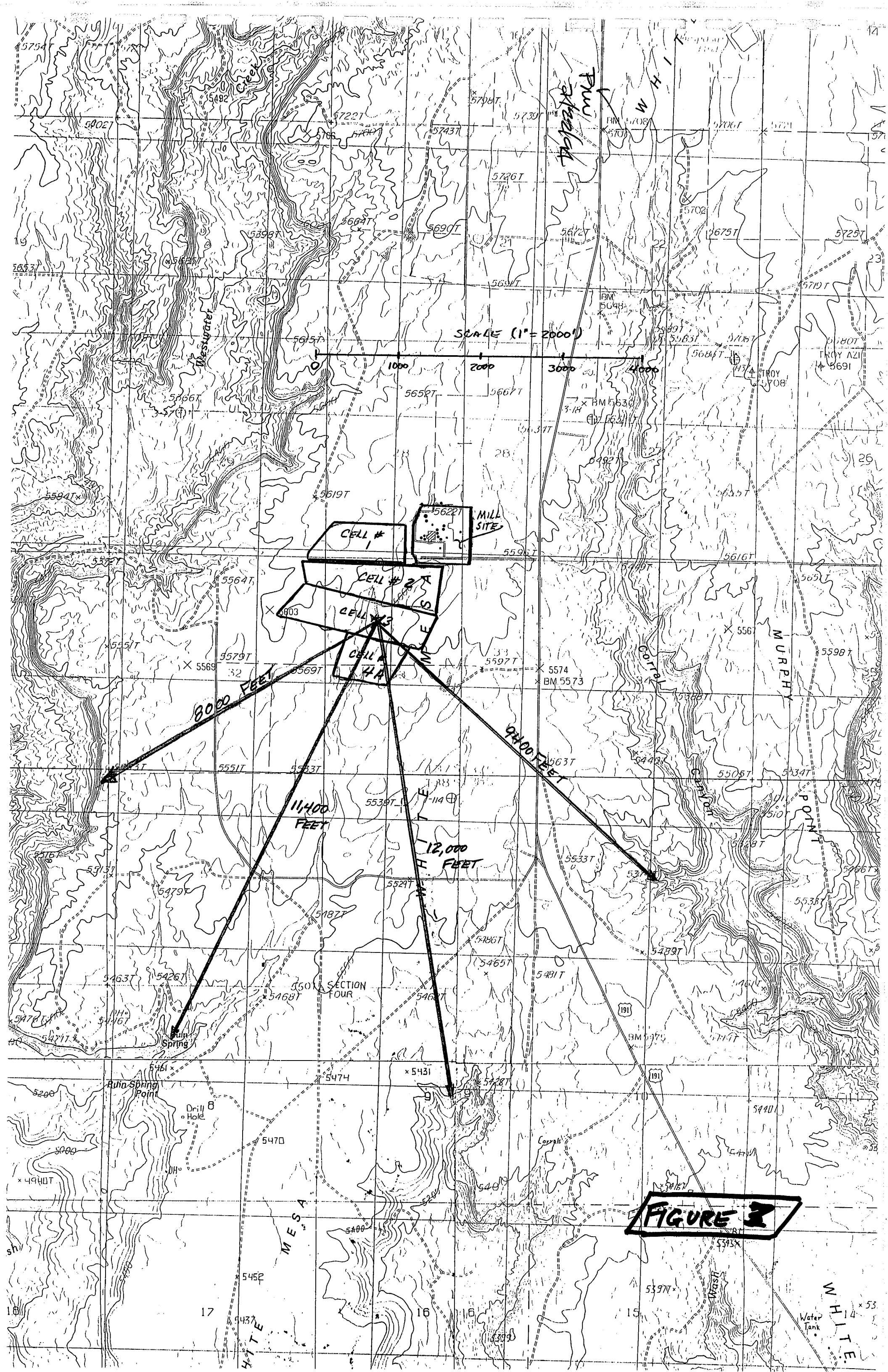

SCALE (1" = 2000')
0
1000
2000
3000
4000
CELL # 1
CELL # 2A
CELL # 3
CELL # 4A
MILL SITE
8000 FEET
9400 FEET
11,400 FEET
12,000 FEET
WHITE MESA
Westwater
Corral Canyon
MURPHY POINT
SECTION FOUR
Ruin Spring
Ruin Spring Point
Drill Hole
Corrals
Wash
Water Tank
TROY
191
FIGURE 3

APPENDIX E

VADOSE ZONE MONITORING EVALUATION

VADOSE ZONE MONITORING EVALUATION

This appendix presents results of an evaluation performed by Energy Fuels on methods to monitor the vadose zone. The methods evaluated include:

1. Conventional Monitoring Wells,
2. Suction Lysimeters,
3. Vacuum Pressure Lysimeters,
4. Neutron Probe Method, and
5. Transient Electromagnetic Geophysical Surveying.

1. Conventional Monitoring Wells

Conventional shallow wells were evaluated to collect solutions in the unsaturated bedrock (Figure E1). The bedrock has a high negative matrix potential (suction) which would prohibit solution from flowing into the well. The only condition under which the wells would produce solution is the case where a massive failure of the liner would occur, thus producing saturated flow conditions directly underneath the cells and outside the perimeter of the cells.

2. Suction Lysimeters

These devices can collect fluids in the vadose zone via a ceramic-type cup. These cups, if properly placed, would become an extension of the pore space in the bedrock. Consequently, the water content in the lysimeter would become equilibrated at the existing bedrock-pore water pressure. A sample of fluid can be collected by applying a vacuum to the cup (Figure E2). These units are generally effective up to six feet below the ground surface. Below this depth, detection of a migrating contaminant plume would be impossible.

3. Vacuum Pressure Lysimeters

This device is a modification of the suction lysimeter in that pressure can be applied to extract the fluid (Figure E3). The disadvantage is that forcing pressure into the cup would also force fluids back into the bedrock, thus limiting the amount of the sample that could be obtained. This condition is exacerbated with depth and becomes ineffective below depths of a maximum of 30

feet. Consequently, this method is also not useful where the devices are placed at the edge of a tailings disposal cell.

4. Neutron Probe Method

Use of the neutron probe (Figure E4) to determine the moisture profile in a borehole has proven to be a reliable indirect method of obtaining a subsurface moisture distribution. The prime disadvantage of using this technique is that moisture measurements are limited to a few inches from the borehole. This method also does not provide data on the quality of seepage. Therefore, information from this method will be nonconclusive.

5. Transient Electromagnetic Geophysical Surveying

General - The following describes the basic concepts of the method transient electromagnetic (TEM) geophysical surveying, which will be considered in applying the method at White Mesa Mill.

Electromagnetic techniques are used for measuring the electrical resistivity of the ground, with the electrical resistivity being derived by determining resistance to flow of electrical current. With TEM, current driven through a transmitter (Tx) loop laid on the ground surface creates a primary magnetic field. At the instant the current is turned off an electromagnetic induction is established by the primary magnetic field. This electromagnetic induction in turn results in eddy current flow in the subsurface. The intensity of these eddy currents at certain time, and depth, depends on ground resistivity. Immediately after turnoff, the eddy currents are concentrated near the surface. With increasing time, the eddy currents diffuse down and out, which can be illustrated as a "smoke ring" pattern. Eddy currents generate a secondary magnetic field whose lines of force are opposite those of the primary magnetic field. The receiver (Rx) measures the electromagnetic forces (EMF) due to the secondary magnetic field. A schematic of the resistivity loop is shown on Figure E5.

Eddy Currents - At early time when the eddy currents are concentrated near the surface, the EMF's measure will reflect the electrical resistivity of near-surface layers. With increasing time, the EMF measured will progressively be more influenced by physical properties of deeper layers.

In a uniform layered environment the secondary magnetic field produced by the eddy currents is symmetric about the Tx loop center. The behavior of the EMF due to the vertical magnetic field (Bz) is relatively flat about the center, so that measurements of the EMF due to Bz are relatively insensitive to errors in surveying the center of the loop. The EMF due to Bz has a maxima in the center of the loop, has a zero crossing on both sides of the center, and passes through a minimum before decaying to zero with increasing distance. The EMF due to the horizontal magnetic fields (Bx and By) has a zero crossing in the center of the loop, passes through a minimum and maximum outside the loop and decays to zero with increasing distance. The position of the minimum and maximum for Bx and By is a strong function of the geoelectric section of the ground. Measurements made inside the loop will exhibit a maximum Bz component with a weak-to-no Bx and/or By component as opposed to measurements made outside the loop which will have a weak Bz component and maximum Bx and/or By component response.

Coupling - The term used in electromagnetic theory for how well a body can be detected is "coupling", or how well is the target energized. The target must have a different resistivity than the host rock to be detected. It is advantageous if the target is a better conductor. The direction of the electromagnetic field varies with position. Electromagnetic coupling is a crucial concept for planning a survey, as even good conductors can be missed. Coupling depends on the location and must be considered any time one is planning a survey using electromagnetic methods. It is of particular importance for conducting resistivity surveys.

Asymmetry in the component profiles in regards to geometry and/or magnitude is an indicator of two-dimensional (2-D) and three-dimensional (3-D) conductors. The induced EMF in the conductor(s) will produce a secondary magnetic field whose amplitude and decay rate are dependent on the quality of the conductor. In TEM, the depth and size of the conductor are reflected primarily in the amplitude of the secondary field, whereas the quality of the conductor is reflected mainly in the rate of decay of the secondary magnetic field, a good conductor having a long decay and a poor conductor having a short decay.

With 2-D conductors the vertical and horizontal component asymmetry will be restricted to measurements taken orthogonal to strike of body, i.e. an E-W striking fault will exhibit change in both the Bz and Bx component response along a N-S transect, but little variance in measurements made parallel to strike.

With 3-D conductors, symmetry in component profile will exist about the Tx loop center when the Tx loop is positioned directly over the body (similar to a uniform half-space response). However, EMF magnitudes for the conductor will be much higher, perhaps one order of magnitude than the response of the surrounding half-space. Asymmetry in profiles will exist when the Tx loops are offset from the conductor. Shape and magnitude will be indicators of strike, dip and plunge.

Downdropping of surface and subsurface strata, increased fracturing and interstitial water content, increased silicification and argillization, depletion of carbonates and anhydrides and increased salinity are factors contributing to the EMF response of the pipe environment. Variations in one or all of the factors can alter the measured EMF from one target to the next.

Depth of Investigation - Depth depends on several factors. The later in time a measurement is taken, the deeper the response. It is important to note, that in some cases near surface conductive responses can obscure any response from depth. The near surface responses can be cultural, fences or drill pipe, or surface geologic structures. Separation between the transmitter loop and the receiver loop is also important especially with slingram or profiling. A greater separation increase the depth of penetration.

Depth of penetration also depends on the resistivity of the rock. Through a resistive basalt it may be possible to see several thousand feet, through a conductive shale the depth of penetration may be limited to several hundred feet. Survey design is critical.

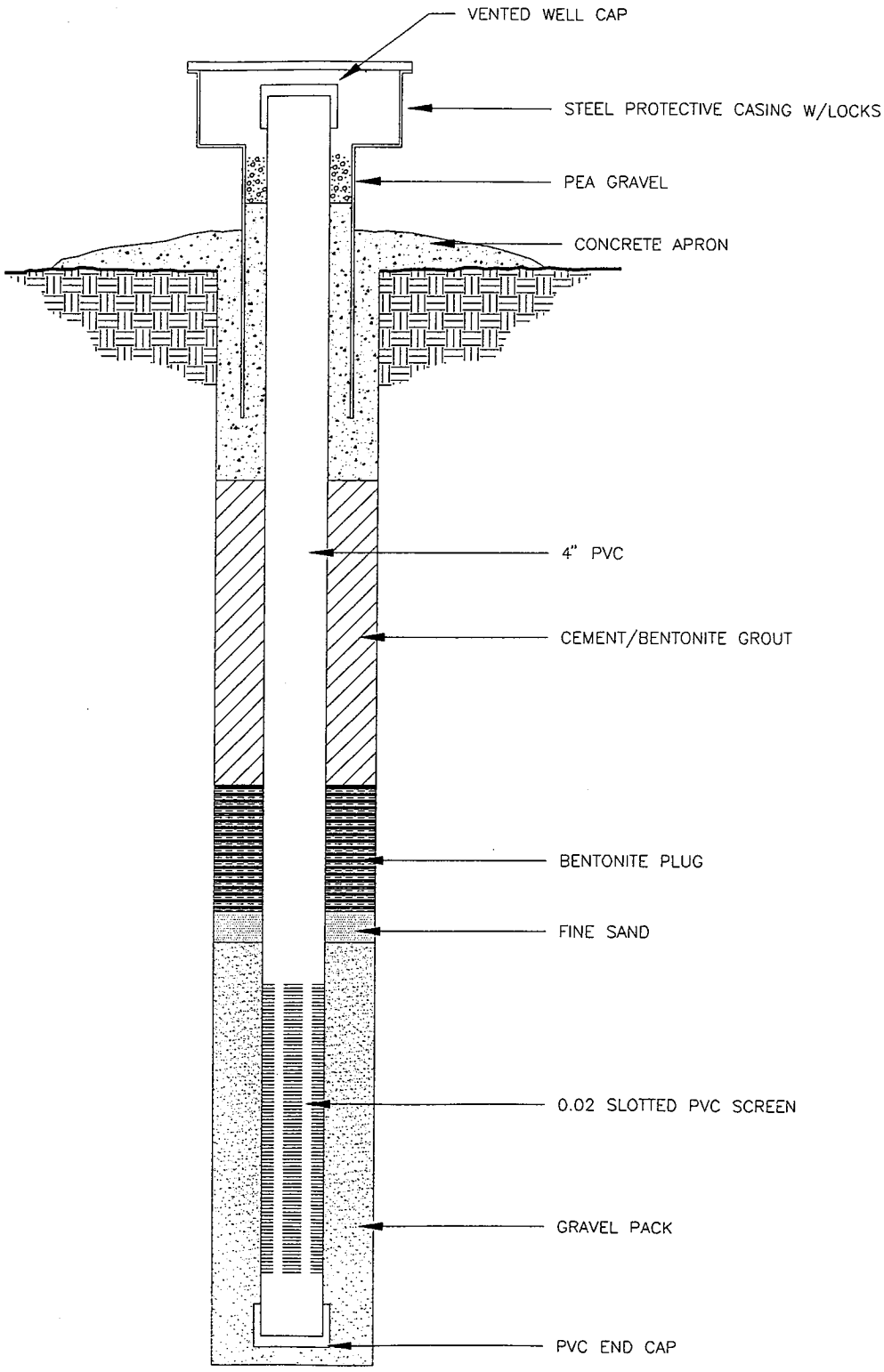
Induced Polarization Response - In almost all situations, current flow in the earth is carried in the solutions filling the pore spaces of the rocks. The current flow is actually maintained by charged ions in the solutions (electrolyte). Ions in fluid-filled pore space within the rock are driven by eddy currents, conceptually creating an additional current flowing in the same direction as the eddy currents. This additional current is termed the induced polarization (IP) current which is a result of additional charge carriers supplied by the pore-space electrolyte.

After the initial ionic movement has ended with ions "stacking up" at boundaries of regions of different ion mobility, the charged state of a conductor is achieved. When the eddy currents decay sufficiently, the ions want to return to the equilibrium position that existed prior to the induction of the eddy currents. This ion flow again constitutes a polarization current, now in the opposite direction to that of the rapidly decaying eddy currents.

This reversed polarization current may be large enough to dominate the eddy currents, causing the secondary magnetic field and EMF to decay faster than normal, and possibly reverses completely. In general the amplitude of the polarization current depends on the chargeability and resistivity of the medium. Increasing resistivity decreases the strength of the eddy currents allowing the polarization current to dominate earlier in time, while increasing the chargeability increase the amplitude of the polarization current.

While in the conventional IP frequency range a small increase in IP response (few milliradians) may not be detected, at the higher EM frequencies these small changes can have a strong influence on the measured response. The IP response will be strongest near the Tx loop wire where the current density is greatest.

DRAWING NUMBER 4111-A21



CONVENTIONAL MONITORING WELL

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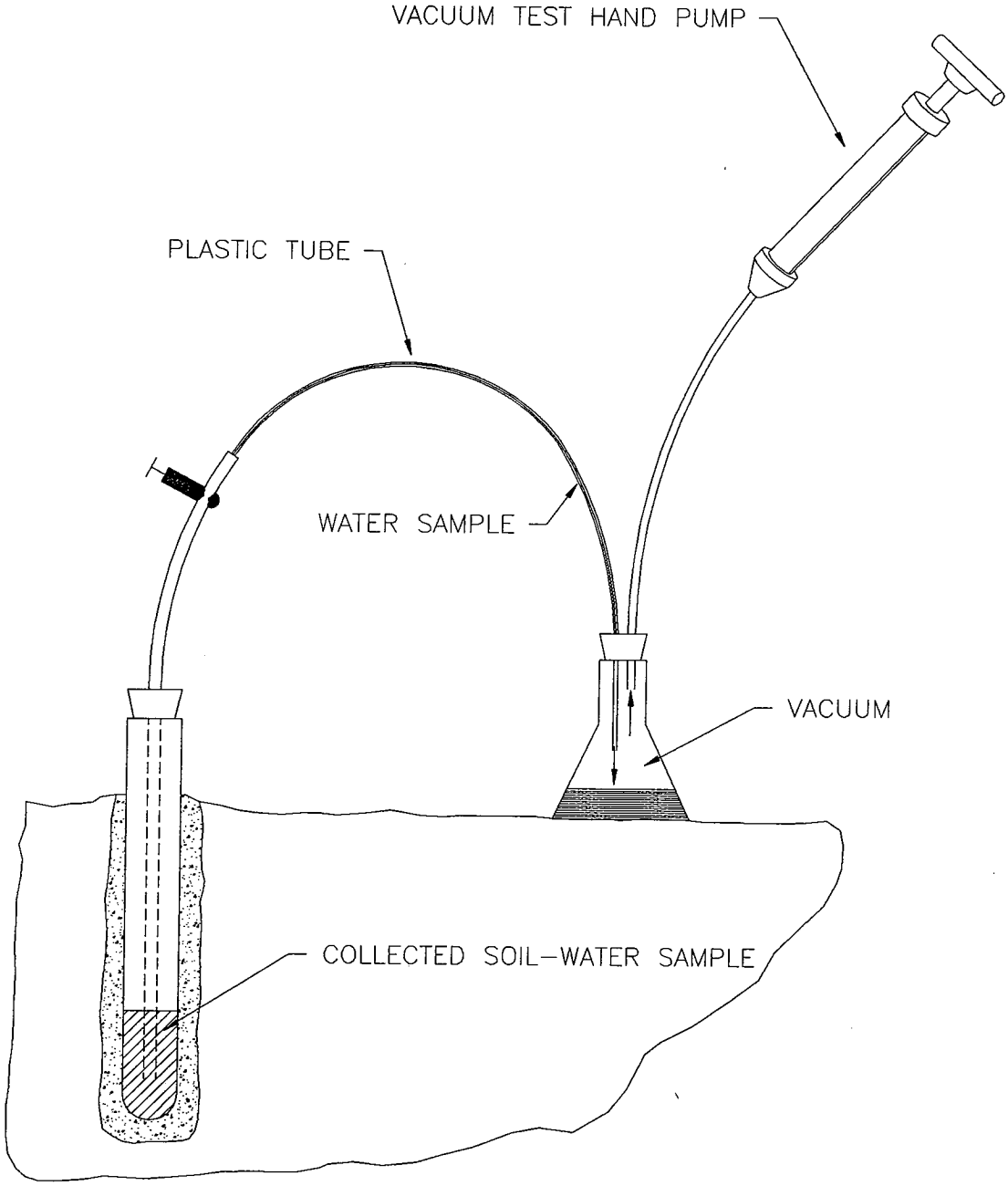
FIGURE E1

DRAWING NUMBER 4111-A21

1

DRAWING NUMBER 4111-A22



SUCTION LYSIMETER

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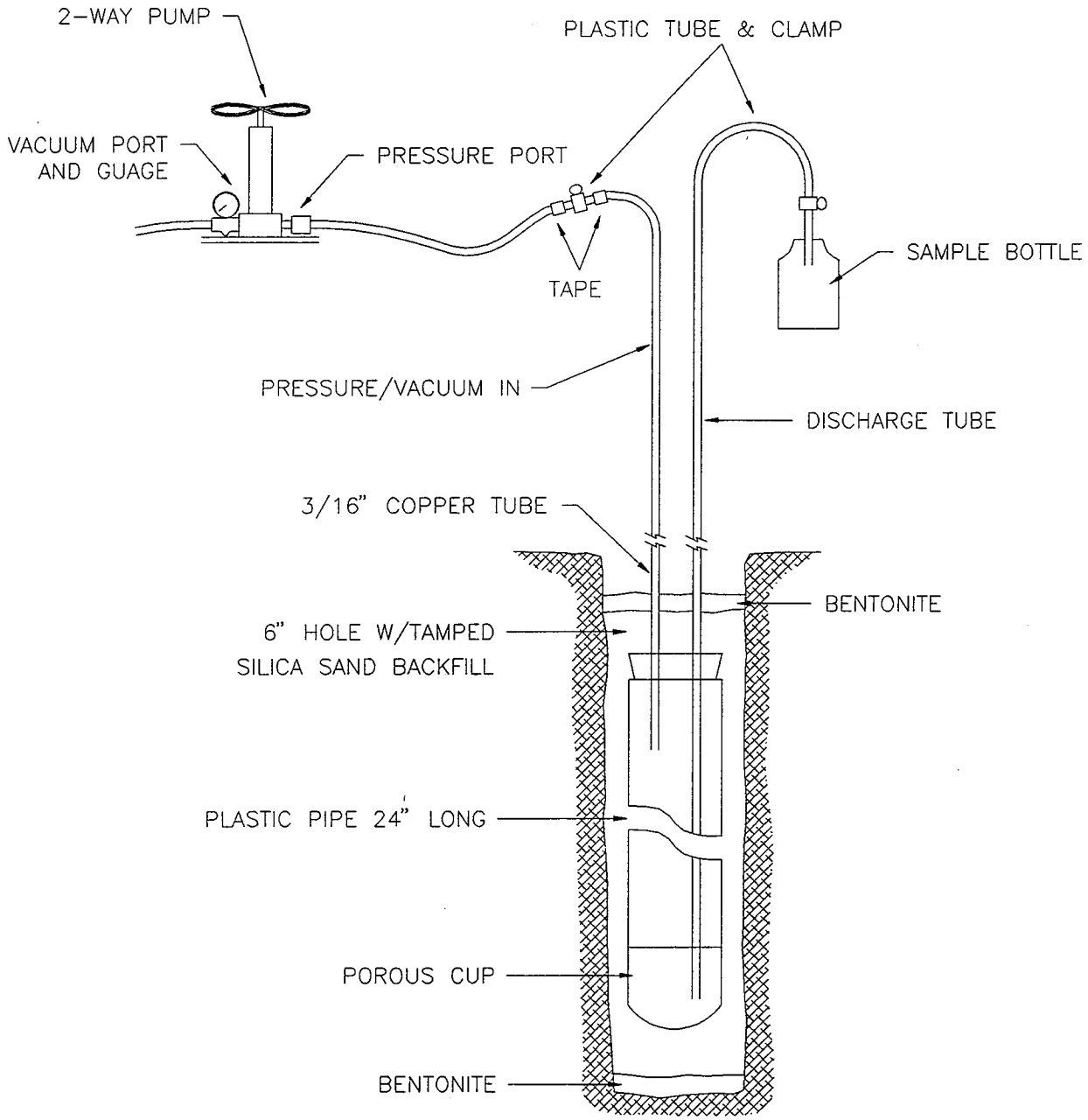
FIGURE E2

DRAWING NUMBER 4111-A22

1

DRAWING NUMBER 4111-A24



VACUUM PRESSURE LYSIMETER

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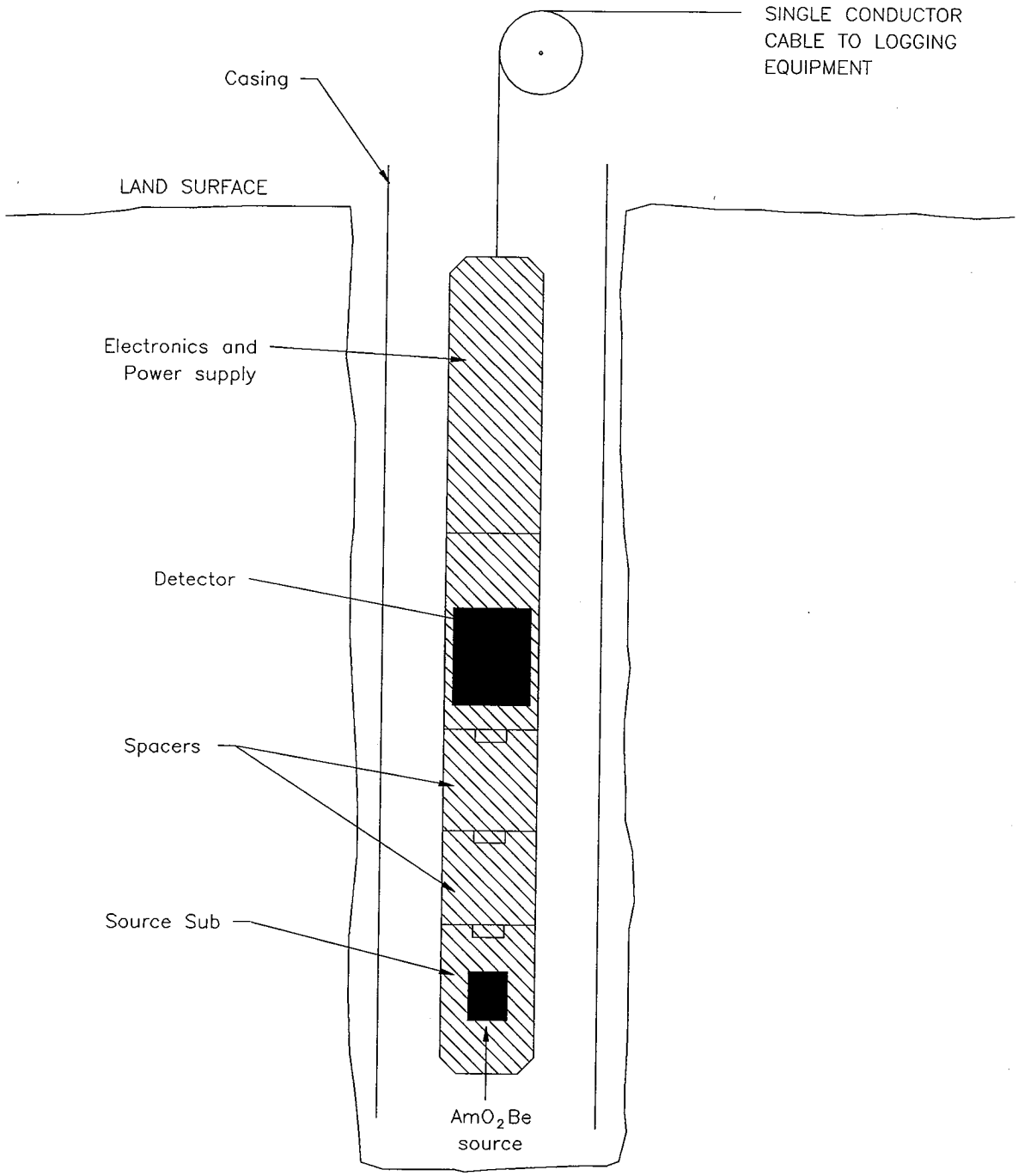
FIGURE E3

DRAWING NUMBER 4111-A24

1

DRAWING NUMBER 4111-A25



Average energy loss per collision:

hydrogen 63%
oxygen 12%

NEUTRON PROBE

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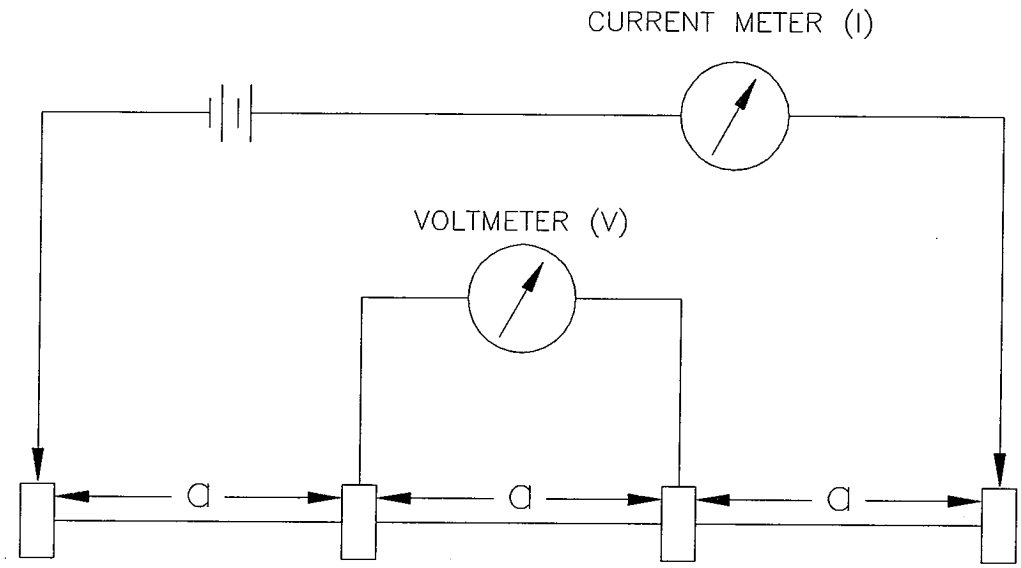
FIGURE E4

DRAWING NUMBER 4111-A25

1

DRAWING NUMBER 4111-A26



$$P_a = 2\pi \frac{V}{I} a$$

RESISTIVITY SURVEY LAYOUT

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FIGURE E5

DRAWING NUMBER 4111-A26

1

APPENDIX F

EFNI RESPONSE TO NRC AND EPA COMMENTS

RESPONSE TO NRC LETTER OF MARCH 31, 1994

In the NRC letter dated March 31, 1994, the NRC requested a response to specific questions so that they could proceed with the review of the license renewal and the Monticello amendment request. For clarity, the specific requests of the NRC are included in italics immediately before the corresponding reply:

NRC REQUEST:

A. Please propose modifications to enhance the tailings cell leak detection system to provide prompt detection of a major cell leak.

ENERGY FUELS NUCLEAR RESPONSE:

Leak detection systems are currently in place at Cell 3 and Cell 4-A and are monitored to identify excursions should they occur. The leak detection systems in the cells cannot be modified. However, additional monitoring of the vadose zone can be conducted. This additional monitoring for both Cell 3 and Cell 4-A is described below in response to NRC Request B and in Section 4 of the main report.

NRC REQUEST:

B. Please propose additional detection monitoring points for the vadose zone lying beneath or adjacent to the tailings cells, since the nonuniform plume migration can occur in this zone.

ENERGY FUELS NUCLEAR RESPONSE:

Energy Fuels has researched several methods of measuring the development of a wetting front beneath the tailings disposal cells and movement through the unsaturated zone to the perched water. These methods include conventional monitor wells, suction lysimeters, vacuum pressure lysimeters, neutron probes, and geophysical surveys. Results of this research are presented in Section 4.5 of this report.

Energy Fuels proposes to monitor fluid movement in the unsaturated zone through the use of transient electromagnetic (TEM) geophysical surveys. Discussions of TEM surveys are presented in Section 4.5 and Appendix E of this report. We propose to monitor a line that would detect excursions to the west, the south or the east of the tailings impoundments. Initial surveys will be obtained to establish a "baseline" moisture profile with depth at the survey locations.

The TEM survey information will be evaluated to determine if a wetting front has occurred and contaminants are advancing downward in the vadose zone. The data and yearly evaluation will be presented in the "Annual Technical Evaluation of White Mesa Mill Tailings Management System." If the evaluation indicates that significant seepage is occurring from the cells, Energy Fuels will develop an appropriate contingency plan.

NRC REQUEST:

C. Please propose additional detection monitor wells in the saturated Burro Canyon Formation. Umetco indicated this formation, not the Dakota Sandstone, is the uppermost aquifer at the White Mesa facility. Currently, water quality in the southerly, downgradient direction is monitored only at Monitor Well MW-3. The areal extent of the tailings cells and, therefore, the potential source of tailings seepage, requires an enhanced ground water monitoring network.

ENERGY FUELS NUCLEAR REPLY:

Monitor Wells MW-5, MW-12, MW-14, MW-15 and MW-3 are currently used to detect changes in water quality in the saturated zone of the Burro Canyon Formation. Energy Fuels feels that this saturated zone is not an aquifer by virtue of its inability to sustain any reasonable production rates.

Notwithstanding the above, a drilling program is proposed to install three new monitoring wells in areas downgradient of the tailings cells. These wells will be used to monitor water quality within the saturated Burro Canyon and to provide information on the saturated thickness. This program is set forth in Section 4.0 and locations of the borings are shown on Figure 4.1.

NRC REQUESTS:

D. You have indicated that the variable quality of ground water necessitates developing (baseline) standards on a well-by-well basis. To justify your position, please demonstrate that the reported water quality is representative of only one aquifer. One way to demonstrate that your ground water samples are from an hydraulically-connected aquifer, for example, would be to perform a pressure test comprising pumping one monitor well and measuring the effects on sensors positioned in the other monitor wells. The necessary time for performing this test would be based on aquifer hydraulic properties and the various distances between sensor-equipped monitor wells and the pumping well. In addition, please provide documentation such as well logs, electric logs, or other borehole data to verify well screen positioning.

ENERGY FUELS NUCLEAR REPLY:

The available site data suggest that the perched water within the Burro Canyon is continuous beneath the site. Site data shown on Figures 2.4 and 2.5 indicate the perched water has limited saturated thickness but is continuous beneath the site.

The variable quality of the subsurface water is likely the result of the slow-moving nature of the water, as demonstrated by on-site permeability and gradient measurements and the very limited direct-recharge of the perched system. The ground water quality is characteristic of slow-moving water circulation with high total dissolved solids. The variable nature of waters in the slow-moving system may be the result of local variations in the availability of gypsum near the contact between the Burro Canyon and Brushy Basin units.

1.0 ENCLOSURE 1

NRC COMMENTS:

1. Please provide the laboratory analytical results for monitored, ground water constituents from four quarterly sampling events for Monitor Wells MW-17, MW-18 and MW-19. These wells will provide additional data for establishing background ground water quality.

ENERGY FUELS NUCLEAR REPLY:

The data requested is included in Appendix B of this report. Data from sampling events to December 1993 are included.

NRC COMMENT:

2. Please discuss alternative corrective action programs (CAP) that could be implemented in the event of detected seepage from your tailings cells. The purpose of this discussion is to enable the NRC to conclude that feasible and practical corrective actions are available.

ENERGY FUELS NUCLEAR REPLY:

Alternative corrective action programs that could be considered for implementation at the White Mesa Facility include: 1) increased site monitoring, 2) reduction of head on the synthetic liner, 3) collection of water in the leak detection system, or 4) treatment of the liquids within the cell or cells. If necessary, one or a combination of these or other technologies could be employed at the site to achieve or maintain compliance with the ground water protection standard.

Increased Site Monitoring - Increased site monitoring could potentially entail collection and analysis of additional water samples from the site, drilling and sampling of additional wells, and conducting additional resistivity survey measurements. These actions could be used to assess the potential, long-term impact to the Entrada/Navajo aquifer and to determine if additional corrective actions are necessary.

Reduction of Head in the Cells - Reduction of the head on the cell liner could possibly be accomplished by transfer of free liquids from the top of the cells to the evaporation impoundment and a withdrawal of liquids from the tailings material by pumping the slimes drain system.

Collection of Water from the Leak Detection System - Water accumulating in the seepage collection system beneath the synthetic liner could be removed to minimize the flux of tailings liquids into the subsurface materials. Most likely, a combination of head reduction on the liner and removal of liquids from the underdrain system would provide a feasible, practical approach to mitigating contaminant flux to the environment.

Treatment of Liquids within the Cells - Liquids within the cells could potentially be neutralized to lessen the migration of contaminants from the impoundment. The addition of lime or hydrated lime to the tailings liquids has been proven to be an effective technology in the control of contaminant migration. NUREG/CR-3030 "Evaluation of Selected Neutralizing Agents for the Treatment of Uranium Tailings Leachates" and NUREG/CR-3449 "Laboratory Evaluation of Limestone and Lime Neutralization of Acidic Uranium Mill Tailings Solution" can be consulted for an assessment of the potential benefits of tailings liquid neutralization. It should be noted that these are laboratory studies only, and not scaled-up to the real world of 3.5 MM tons of tailings and solutions.

NRC COMMENT:

3. Based on your evaluation of the ground water monitoring and leak detection programs, as well as geologic and hydrogeologic information, please provide an analysis of the rate of plume migration through the Dakota/Burro Canyon Formation and Brushy Basin to the underlying Entrada Sandstone Aquifer, if a tailings cell leaks.

ENERGY FUELS NUCLEAR REPLY:

Potential rates of plume migration from the disposal cells are proposed in Section 3.2 of the main report. As discussed there, travel time through the Dakota-Burro Canyon Sandstones to the top of the Brushy Basin is conservatively estimated on the order of 50 to 150 years. Based on existing information, which will be enhanced with the proposed field investigations, it is assumed that the Brushy Basin is in an effective aquitard and will prevent migration downward to the underlying Entrada/Navajo Aquifer. The function of the Brushy Basin in preventing downward migration is further enhanced by the 850-foot hydrostatic head pressure within the Entrada/Navajo Aquifer.

NRC COMMENT:

4. Please provide a technical analysis of, or a reference to, a previous submittal which describes the anticipated impact of the low pH raffinate on the clay liner integrity and potential ensuring consequences.

ENERGY FUELS NUCLEAR REPLY:

The effect of low pH solutions on the clay liner is addressed in NUREG/CR-2946, "The Long-Term Stability of Earthen Materials in Contact with Acidic Tailings Solutions," NUREG/CR-3124, "Laboratory Measurements of Contaminant Attenuation of Uranium Mill Tailing Leachates by Sediments and Clay Liners," and NUREG/CR-2494, "Interaction of Uranium Mill Tailings with Soils and Clay Liners." These reports indicate that clay liner permeability decreases over time when low pH, high TDS solutions contact natural earth materials. This decrease in permeability is due to the precipitation of hydroxides and amorphous members of the alunite mineral group. These reactions are likely to occur at the White Mesa facility because the raffinate solutions and clay materials are similar to those used in the studies.

NRC COMMENT:

5. At the February 9, 1994 meeting, you stated you were going to perform a drilling program at the White Mesa site. Therefore, please provide the results of the angle-hole drilling, packer tests, and any other analyses you performed to determine the presence of a subsurface fracture system. Based on information you presented, in the event of a liner failure, tailings seepage could reach the Brushy Basin. The angle-hole drilling program should, therefore, incorporate penetration and analyses of this strata. This is necessary to evaluate whether a fracture system exists which could provide a conduit for seepage migration through the Dakota Sandstone, Burro Canyon Formation, and Brushy Basin, to impact the Entrada Sandstone. It is our understanding that the drilling program will comprise two sets of boreholes, and that each borehole will be 100 feet in length. Based on available information for the thickness of the overlying strata, this would allow as much as 20 feet of penetration into the Brushy Basin unit. Each borehole set would include one borehole perpendicular to the previously identified, primary joint system. We understand these boreholes would be at approximately 30 degrees to the vertical. The accompanying borehole would be perpendicular to the secondary joint system. At a minimum, the following information for the vadose zone (Dakota Sandstone), Burro Canyon Formation, and the uppermost 20 feet of the Brushy Basin strata should be provided: A) Characterization of subsurface structure (fracture systems), and b) A quantitative analyses of the rate and direction of effluent migration through the system in both horizontal and vertical, cross and downgradient directions.

ENERGY FUELS NUCLEAR REPLY:

Observational data presented in the Environmental Report (Dames and Moore, 1978) indicate that jointing is common in the exposed Dakota/Burro Canyon Formations along the mesa's rim with primary joints parallel to the cliff faces and secondary joints almost perpendicular to the primary joints. Umetco (1991) also mapped surface fractures along the canyon rim and found a primary joint vector with strike of N11E, and a secondary joint vector with a strike of N47W.

Investigations are proposed to determine whether the surficially-mapped joint sets are present in the subsurface Dakota/Burro Canyon Formations beneath Tailings Disposal Cells No. 3 and No. 4A at the site and whether their presence, if any, is causing an increase in the rock mass permeability.

The scope of investigations to identify subsurface joint sets consists of advancing four angled borings into the Dakota/Burro Canyon Formations and at least 25 feet into the Brushy Basin Member beneath Tailings Disposal Cells No. 3 and No. 4A. Figure 4.1 of this report presents the location of the angled borings. At each location, one angled boring will be advanced parallel to the strike of the primary joints mapped on the surface. A second boring will be advanced perpendicular to the strike of the primary joints. This method should intersect the maximum number of potential subsurface fractures, if present. Each boring will be fully-cored with an NX or NWQL double-core barrel. Cores will be logged with particular attention given to fractures, specifically, their orientation, spacing, aperture, and any evidence of flow (e.g., staining, mineral redeposition or presence of clay).

Permeability pressure (packer) tests will be conducted in each borehole in five- or ten-foot increments throughout the entire length of the borehole. Upon completion, borings will be grouted with cement/bentonite grout from the bottom up.

NRC COMMENT:

6. Please provide the geologic and hydrogeologic information necessary to characterize that the Brushy Basin acts as an aquitard between the Burro Canyon and the Entrada Sandstone. This information should include the vertical and horizontal conductivities characterized at the site, verification of the effective porosity, and thickness of this unit. Also, please provide this information for any wells constructed in the Entrada Sandstone.

ENERGY FUELS NUCLEAR REPLY:

As discussed in Section 4.3 of the main report, the primary objective of the Brushy Basin Member investigation is to quantify the hydraulic properties of the unit and evaluate its effectiveness as an aquitard. For the sake of expediting the investigations, borings from which the above information will be obtained will be converted into observation wells to further define the extent of saturation in the Burro Canyon Formation.

The proposed Brushy Basin Member investigation includes:

- Drilling three exploratory borings into the Brushy Basin Member. Each boring will penetrate 20 feet into the unit. The boring data will also be used to define the Brushy Basin-Burro Canyon Member contact. The proposed locations of the borings are presented on Figure 4.1.

- From each boring, collecting two 5-foot sections of the core from the Brushy Basin Member.

- Conducting packer permeability tests in each boring within the section of the hole in the Brushy Basin Member.

- Conducting laboratory liquid permeability tests on vertically-oriented cores from the Brushy Basin Member. These tests will be necessary to quantify the vertical permeability which is expected to be orders of magnitude lower than the horizontal permeabilities from the field packer tests (horizontal permeability will be calculated from packer tests).

All borings advanced within the Brushy Basin Member will be converted into the observation wells screened in the Burro Canyon Formation.

As discussed in Section 3.0 of the main report, not only the Brushy Basin but the Westwater, Recapture and Salt Wash of the Morrison Formation as well as the Summerville Formation are effective aquitards because the Entrada/Navajo is a confined aquifer under artesian pressure.

No wells have been constructed in the Entrada Sandstone; however, driller's logs of the Navajo water supply wells constructed at the site and geophysical logs for these wells have been included as an attachment to Appendix A.

NRC COMMENT:

7. In consideration of both stratigraphy and structure, please provide a quantitative assessment of horizontal and vertical effluent travel times within the Dakota Sandstone, Burro Canyon Formation and Brushy Basin.

ENERGY FUELS NUCLEAR REPLY:

Calculations for travel time within the Dakota Sandstone, Burro Canyon Formation and Brushy Basin are provided in Section 3.0. Travel times could range from 50 to 150 years from the base of the cell to the top of the saturated zone in the Burro Canyon.

Ground water velocity calculations for the perched water in the Burro Canyon are presented in Appendix D. Using Darcy's equation, ground water velocity is estimated to be 0.89 feet per year in a southerly direction in the Burro Canyon.

Site-specific data for the Brushy Basin have not been collected yet but will be the focus of the current drilling program.

NRC COMMENT:

8. Please provide well log, geophysical data, piezometric data, or other data to justify your interpretation of the southerly pinch-out of the saturated thickness of the Burro Canyon Formation that was presented in the referenced meeting. As discussed in the meeting, the unit thickness isopachs are somewhat speculative in the region downgradient of the tailings cells. It is not clear whether the downgradient direction is actually south, southwest, or southeast. Please include isopach maps and a map depicting the bottom surface of the Burro Canyon Formation.

ENERGY FUELS NUCLEAR RESPONSE:

Figure 2.5 in the main report is a map of the Burro Canyon saturated thickness. The thickness of saturation is greatest in the northern and central sections of the site and reduces toward the south.

The topography of the Brushy Basin Member which defines the bottom of the perched water is included in the report at Figure 2.6.

The general direction of ground water flow is toward the south, with southeast and southwest components, as depicted in Figure 2.4.

NRC COMMENT:

9. During the meeting, four piezometric wells were noted as being constructed southwest of the tailings cells. Please identify these wells and include any piezometric and subsurface structural or stratigraphic information collected during this drilling program, such as that from electric logs or core samples, to enhance site characterization.

ENERGY FUELS NUCLEAR RESPONSE:

The four piezometers are located on a site map (Figure F1). The piezometers are west of Cell 1-1. They are designated as #9-1, #9-2, #10-1 and #10-2. The depths of these piezometers are as follows:

Piezometer	Depth
#9-1	30.0'
#9-2	59.7'
#10-1	31.3'
#10-2	59.2'

These piezometers have been monitored annually and were dry at all sampling events. More information about these piezometers is available in D'Appolonia's February 1982 report, "Ground Water Monitoring Program," which is on file at the White Mesa Mill site.

NRC COMMENT:

10. Please provide piezometric data to characterize the Burro Canyon formation and Entrada Sandstone aquifers.

ENERGY FUELS NUCLEAR RESPONSE:

The occurrence of perched water in the Burro Canyon Sandstone is discussed in Section 2.0 of the main report. Levels of perched water are presented on Figure 2.4 of the main report.

Ground water level data for the Entrada/Navajo Aquifer based on drillers' logs are presented in Table 3.1 of the report. These data indicate artesian pressures up to 850 feet of head exist within the aquifer.

2.0 **ENCLOSURE 2** - EPA COMMENTS AND QUESTIONS CONCERNING THE UMETCO MINERAL CORPORATION, WHITE MESA FACILITY

EPA COMMENT:

EPA believes, based on the data which we have received and reviewed, the Umetco, White Mesa facility is not in violation of any applicable Federal or State of Utah regulations. However, EPA is concerned the U.S. Nuclear Regulatory Commission (NRC) and Umetco have not agreed upon a Point of Compliance (POC) for the White Mesa facility. EPA will not allow the facility to receive the Monticello Mill tailings until such time as a POC is established and "constituent" levels have been determined, which, if exceeded, will indicate a release has occurred.

After reviewing the design of cells 3 and 4A, especially the leak detection systems (LDS), we would concur with Umetco, the LDSs, as designed and constructed, will only detect minor leaks positioned almost directly over the detection system unless a major breakthrough were to occur. For this reason, we are not certain what is gained by making the LDS the POC. Based on the data presented, we would agree that the "saturated" Burro Canyon-Dakota Formation would be suitable as the POC. If NRC accepts the Burro Canyon Formation as the POC, additional hydrogeological characterization of the Burro Canyon Formation needs to be conducted. Since the Brushy Basin Member of this Morrison Formation is considered to be the geological unit providing protection of potable water in the underlying Entrada Formation aquifer, the characterization effort should extend into the Brushy Basin. Additional comments addressing some of the necessary characterization efforts of the Brushy Basin Member are attached.

EPA requests that NRC and Umetco explain how background levels for constituents of concern will be determined. If it is eventually determined that "site-wide" constituent background and compliance levels cannot be developed, how will appropriate compliance levels be established for the individual wells? It might be appropriate to determine, if possible, why there is such a variation in constituent levels in the upgradient wells (i.e., could well construction, completion, and development, sampling procedures, or other factors account for this variability?). It may be appropriate to initially set constituent levels for several of the mobile constituents, while further sampling and analyses is conducted to determine if "site-wide" background levels can be

established. EPA would note if a State of Utah Ground Water Discharge Permit (GWDP) is required or if Umetco intends to gather the data required to substantially meet the intent for obtaining the GWDP, it may be appropriate to discuss with the State of Utah, Division of Water Quality any additional requirements that they may have.

ENERGY FUELS NUCLEAR REPLY:

The spatial variability of water within the Burro Canyon formation is presented in Section 2.2 of this report. Upgradient wells and wells across the site show variability in water chemistries as demonstrated by sulfate and chloride concentrations. This variability may be related to the dissolution of minerals near the Brushy Basin Shale and Burro Canyon Sandstone contact by very slow-moving (0.89 feet per year) ground water. Because of the variable ground water chemistry, comparison of well chemistries to single or multiple background wells may not be an appropriate means of detection for cell seepage or ground water contamination. Rather, it may be appropriate to establish water quality baseline values on a well-by-well basis with appropriate compliance level values set for selected compliance monitor wells.

The existing well construction and water quality data, and additional data gathering programs will be further evaluated. Energy Fuels will then propose methods for developing background and compliance levels for constituents of concern.

As EPA has suggested, it may be appropriate to initially set constituent levels for particular mobile constituents, while conducting further sampling and analyses to determine the appropriate approach to background determination. The collection of additional data will provide insight into the means of selecting proper point(s) of compliance.

EPA COMMENT:

Our review of the Student T test ("T") analyses contained in the documents indicates that some of the data were excluded. Furthermore, the use of the "T" test may be inappropriate since the data are not normally distributed. However, we concur with Umetco that if a significant leak were to occur, the chlorides would be one of the first constituents to break through and that the chloride constituent levels would be elevated significantly above background.

ENERGY FUELS NUCLEAR RESPONSE:

The statistical analysis was an attempt to determine whether a small population (10 samples) collected during the early period of sampling was statistically similar to a similar size population for the most recent sampling periods. This analysis indicated, in the case of the chlorides (the more critical of the indicator solutes), that the means of the two populations not only differed but indicate a decrease in the mean chloride concentration over time. This suggests that the ground water has not been impacted by fluids from the ponds.

Energy Fuels recognizes the need to consider the distribution of the data in selection of statistical text. In the future, Energy Fuels will refer to guidance, such as "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities," (EPA, 1989) for selecting appropriate statistical analysis of ground water data.

EPA COMMENT:

EPA believes if a major leak occurs it will migrate through joint fractures and along preferential pathways and not be held in the pore spaces of the matrix, especially if the matrix is well-cemented, as is generally assumed by many proponents of flow mechanisms through unsaturated sediments. Water level fluctuations in excess of 1.5 feet have been observed in several wells over a 5-month period. This suggests that the ground water table responds relatively quickly to influx. We did not evaluate or prepare detailed ground water table maps to determine if any trends could be established; however, it might be useful to do so.

ENERGY FUELS NUCLEAR RESPONSE:

Although joints have been observed and mapped on the edge of the mesa, no significant joints have been documented in the subsurface from over 45 wells and borings at the site. In addition, hydraulic tests conducted at the site do not indicate the presence of extensive jointing.

A review of the hydrographs of the monitoring wells showed that the majority of the recorded water-level fluctuations greater than 1.5 feet are in a negative direction to the mean water surface elevation in that well. This may suggest a lowering of the water table. The few measured, positive water-level fluctuations were sporadic, single-well fluctuations with no trend. In many cases these water-level fluctuations occurred in one sampling event, followed by a similar fluctuation in the reverse direction. These fluctuations probably were due to measuring error.

The majority of these errors occurred prior to 1989, at which time new equipment was purchased. The present sampler also started at that time and has had a better understanding of quality control. In addition, Energy Fuels has prepared a new quality assurance plan which will include an updated Standard Operating Procedure (SOP) for water level measurements. The SOP is currently under review.

EPA COMMENT:

We concur with Umetco's statement that they need to confirm that the saturated thickness of sediments in the Burro Canyon is pinching out. Review of the well logs suggests that the reason Well No. 16 is dry is that the bottom of the well was screened at the bottom of the Burro Canyon Formation at an elevation of 5,497 feet above sea level. Water elevations in Wells 5 and 12 were at approximately 5,501 feet. Based on the assumed phreatic surface gradient, the linear distance between Well 16 and Wells 5 and 12, and the fact that the Burro Canyon Formation is unconformable over the Brushy Basin Member, water at that elevation would not be detected. EPA's review and analysis of the existing well logs suggests that the bottom of the Burro Canyon-Dakota Formation is generally dipping to the southeast with the possible exception of a topographic high at Well 4.

ENERGY FUELS NUCLEAR RESPONSE:

Data from MW-16 indicate the elevation of the top of the Brushy Basin is at 4,597 feet. The projected phreatic surface at this location is approximately 4,590 feet (see Figure 2.4 of this report). Therefore, the projected perched water level is below the top of the Brushy Basin. This would indicate the saturated thickness of the perched water approaches zero at this location.

EPA COMMENT:

We concur with Umetco that additional exploratory borings are needed to be made and additional piezometers constructed when water is encountered. Additional compliance monitoring wells may need to be constructed based on the results of further characterization. Additional characterization efforts should extend southerly, from a line formed by extending the common wall/dike between cells 2 and 3, east and west to the mesa edge to confirm that the saturated thickness of Burro sediment pinches out. Data from the existing wells and any additional data collected from further characterization efforts can be utilized to prepare a geologic map depicting

the bottom of the Burro Canyon Formation and an isopach map depicting the thickness of the formation and saturated intervals.

ENERGY FUELS NUCLEAR RESPONSE:

All data gathered during the drilling program will be added to existing data to update maps and cross sections. The vertical borings completed during this program will be developed as monitoring wells and will become part of the ground water monitoring program. These data will be included in the Semi-annual Effluent Reports that are submitted to the NRC.

EPA COMMENT:

During the meeting, Umetco indicated that the hydraulic conductivity of the Brushy Basin Member was approximately 10^{-8} and that the effective porosity was approximately 15 percent. Is there any site-specific data supporting these assumptions at the Umetco site? Can Umetco provide reasonable assurance that if a significant release occurs there will be time to put in place a contingency plan (e.g., a pump-and-treat system) to avoid contamination from moving horizontally offsite or vertically through the Brushy Basin Member? The angle holes, core recovery, and the packer testing should extend into the Brushy Basin Member so that confirmation of the assumed hydraulic conductivities in the Brushy Basin Member can be obtained.

ENERGY FUELS NUCLEAR RESPONSE:

Effective hydraulic conductivity of the Brushy Basin Shale has not been measured at the site. However, hydraulic conductivity values for mudstone and claystone in the Burro Canyon Formation, reported in Table 2.2 of the report, range from 1.58E-03 to 1.93E-07 cm/sec.

The slow-moving nature of water in the saturated zone of the Burro Canyon Formation (0.89 feet per year) and the low permeability of the underlying Brushy Basin Shale allows for the implementation of a contingency plan if a significant release were to occur from the disposal cells. Horizontal migration offsite, a distance of over 8,000 feet, would take over 8,000 years and vertical migration through the Morrison Formation would be negligible.

The proposed field program is designed to penetrate into the Brushy Basin Shale so that packer tests can be conducted to provide site-specific values for the hydraulic conductivity of the Brushy Basin Shale.

EPA COMMENT:

Some of the wells logs and any test data from the culinary wells may be useful to respond to or support eh above concern. Can the culinary well locations be placed on the map, and the well logs be made available to EPA for review? As a minimum, the lithologic logs for the culinary wells should provide a good estimate of the thickness of the formations from the surface down to the Entrada.

ENERGY FUELS NUCLEAR RESPONSE:

Drillers' logs of site water supply wells are included in Appendix A. Thicknesses of the formations were inferred from these logs as:

Unit	Thickness
Dakota	81'
Burro Canyon	65'
Morrison	672'
Summerville	37'
Entrada	365'

EPA COMMENT:

EPA also requests that all additional compliance monitoring wells be constructed in accordance with the Handbook of Suggested Practices for the Design and Installation of ground Water Monitoring Wells (EPA 1991 Document No. EPA/600/4-89/034) or be functionally equivalent.

ENERGY FUELS NUCLEAR RESPONSE:

This document was used to design MW-16 through MW-19 and is the basis for the design of any future monitoring wells.

EPA COMMENT:

EPA also requests the results of any packer tests which were completed in the vadose zone. Please provide EPA with any packer and pump/slug tests that may have been conducted and were not included or referenced in the February 1993 Ground Water Study, White Mesa Facility, Blanding, Utah.

ENERGY FUELS NUCLEAR RESPONSE:

The results of all packer tests conducted in the vadose zone are included in this report in Table 2.2

EPA COMMENT:

EPA would like to have the confidence and assurance that field sampling techniques and laboratory quality assurance and quality control procedures are in place to validate data. We would like to see in place, a system which would preclude questionable "hits" based on sampling techniques and analytical methods.

ENERGY FUELS NUCLEAR RESPONSE:

Energy Fuels has prepared an updated Quality Assurance Project Plan (QAPP) for the White Mesa Mill ground water compliance monitoring program. The QAPP is included as Appendix G to the main report. The current version addresses data quality objectives, quality assurance objectives, sample and document custody procedures, quality control procedures, data evaluation methods, and analytical procedures. The QAPP presents the organization structure to ensure conformance to the Quality Assurance Plan. The SOPs to be attached to the QAPP are currently being revised from the SOPs that were used previously.

3.0 ATTACHMENT

EPA COMMENT:

If the Burro Canyon-Dakota Formation is used as a point of compliance, the Brushy Basin Member of the Morrison Formation must also be characterized since it is the geologic unit separating the Burro Canyon aquifer from the underlying aquifer in the Entrada Formation.

Characterization of the Brushy Basin Member should verify the assumption that it is acting as an "aquitard." Characterization of the Brushy Basin Member should include, but not be limited to:

- *lithologic and geophysical logs for the culinary wells previously installed into the Entrada Formation,*
- *thickness of the unit,*
- *any fractures observed in the unit,*
- *packer tests at different depth intervals,*
- *other data related to horizontal and vertical hydraulic conductivity, including laboratory tests conducted on samples,*
- *verification of 15 percent effective porosity of the Brushy Basin underlying the White Mesa area or laboratory data from tests conducted for effective porosity on samples collected from the Brushy Basin Member underlying the site, and*
- *any other data pertinent to characterizing the Brushy Basin Member which supports the assumption that the Brushy Basin is an aquitard.*

EPA believes by extending the proposed characterization effort into the Brushy Basin Member, Umetco should be able to provide answers to our questions and comments. The minimum apparent depth of penetration into the competent Brushy Basin Member would be 20 feet. Based on the assumption that a 30-degree angle from the vertical is used for angle drilling, the total length of core would be 25 feet and the horizontal distance would be 15 feet. The decision of the actual depth occurred can be made on criteria observed in the field such as lithology, the occurrence, spacing, and orientation of joints and fractures observed in the Dakota/Burro Formation. The core should be recovered for observation and laboratory analyses. Packer testing intervals should be determined after observation of the core.

ENERGY FUELS NUCLEAR RESPONSE:

The Brushy Basin Member of the Morrison Formation will be investigated in the additional characterization studies proposed for the White Mesa Facility. These studies, described in Section 4.0 of this report, include penetration of at least 25 feet of Brushy Basin in the angle boring, core sampling, lithologic and geophysical logging, and permeability testing. Laboratory analysis of the shale will also be conducted to estimate the effective permeability of the Brushy Basin.

4.0 ENCLOSURE

EPA COMMENT:

Various types of leaks may occur through the bottom of Cell 4A. EPA would like to see various leakage scenarios to assess the possible leakage rates that may occur through the cell lining. Leak scenarios that examine a range of leakage rates, types of leakage that may occur through the bottom of the cell using reasonable assumptions about the subsurface characteristics directly below the cell are appropriate.

These leakage rates should include the following scenarios:

1. *areal leakage though the bottom of the cell equal to the expected flux of water infiltrating the cover,*
2. *areal leakage through the bottom of the liner 10- to 100-times the expected flux of water infiltrating the cover,*
3. *a scenario that simulates a major liner failure.*

Based on Umetco's figure titled "Cell 4A Schematic" from the February 9, 1994 meeting at NRC, the cover flux is projected at 0.01 $ft^3/yr/ft^2$. This flux may be considered as an areal flux through the bottom of the liner ($Q^{in} = Q^{out}$). The three-dimensional extent of leakage can be calculated using this flux rate, assuming that the leakage occurs throughout the bottom of the cell and making some <u>reasonable</u> assumptions about the in situ material characteristics directly below the cell clay liner. These assumptions would include flow through the matrix and the potential for fracture flow in the subsurface. If a major leak occurs, the movement of fluid will be primarily in the open fractures, if fractures are present, and not within the matrix of the sedimentary units. The cover may fail and, therefore, the second scenario, leakage through the bottom of the liner at 10- to 100-times the expected cover flux (0.1 to 1.0 $ft^3/yr/ft^2$), should be calculated. Finally, a worse-case scenario that assumes a major liner failure should be calculated. For this worse-case scenario, assumptions may include the maximum water level expected in the cell, a leak in the southwest corner of the cell, and a significant leakage rate of at least 10^{-5} cm/sec.

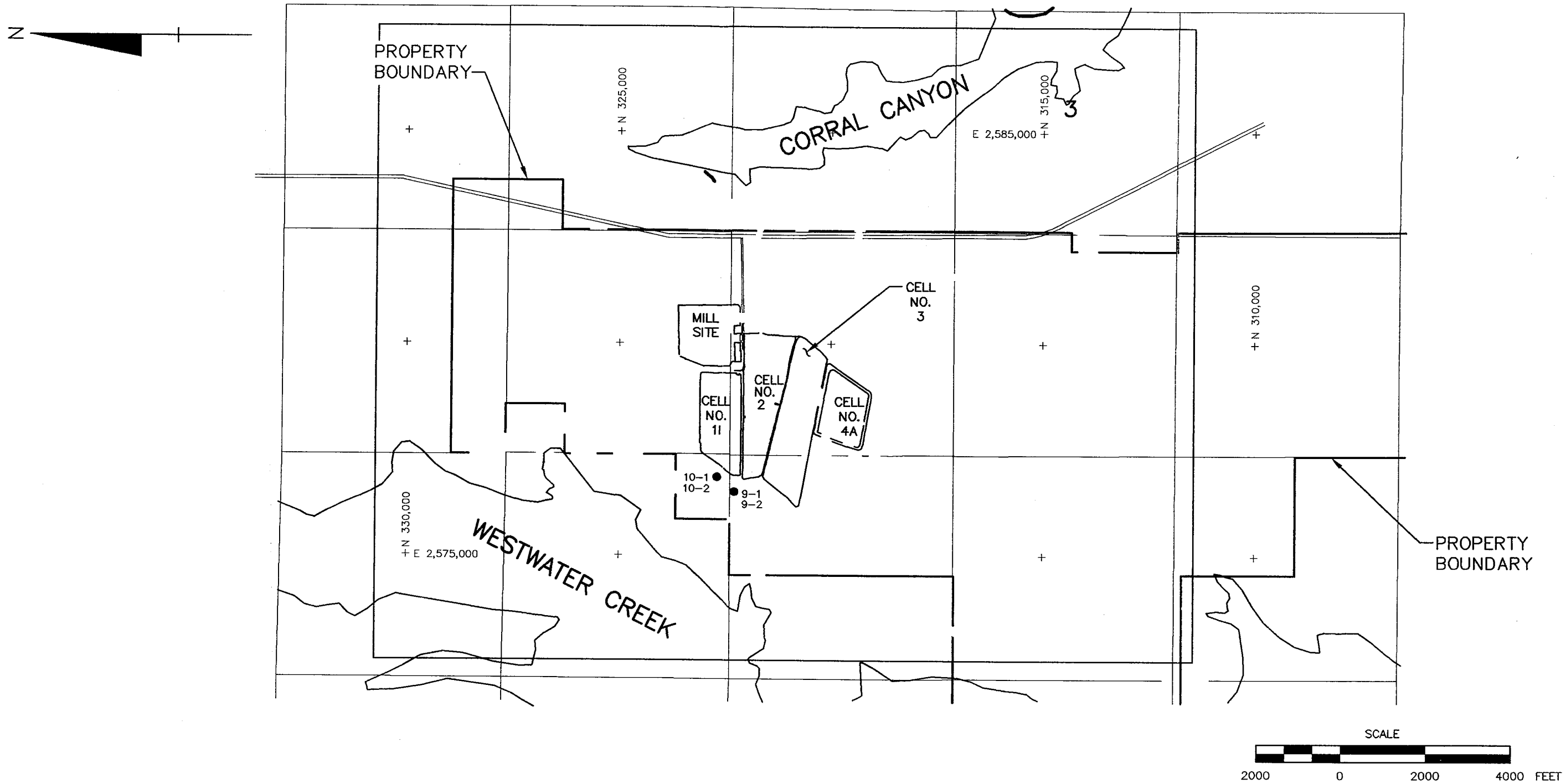
ENERGY FUELS NUCLEAR RESPONSE:

Analyses of infiltration through the bottom of wet and dry tailings disposal cells are discussed in Section 3.1 of the main report. The analyses were conducted using the EPA HELP Model

(Version 2.0) using site-specific soil data and climatological data from Blanding, Utah and Grand Junction, Colorado. The results of the HELP Model are presented in Appendix C of this report.

The results of the analyses indicate that zero net infiltration would occur through the dry tailings cell. An infiltration rate of 0.04 to 0.12 feet per year was predicted for the wet tailings cell assuming a partially- and fully-leaking bottom liner.

DRAWING NUMBER 4111-B28



LEGEND:

● 9-1 / 9-2 SHALLOW PIEZOMETERS (DRY)

SHALLOW PIEZOMETER LOCATIONS
WHITE MESA MILL
BLANDING, UTAH

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

TITAN Environmental

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1		ISSUED FOR DRAFT SUBMITTAL	T.M.G.		

REFERENCE:
Umetco 1992 AND 1988.

DATE: 7-18-94	FIGURE F1	DRAWING NUMBER 4111-B28
SCALE: AS SHOWN		

APPENDIX G

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

FOR GROUND WATER MONITORING

WHITE MESA MILL

BLANDING, UTAH

Energy Fuels Nuclear, Inc.
P.O. Box 789
Blanding, Utah

28 July 1994

Note: Standard Operating Procedures are under revision.

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WHITE MESA MILL'S GROUND WATER QUALITY ASSURANCE PROJECT PLAN

1.0 INTRODUCTION

This quality assurance program is based on U.S EPA Guideline SW-846, U.S NRC Regulatory Guide 4.14 and 4.15, and is designed to provide specific guidance and quality assurance requirements for White Mesa Mill's environmental sampling activities. This quality assurance (QA) program presents the purpose, organization, and Standard Operating Procedures (SOPs) pertinent to conduct sampling in a manner consistent with specific quality assurance goals.

These quality assurance goals focus on precision, accuracy, completeness, representativeness, and comparability. The QA program addresses data quality objectives (DQOs), quality assurance objectives, sample and document custody procedures, quality control procedures, data evaluation procedures, and analytical procedures.

2.0 DESCRIPTION AND OVERALL DATA QUALITY OBJECTIVES

2.1 INTRODUCTION

The overall intent of the environmental sampling activities is for compliance purposes under the NRC Material License SUA 1358.

2.2 ANALYTICAL OBJECTIVES

The data quality objective process described in U.S EPA Guideline SW-846 is used as a basis for development of the analytical objectives. For analysis of the ground water samples, analytical objectives have been developed and are described in detail in Sections 4.0 and 8.0.

Analytical objectives include criteria for precision, accuracy, representativeness, completeness, and comparability of the ground water data. Analytical methods used vary according to the analyses required and according to the methods used by the laboratory. Procedures regarding review of data and data validation are included in Appendix A, Part 2, Standard Operating Procedure (SOP) No. 6.

2.3 DATA MANAGEMENT OBJECTIVES

Procedures are given to document sample quality. Procedures include all SOPs for ground water monitoring well sampling activities. Field logbooks will be kept as described in Appendix A, Part 2, SOP No. 1. Sample analyses from the in-house laboratory and from the contract laboratory will be retained in the monitoring wells file. All ground water analyses shall be summarized and included in the semi-annual effluent reports.

2.4 PROJECT SCHEDULE

The ground water project schedule is discussed in Section 1.0 of Appendix A, Part 1, Ground Water Monitoring Plan.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

3.1 PROJECT ORGANIZATION

Project organization consists of the environmental coordinator reporting to the Department Head of EA/HS. The Department Head of EA/HS has the overall responsibility for assuring that the QA program is being followed and that QC measures are adequate. The environmental technician reports to the environmental coordinator on the progress of ground water sampling activities and any problems incurred. In addition, both the in-house chemist and the laboratory project chemist send all ground water analyses to the environmental coordinator for review. An organizational chart is included in Table 1.0.

3.2 RESPONSIBILITIES OF EFN PERSONNEL

The environmental technician is responsible for sample collection, sample storage, sample management, and equipment calibration. The technician is required to follow all SOPs relating to ground water sampling activities. The in-house chemist is responsible for performing ground water analyses for chemical analytes specified by EFN.

The chemist is also responsible for following US EPA analytical methods in Guideline SW-846. In addition, White Mesa Mill's environmental coordinator is responsible for directing and coordinating all environmental sampling activities. The Department Head of EA/HS will supervise all QA/QC measures to assure proper adherence to the QA program and will determine corrective measures to be taken when deviations from the program occur.

3.3 RESPONSIBILITIES OF CONTRACT LABORATORY

The contract laboratory is responsible for providing sample analyses for ground water monitoring and for reviewing all analytical data to assure that data are valid and of sufficient quality. The laboratory is also responsible for data validation in which 10% of the data is checked in reference to data quality objectives.

In addition, the laboratory must adhere to the specified guidelines EFN is requiring the laboratory to meet. The guidelines the contract laboratory is expected to follow are US EPA Guideline SW-846, and US NRC Regulatory Guide 4.14 and 4.15.

The contract laboratory will be chosen based on the following criteria: (1) experience in analyzing environmental samples with detail for precision and accuracy, (2) experience with similar matrix analyses, (3) operation of a stringent internal quality assurance program meeting EFN's specifications, (4) ability to satisfy radionuclide requirements as stipulated in NRC Regulatory Guide 4.14, and (5) audit and approval of the laboratory by EFN. Details of quality assurance/ quality control (QA/QC) requirements for laboratory performance are addressed in Sections 6.0 and 15.0 respectively.

4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT OF DATA

The primary QA objective for all White Mesa Mill's ground water sampling activities is to identify and implement procedures for field sampling, laboratory analyses, data management, and reporting that will provide data of sufficient quality to meet ground water monitoring objectives.

Project objectives are previously discussed in Section 2.0. The quality assurance objectives are to document data quality in terms of precision, accuracy, representativeness, completeness, and comparability.

4.1 QUALITY ASSURANCE PARAMETERS

4.1.1 PRECISION

Precision is defined as the measure of variability that exists between individual sample measurements of the same property under identical conditions. Precision is measured through the use of sample splits taken at specified regular intervals. Split samples are prepared during laboratory analysis and must contain identical concentrations of the parameters of concern.

Analysis of sample splits generates an estimate of overall precision in sampling and analysis. Laboratory split analyses express precision as a relative percent difference (%RPD). Field and laboratory split analyses are evaluated during data validation as discussed in Section 9.0.

4.1.2 ACCURACY

Accuracy is defined as a measure of bias in a system or as the degree of agreement between a measured value and an accepted or measured value. The accuracy of laboratory analyses is evaluated based on analyzing standards of known concentration both before and during analysis. Accuracy is also measured by spiking samples with a known concentration of reagent and measuring the actual versus expected recovery in analysis.

Blank analysis also notes bias that may have occurred due to cross-contamination. Analytical QC samples which will be used to control analytical accuracy are discussed in Section 4.3. Accuracy is moreover measured and evaluated through the Standard Operating Procedures(SOPs). SOPs are provided in Part 2, Appendix A.

Accuracy is evaluated through the use of blanks. Blanks may be field blanks of equipment rinsate blanks which may demonstrate the bias resulting from contamination. Such contamination may be due to sampling equipment, sample containers, or sample handling. Section 4.2 addresses quality control samples collected in the field to be used to evaluate the accuracy of sampling activities. The impact of bias encountered during sampling will be evaluated during data validation as discussed in Section 9.0.

4.1.3 REPRESENTATIVENESS

Representativeness is defined as the degree to which a set of data accurately represents the characteristics of a population, parameter conditions at a sampling point, or an environmental condition. Representativeness is controlled by collecting QC samples and performing all sampling in compliance with the applicable procedures. Detailed sampling procedures are provided in Appendix A. QC samples collected in the field to control data representativeness are discussed in Section 4.2.

4.1.4 COMPLETENESS

Completeness refers to the amount of valid data obtained from a measurement system in reference to the amount that could be obtained under ideal conditions. Laboratory completeness is a measure of the number of samples submitted for analysis compared to the number of analyses found acceptable after review of the analytical data.

4.1.5 COMPARABILITY

Comparability refers to the confidence with which one set of data can be compared to another measuring the same property. Data can be prepared based on accuracy, precision, and representativeness. Data are comparable if sampling conditions, collection techniques, measurement procedures, methods, and reporting units are consistent for all samples within a sample set.

Data subject to quality assurance/quality control (QA/QC) measures are deemed more reliable than data without any QA/QC measures. Quality control samples which help evaluate comparability are discussed in Section 4.3.

4.2 FIELD AND LABORATORY QUALITY CONTROL

4.2.1 FIELD QC CHECKS

Field QC checks consist of field duplicates and rinsate blanks collected and submitted to the analytical laboratory in order to assess the quality of data resulting from the field sampling program. Field duplicates will be analyzed to determine the reproducibility of sampling and laboratory results.

Equipment rinsate blanks will serve as a check for cross-contamination that may have occurred during the sampling process. The Standard Operating Procedures address the topics of equipment decontamination and sampling procedures to be followed. Equipment rinsate blanks provide a check for cross-contamination by sampling equipment. The frequency for collection of equipment rinsate blanks is described in Part 1, Appendix A, Ground Water Monitoring Plan.

Field blanks will be analyzed to evaluate data accuracy through presentation of possible bias.

4.2.2 FIELD QC CHECK PROCEDURES

Field QC check procedures will include peer review and approval of field procedures by the Department Head of EA/HS. All procedures must be signed off by the Department Head of EA/HS in order to be properly implemented and documented. For field QC check procedures, instrument calibration of all field instruments involved in the sampling process will done prior to each day of sampling. Procedures for instrument calibration are contained in the SOP No 1.

4.3 LABORATORY QC CHECKS

The QC checks for the in-house and contract analytical laboratory will meet or exceed the quality control measures set forth in the analytical methods used by the laboratory. Laboratory QC samples will assess the accuracy and precision of the environmental analyses. The following describes the type of QC samples which will be used to assess the quality of the data.

4.3.1 MATRIX SPIKE

A matrix spike is an environmental sample to which known concentrations have been added. The spike is taken through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery of the known amount spiked. The matrix spike serves as a check evaluating the effect of the sample matrix on the accuracy of analysis.

Matrix spike analyses will be documented in the field logbook and the Chain-of Custody form by the environmental technician using a sample identification number. Extra sample volume may be collected as needed. A minimum of 1 in 20 samples shall be designated for spike analysis. The same minimum will hold true for the in-house laboratory as well as the contract laboratory.

The amount of spiked reagent to add to a sample can be determined from the following formula:

$(N1)(V1) = (N2)(V2)$ where N1 is the concentration of sample water and where N2 is the concentration of the spike reagent ; V1 is the volume of the sample water. V2 is the volume of reagent that needs to be added. When solving the equation V2 can be determined.

4.3.2 LABORATORY DUPLICATES

A laboratory duplicate is taken as a split from an environmental sample. A duplicate is prepared and analyzed by identical methods to the original sample. Duplicates serve to check precision of the analysis. Results are expressed as a relative percent difference (%RPD) between analytical results for the split and the original sample. Both the in-house and the contract lab will analyze duplicates.

4.3.3 LABORATORY AND PREPARATION BLANKS

A laboratory blank is prepared and analyzed in an identical manner to the environmental sample. A preparation blank consists of analyte-free deionized water analyzed in a manner identical to the environmental sample. Contamination detected in analysis of laboratory or preparation blanks will be used to evaluate any laboratory contamination of ground water samples which may have occurred.

4.4 MEASUREMENT GOALS

The objective of quality assurance is to assess the accuracy and precision of sampling activities and laboratory methodology, and to provide quantifiable data with known accuracy and precision limits.

Field activity QA objectives will be fulfilled by the approved sampling and sample handling procedures described in the Ground Water Monitoring Plan and the Ground Water SOPs.

The accuracy and precision of laboratory analyses will be determined by analysis of laboratory spiked samples, laboratory duplicates, and sample blanks collected and analyzed with frequency as described below. Accuracy is measured as the percent recovery (%R) of a known standard or spiked amount for method-specific calibration standards and spiked field samples. Precision is measured as relative percent difference (%RPD) for field duplicates.

The frequency of the duplicates is 1 for every 20 samples submitted. The frequency for blanks is 1 for every 20 samples submitted. Equipment rinsate blanks will be collected each day ground water sampling is conducted and submitted with the quarterly samples. Furthermore, a spike should be performed for every 20 samples submitted.

QA measurement of the representativeness of data is achieved through analysis of field duplicates assuming that comparable sampling and analysis procedures have been followed. QA measurement of data comparability is also achieved through analytical methods and laboratory quality assurance programs.

Laboratory quality assurance provides a means for establishing consistency in the performance of analytical procedures and assuring adherence to analytical methods utilized. Laboratory quality control programs include traceability of measurements to independence reference materials and internal controls. QA measurement of completeness will be evaluated during data validation as discussed in Section 9.0. Completeness goals for ground water are addressed in Section 4.14.

4.5 FIELD MEASUREMENTS

Measurement data will be generated for all ground water sampling activities and will include a description of weather conditions during the time of sample collection. QA objective for the data will be achieved by recording field instrument calibrations and by following preventive maintenance procedures addressed in Part 2, Appendix A, SOP No. 1

5.0 SAMPLING PROCEDURES

Sampling procedures are specified in Part 2, Appendix A, Ground Water Standard Operating Procedures. These procedures include procedures for preparation of sampling equipment, sample designation, sample preservation, and decontamination.

6.0 SAMPLE AND DOCUMENT CUSTODY PROCEDURES

Sample and document custody procedures are addressed in Part 2, Appendix A, SOP No. 2. Procedures will include sample handling, labeling, shipping, Chain-of-Custody documents, field documentation, and project documentation. Verifiable sample custody will be an integral part of all field and laboratory operations related to ground water monitoring. Traceable steps will be taken in the field and laboratory to document that all samples have been properly acquired, preserved, and identified.

7.0 CALIBRATION AND FREQUENCY PROCEDURES

Calibration and frequency procedures are addressed in the Part 2, Appendix A, SOP No. 1. Procedures include calibration of field and laboratory equipment, and frequency of calibration. A fundamental requirement for collection of valid data is the proper calibration of all analytical instruments. Calibration documents that analytical equipment is operating properly and that data produced are within defined calibration ranges.

8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY PROCEDURES

The analytical procedures to be used by the in-house laboratory and contract laboratory will depend on the analysis being done. Methods will vary depending on the laboratory contracted. All compliance analyses will be performed at the contract laboratory. However, both labs are to meet the specifications as outlined by EFN.

These specifications require both the in-house and contract laboratory to follow US NRC Regulatory Guide 4.14 and US EPA Guideline SW-846. The ground water limits for radionuclides are given in NRC Regulatory Guide 4.14 and the contract laboratory is expected to meet these limits. Analytical procedures are discussed in section 11.0 and SOP No. 6.

8.2 PHYSICAL TESTS AND FIELD PROCEDURES

Parameters such as pH and specific conductance will be measured upon sample collection with appropriate instruments in accordance with the procedures defined in the SOP No 1.

The contract lab will be required to meet the guidelines specified for LLD values for radionuclides in ground water and may deviate from the LLD values provided that the standard error is not greater than 10% of the estimated value of the sample.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

The analytical data generated by the contract laboratory will be evaluated for precision, completeness, accuracy, and representativeness using specific data validation procedures. All ground water data will go through two levels of data review and validation. The first level of review will be by the contract laboratory. A data validation specialist will validate all analyses for the contract lab.

Full validation will include recalculation of raw data for a minimum of one or more analytes for ten percent of the samples analyzed. The remaining 90% of all data will undergo a QC review which will include validating holding times and QC samples. Overall data assessment will be a part of the validation process as well.

The laboratory reviewer will evaluate the quality of the data based on US NRC Guide 4.14 and on analytical methods used. The reviewer will check the following: (1) sample preparation information is correct and complete, (2) analysis information is correct and complete, (3) appropriate laboratory SOPs are being followed, (4) analytical results are correct and complete, (5) QC samples are within established control limits, (6) blanks are within QC limits, (7) special sample preparation and analytical requirements have been met, (8) documentation complete.

The laboratory will prepare and retain full QC and analytical documentation. The laboratory will report the data as a group of 20 or less, along with the QA/QC data. The contract laboratory will provide the following information: (1) cover sheet listing samples included in report with a narrative, (2) results of compounds identified and quantified, (3) dilution factors, and (4) reporting limits for all analytes. Also to be included are the QA/QC analytical results.

The second level of review will be the responsibility of the environmental coordinator. The review will be objective and independent since the coordinator is not directly involved in the analysis of the ground water samples. Additional chemical analyses for ground water samples will be provided by the in-house laboratory. Other areas of interest for validation purposes will include the review of sampling procedures, rinsate blanks, laboratory blanks, laboratory duplicates, and spikes. Laboratory analyses will also be checked for completeness upon receipt from the contract laboratory. Re-runs will be required for samples not meeting reporting limits or LLD values.

In addition, the holding time for ground water samples vary according to the analyte being analyzed. As part of the data validation process, the holding time will be compared to the date of the laboratory sample analyses and the date of sample collection to assure validity of the analyses.

10.0 INTERNAL LABORATORY CHECKS

Laboratory QA procedures will be followed to ensure proper handling and tracking of analytical accuracy and precision. Accuracy will be evaluated using spikes, blanks, and duplicates. All out-of-compliance results will be logged by the laboratory QA officer with corrective actions described as well as the results of the corrective actions taken. All raw and reduced data will be stored according to the laboratory's record keeping procedures and QA program. All records will be available for on-site inspection at any time during the course of investigation.

The contract laboratory will follow specific SOPs and analytical methods used by the laboratory. SOPs will be available for on-site review by non-laboratory personnel during the course of investigation.

If re-runs occur with increasing frequency, the QA officer and the project chemist will be consulted to establish more appropriate analytical approaches to problem samples.

11.0 SYSTEM AND PERFORMANCE AUDITS

System audits are conducted to verify documentation and implementation of the QA program. The audits also evaluate the effectiveness of the established QA program and identify any weakness within the program needing improvement. Audits identify deviations from the QA program and verify correction of such deviations. The Department Head of EA/HS will be responsible for initiating and overseeing system audits.

Performance audits are used to assess the accuracy of measurement data through the use of laboratory performance evaluation and blind check samples. Blind performance evaluation samples will be submitted to the contract laboratory for analysis.

11.1 AUDIT PROCEDURE

The system audits will be conducted by EFN staff or by other qualified and approved persons. System audits will review field and laboratory operations including sampling equipment, laboratory equipment, sampling procedures, and equipment calibrations to evaluate the effectiveness of the QA program and to identify any weaknesses that may exist.

11.2 FOLLOW-UP ACTIONS

Response to the system audits is required when deviations are found and corrective action is required. The Department Head of EA/HS in coordination with the environmental coordinator will respond to each Audit Finding Report by completing the Corrective Action Reply section on each form. The response is to be completed within 20 days of receipt and is to state the corrective measures taken for each finding. The response will include the corrective action, the date of implementation, and include corrective action to prevent recurrence.

11.3 AUDIT RECORDS

Audit records for all audits conducted to date will be retained in Central Files. These records will contain audit reports, written replies, records of completion for corrective actions, and any other documents associated with the audits supporting audit findings or corrective actions.

12.0 PREVENTIVE MAINTENANCE

Preventive maintenance concerns the proper maintenance and care of field and laboratory instruments. Preventive maintenance helps ensure that ground water data generated will be of sufficient quality to meet QA objectives. Both field and laboratory instruments have a set maintenance schedule to ensure proper functioning of the instruments. Both field and laboratory instruments will be maintained as per the manufacturer's specifications and established sampling practice.

Field instruments will be checked and calibrated prior to use. Batteries will be charged and checked daily or as needed. All equipment out of service will be immediately replaced. Field instruments will be protected from adverse weather conditions during sampling activities. Instruments will be stored properly at the end of each working day. Calibration and maintenance problems encountered will be recorded in the field logbook. Calibration and maintenance procedures are specified in SOP No. 1.

Both the in-house and the contract laboratory are responsible for the maintenance of their instruments. Preventive maintenance will be performed on a scheduled basis to minimize downtime and the potential interruption of analytical work.

13.0 DATA ASSESSMENT PROCEDURES

Data assessment and review will be accomplished by the project chemist in conjunction with data validation and QC review described in Section 9.0 and SOP No. 6. A summary of this assessment of chemical data quality will be reviewed by the environmental coordinator. Any problems regarding sample collection, shipping, handling, or analysis will be taken into consideration when evaluating the quality of the data.

Both precision and accuracy of the data will be evaluated to assess the quality of the data. Assessment of data with respect to the quality assurance objectives will be accomplished through the joint efforts of the project chemist, environmental coordinator, and the Department Head of EA/HS. The assessment will evaluate sample collection, sample handling, field data, validated blank values, and any other data flags or qualifiers.

14.0 CORRECTIVE ACTION

Both the field technician and project chemist are responsible for following procedures in accordance with the protocols established in the Quality Assurance Project Plan.

Corrective action should be taken for any procedure deficiencies or deviations noted in the ground water monitoring program. All deviations from field sampling procedures will be noted in the field logbook. Any QA/QC problems that arise will be brought to the immediate attention of the environmental coordinator. Laboratory deviations will be recorded by the QA officer in a logbook as well.

Corrective actions will be made and documented when procedures are not strictly in compliance with the established protocol. Data associated with these deviations is considered suspect. Additional samples or measurements will be taken in the field to replace data considered suspect. Upon implementation of corrective action, a memorandum documenting the field corrective action will be placed in the monitoring well files and in Central Files.

Corrective action for laboratory deviations will be the responsibility of both the environmental coordinator and lab supervisor. Any deviation apparent during analysis will be addressed and corrective action will be taken when deemed necessary. All corrective measures will be documented and filed.

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The environmental technician will report to the environmental coordinator regularly regarding progress of the ground water sampling. The technician will also brief the coordinator on any QA/QC issues associated with ground water sampling activities. Refer to Section 3.0 and Table 1.0.

The in-house and contract laboratory maintain detailed procedures for laboratory record keeping. Each data set report submitted to the environmental coordinator will contain the laboratory's certification of the analytical methods performed and identify all QA/QC measures not within the established control limits. Any QA/QC problems will be brought to the environmental coordinator's attention as soon as possible.

After sampling has been completed and final analyses are completed and reviewed, a brief data evaluation summary report will be prepared. The report will summarize the data validation efforts and provide an evaluation of the data quality in regard to precision, accuracy, and completeness. The final summary will be prepared by the project chemist for the contract lab and by the staff chemist at the in-house lab. The final summary will be reviewed by the environmental coordinator and incorporated into the ground water semi-annual effluent report.

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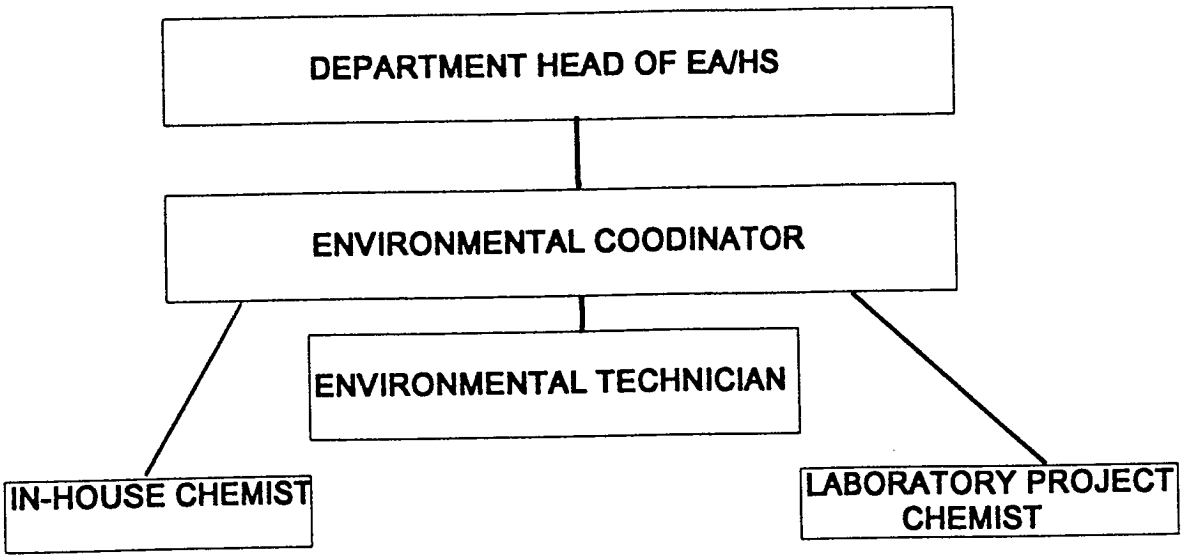
TABLE 1.0

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